Geneva
16 May–3 June
2011

Sixteenth World Meteorological Congress

World Meteorological Organization

WMO-No. 1077

Weather • Climate • Water

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Abridged final report with resolutions

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Chair, Publications Board
World Meteorological Organization (WMO)
7 bis, avenue de la Paix
P.O. Box 2300
CH-1211 Geneva 2, Switzerland

Tel.: +41 (0) 22 730 84 03
Fax: +41 (0) 22 730 80 40
E-mail: publications@wmo.int

ISBN 978-92-63-11077-0

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ANNEXES

GENERAL SUMMARY OF THE WORK OF THE SESSION

The World Meteorological Organization (WMO) held its Sixteenth Congress at the International Conference Centre of Geneva (CICG) from 16 May to 3 June 2011, under the chairmanship of Dr A.I. Bedritskiy, President of the World Meteorological Organization. The list of participants is given in the appendix to the present report.

1. ORGANIZATION OF THE SESSION *(agenda item 1)*

1.1 OPENING OF THE SESSION *(agenda item 1.1)*

1.1.1 The Sixteenth World Meteorological Congress opened at 10.00 on 16 May 2011 at the International Conference Centre of Geneva (CICG).

1.1.2 The President, Dr A.I. Bedritskiy, welcomed all participants to Congress, in particular the new Members, the Democratic Republic of Timor-Leste, and Curaçao and Sint Maarten which has replaced the former Netherlands Antilles and Aruba.

The President emphasized that the Organization has functioned effectively over the last four years despite various challenges, including financial and other difficulties faced by Member States. WMO will begin the sixteenth financial period with good future prospects, clear strategies and strong support from Members and the Secretariat.

He pointed out the crucial role played by the World Meteorological Organization for the global hydrometeorological community. The Programmes and activities of WMO are of growing importance in promoting sustainable economic and social development, especially in light of the increasing negative impacts of weather and climate on the human population. Through strong international cooperation, WMO and National Meteorological and Hydrological Services (NMHSs) around the world contribute in a vital way to protecting human life, reducing the impact of natural disasters, and providing an effective and scientifically based response to climate change. More needs to be done, however, to promote the social and economic role and visibility of NMHSs and to ensure their constant improvement of the quality of services provided.

The strategic direction of WMO for the period 2012–2015 is focused on five strategic thrusts and the Organization is committed to achieving its vision of providing world leadership in weather, climate, hydrology, and water resources, as well as related environmental issues. This will contribute to the safety and well-being of people throughout the world, and to economic prosperity for all countries. Utilizing the capabilities of NMHSs, WMO will focus its programmes and activities on providing the best possible services to support its Members and their efforts to address global societal needs.

The decisions of Congress will aim at meeting these needs by strengthening the underlying scientific foundation, hydrometeorological monitoring and early warning, as well as operational meteorological, hydrometeorological and climate services. This will entail greater cooperation with organizations within the United Nations system and with other international organizations and financial institutions. The Global Framework for Climate Services (GFCS) will be a key part of this process.

1.1.3 Mr M. Jarraud, the Secretary-General of the Organization, welcomed all participants to the session and stressed the importance of the High-level Segment, as well as the three key documents that should form the foundation for deliberations: the WMO Strategic Plan, the WMO Operating Plan and the Budget Proposal for the sixteenth financial period.

The Secretary-General touched upon a number of highly destructive natural hazards that have struck communities around the planet since the last Congress was held four years ago, and noted that many of these extreme events were unprecedented in scale. He pointed out the importance of integrated disaster risk management activities to address the consequences of such events. In this context, the Congress' decision on the Global Framework for Climate Services (GFCS) will play an essential role in coming years.

1.1.4 Mr Ban Ki-moon, the Secretary-General of the United Nations in his message addressed to the Congress, stated that Congress takes place at a time when the significance of weather, climate and water information and services are increasingly being recognized as essential elements in global efforts to achieve sustainable development and human well-being. The science that is the foundation of the work of WMO must continue to drive our response to climate change. Climate change is altering the geopolitical landscape and threatens economies around the world. The World Meteorological Organization and its network of National Meteorological and Hydrological Services in 189 Member countries are critical to meeting the climate challenge. The Global Framework for Climate Services, established by the Third World Climate Conference, is also vital. "We must work together to assist the poorest and most vulnerable countries adapt to the inevitable impacts," stressed Mr Ban Ki-moon.

The Secretary-General urged WMO and its Members to continue their work to improve predictions and early warning on impending weather and climate hazards. This issue will only grow in importance. "Climate change means more incidents of freak and increasingly severe weather. At the same time, information provided by National Meteorological and Hydrological Services in the aftermath of natural and technological hazards has also proven to be essential and should be supported." he said in his message.

1.1.5 H.E. Ms Micheline Calmy-Rey, President of the Swiss Confederation, in her message welcomed all participants to Switzerland, the home of the World Meteorological Organization. She underlined that the Sixteenth World Meteorological Congress in Geneva will determine the Organization's policies and strategies for the next few years and she wished great success in this important task.

In her message, she recalled that Switzerland has allocated substantial financial resources to reinforce the meteorological observing network. "With our European partners, we are investing in a new generation of meteorological satellites and in the design of better short-, medium- and long-range forecast models. Meteorological and climatic issues know no boundaries. Unfortunately, it is often the poorest countries that are hit the hardest by hurricanes, extreme precipitation, drought and even sea-level rise."

She emphasized that in order to ensure the durability of investments in the meteorological observing network, we need to work together to provide the system with accurate data. But there are still some regions, and even entire countries, that cannot afford to build the infrastructure needed for taking meteorological and hydrological measurements. The mission of WMO, which consists of enabling and organizing global cooperation in the areas of meteorology, climatology and hydrology, is therefore of major importance for Switzerland.

The President of the Swiss Confederation pointed out that the role of WMO is all the more important because achievement of the Millennium Development Goals continues to be a major concern. Switzerland, which assigns the highest importance to agricultural development and food security, is convinced that these issues must remain a focus of attention among the international community. Decision-makers therefore need to ensure that the knowledge acquired through WMO and NMHSs activities is integrated into these strategies, at all levels, so that it becomes a central factor in the achievement of the Millennium Development Goals. This will require the optimization of collaboration within the United Nations system, as well as the overall strengthening of governance structures for sustainable development.

1.1.6 Mr Mark Muller, President of the State Council of Geneva, indicated that WMO develops programmes that can have repercussions on the lives of entire populations, on regions, economic systems and whole nations. WMO is one of those organizations which, through the science of forecasting, can try to take action beforehand. It deploys indicators, analyses data and predicts movements in a world where, as it is known, human activity is not without effect on the climate. Natural disasters that are climatic in origin are often synonymous with nations deprived of their life blood, families wiped out, industries brought to their knees, failure of the food supply, the breakdown of communication and the dislocation of schools.

He expressed the view that forecasting is a long-term vision. Scientific advances can extend the field of vision and improve the accuracy of findings. It behoves the governments under whose mandate you work, and society, to listen to you and to understand the changes which your analyses can bring about. WMO's missions – standardization of meteorological measurements, operational hydrology, detection of atmospheric changes, analysis and international cooperation.

He also emphasized that this sensitivity of governments to meteorological and atmospheric questions prefigured political cooperation. Clearly it is economic in origin. The first international meteorological conference was held in Brussels in 1853; at that time, the aim was to improve the safety of maritime trade. WMO has the ear of nations because each and every one of them needs to understand the climate. The essence of WMO work is to understand this phenomenon and propose ways of controlling it. "Our mother ship, the Earth, needs look-outs – and you are those look-outs", he concluded, and wishing a very productive and successful Congress.

1.2 ESTABLISHMENT OF THE CREDENTIALS COMMITTEE *(agenda item 1.2)*

In accordance with Regulations 23 and 24 of the General Regulations (2011 edition), the Congress established a Credentials Committee, comprising principal delegates of the following Members:

Regional Association I	–	Congo, Algeria, Senegal, United Republic of Tanzania
Regional Association II	–	India, China, Kuwait
Regional Association III	–	Ecuador
Regional Association IV	–	Trinidad and Tobago, British Caribbean Territories
Regional Association V	–	New Zealand
Regional Association VI	–	Israel, Spain, Ukraine

Dr N.D. Gordon (New Zealand) was elected chair of the Credentials Committee.

1.3 APPROVAL OF THE AGENDA *(agenda item 1.3)*

Congress approved the proposed annotated agenda as contained in Cg-XVI/ Doc. 1.3(2), Rev. 1.

1.4 REPORT OF THE CREDENTIALS COMMITTEE *(agenda item 1.4)*

The Credentials Committee submitted three reports concerning the credentials of the delegates of Members, Non-members, Organizations of the United Nations system, and other intergovernmental and other organizations. Those reports were approved by Congress.

1.5 ESTABLISHMENT OF COMMITTEES *(agenda item 1.5)*

The following committees were set up:

Nomination Committee

1.5.1 In accordance with the provisions of Regulations 25 and 26 of the General Regulations (2011 edition), the Nomination Committee was established composed of the principal delegates of the following 12 Members:

Regional Association I	–	Guinea, Lesotho, Rwanda
Regional Association II	–	Uzbekistan, Viet Nam
Regional Association III	–	Chile
Regional Association IV	–	Bahamas, Barbados
Regional Association V	–	Indonesia
Regional Association VI	–	Croatia, Italy, Sweden

Mr H. O'Brian Lovell (Barbados) was elected chair of the Nomination Committee. The Committee submitted three reports to the Congress on items 12.1, 12.2 and 12.3.

Working Committees

1.5.2 Three Working Committees were set up to consider various agenda items as indicated below:

(a) **Working Committee A**

Chair Dr A.M. Noorian, First Vice-President of WMO (Islamic Republic of Iran)

Vice-chair Mr YAP Kok Seng (Malaysia)

This Committee reported to Congress on the following agenda items:

3.5, 3.6, 4, 5.3, 5.4, 5.5, 7, 11.1, 11.5 and 11.6

(b) **Working Committee B**

Chair Mr T. Sutherland, Second Vice-President of WMO (British Caribbean Territories)

Vice-chair Dr J.R. Mukabana (Kenya)

This Committee reported to Congress on the following agenda items:

6, 8.3, 8.4, 8.5, 10.3, 10.4, 10.6, 11.2, 11.7 and 11.8

(c) **Working Committee C**

Chair Dr A.D. Moura, Third Vice-President of WMO (Brazil)

Vice-chair Prof. G. Adrian (Germany)

This Committee reported to Congress on the following agenda items:

3.1, 3.2, 3.3, 3.4, 3.7, 5.1, 5.2, 9, 11.3, 11.4 and 11.9

Coordination Committee

1.5.3 The Coordination Committee consists of the President and the Vice-Presidents of WMO, the Secretary-General or his representative, and the chairs of the committees of the body other than the Credentials and Nomination Committees. The Committee was assisted by the Deputy Secretary-General and the Assistant Secretary-General.

1.5.4 Sub-Committees

The following subcommittees were established for in-depth discussion and detailed consideration of particular items:

Operating Plan and Budget, Chair, Mr I. Čačić (Croatia)

Global Framework for Climate Services (GFCS), Chair, Dr D. Grimes (Canada)

Amendments to the General Regulations, Chair, Mr I. Čačić (Croatia)

1.5.5 Congress appointed Dr A.C. Anuforom (Nigeria) Rapporteur on Review of the Previous Resolutions of the Congress. The rapporteur reported to Congress on item 10.5.

1.6 PROGRAMME OF WORK *(agenda item 1.6)*

Congress decided on the following working hours:

Monday to Friday	9.30 a.m. – 12.30 p.m. 2.30 p.m. – 5.30 p.m.
Saturday	9.30 a.m. – 12.30 p.m.

1.7 APPROVAL OF THE MINUTES *(agenda item 1.7)*

1.7.1 Congress suspended Regulation 112 of the General Regulations (2011 edition) for the duration of its session and decided that no minutes of plenary meetings at sessions of Congress should be prepared unless otherwise decided for special items. Audio recordings of plenaries would continue to be made and would be retained for the record.

1.7.2 Congress also decided to suspend Regulation 110 of the General Regulations (2011 edition) for the duration of the Congress and agreed on the distribution of documents eight hours prior to discussion at plenary meetings.

1.7.3 Congress decided to prepare minutes for items 12.1, 12.2 and 12.3. The minutes of the eighth, ninth and tenth meetings of Plenary will be approved by correspondence.

2. HIGH-LEVEL SEGMENT AND REPORTS *(agenda item 2)*

2.1 REPORT BY THE PRESIDENT OF THE ORGANIZATION *(agenda item 2.1)*

2.1.1 Congress noted with appreciation the report by the President including the summary of the activities of the Organization, its constituent bodies and the Secretariat since the close of Fifteenth Congress.

2.1.2 The President underlined the importance of the work done by WMO during the intersessional period and expressed his appreciation to all those who had contributed to the achievements and successes of the Organization. The membership of the Organization had increased to 189 before the Congress with the Democratic Republic of Timor-Leste; and Curaçao and Sint Maarten replaced the former Netherlands Antilles and Aruba. The officers elected at

Fifteenth Congress continued their duties. The Executive Council, the regional associations and the technical commissions, as well as the Secretariat, had each carried out their work efficiently.

2.1.3 During the next four years, the Organization would have to face several challenges. These have driven the evolution of the WMO Strategic Plan to keep on responding efficiently to the activities of the Organization and framed the proposition of the WMO strategic priorities, and in particular the WMO contribution to the implementation of the Global Framework for Climate Services (GFCS) established by the Third World Climate Conference (WCC-3). The WMO strategy also accounts for the need to strengthen WMO's role as the authoritative voice on Weather, Climate and Water, including to strive to achieve recognition of WMO as the authoritative source of information on hazardous meteorological and hydrological phenomena; the need to develop indicators linking the risks of natural disasters on the economy and the population; the need to expand partnerships with both the UN and other organizations; developing further the concept of hydrometeorological security; and assessing the social and economic benefits of meteorological and hydrological services. Furthermore WMO is expected more than ever to contribute to the fructification of the legacy of the International Polar Year 2007–2008; increasing the accuracy of weather forecasting; fostering the introduction of new education and training technologies; addressing the crucial issue of disaster prevention and mitigation; strengthening the coordination mechanism for international WMO cooperation; and expanding resource mobilization to achieve the strategic goals of WMO.

2.1.4 Congress reviewed the various matters affecting the current operation and future development of the Organization as summarized in the President's report and expressed its satisfaction with the work done on those and other issues in preparation for their consideration by Sixteenth Congress. Congress further noted with satisfaction the action taken by the President on behalf of the Executive Council since its fifty-ninth session.

2.1.5 Those matters in the President's report, which called for specific action by Congress, were considered under the appropriate agenda items.

2.2 REPORT BY THE SECRETARY-GENERAL *(agenda item 2.2)*

2.2.1 The Secretary-General presented his report, noting that many issues mentioned in his report to Congress would be considered in depth under the relevant agenda items. He recalled that an unprecedented Congress High-level segment would provide dignitaries the opportunity to express their views on WMO strategic orientation, including the report of the High-Level Task Force (HLT) on the GFCS and, if they so wished, to pledge voluntary contributions to the WMO integrated budget.

2.2.2 The Secretary-General highlighted the role of three closely interlinked issues, namely the WMO Strategic Plan, Operating Plan and budget proposal for the sixteenth financial period. He evoked how the last four years were marked by numerous natural disasters in all parts of the world and he provided examples in which WMO had played a key role, also including some disasters of seismological origin, since severe weather has the potential to aggravate hazards aftermath or to hinder the rescue operations. Moreover, he stressed that local disasters can have global impacts, as was the case with the 2010 Iceland volcanic eruption and the three consecutive disasters recently experienced by Japan.

2.2.3 The Secretary-General recalled that, at the beginning of his first mandate, a key priority had been the strengthening of internal controls. These efforts continued during the current financial period, in particular through enhanced ethics and financial disclosure functions, staff training and periodic briefings to Geneva Missions. At the same time, significant attention was paid to enhancing the efficiency of the WMO Secretariat.

2.2.4 The Secretary-General expressed his appreciation for the collaboration of the Audit Committee and the External Auditor, as well as his satisfaction at receiving the seventh

consecutive unqualified external audit opinion in a row, an especially significant achievement since 2010 was the first year of IPSAS implementation in the WMO Secretariat.

2.2.5 Partnerships with organizations inside and beyond the UN System were also considerably enhanced over this period. The Secretary-General recalled the events that at the time of the United Nations Framework Convention on Climate Change (UNFCCC) COP 15 and afterwards led to an independent review of Intergovernmental Panel on Climate Change (IPCC) procedures by the Inter-Academy Council, which proposed a number of measures currently being implemented.

2.2.6 Other key events occurred during the same period, such as the first Conference of Ministers Responsible for Meteorology in Africa; the International Polar Year 2007–2008; and the historic third World Climate Conference (WCC-3), in which participated an unprecedented number of high-level dignitaries, scientists, decision-makers and climate-sensitive sectors. He recalled that WCC-3 led to the HLT and its key report, shared with the UN Secretary-General at the recent Nairobi session of the UN System Chief Executives Board (CEB) for Coordination.

2.2.7 The Secretary-General also thanked China Meteorological Administration (CMA) for the MeteoWorld Pavilion in the context of the Shanghai World Expo 2010, which attracted nearly one million visitors, including in particular the UN Secretary-General and several Ministers.

2.2.8 In concluding his presentation, the Secretary-General recalled that at the end of 2008 all WMO staff shared the Distinguished Service and Achievement Award of the World Association of Former UN Interns and Fellows (WAFUNIF), which for the first time was awarded collectively to the staff of a UN System organization.

High-level Segment

2.2.9 The High-level Segment began with the presentation by Mr Jan Egeland (Norway), Co-chair of the High-level Taskforce (HLT), on behalf of the other Co-chair Mr Mahmoud Abu-Zeid (Egypt) on the Global Framework for Climate Services (GFCS). The Report contains a number of recommendations regarding, among other things, the investments needed to cover the “last mile” to reach the populations most vulnerable to climate change. The key targets for investment are capacity-building, development of research capacity, national climate services and a user interface platform. One recommendation included eight guiding principles for the implementation of the GFCS, which touch upon maximizing the use of climate services, ensuring that the framework is operational, promoting free and open data exchange, and establishing partnerships between service providers and stakeholders. Mr Egeland stressed that the Taskforce approved the Report unanimously, and the need important to maintain the momentum following the release of the Report and to establish an ad hoc technical group as soon as possible after Congress to focus on drafting a detailed implementation plan for the GFCS.

2.2.10 The speakers who followed this presentation consistently expressed their countries’ strong support for the GFCS and for the role of WMO in providing leadership on climate, knowledge information and services. A number of speakers described the specific conditions in their own countries and how they relate to climate change adaptation and mitigation initiatives. The Prime Minister of Bangladesh discussed the particular vulnerability of her country to highly destructive flooding and cyclones. She called for the drafting of a binding agreement on reductions in greenhouse gas emissions.

2.2.11 The increasing frequency of extreme weather events was cited by many speakers as a call to action for heightened disaster risk reduction programmes. A number of representatives noted that much is expected from scientific experts working on climate change, and with the intensified attention being given to climate science, it was mentioned that every effort should be made to ensure the accuracy of the next Assessment Report of the Intergovernmental Panel on Climate Change. Many speakers addressed the need for further action on disaster risk

management and mentioned the heavy toll natural hazards can take on human lives, livelihoods, ecosystems, the agricultural sector, food security, transportation and environmental protection, both in their own countries and around the planet. The GFCS was spoken of as an important tool for helping developing countries to move in the direction of sustainable development by managing climate risks and opportunities.

2.2.12 High-level speakers from a number of African countries voiced their appreciation for the holding by WMO of the first Ministerial Conference on Meteorology in Nairobi in April 2010 and pointed to that meeting as a sign of the Organization's commitment to capacity-development and the establishment of regional and international networks to help close the gap between developing and developed countries as well as a landmark in international recognition of the unique conditions and needs of the African continent. Many high-level speakers cited technical advances and accomplishments in their own countries, while noting the need for further support and cooperation on the part of WMO and other international organizations.

2.2.13 The need for effective monitoring and warning systems, education and communication was a constant theme among the speakers, while the representatives from some countries called for high-quality user-defined climate services for all. The speaker from the United States of America cited new programmes being undertaken by NOAA to provide early warning for tsunamis to help promote tsunami-resilient coastal communities.

2.2.14 Several speakers mentioned the critical importance of early warning systems for natural hazards, while the need for assistance in developing sector-specific information to deal with devastating drought and flooding was highlighted by the representatives of a number of African countries. Many speakers referred to the valuable role played by the WMO Voluntary Cooperation Programme and expressed support for boosting the funding for the Programme. To this end, international collaboration and cooperation among Members are essential and Governments should take further measures where possible, to strengthening and improving capacity of National Meteorological, Hydrometeorological and Hydrological Services.

2.2.15 Speakers also recognized that in the past six decades, the World Meteorological Organization's scientific work has spanned disciplines and borders and provided a model of international cooperation. Its work has highlighted the need for global solutions to global challenges such as climate change. The Global Framework for Climate Services is the right vehicle to guide and coordinate this effort. It requests the WMO to continue providing governments around the world with high quality weather data, climate assessments and forecasting tools so their populations can be better protected. Many Members expressed that they will continue to support Programmes and activities of the Organization in all possible ways.

2.2.16 A summary of statements during the High-level Segment will be included in Part II of the abridged final report with resolutions of Sixteenth Congress.

2.3 REPORT OF THE CHAIR OF THE FINANCIAL ADVISORY COMMITTEE (*agenda item 2.3)*

2.3.1 Congress considered the report of the Financial Advisory Committee. It noted with appreciation the various recommendations of the Committee contained in Annex I to the present report. Congress took account of those recommendations in making its decisions under the various related agenda items.

2.3.2 Congress approved that Peru and Chad had fulfilled the financial obligations to recover their voting rights for the sixteenth session of Congress, as an exception to Resolution 41 (Cg-XV).

2.4 REPORTS BY PRESIDENTS OF REGIONAL ASSOCIATIONS *(agenda item 2.4)*

2.4.1 Congress noted with appreciation the reports of the presidents of regional associations, which provided an overall review and assessment of the major activities of the Associations since

the Fifteenth Congress and their future priorities. Congress commended the presidents and vice-presidents of the RAs for their contribution to the work of the respective Associations and for their efforts in the enhancement of the meteorological and hydrological services in their Regions. Congress welcomed the newly elected RA presidents and vice-presidents, as follows:

(a) Dr M. Lamine Bah (Guinea) and Dr Amos Makarau (Zimbabwe) re-elected as president and vice-president, respectively, during the fifteenth session of RA I;

(b) Professor Victor E. Chub (Uzbekistan) and Dr Qamar-uz-Zaman Chaudhry (Pakistan) elected as president and vice-president, respectively, during the fourteenth session of RA II;

(c) Mrs M. Araneda (Chile) and Mr Julián Báez (Paraguay) elected as president and vice-president, respectively, during the fifteenth session of RA III;

(d) Mr Arthur Rolle (Bahamas) elected president during the fifteenth session of RA IV, and the re-elected vice-president, Mrs Luz Graciela de Calzadilla (Panama), who was later replaced by Mr Juan Carlos Fallas Sojo (Costa Rica);

(e) Mrs Sri Woro B. Harijono (Indonesia) and Mr ‘Ofa Fa’anunu (Tonga) elected as president and vice-president, respectively, during the fifteenth session of RA V;

(f) Mr Ivan Čačić (Croatia) and Professor Mieczyslaw S. Ostojski (Poland) elected as president and vice-president, respectively, during the fifteenth session of RA VI.

2.4.2 Congress further commended the former presidents and vice-presidents of RAs for their contribution to the work of the respective Associations and expressed its gratitude to the following:

(a) The former president of RA II, Mr A. Majeed H. Isa (Bahrain), and the former vice-president, Mr Chiu-Ying Lam (Hong Kong, China);

(b) The former president of RA III, Mr Ramón Viñas García (Bolivarian Republic of Venezuela), and the former vice-presidents Mr C. Costa (Colombia) and his successor Mrs Myrna Araneda (Chile);

(c) The former president of RA IV, Mr Carlos Fuller (Belize);

(d) The former president of RA V, Mr Arona Ngari (Cook Islands);

(e) The former president of RA VI, Mr Daniel Keuerleber-Burk (Switzerland), and the former vice-president, Mr A. Leitass (Latvia).

2.4.3 Congress expressed its appreciation to the chairs and members of the working groups, the task teams and rapporteurs, who had actively collaborated in carrying out the activities of the RAs in their respective Regions.

Meeting of the Presidents of Regional Associations

2.4.4 Congress endorsed the decisions made by EC-LX in 2008 to formalize the annual Meeting of Presidents of Regional Associations (PRA) (Resolution 1 (EC-LX)) and the annual joint Meeting of Presidents of Regional Associations and Presidents of Technical Commissions (PRA-PTC) (Resolution 2 (EC-LX)) to improve coordination mechanisms and provide advice to Congress, the Executive Council and other WMO constituent bodies and to the Secretary-General, as appropriate.

2.4.5 Congress recognized that these meetings would lead to a stronger coordination of the work of RAs, and a closer interregional cooperation, as well as to a closer cooperation and a stronger coordination mechanism between RAs and TCs for a more responsive and proactive implementation of WMO Programmes in the framework of the results-based management of the Organization.

2.4.6 Considering the report of the 2011 Meeting of Presidents of RAs, Congress took note of the full support during the 15 May meeting of all the presidents of RAs for the initiative taken by RA I to formalize the distribution of seats in the Executive Council between WMO Regions and noted changes to the General Regulations are addressed under agenda item 10.3.

2.4.7 Congress urged presidents of RAs to hold consultations with the Secretariat in order to reflect regional priorities in executing the budget, taking into account the need for more synergy between RAs and TCs at programme implementation level, including regional working groups and relevant TCs subsidiary bodies.

2.4.8 Congress further noted that there is need for a dynamic management process to be put in place to manage and coordinate efforts related to the five priorities, cross-cutting areas and effectively deal with the resources that are made available through voluntary contributions of human and financial resources. Congress agreed that the development of such a management process would be facilitated through enhancing the role of the regular Meetings of Presidents of RAs and Presidents of TCs as a coordination and advisory body in planning and implementation of the deliverables of the WMO Strategic and Operating Plans.

Common regional issues

2.4.9 Congress was pleased to note that all RAs developed and adopted regional strategic plans based on the WMO Strategic Plan. The regional plans helped in downscaling the WMO global plan initiatives and inclusion of regional specifics, needs and priorities. Congress welcomed the effort of the Secretary-General to assist this process in order to ensure harmonized and synchronous implementation by all RAs and their Members. Congress recommended that the RAs should update their regional plans as soon as possible after the adoption of the new WMO Strategic Plan in view of developing operating plans forming part of the WMO-wide Operating Plan for the period 2012–2015.

2.4.10 Congress also noted that all RAs agreed to award recognition to the experts who volunteered to devote their time and expertise to RA activities. It urged Members to continue to support the RAs work through volunteerism and agreed that the Secretary-General should consider development of a common scheme for awarding recognition to those experts contributing significantly to RA activities.

2.4.11 Congress agreed that the Secretary-General and Members should continue to give high priority to a seamless data exchange through modernization of the GTS and implementation of the WMO Information System (WIS) in a coordinated manner at regional and subregional level.

2.4.12 Noting the concerns of many Regions regarding the efforts needed to meet the ICAO requirements on the competencies of aeronautical meteorology personnel and Quality Management System, Congress agreed that the Secretary-General, working with WMO development partners, should provide further assistance to Members through training and fellowships programmes and other cooperation.

2.4.13 Considering the planning and the development of the Global Framework for Climate Services (GFCS), Congress requested the Secretary-General and all stakeholders to assist RAs and Members to maximize potential benefits of the GFCS at national and regional levels. Congress requested the RAs to continue their efforts in developing regional components of the GFCS,

including the establishment of appropriate Regional Climate Centres (RCCs) and expansion of the Regional Climate Outlook Forums (RCOF).

2.4.14 Congress urged the RAs to continue to accord highest priority to the development of adequate capability at national, subregional and regional levels for the provision of hydrometeorological products and services in support of disaster risk reduction efforts. In this regard, Congress encouraged promoting further examples of cooperation in DRR-related activities between WMO, and partner UN agencies, and other international and regional organizations.

2.4.15 Congress encouraged RAs and their subsidiary bodies to play a leading role in the capacity development activities in their Regions. Congress emphasized the role of the RAs in the systematic monitoring of the attained institutional and technical capacity of the NMHSs to provide required products and services as per their mandates, and in developing and implementing adequate capacity development response in order to resolve identified high impact gaps and deficiencies in their Regions.

Report by the president of Regional Association I

2.4.16 Congress noted the most important activities and achievements in RA I, which included:

(a) Approval of the RA I Strategic Plan for the Enhancement of Meteorological and Hydrological Services in the Region (2010–2015) by the XV-RA I session in November 2010. The plan addresses critical development areas of NMHSs taking into account areas of regional common concerns and priorities. The Plan will be complimented by an action plan for implementation by the Members, in cooperation with regional partners and stakeholders;

(b) Optimization of the work structure of the Association done by XV-RA I, aimed at improving efficiency and effectiveness of regional activities; the new structure consisting of a Management Group, three working groups and a flexible structure of task teams addressing specific tasks;

(c) Successful holding of the First Conference of Ministers Responsible for meteorology in Africa (Nairobi, Kenya 12–16 April 2010). The conference was organized by WMO in partnership with the African Union and the Government of Kenya. The main outcome of the conference was the adoption of a Ministerial Declaration which, among others, agreed to establish the African Ministerial Conference on Meteorology (AMCOMET) as a high-level mechanism for the development of meteorology and its applications in Africa, and decided to increase support of NMHSs at national level. The conference requested WMO, in collaboration with the African Union, to be the Secretariat of AMCOMET;

(d) Continuation of the Regional Climate Forums, organized through regional institutions, which have become important mechanism in capacity-building for Members to fully utilize the products of the GPCs in producing seasonal forecasts and meeting user needs;

(e) Continued participation of RA I Members in the implementation of, and to benefit from, the African Monitoring of Environment for Development (AMESD) project which is funded by the European Union and implemented through the African Union and the Regional Economic Communities;

(f) Implementation of the Climate for Development in Africa (CLIMDev*)* project under the auspices of UNECA and the African Union coordinated by the African Centre of Meteorological Applications for Development (ACMAD) and funded through the African Development Bank;

(g) Successful Implementation of Severe Weather Forecasting Demonstration Project (SWFSP) in Southern Africa and plans to implement the project in other subregions in Africa;

(h) An integrated approach to the development of meteorology and hydrology in the Region has been encouraged by WMO in collaboration with the Regional Economic Communities in Africa. In this regard, the Meteorological Association of Southern Africa (MASA) has been established and similar initiatives are at advanced stages in East and West Africa. Implementation of the Spanish Agencia Estatal de Meteorología (AEMET) West Africa Cooperation Programme, including the Farmers Training Project for all the West African countries and the initiation of a pilot project on Marine Meteorology Monitoring and Services covering Cape Verde, Guinea, The Gambia, Mauritania and Senegal;

(i) Implementation of the WIGOS Demonstration Projects by Kenya, Morocco and Namibia.

2.4.17 Congress expressed its satisfaction of the successful organization, in collaboration with the African Union, of the First Conference of Ministers Responsible for Meteorology in Africa. Congress agreed that the Secretary-General should give high priority to the implementation of the outcomes of this Conference.

2.4.18 Congress noted the highest priority areas for the Region identified by the XV-RA I session, as follows: (a) the capacity of the WMO Field Offices has to be strengthened to serve Members more effectively; (b) to operationalize the decisions contained in the Ministerial Declaration; (c) to prepare the RA I Operating Plan; (d) the enhancement of regional integration in meteorological and hydrological development; (e) the establishment of QMS for all NMHSs in Africa for services to aviation; and (f) to meet the November 2013 deadline for aeronautical meteorological personnel to be able to demonstrate compliance with the competency requirements agreed to by EC-LXII.

Report by the president of Regional Association II

2.4.19 Congress noted the most important achievements in RA II, which included:

(a) Successful implementation of the RA II Strategic Plan for the Enhancement of National Meteorological Services (NMSs) in Regional Association II (Asia) (2005–2008) and the Strategy for the Enhancement of National Hydrological Services (NHSs) in Regional Association II (Asia) (2006–2008);

(b) Adoption of the Strategic Plan for the Enhancement of National Meteorological and Hydrological Services in Regional Association II (Asia) (2009–2011) developed in alignment with the WMO Strategic Plan 2008–2011 and based on the regional surveys on basic capabilities of NMSs and NHSs in RA II (2005–2008);

(c) Implementation of the new working mechanism of the Association for effective implementation of the RA II Strategic Plan by establishing the Management Group and four working groups with sub-groups and themes;

(d) Establishment and implementation of three new Pilot Projects on observations, NWP and satellites in addition to the two existing Projects on city-specific NWP products and the Aeronautical Meteorology Programme;

(e) Completion of the GTS upgrade projects for the Indian Ocean tsunami-affected Members through the WMO/ISDR Trust Fund/VCP projects and bilateral arrangements which contributed to the development of multi-hazard early warning systems;

(f) Progress in the establishment of the Regional Climate Centre (RCC) network with the two designated RCCs in Beijing and Tokyo and four candidate RCCs in India, Islamic Republic of Iran, the Russian Federation and Saudi Arabia; and conducting Regional and Subregional Climate Outlook Forums (RCOFs);

(g) Development of projects in enhancing the capacity of NMHSs in Central Asia and Southeast Asia in DRR activities in collaboration with the World Bank, UNISDR and UNDP;

(h) Regional collaborative assistance to the disaster-affected Member NMHSs, in particular to Bangladesh following Cyclone *Sidr* in 2007, Myanmar following Cyclone *Nargis* in 2008 and Pakistan following the 2010 floods;

(i) Further enhancement of partnerships with UN and regional organizations/bodies, including UNDP, UNISDR, UNEP, ASEAN, UNESCAP, League of Arab States, CASPCOM, Mekong River Commission and Regional Integrated Multi-Hazard Early Warning System (RIMES) for Africa and Asia;

(j) Implementation of the initiative of the Asian node of the WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS);

(k) Implementation of the WIGOS Demonstration Projects by the Republic of Korea.

2.4.20 Congress noted the highest priority areas for Region II, as follows: (a) further improvement of the GTS and implementation of WIS/WIGOS; (b) sustainable capacity-building including human resources development; (c) better climate services through the enhancement and operation of the RA II RCC network; (d) establishment of a Region-wide multi-hazard early warning system; (e) upgrading of service delivery capability, in particular for aeronautical and marine meteorological services; and (f) implementation of WMO Flood Forecasting Initiative, water resources assessment and regional exchange of hydrological data and information.

2.4.21 Congress also noted specific challenges to RA II, related to cost recovery, commercialization of products and services, certification/quality management and sand and dust storms, as well as further development of RA II RCC network activities to contribute to the GFCS at national and regional levels, and requested the Secretary-General and Members to take into consideration the regional needs and priorities for the future strategic and operational planning in the Region. Congress further noted that rebuilding infrastructure and delivering hydrometeorological services in some Members in RA II is still challenged by political conflicts or natural disasters.

Report by the president of Regional Association III

2.4.22 Congress noted the most important activities in the Region, which included:

(a) Development of the Strategic Plan (2010–2013) for the Enhancement of the National Meteorological and Hydrological Services (NMHSs) in Regional Association III (South America) based on the previous RA III Strategic Plan for NMHSs (2006–2009) and taking into account the WMO Strategic Plan, the WMO Secretariat Operating Plan 2008–2011 and suggestions from Members of the Region. Likely trends, developments and evolving needs were considered to identify a set of deliverables, action-oriented and categorized under Regional Expected Results in accordance with WMO's set of Expected Results;

(b) Establishment of a new work structure for the efficient management and good governance of the Region, aligned with the Strategic Thrusts of the WMO Strategic Plan. This review of the RA III subsidiary bodies consists of one Management Group,

three working groups and a flexible functioning of subgroups and task teams for specific tasks;

(c) Continuation of the Meeting of Directors of Ibero-American Countries of RA III and RA IV with annual Action Plans adopted and approved for the implementation of the Ibero-American Climate Project (CLIBER), funded by Spain in favour of the Plurinational State of Bolivia, Colombia, Ecuador, Paraguay, Uruguay and the Bolivarian Republic of Venezuela, including several training activities, the new Meteorological Data Management System for the Region and the participation of Ibero-American Directors of NMHSs in the Third World Climate Conference in 2009;

(d) Implementation of the new telecommunications network (using VPN technology through the Internet) offering a cost-effective mechanism to exchange large volumes of information available from the Global, Regional and National Forecasting Centres, as well as from Climate Centres, and all the basic weather information on surface and upper-air observations;

(e) Establishment of three pilot Regional Climate Centres (RCCs) in the Region: the International Research Centre on El Niño Phenomenon (CIIFEN), in Guayaquil, Ecuador, (for Western South America); the NMHSs of Brazil and French Guiana (for Northern South America) and the NMHSs of Brazil and Argentina (for Southern South America). These RCCs were established on a pilot basis, with the guidance and support provided by the presidents of the Region, the Commission for Climatology (CCl), the Commission for Basic Systems (CBS) and the Secretary-General;

(f) The establishment of a Regional Training Centre in La Molina National University (Lima, Peru) which extends the options of human capacity development activities in the Region complements the training institutions in the area (Argentina, Brazil, Costa Rica and the Bolivarian Republic of Venezuela) and offers degrees to meet the education demands within Central and Southern America;

(g) Implementation of the WIGOS Demonstration Projects by Brazil.

2.4.23 Congress also noted identified priorities and related challenges in RA III, including the traceability of meteorological instrument calibration and measurement; the incorporation of WIGOS implementation activities into the strategic plan/work programme of RA III; the need for research to improve understanding of climate variability and change and their linkages to changing cycles and characteristics of El Niño/Southern Oscillation (ENSO) and its impacts on hydrometeorological hazards; the need for a coordinated framework of the GFCS and RCCs which include the development of tools and climate products and services to address disaster risk reduction at different timescales; and the need to mobilize resources and provide assistance to the NMHSs in the Region.

Report by the president of Regional Association IV

2.4.24 Congress noted the most important activities in the Region, which included:

(a) Development of the Strategic Plan (2010–2013) for the Enhancement of the National Meteorological and Hydrological Services (NMHSs) in Regional Association IV (North America, Central America and the Caribbean), based on the previous RA IV Strategic Plan for NMHSs (2006–2009) and taking into account the WMO Strategic Plan, the WMO Secretariat Operating Plan 2008–2011 and suggestions from Members of the Region;

(b) Establishment of a new simplified work structure for the efficient management and good governance of the Region, consisting of one Management Group, the Hurricane Committee and ad hoc task teams to address regional priorities;

(c) Continuation of the Meeting of Directors of Ibero-American Countries of RA III and RA IV with annual Action Plans adopted and approved for the implementation, among other activities of the Ibero-American Climate Project (CLIBER), funded by Spain, in favour of Colombia, Guatemala, Honduras, Nicaragua and the Bolivarian Republic of Venezuela, including several training activities, the financing of Central America Climate Forum Meetings, the new Meteorological Data Management System for the Region and the participation of Ibero-American Directors of NMHSs in WCC-3;

(d) Implementation of the Radar Networking System Project in 2009, with four new radars in Barbados, Belize, Guyana and Trinidad, supported by the European Union, under the coordination of the Caribbean Meteorological Organization (CMO), for the provision of early warnings on hurricanes and severe weather conditions in the Caribbean area;

(e) Revision of the Technical and Operational Plans of the Hurricane Committee during its annual meetings (30th to 33rd) successfully carried out with support from WMO, in Orlando (United States Nassau (Bahamas), Hamilton (Bermuda) and Grand Cayman, Cayman Islands (British Caribbean Territories);

(f) Establishment of a Task Team to coordinate the different actions and efforts to help Haiti after the earthquake that impacted this country in January 2010, providing immediate assistance including a set of seven new GSM enabled Automatic Weather Stations through VCP funds, two EMWIN systems and a flash flood guidance system supplied by the United States, technical support and training of local staff as well as France-funded specialized training of 5 staff members for 10 months in Toulouse, France. The active participation of Canada, the Dominican Republic, France, the Caribbean Meteorological Organization and the United Kingdom of Great Britain and Northern Ireland was determinant in this effort. The information provided in 2008 by the joint WMO/Spain AEMET Mission to Haiti focused on an Early Warning System Proposal, served as a useful reference basis for the Task Team. WMO also coordinated its work with other UN Agencies to include in the Flash Appeal nearly USD 1.0 million to support meteorological activities in Haiti;

(g) Canada, the Caribbean Meteorological Organization, the Dominican Republic, France, the United Kingdom and the United States provided logistic, technical and operational support to Haiti after the initial work of the Task Team and agreed to continue the support through 2011;

(h) Implementation of the WIGOS Demonstration Projects by the United States.

2.4.25 Congress also noted identified priorities and related challenges in RA IV, including:

(a) The enhancement of the availability of university-level education opportunities for meteorological personnel;

(b) The revised plans of ICAO for the implementation of a recognized Quality Management System for meteorological services to civil aviation;

(c) Strengthening of regional and national capacities for the provision of meteorological, hydrological and climate services to support disaster risk assessment and multi-hazard early warning systems, and development of operational cooperation of NMHSs with disaster risk reduction stakeholders across socio-economic sectors;

(d) The work with regional intergovernmental organizations and the use of regional forums to promote meteorology, hydrology and environmental issues, and raise policy-makers' awareness of the role of the NMHSs and WMO in contributing to sustainable development and disaster risk reduction.

Report by the president of Regional Association V

2.4.26 Congress expressed a warm welcome to Timor-Leste for its new Membership with WMO (189th Member of WMO) as from 4 December 2009. Noting with pleasure that the Marshall Islands, Palau and Tuvalu had taken the necessary steps towards becoming Members of WMO, Congress encouraged these potential Members to accelerate the WMO Membership process.

2.4.27 Congress noted the most important achievements in RA V, which included:

(a) Adoption of the Strategic Plan for the Enhancement of National Meteorological and Hydrological Services in Regional Association V (South-West Pacific) 2010–2011 (RA V Strategic Plan) and the development and adoption of a new RA V Strategic Operating Plan (SOP) for 2012–2015 (RA V SOP 2012–2015) approved by the president through the finalization by the Management Group;

(b) Establishment of a new working mechanism for effective implementation of the RA V Strategic Plan by strengthening the Management Group and the Tropical Cyclone Committee for the South Pacific and South-East Indian Ocean (TCC) and by establishing four working groups and time-bound task teams;

(c) Assistance provided by Members and the Secretary-General to support RSMC Nadi-TCC operational activities, including human resources development, in line with the findings and recommendations by the WMO fact-finding mission carried out in July 2007 in response to the request of Cg-XV;

(d) Implementation of the pilot phase and then the full demonstration phase of the Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project (SWFDDP), a regional subproject of SWFDP in RA V, with operational support from RSMC Wellington;

(e) Implementation of the VCP coordinated project, supported by the United States, for the provision of Low Rate User Station (LRUSs) to enable SIDS in the Pacific to have access to meteorological satellite images in Low-Rate Information Transmission (LRIT) format;

(f) Provision of assistance to several Pacific SIDS/LDCs NMSs to prepare their NMS strategic development plans and legal frameworks;

(g) Further enhancement of partnerships with UN and regional organizations, including UNDP, ASEAN, UNESCAP, SPREP and SPC-SOPAC: among others, the implementation of QMS in Pacific Island Countries (PICs) NMSs and raising the profile of meteorology and visibility of PICs NMSs among national governments and development partners with SPREP; and the implementation of the Pacific-HYCOS project and establishment of flood early warning systems with SPS-SOPAC;

(h) Implementation of the WIGOS Demonstration Projects by Australia.

2.4.28 Congress also noted that XV-RA V decided to attach the highest priority for the Region to: (a) improved end-to-end Multi-Hazard Early Warning Systems (MHEWS); (b) improved infrastructure (data and information services) for weather, climate and water; (c) better climate services; (d) sustainable aviation services; and (e) capacity-building.

2.4.29 Congress further noted specific challenges to and needs for RA V, among others, related to the following:

(a) Mobilizing and securing resources for the implementation of RA V SOP 2012–2015 and the integration of RA V SOP into subregional and national sustainable development strategies/plans as well as streamlining them with the GFCS;

(b) Human resources development and institutional capacity development of NMHSs;

(c) Establishment of Regional Climate Centre(s) (RCC(s)), where international and regional organizations/bodies are expected to be involved in building institutional capacity for the implementation of GFCS;

(d) Establishment of the new Regional Training Centre for Hydrology for RA V;

(e) Establishment of QMS for all NMHSs in the Pacific for services to aviation;

(f) Full operation and extension of the coverage in SWFDP and the implementation of a Storm Surge Watch Scheme in the Region;

(g) Strengthening the capabilities of NMHSs in the Pacific region to access sophisticated products in the preparation and dissemination of weather information and products and timely warning for severe weather and climate extremes and in doing so, enhancing the capacity-building programme in the area of climate modelling;

(h) Further collaboration with SPREP through co-organizing biennial meetings of Regional Meteorological Services Directors (RMSD) and the proposed Pacific Meteorological Council (PMC), and establishment of a Regional Meteorological Pacific Desk for the PMC;

(i) Further enhancement of the hydrology and water resources activities including the development and implementation of the South-East Asian (SEA)-HYCOS project.

Report by the president of Regional Association VI

2.4.30 Congress noted the most important activities and achievements in the Region, which included:

(a) Development of the RA VI Strategic Plan for the Enhancement of Meteorological and Hydrological Services in the Region (2008–2011). The RA VI Strategic Plan was the first successful attempt to downscale the WMO Strategic Plan by taking into consideration regional specifics, requirements and priorities. It was complemented by an Action Plan for implementation by the Members, in cooperation with regional partners and stakeholders, with defined objectives, deliverables and target dates;

(b) Optimization of the work structure to improve efficiency and effectiveness of regional activities; the new structure consists of a Management Group, three working groups and flexible structure of task teams established as necessary by the Management Group to address specific tasks;

(c) Initiation in 2009 of the RA VI Pilot Regional Climate Centres Network as network of centres which provide regional level services according to their individual strengths, while making use of as many national level data and products as possible. Three nodes have been established: Data Services (lead: Netherlands); Climate Monitoring (lead: Germany); Long-Range Forecasting (lead: Russian Federation and France). Each of these nodes is supported by a consortium of NMHSs in the Region;

(d) Maturing of the SEE Climate Outlook Forum (SEECOF) which enabled Members to better utilize the GPC products in producing seasonal outlooks and forecasts, as well as in facilitating Member's interaction with users from different economic sectors;

(e) Progress of RA VI in the implementation of WIS through designation of GISCs, DCPCs and national centres and further development of the RMDCN;

(f) Establishment of WIGOS demonstration projects in the Region: on Integrated Meteorological and Hydrological Network in the Russian Federation; and on the re-design of the Regional Basic Observing Network (RBON), led by the RA VI Working Group on Technology Development and Implementation;

(g) Regional Programme on Disaster Risk Reduction in South East Europe (DRR/SEE) being implemented through regional cooperation with the European Commission, UNDP, UNISDR, World Bank and other regional partners. WMO was the main implementing agency of a DRR/SEE Project financed by the European Commission (DG Enlargement) during the period April 2009 to April 2011 which contributed to enhancing the capacity of NMHSs in the SEE as key stakeholder in DRR at national and regional levels;

(h) Extension of partnership with regional partners ECMWF, EUMETSAT and EUMETNET, contributing to capacity development through knowledge and technology sharing and transfer.

2.4.31 Congress noted that RA VI identified as main priorities the development of the regional components of GFCS, the coordinated implementation of the WIS and WIGOS, further enhancement of the NMHS's' support to DRR, and the capacity-building of less developed NMHSs. Congress noted also specific challenges to RA VI related to requirements for compliance with data policies of the European Union; increasing role of the private sector in service delivery; growing need to study and demonstrate the socio-economic benefits of the hydrometeorological services in order to ensure sustainable government support and investments; and the need to mobilize resources and provide assistance for filling the technological and institutional gaps between the developed and developing parts of the Region.

2.5 REPORTS BY PRESIDENTS OF TECHNICAL COMMISSIONS *(agenda item 2.5)*

2.5.1 The presidents of the technical commissions presented specific highlights in the areas of responsibility of the Commissions from the last four years and their perspectives on the priorities and vision for the next financial period. Detailed consideration of scientific and technical aspects of the work of the Commissions was discussed under the respective agenda items on technical programmes.

Commission for Climatology (CCl)

2.5.2 Congress was informed by Dr Thomas Peterson, president of CCl, that it has established four Open Panels of CCl Experts (OPACEs), focused on development of information, guidance, best practices and capacity-building that will assist National Meteorological and Hydrological Services (NMHSs) provide climate services, and address the climate-related issues raised by social and economic systems around the world. The Panels include: Panel 1 on Climate Data Management; Panel 2 on Climate Monitoring and Assessment; Panel 3 on Climate Products and Services and their Delivery Mechanisms and Panel 4 on Climate Information for Adaptation and Risk Management. Details about the work of the different panels can be found at: http://www.wmo.int/pages/prog/wcp/ccl/index_en.html.

2.5.3 Congress noted with satisfaction that CCl has finalized the third edition of the *Guide to Climatological Practices*, and is setting up an updated schedule to keep it current. CCl is also

engaged in fostering Quality Management for Climatology; and is developing cross-panel strategies for Capacity Development for Climate Services. In addition, it agreed that the Commission contributes to all components of the Global Framework for Climate Services (GFCS), which will continue to be a top priority for CCl.

2.5.4 Congress recognized the work of the 215 volunteers from 54 Members that support the CCl and carry out its work, and welcomed their commitment and engagement.

Commission for Hydrology (CHy)

2.5.5 Mr Julius Wellens-Mensah, president of CHy, stressed that most, if not all, NMHSs would measure their success by the degree to which their products and services contribute to the social, economic and environmental betterment of their countries. CHy focus was put on the specific thematic areas of stakeholder engagement, observations, research and development, services delivery and capacity-building, through the WMO Strategy in Education and Training in Hydrology and Water Resources.

2.5.6 Congress noted that Quality Management Framework for Hydrology provides the basic foundation to enable development and delivery of hydrological products and services. From an observations perspective, CHy will focus on new measurement capabilities, new parameters and new transmission and delivery mechanisms. The World Hydrological Cycle Observing System (WHYCOS) and the associated HYCOS Projects collect hydrological data, as well as, setting the standards for hydrological data collection and will progress towards global coverage. CHy will put in place processes and procedures that will support the assessment/evaluation of research developments in hydrological techniques for their degree of applicability across various climatic and physiographic regions, and under varying levels of data availability. WMO, together with Open Geospatial Consortium (OGC), will develop agreed international standards for a water data model that relates the flow, storage and loss of water through a system.

2.5.7 Congress was pleased to note that through CHy, WMO will provide guidance on how to make better use of the Internet and other new technologies to deliver real-time hydrological information services and products.

2.5.8 WMO will continue to promote improved cooperation between NMSs and NHSs in the provision of flood forecasting and warning services. Applications such as the Flood Early Warning System and associated initiatives such as the Flash Flood Guidance System, the Global Flood Alert System, the Flood Forecasting Initiative and the International Flood Initiative (IFI) should continue to be directed towards the needs and requirements of Members.

2.5.9 Congress stressed that to be able to respond adequately to the future needs in hydrology and water resources of Members, WMO, through CHy should continue to develop cost-effective, demand-driven and priority-focused education and training programmes.

Commission for Agricultural Meteorology (CAgM)

2.5.10 Mr Byong-Lyol Lee, newly elected president of CAgM, noted that CAgM is the main interface between the work of WMO Programmes and Commissions and the agricultural community which includes farmers, extension services, and policy makers. The priority areas of WMO and the CAgM strategic plan for 2011 to 2014 are well aligned, in particular with regards to developing better climate services for agricultural users through the Global Framework for Climate Services (GFCS), capacity-building, and disaster risk reduction. The Commission can also contribute to WIGOS and WIS through close collaborations with associated technical commissions and member countries.

2.5.11 Congress was informed of the four broad implementation strategies for CAgM focusing on:

(a) Improving the quality and quantity of agrometeorological services for Members through the GFCS, the World AgroMeteorological Information Service (WAMIS), engaging regional associations on regional agrometeorological pilot projects and integration of non-NMHS agrometeorological station networks into WIGOS and WIS through the National Agrometeorological Station Network (NASNET) initiative;

(b) Providing better education and training in agrometeorology for Members through collaboration with various regional training partners, in particular the WMO RMTCs;

(c) Improving communication with CAgM members through the development of the next phase of the online International Society of Agricultural Meteorology (INSAM) into a Global Federation of Agrometeorological Societies. The Commission will also be committed to the Joint CCl-CHy-CAgM Joint Expert Group on Climate, Food, Water in addition to the Joint CAgM-JCOMM Expert Team on Weather, Climate and Fisheries;

(d) Strengthening collaborations with relevant international and regional programmes/ institutions such as FAO, UNCCD, and agricultural research institutions.

Commission for Instruments and Methods of Observation (CIMO)

2.5.12 Professor Bertrand Calpini, the president of CIMO, highlighted how CIMO activities directly relate to WMO high priorities and impact Members.

2.5.13 Congress noted that CIMO, at its last session, modified its working structure to best support WMO high priorities, especially WIGOS, GFCS and capacity-building, putting emphasis on three areas: (a) Standardization and Intercomparisons; (b) Remote-sensing and New Technologies; and (c) Capacity-building.

2.5.14 The session was pleased to note that, in order to better support climate requirements, CIMO is vigorously promoting traceability of measurements to the International System of Units (SI), including through collaboration with BIPM and by strengthening of Regional Instrument Centres.

2.5.15 Congress noted with appreciation that CIMO developed a siting classification for observing stations, which provides a tool to assess whether the siting of stations is appropriate for specific activities, in particular for climate monitoring. It is expected that it will be further developed as a common WMO-ISO standard and to include the maintenance aspect.

2.5.16 Congress noted with satisfaction that intercomparisons of various instruments conducted by CIMO are providing valuable information on performance of instruments that can enable Members make informed decisions when modernizing their networks and have a direct impact on lowering the cost of e.g. radiosondes. In addition, Congress noted that NMHSs and the private sector provide significant support to CIMO's intercomparisons. In the coming years, the focus will be put on an intercomparison of solid precipitation in support of climate and global cryosphere watch requirements and on an intercomparison of weather radar algorithms, in support for severe weather forecasting and warnings.

2.5.17 Congress agreed that in the area of remote-sensing and new technologies, CIMO should provide guidance on how modern systems can supplement traditional observations to enhance benefits that can be gained from the use of these technologies. This will be best achieved making use of the expertise that is available in CIMO Testbeds and CIMO Lead Centres.

2.5.18 Congress noted that as far as capacity-building is concerned, the ultimate goal of CIMO is to maintain the *Guide to Meteorological Instruments and Methods of Observation* (CIMO Guide, WMO-No. 8) up-to-date as it is the major source of information for network managers. Beside specific training workshops, instrument intercomparisons also provide a major capacity-building

component as well as CIMO technical conferences, which attract 250–300 experts and are held together with Meteorex.

Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM)

2.5.19 Dr Peter Dexter, the co-president of JCOMM, highlighted the important role being played by JCOMM in bringing together the expertise and energies of the meteorological and oceanographic communities in addressing the many issues and priority areas of common concern, as specified through its parent Organizations, WMO and IOC.

2.5.20 Congress was pleased with the achievements during the past intersessional period, which included significant advances in the in situ ocean observing system for climate; the successful completion of the JCOMM Pilot Project for WIGOS, which is focused on delivering high quality ocean data to the WIS; and the implementation on the five new Metareas for maritime safety services in the Arctic Ocean.

2.5.21 Congress noted and supported the priority work areas for JCOMM in the coming intersessional period, including: implementing and maintaining a comprehensive in situ long term ocean observing system, for multiple applications, at the same time ensuring that all ocean and marine met data are delivered through WIGOS/WIS, to Members/Member States. Congress also agreed, in particular, on the priority given to; developing capacity in maritime Members/Member States, especially least developed countries and small island states, to generate and deliver services to warn and protect coastal communities vulnerable to ocean related hazards; contributing ocean climate-related services under GFCS; enhancing and expanding safety services for mariners; guiding the development and implementation of new operational ocean forecast systems, to provide timely and accurate ocean information to Governments, NMHSs, industry and commerce, environmental management, and individuals, both on and near the sea. Finally, Congress supported that JCOMM should enhance and expand collaboration with other technical commissions in cross-cutting projects contributing to all the Strategic Thrusts and Expected Results of WMO and IOC.

Commission for Aeronautical Meteorology (CAeM)

2.5.22 Mr Chi-ming Shun, the president of CAeM, highlighted the high-priority issues of the Commission, in particular the ICAO Standard requiring Members to implement a recognized QMS for aeronautical meteorological services with applicability date of 15 November 2012. Congress encouraged Members to utilize documentation and recommendations of the Tanzania Pilot Project. In this regard, it welcomed the support to Members provided by the Secretariat and Members including Australia, Finland, Canada, the Russian Federation, South Africa, Spain and the United States, among others. In addition, Congress encouraged cooperation on a twinning basis to assist Members in need.

2.5.23 Congress recalled that the question of personnel competencies in aeronautical meteorology were closely related to Quality Management and that EC-LXII had approved AMP Competency Standards (for inclusion in WMO-No. 49 Vol. I). Congress praised the prompt and successful development of the Competence Assessment Toolkit (CAT) by the Task Team (TT-CAT), to assist Members implementation of the AMP Competency Standards, which allowed for regional and national differences in service delivery. The competency standards are to be implemented by Members by 1 December 2013, which was considered challenging, but realistic given the support provided.

2.5.24 Congress recognized Members' concerns relating to AMF requirement as approved by EC-LXII and this subject would be further discussed under agenda item 11.6 "Aeronautical Meteorological Programme".

2.5.25 Congress noted the progress in terms of new services for aviation, particularly new Meteorological Services in the Terminal Area (MSTA) which will be proposed to the next Conjoint WMO CAeM/ICAO MET/AIM Divisional meeting in 2014 with support by ICAO and aviation users. These services will support Global Air Traffic Management (ATM) and Performance Based Air Navigation (PBN) concept of ICAO, and was expected to help reduce weather delays while improving safety in high-density airspace and avoiding costly duplication of development efforts.

2.5.26 In the safety-relevant area of SIGMET delivery, Congress expressed concern over long-standing deficiencies in SIGMET issuance resulting in serious concerns and user complaints, which were being addressed by a trial production of SIGMET advisories conducted by ICAO in cooperation with WMO, involving three selected regional centres (China, France and South Africa). Recent SIGMET monitoring efforts revealed some improvements in SIGMET issuance during the trials.

2.5.27 On the issue of volcanic ash affecting aviation, Congress welcomed the recently established Joint WMO-IUGG Volcanic Ash Scientific Advisory Group (VASAG), playing a key role in the ICAO International Volcanic Ash Task Force. The Advisory Group was working with ICAO and the aviation industry to better understand Volcanic Ash impacts and user requirements in relation to: (i) aviation safety; and (ii) maintenance/airworthiness considerations.

Commission for Basic Systems (CBS)

2.5.28 Mr Fred Branski, president of CBS, highlighted the high priority activities and achievements over the four years since Cg-XV.

2.5.29 Congress expressed appreciation to Croatia and Namibia for supporting the fourteenth session of CBS in 2009 and of the CBS extraordinary session 2010 respectively, as well as the technical conferences on WIGOS in Dubrovnik and on End to End Services in Windhoek. It noted that both technical conferences played an important role in the Commissions understanding and refinement of the WIGOS concept and the establishment of a users focus for end to end services.

2.5.30 The session noted that CBS has refined its terms of references to reflect the progress in the development and implementation of WIGOS and WIS. In addition, consideration and approval of the new Manual on WIS, and refinements to the technical regulations and manuals such as the Manual on DPFS are just some of the decisions necessary to support the continued evolution and development of WMO Members' capabilities.

2.5.31 Congress noted that the priorities of CBS are well aligned to the priorities of regional associations and those under review of this Congress. In addition to the continued rollout of WIS and implementation of WIGOS, all CBS activities support crosscutting priorities such as continued multi-programme multi-sectoral collaboration to address regional disaster risk reduction needs for multi-hazard early warning systems and improve forecasting and warning services. This includes enabling NMHSs of developing countries to extend alerting lead-time for severe weather and for estimating forecast uncertainty through improved delivery of Ensemble Prediction System based products for probabilistic forecasting as demonstrated in the SWFDP pilot projects that have already benefited many Members.

2.5.32 The session noted the importance of CBS continuing to review its working practices to allow greater flexibility to integrate support for new initiatives such as the global framework on climate services into WIS, WIGOS, data processing and forecasting systems, public weather services (PWS) delivery mechanisms and disaster risk reduction. It noted that the ability to provide decision support services seamlessly across time scales and applications is the true measure of WMO's success.

Commission for Atmospheric Sciences (CAS)

2.5.33 Dr Michel Béland, president of CAS, provided the overall mission of CAS pointing out how it was implemented and some of the major accomplishments of the Commission in the last 4–6 years, which include: (1) the development of a Unified Approach to Climate, Weather, Water and Earth System Prediction (EC RTT Report endorsed at EC-LXI); (2) the development of the chemical weather concept, and its strong linkages with numerical weather modelling centres and techniques; (3) an enhanced greenhouse gas observations programme, because of their increasing role in global background monitoring and potential role in the future of emissions control and trading, and, international conventions on ozone and toxics; (4) the rise of the WWRP as an internationally respected research programme in both the operational and academic research community; and (5) the implementation of THORPEX TIGGE and YOTC research sub-programmes, and numerous involvements in key field programmes to advance fundamental science issues in weather and climate predictions.

2.5.34 Congress was presented with a rationale for identifying upcoming priority projects for the Commission, asking the following question: what are the significant social and environmental stressors that will drive the demand for more accurate and user-friendly environmental assessments and predictions? In this regard, the following were identified successively: (1) population growth and urbanization that is bound to have a major impact on the type of services expected from NMHSs, given the specificities of urban environments, and of their populations and socio-economic activities; (2) the steady increase observed in the last few decades on the number and impacts of both natural and anthropogenic disasters; (3) climate change, and its increasing impacts, particularly in the polar regions, where rapid melting of ice and glaciers would inevitably lead to significant sea-level rise (up to 1 metre) over the next century; and finally (4) water quality and quantity issues.

2.5.35 Congress was presented with six research proposals to help mitigate and adapt to the stresses mentioned in the above paragraph, namely:

(a) Carbon Flux Measurement Systems;

(b) Better Sub-seasonal to Seasonal predictions;

(c) Tackling the Grey Zone (Precipitation);

(d) Geo-Engineering;

(e) Megacities: Integrated Environmental Prediction Initiative;

(f) Improving polar forecast services.

2.5.36 Furthermore, Congress was provided with a quick description of these six projects. It was reminded that four of these projects were part of the compendium of projects proposed for voluntary funding and that most of these projects were contributions in one way or another to the GFCS agenda, and would be described more fully in side meetings during Sixteenth Congress. Congress was urged to consider financial support to these projects, as they would pave the way for the future of key services and science accomplishments from WMO and its Members.

Discussion

2.5.37 In general, Congress recognized the critical work being done by technical commissions in promoting standards, strengthening the capacities of Members through involvement of experts in training and technology transfer, introducing innovative ways to improve the efficiency of their work and increased cross-commission collaboration and collaboration with the RAs. In addition, the relevance of working groups/task teams being established by technical commissions was recognized for the role they play as contact points within technical commissions for specific areas.

2.5.38 The session expressed the need for:

(a) Technical commissions to observe geographical balance, gender representation and inclusion of young experts in their Management Groups and work;

(b) Technical commissions to increase inter-commission coordination to respond to needs, particularly in developing countries;

(c) Particular attention to be given to water issues (e.g., scenarios of surface water availability, development of services for large inland water bodies, etc.);

(d) CIMO to provide standards of equipment for Members to use when buying instruments and equipments, given the wide range of products available on the market;

(e) CAS to consider Geo-engineering in its work;

(f) CHy to work with the Water Programme of UNESCO in advancing flood forecasting and assessment of water resources and establish mechanisms (in collaboration with JCOMM) for accounting for fresh water fluxes into the oceans, particularly in the polar basins;

(g) CAS to consider urban meteorology as a priority in view of rapid urbanization.

2.5.39 Congress stressed the need of more dynamic management processes in the implementation of WMO key priorities through promotion of regular joint meetings of the technical commissions and regional associations.

2.5.40 Congress stressed the weaknesses of the African continent with respect to observations, monitoring, forecasting, etc., and requested that these be addressed with the implementation of the GFCS. In addition, RA I highest priorities include:

(a) Meeting aeronautical ICAO QMS implementation requirements by November 2012;

(b) Meeting aeronautical meteorological personnel competence Standards by December 2013.

3. SCIENCE AND TECHNOLOGY DEVELOPMENT AND IMPLEMENTATION *(agenda item 3)*

3.1 WORLD WEATHER WATCH PROGRAMME *(agenda item 3.1)*

3.1.0.1 Congress recognized that the WWW continues to be the “core” operational infrastructure facility for all WMO Programmes as well as for many international programmes of other agencies. Congress reaffirmed that the WWW Programme (as described in Annex II to the present report), with the evolving development of its observing, information and data-processing and forecasting components, continues to be the backbone Programme of WMO that not only accomplishes its goals through the coordinated efforts of Members, but also directly contributes to cross-cutting activities. Congress agreed that the WWW should provide a fundamental contribution to all WMO priority areas, namely, the Global Framework for Climate Services (GFCS), Disaster Risk Reduction, the WMO Integrated Global Observing System (WIGOS), the WMO Information System (WIS), Capacity-building and Aeronautical Meteorology.

3.1.0.2 Congress re-affirmed that there is a need to further strengthen public awareness of this unique Programme of WMO, which contributes to the security of life and property and sustainable development. It noted that the celebration in 2013 of the fiftieth anniversary of the establishment of

the WWW should provide this opportunity, and invited the Secretary-General to make necessary arrangements and encourage Members to provide the necessary resources. Congress also stressed the need to mobilize resources for strengthening the components of the WWW, especially in developing countries.

3.1.0.3 Congress confirmed that the WWW continues to provide an effective mechanism for the application of developments in science and technology in operations of NMHSs as well as for the WMO and co-sponsored programmes. Congress recognized the opportunities new science and technologies offer the WWW and encouraged Members to continue working with the private sector to rapidly implement those which provided increased efficiency and new capabilities. In this connection, Congress noted with satisfaction the RA VI (Europe) initiative to organize a technical conference on interaction with the private sector and requested the Secretary-General to identify resources needed to organize it in the near future. Congress stressed the need to ensure that support for the WWW Programme reflects the highest priority attributed to that Programme and is sufficient to carry out its important activities in order to fulfil and sustain the core activities of the Organization. It agreed on the purpose, scope and main long-term objectives of the WWW and adopted Resolution 1 (Cg-XVI) – World Weather Watch Programme for 2012–2015.

3.1.0.4 Congress noted that CBS had reviewed its specific Terms of Reference, with guidance provided by the Executive Council, and had recommended amendments to its Terms of Reference. Congress adopted Resolution 2 (Cg-XVI) – Terms of reference of the Commission for Basic Systems, which provides these amended Terms of Reference.

WWW System Support Activities (WWWSSA)

3.1.0.5 Congress requested the Commission for Basic Systems and the regional associations to continue identifying gaps in the implementation and operation of the WWW, and defining guidelines for the allocation of priorities in support of the implementation of WWW component systems to allow Members to provide required services to users. In this respect, it encouraged the establishment of a two-way communication mechanism for improving the strategic level coordination and feedback between the Commission for Basic Systems and the regional associations. Congress requested the Secretary-General, in collaboration with Members and funding agencies, to give a high priority to resource mobilization for supporting the implementation and operation of the WWW, in particular for mitigating the deficiencies observed.

3.1.0.6 Congress noted with appreciation that the technical advisory services provided in the form of expert missions, guidance materials and meetings in the framework of the WWW system support activities contributes to the development and improvements of the WWW components. It stressed the importance to continue providing such technical advisory services.

3.1.0.7 The CBS software registry provides information to Members on the software packages offered by individual Members through the WMO Web server. Since the efficiency of the World Weather Watch is highly dependent on computer-based applications and systems for its operation, Congress invited WWW centres to consider offering meteorological application software for free exchange among Members and to provide relevant updates to the 2006 edition of the CBS software registry.

3.1.0.8 Congress recalled that the objective of the WWW Operational Information Service (OIS) is to collect from, and distribute to, WMO Members and WWW Centres detailed and up-to-date information on facilities, services and products made available in the day-to-day operation of the WWW. Congress was pleased to note that the updated operational information is available on the WMO server. Since the overall efficiency of the OIS depends on the prompt notifications of changes and updated information from NMHSs, Congress stressed the importance for all Members to continue reviewing the operational information and updating it as required.

3.1.1 Global Observing System

3.1.1.1 Congress noted with appreciation that through the further integration of the surface and space-based components of the Global Observing System (GOS), the WMO Integrated Global Observing System (WIGOS) initial integration activities, as well as through coordinated efforts of Members, GOS continued to provide unique and sustainable observational data and information on the state of the Earth and its atmosphere to meet evolving requirements of various users. It agreed that along with the increasing amount of satellite data and services, further improvements were achieved globally in the quality and availability of data produced by other components, notably marine and aircraft-based observations.

3.1.1.2 Congress also noted that the implementation of stations and the availability of reports from RA I Regional Basic Synoptic and Climatological Networks (RBSN/RBCN) still remain low, and agreed that a concentrated effort on the part of the international community is needed to assist RA I Members in implementation and operation of RBSN/RBCN stations. Congress further noted that the reduced availability of, especially, upper-air data over Region I has a negative impact on the quality of medium-range forecast products over all Regions, not just over Region I itself. Congress was also informed that the availability of RBSN/RBCN reports from RA V was also low and this also resulted in impacts beyond the Region itself. Improving report availability in RA V also needs to be addressed.

3.1.1.3 Congress reaffirmed the importance of satellite systems on geostationary and on low-Earth orbits as a unique source of observational data, to be fully integrated into the WMO Global Observing System, while noting that satellite matters were addressed under agenda item 3.7.

3.1.1.4 Congress recognized the increased need for marine meteorological and other appropriate oceanographic observations to address the requirements of the Global Framework for Climate Services (GFCS), and urged Members to provide resources towards the further development of the global ocean observing system. It requested the Secretary-General to facilitate a systematic survey of marine meteorological and oceanographic observations to assess the strength and weaknesses of Member countries thus allowing interested Members to provide targeted assistance to those in need. Considering the substantial benefits expected for all parties in strengthening the partnership between developed countries and developing countries with regard to the implementation of the ocean observation systems, and the use of the collected data, Congress requested developed countries to consider providing support to capacity-building workshops and other technical capacity-building activities related to ocean observation systems to be organized by JCOMM within the JCOMM Partnership for New GEOSS Applications Concept (PANGEA).

3.1.1.5 Congress welcomed that the evolution of the global observing systems was systematically adapted to user requirements and observing systems' capabilities and was coordinated with Members so that it can provide the best possible value for investment. In this regard, the Rolling Review of Requirements (RRR) expanded to cover new application areas and the Observing System Experiments (OSEs) and Observing System Simulations Experiments (OSSEs) addressed new impact studies. In this context, Congress noted that Members will take into account the cost of individual observing systems, particularly radiosounding systems, in the design of their national or regional observing networks. The Fifth Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction, to be held in the United States in 2012, will assist in addressing this issue.

3.1.1.6 Congress requested CBS to consider adding new application areas to RRR that are important from the WIGOS and climate perspectives, such as Polar Meteorology, including cryosphere, the global carbon cycle and Space Weather. Congress welcomed the decision of CBS to address the evolution of global observing systems in general and to rename the Expert Team for Evolution of the GOS to the Expert Team for Evolution of Global Observing Systems. In this regard,

it noted development of the new implementation plans for the evolution of global observing systems and underlined the necessity that the new plans take into account not only the newly approved Vision for the GOS in 2025 and also WIGOS, GFCS and GAW and GCW developments. Congress noted that the CBS strategy for the evolution and future hosting of WMO databases of observational user requirements and observing systems' capability is addressing sustainable solution of further development and maintenance of the RRR Database.

3.1.1.7 Congress welcomed CBS activities in support of the WMO Polar activities, while noting that WMO Polar activities were addressed under agenda item 11.9.

3.1.1.8 Congress noted the increased importance of aircraft-based observations for a cost-effective GOS, especially after implementation of reliable water vapour sensor into AMDAR sensor suite. Together with GPS Radio-occultation techniques, this would allow contribution to the optimization of the upper-air observing network. In this regard, Congress appreciated that the WMO Secretariat took over the responsibility for technical coordination of AMDAR activities, through a staff position currently supported predominantly from the AMDAR Trust Fund. It requested Members to continue providing support to the AMDAR Trust Fund and the Secretary-General to consider, in future, funding this activity from the WMO Regular Budget.

3.1.1.9 Congress supported establishment of an international forum of users of satellite data telecommunication systems covering a wide user base, and to address remote data communication requirements – including tariff negotiations as needed – for automatic environment observing systems coordinated through WMO and partner organizations such as IOC and FAO. Congress requested the Secretariat to approach the partner organizations, and coordinate with the Argos Joint Tariff Agreement (JTA) with the view to establish such a forum during the next intersessional period. Congress emphasized that such a forum should not only consider tariff negotiations but should take a very broad view of available technologies, options and prices as well as cooperative mechanisms through the Data Collection Platform (DCP) services of meteorological satellites.

3.1.1.10 The Congress expressed its concern about the significant occurrence of intentional or unintentional damage to platforms used for ocean observation and marine scientific research, such as moored buoys essential for climate monitoring and storm surge and tsunameters and tide gauges necessary for tsunami early warning, and discussed this issue further in the Marine Meteorology Programme (agenda item 4.4).

3.1.1.11 Congress reaffirmed that GOS should continue its fundamental mission in providing, through coordinated efforts of Members, timely, reliable and consistent meteorological data to meet the national, regional and global requirements. It emphasized that GOS would become one of the core components of the WIGOS and that implementation of WIGOS would build upon and add value to it in fulfilling requirements of WMO and WMO co-sponsored Programmes in an effective and efficient way. In view of the growing significance of the GOS operations, Congress adopted Resolution 3 (Cg-XVI) – Global Observing System.

3.1.2 The Global Telecommunication System and Data Management as components of WMO Information System

Global Telecommunication System (GTS)

3.1.2.1 Congress noted with appreciation the progress on the Improved Main Telecommunication Network (IMTN) with the merging of the two IMTN clouds. It noted that as most MTN centres are now on the IMTN cloud and that the others have plans to join the cloud, the IMTN project is now completed. It noted the significant progress in the regional networks and that the migration to IP was almost complete. However, it was concerned that serious shortcomings still existed in some WMO Regions. Congress emphasized the importance of continued improvement of the regional component of the GTS to underpin the meteorological services of each Member, as

well as to enable the implementation of WIS and WIGOS, and other new initiatives of WMO, such as the Global Framework for Climate Services (GFCS). It urged Members and regional associations to sustain their commitment in this effort and to take effective actions to modernize their national and regional data-collection systems, especially to get as many NMCs as possible connected to the GTS. It encouraged the Secretary-General to focus on improvement of the GTS, especially in developing and least developed countries, when implementing capacity-building and disaster risk reduction actions for the next financial period.

3.1.2.2 Congress recalled that CBS had agreed that the IMTN, now connecting the main RTHs of the GTS, will form the core network of WIS providing any-to-any connectivity among all GISCs. It also recalled that CBS had defined the network connecting Data Collection or Production Centres (DCPCs) and National Centres (NCs) to each GISC as the GISC's Area Meteorological Data Communication Network (AMDCN). Each GISC will take a leading role in ensuring the effectiveness of its AMDCN so that each connected centre can take advantage of more reliable, cost-effective and sustainable managed data communication networks. Congress noted that this new two-level network structure incorporating the GTS will enable further optimization of operational arrangements for global and regional data exchange, especially improving the timeliness of end-to-end delivery of warning messages.

3.1.2.3 Congress requested CBS to further refine the new structure of GTS, and to pursue a smooth evolution of networks and related applications, such as Automated Message Switching Systems, from the current point-to-point topology to the two-level managed data communication network service architecture. In particular, Congress requested CBS to further explore the potential efficiencies from multicast and related services available in the new architecture. Congress noted that innovative administrative and financial arrangements and partnership were required to share and take full benefit from those new network services, and invited NMHSs to work with their associated GISC and to be as flexible as possible in that regard, taking account of respective national policies.

3.1.2.4 Congress noted with appreciation that the satellite-based data distribution services continue to be an important component of GTS for the distribution of large volumes of information, and that there had been extensive implementation and significant technological upgrades. Furthermore it noted that some satellite systems also provide a data collection service. It urged NMHSs to consider taking advantage of this new service in designing their new observing and warning systems. Congress expressed its gratitude to all Members and organizations operating satellite-based meteorological data distribution and collection systems for the benefit of all NMHSs.

3.1.2.5 Congress noted that the Internet had continued to play an increasingly important role for access to and delivery of a wide-range of data and products and as a complement to dedicated circuits for the GTS, with particular importance for smaller NMHSs. Congress recalled the complementary role of the GTS dedicated circuits, GTS circuits implemented across the Internet and of the Internet itself to meet the various operational and other needs and to ensure overall robustness of the system. It welcomed CBS's effort in updating the technical guidance for the efficient use of the Internet with minimized operational and security risks. Congress emphasized that as the Internet is necessary for the WIS information Discovery, Access and Retrieval (DAR) service, it is essential that the Internet guidance developed by CBS reflect the new WIS functionality and should include recommended practices for user authentication and authorization. Noting the risks associated with the Internet usage, Congress requested CBS to pay particular attention to Internet security and continue to review and update related practices, procedures and guidelines. Congress approved the relevant CBS recommendation for amendments to the *Manual on the Global Telecommunication System* and adopted Resolution 4 (Cg-XVI) – Report of the extraordinary session (2010) of the Commission for Basic Systems relevant to Technical Regulations concerning the Global Telecommunication System, data management and the WMO Information System.

WWW Data Management

3.1.2.6 Congress noted the significant effort made by many Members to successfully meet the deadline of migration to Table-Driven Code Form (TDCF), and the significant support provided by CBS experts. It recalled that the 2010 target for migration of the data category 1 (SYNOP, TEMP, PILOT and CLIMAT) had not been fully met. It endorsed the EC-LXII invitation for CBS to consider measures with a view to ensuring that all WMO Members continue accessing the observational data available on the GTS in the appropriate format as well as to facilitate and foster the migration from TAC to TDCF. Congress supported the decision by CBS that after November 2010 the parallel distribution of TAC and TDCF category 1 data as well as the category 2 (satellite observations) and 4 (marine data) may continue and will be discontinued step by step whenever possible with respective advance notification by November 2014. It stressed the need for assistance to some developing countries in implementing the migration, and expressed its gratitude to those Members and organizations that had made available their TDCF converter software or contributed to relevant training workshops to complete this task.

3.1.2.7 Congress noted the efforts led by CBS, with participation of relevant technical commissions, in further developing the WMO Core Profile of the ISO 19115/19139 metadata standard. Recalling that EC-LVIII assigned the presidents of technical commissions the responsibility for the management of WMO metadata, Congress requested the Secretariat to publish it as WMO Core Profile of ISO metadata standard version 1.2 on the WIS web page (http://wis.wmo.int/2010/metadata/version_1-2/) after the endorsement of the presidents of technical commissions. Congress noted that CBS identified the need for interim releases of the WMO Core Profile in order to respond to the evolving needs of other technical commissions and cross-cutting Programmes. Congress agreed that the Secretariat should publish the interim releases and ensure compatibility with previous versions. Congress emphasized the need to assist NMHSs in implementing metadata generation and exchange, and decided that CBS should develop recommended practices, procedures and guidelines for operation, including training.

3.1.2.8 Congress was pleased to note that a Memorandum of Understanding (MoU) between WMO and the Open Geospatial Consortium (OGC) was signed in November 2009. This partnership is important for the development and use of relevant international standards for the WIS. It invited all technical commissions to join their efforts in these activities, in particular with a view to developing a WMO conceptual model of data representation and further developing the WMO Core Profile of the ISO 19100 standards for metadata. Congress particularly stressed the importance to ensure the interoperability of different data representation systems (e.g. WMO TDCF, XML-based, NetCDF, HDF) used, or planned to be used, for the exchange or access of weather, climate and water information within and outside the WMO community.

3.1.2.9 Congress approved the relevant CBS recommendations for amendments to the *Manual on Codes* and adopted Resolution 4 (Cg-XVI) – Report of the extraordinary session (2010) of the Commission for Basic Systems relevant to the Global Telecommunication System, data management and Technical Regulations related to the WMO Information System.

Climate Data Management

3.1.2.10 Congress emphasized the important work being undertaking by CCl and WCP for ensuring that high quality climate data is available to develop high quality climate monitoring products, climate assessments, research and climate services. It noted with appreciation the involvement of CCl in developing new and modern climate data management systems which take into consideration the WIS architecture and WMO and ISO standards for data and metadata exchange. It requested CBS and CCl to further strengthen this collaboration based on identified needs of the Members and on the user requirements for improving climate data interoperability.

Operational Information Service related to Information System and Services

3.1.2.11 Congress noted the migration plan for transition from the catalogue of meteorological bulletins (Volume C1) to WIS Discovery, Access and Retrieval (DAR) metadata catalogue. The transition plan indicates that RTHs will continue to maintain Volume C1 using existing procedures in parallel with providing updates to the WIS DAR metadata catalogue. Volume C1 will be considered the primary source of this information until 2015.

3.1.2.12 Noting that several MTN centres had not implemented the maintenance of their parts of Volume C1 and/or had not provided updates of their routeing catalogue, Congress urged Members operating these centres to fully implement the standard procedures for the maintenance of Volume C1 and the recommended practices for updating the routeing catalogues.

3.1.2.13 Noting the deficiencies in the updating and presentation of Volume C2 of WMO-No. 9 – Transmission Programmes, Congress requested that WMO Members review the contents of Volume C2 and send amendments to the WMO Secretariat as required. Congress emphasized that failure to adhere to the agreed GTS practices negatively impacted on other NMHSs causing loss of data and products essential to their operations.

Radio Frequency Coordination

3.1.2.14 Congress appreciated the substantial efforts made by Members, CBS and the Secretariat in protecting the radio frequency bands allocated to meteorological systems and environmental satellites. It urged all Members to ensure continuous coordination with their national radio communication authorities and to actively participate in the national, regional, and international activities involving radio communication regulatory issues for meteorological and related activities. It encouraged all Members to use as a reference the new joint International Telecommunication Union (*ITU)–WMO Handbook Use of Radio Spectrum for Meteorology: Weather, Water and Climate Monitoring and Prediction,* freely available online (ITU/WMO *Handbook on Use of Radio Spectrum for Meteorology: Weather, Water and Climate Monitoring and Prediction* http://www.itu.int/publications/publications.aspx?lang=en&media=electronic&parent=R-HDB-45-2008) in all official languages of WMO.

3.1.2.15 Congress strongly urged Members to start early preparations at national level of active participation in the ITU World Radiocommunication Conference 2012, including participation in events organized by regional radio communication organizations.

3.1.2.16 Congress noted the statement delivered by the president of Regional Association VI on behalf of 30 Members of WMO expressing concern at the increasing threats to the parts of the radio spectrum utilized for meteorological purposes. Congress recalled Resolution 4 (Cg-XV) and agreed that the protection of frequencies used for meteorological purposes is of direct and vital interest to the international meteorological community and reiterated its full support for radio-frequency activities. Congress further agreed that a clear, strong and knowledgeable involvement, from all Members and relevant WMO bodies including regional associations, technical commissions and the Secretariat, is essential to the efforts and commitments already made by NMHSs under Resolution 4 (Cg-XV). It urged the pursuance of, in an organized manner, the continuous review of regulatory and technical matters related to radio-frequencies for operational and research meteorological and related environmental activities. Congress requested the Secretary-General to give the requisite high level of priority to this subject, enhancing the Secretariat support and re-allocating the core budget to ensure both coordination among Members and relevant body representation of WMO in the international frequency management process (mainly ITU-R) during the 2012–2015 period.

3.1.2.17 Congress noted that following the recommendation by CBS, the Secretary-General had established a voluntary trust fund on radio frequency coordination (RFC Trust Fund) to secure additional support to WMO representation in radio frequency management process. It encouraged

Members to contribute to the RFC Trust Fund and/or make in-kind contributions and secondments to support WMO radio frequency coordination for the benefit of all Members.

Development of WIS Technical Regulatory Documents

3.1.2.18 Congress noted with appreciation the leading role of CBS in the technical development of WIS, and the critical role of the Intercommission Coordination Group on WIS (ICG-WIS) as a coordination mechanism spanning across WMO Programmes and technical commissions, as well as across global and regional levels.

3.1.2.19 Congress recalled its previous emphasis in 2007 on the need for appropriate technical regulatory documentation for facilitating the implementation by Member countries at global, regional and national levels. Congress noted with satisfaction the progress made by CBS and ICG-WIS on the development of this technical regulatory documentation in the intersessional period and noted that CBS-Ext.(10) (November 2010, Namibia) had reviewed and endorsed the draft amendments to the *Technical Regulations* (WMO-No. 49), Volume I – General Meteorological Standards and Recommended Practices, Section A.3, and the draft of the *Manual on the WMO Information System* (WMO-No. 1060) as Annex VII to the *Technical Regulations* (WMO-No. 49), Congress approved those amendments with the adoption of Resolution 4 (Cg-XVI) – Report of the extraordinary session (2010) of the Commission for Basic Systems relevant to the Global Telecommunication System, data management and Technical Regulations related to the WMO Information System. It agreed that the Manual on WIS be a mandatory publication.

3.1.2.20 Congress noted the progress on the *Guide to WIS* (WMO-No. 1061) and requested CBS to continue and complete this effort. It emphasized the need for additional components including a “best practices for metadata management” and appropriate training material. It noted that due to the requirement for all Members to benefit from WIS, the *Guide to WIS* should also be made available in all official languages.

3.1.3 Global Data-processing and Forecasting System (GDPFS), including Emergency Response Activities (ERA)

Description, goals and objectives

3.1.3.1 Congress recalled that the Global Data-processing and Forecasting System (GDPFS), which is part of the World Weather Watch (WWW) Programme, represents the function of weather and seasonal climate forecasting, including the production of weather and climate analyses, forecasts, specialized forecast products, and alerts, advisories and warnings of severe weather for the protection of life property, and livelihoods. It also includes the network of operational meteorological centres that operate a wide range of numerical weather prediction (NWP) systems that is a part of a global early warning system for meteorological and environmental hazards. The GDPFS and ERA programmes collaborate with the developments in the WMO Information System (WIS) and the WMO Integrated Global Observing System (WIGOS), and with the Tropical Cyclone Programme (TCP), the World Climate Programme (WCP) and the World Weather Research Programme (WWRP) in weather, climate and environmental predictions and applications.

3.1.3.2 Congress noted that the outputs of the GDPFS enable Members to meet their diverse service provision requirements including: immediate meteorological support to emergency management organizations, routine weather forecasts and warnings for the general public and for air traffic operations, environmental predictions such as sea-state or air quality, products that create economic advantage for Members, tailored products and services to different economic sectors. The GDPFS aims to provide ever more relevant, reliable, and quality-assured NWP products spanning forecast ranges from the immediate to long-term, and from local to global scales. Notwithstanding the great improvements in NWP, Congress noted that there was still considerable improvement needed in NWP accuracy and usefulness in the tropical areas, particularly in the handling of convection over tropical oceans. Noting that the accuracy and

usefulness of NWP depend critically on the quality and reliability of all observational data and other information for both NWP data-assimilation and for verification of forecast products, Congress requested the Secretary-General and CBS to develop a strategy to assist Members in the implementation of improved high-resolution regional NWP including data assimilation.

3.1.3.3 Congress reaffirmed that the GDPFS contributes to many of the WMO's high priorities: (i) through a network of centres that carry out seasonal forecasts that are important for the development of the next generation of climate services; (ii) through contributions to disaster risk reduction through the Severe Weather Forecasting Demonstration Project (SWFDP) and in the use of Ensemble Prediction Systems (EPS); (iii) through the use by ERA of applications of NWP for atmospheric transport and dispersion modelling contribute to disaster risk reduction; and (iv) through the provision of benefits to other socio-economic sectors, including aviation, agriculture, and marine safety.

3.1.3.4 Congress concurred that the GDPFS should continue to develop under the responsibility of the Commission for Basic Systems (CBS), with a focus on operationalization of the following key areas: Severe Weather Forecasting, Very-Short-Range Forecasting, Probabilistic Forecasting and Ensemble Prediction Systems, Long-Range Forecasting, and NWP Verification. Additionally Congress noted that the GDPFS should continue to participate in coordinated training and capacity-building activities and that the ERA should continue to provide high quality meteorological support to nuclear and non-nuclear environmental emergency response.

3.1.3.5 Congress noted that recent disasters have demonstrated the robustness of the operational systems that have been in place over time, under the leadership and coordination of the GDPFS. It agreed that the GDPFS is a critical component of a multi-scale (in space and in time) end-to-end system, from observations to service delivery, which is fundamental for disaster prevention and mitigation.

Severe Weather Forecasting Demonstration Project (SWFDP)

3.1.3.6 While the scope of the GDPFS spans the production of day-to-day weather forecasts, Congress agreed it should give priority to the forecasting of severe and high-impact weather, and related phenomena, over a wide-range of forecast timescales.

3.1.3.7 Recalling that Cg-XV had approved a vision for improving severe weather forecasting in developing countries, and noting with satisfaction that many NMHSs of developing countries have been benefiting from their participation in two current regional Severe Weather Forecasting Demonstration Projects (SWFDP), in southern Africa and in the South Pacific Islands, respectively, Congress anticipated similar benefits from the two other projects in development for Southeast Asia and Eastern Africa. Through the implementation of a "Cascading Forecasting Process", an approach that provides improved access to, and effective use by forecasters of NWP/EPS products made available by advanced GDPFS Centres, national warning services have improved significantly, with increased lead-times and greater reliability.

3.1.3.8 Congress therefore approved a vision for the SWFDP as an end-to-end, cross-programme collaborative activity led by the GDPFS, in which the participants in the Projects:

(a) Make best possible use of all existing and newly developed products and facilities at the global, regional and national levels, including high-resolution NWP and ensemble prediction products, and very-short-range forecasting, including nowcasting, tools;

(b) Establish sustainable services of reliable and effective early warnings tailored to the needs of the general public and a wide range of socio-economic sectors in LDCs, SIDSs and developing countries;

(c) Ensure a continuous improvement cycle and quality assurance of services, including efficient and responsive feedback loops between the NMHSs and the end users at the national level.

3.1.3.9 The SWFDP should therefore engage all WMO Programmes that concern the real-time prediction of hydrometeorological hazards, through their respective technical commissions, from observations, to information exchange, to delivery of services, education and training, and to the transfer of relevant promising research outputs into operations.

3.1.3.10 Recognizing the significant benefits already accrued from the SWFDP that has been implemented in Southern Africa and expanded to the Southwest Pacific, Congress requested the Commission for Basic Systems (CBS) to continue to give high priority and leadership to the implementation of the SWFDP and its expansion in all WMO Regions. Congress acknowledged the importance of continued project-critical support from advanced centres that provided NWP and satellite-based products, as well as the roles played by the Regional Centres and commended these centres for their enthusiastic participation in SWFDP regional projects thus far and strongly encouraged them to continue these efforts.

3.1.3.11 Congress also recognized that a significant increase of resources is required to support multiple and simultaneously running projects, including crucial regular training, commitments made by the participating centres, coordination and support by the Secretariat. It therefore acknowledged that its direction to expand the SWFDP could only be realized with appropriate extrabudgetary contributions to augment the regular budget allocations. Congress supported the extension of the SWFDP to further applications, as indicated in the WMO budget proposal.

3.1.3.12 Congress agreed that the SWFDP should be maintained and supported as an important model for enhancing Members' disaster risk reduction and service delivery programmes, and therefore requested the Executive Council to continue to guide the cross-programmatic integration in the SWFDP, including engagement of users, addressing regional needs, and creating sustainable transitions to operations of SWFDP outcomes.

Very short-range forecasting

3.1.3.13 Congress, recognizing the continued development of limited-area, very high-resolution NWP systems, and the importance of real-time observational data for tracking and forecasting the imminent arrival of severe weather or weather-related hazards (e.g. flash floods), requested CBS to increase its attention on applications of NWP systems in very short-range forecasting (predictions for up to 12 hours), in combination with "Nowcasting" methods (forecasts for the next few hours, largely based on combined processing and extrapolation of weather radar and/or satellite data). Noting that the improved accuracy of very short-range forecasting systems, including nowcasting, needs to be complemented by effective and timely communication of forecasts and warnings, Congress requested CBS to promote continued collaboration between the PWS and the GDPFS in deriving the maximum societal benefit from the technical advances in this area.

Probabilistic forecasting and Ensemble Prediction Systems

3.1.3.14 Congress noted significant advances made by several Members in Ensemble Prediction Systems (EPS), whose outputs provide the most important basis for a probabilistic approach to weather forecasting, in all timescales, including short- and very short-range forecasting. These products, used in conjunction with high-resolution deterministic NWP outputs, represent an enhanced forecasting strategy, especially for predicting severe weather events, with longer forecast lead-times. Congress encouraged Members to propagate probabilistic forecasts of important meteorological and other weather-related parameters into impact models, such as in flash floods and coastal flood forecasting.

3.1.3.15 Congress encouraged suitable training be provided to trigger a fundamental change in thinking by both weather forecasters and users (e.g. disaster management organizations) whereby alerts of severe weather would become more probabilistic in nature to represent the risks associated with severe and high-impact weather. Congress requested CBS and other relevant technical commissions to collaboratively address this issue.

Extended- and Long-range forecasting

3.1.3.16 Congress noted CBS and CCl collaborated in the designation of Global Producing Centres (GPC) and Lead Centres (LCs for verification, and for multi-model ensemble) for Long-range Forecasts, and of Regional Climate Centres (RCC), and urged these Commissions to continue the development of the WMO climate services network, including the expansion of the RCCs and RCC-Networks in close coordination with the GPCs and the regional associations.

3.1.3.17 Congress requested GPCs and associated LCs to play a key role in development of the Climate Services Information System (CSIS) component of the Global Framework for Climate Services (GFCS), including assisting in the preparation of WMO Global Seasonal Climate Updates (GSCU). Congress requested GPCs and associated LCs to help improve the capacity of NMHSs from developing countries and LDCs in long-term prediction and its application, through sharing products supported by technical training.

3.1.3.18 Congress noted with appreciation that the twelve GPCs have been actively contributing seasonal forecast data to the LC-LRFMME, which has been jointly operated by KMA and NOAA/NCEP, and the LC-LRFMME products are in use at RCCs, RCOFs and NMHSs. Noting that a number of GPCs have been or are developing operational monthly forecasts systems, Congress requested the LC-LRFMME to explore the possibility of extending its role to include exchange of extended-range predictions. In this context, all GPCs were invited to also provide data from their monthly forecast systems so that the LC-LRFMME would be able to provide sub-seasonal forecast products through the LC-LRFMME web pages. Congress requested CBS, in collaboration with CCl, to develop a set of minimum forecast and verification products, data exchange protocols, and revised roles and functions of the LC-LRFMME, starting with the provision of hindcast and forecast surface data, aiming to extend this to other variables in due course.

3.1.3.19 Congress also envisioned that some GPCs could play an important role in providing global climate predictions from seasonal to longer timescales, and therefore requested CBS, in coordination with CCl and the WCRP, to coordinate international collaboration in, and review research on initialized predictions for timescales longer than seasonal scales and evaluate the potential for operational predictions. Congress welcomed the offer by the UK Met Office Hadley Centre to continue the coordination of experimental decadal forecasts.

NWP forecast verification

3.1.3.20 Congress reaffirmed that NWP forecast verification activities are critical to quality assurance and management of the outputs of the GDPFS, and some “core” verification activities should be defined and considered as essential, and their results be made available for use by operational centres. Therefore, Congress requested the NWP verification Lead Centres, including ECMWF for Deterministic NWP, JMA (Japan) for EPS, and NMOC (Australia) jointly with CMC (Canada) for Long-range Forecasts, to coordinate and facilitate “core” verification activities.

3.1.3.21 Congress emphasized the need for practical guidance to facilitate the implementation of NWP verification requirements and best practices, including those stated in the *Manual on the GDPFS*, so as to promote and ensure coordinated verification activities across these centres, and therefore requested all Lead Centres for NWP verification to assist in this regard.

Emergency Response Activities – atmospheric transport and dispersion modelling (ATM)

3.1.3.22 Congress encouraged the continued collaboration with the International Atomic Energy Agency (IAEA) as the lead UN agency for nuclear accidents and radiological emergencies, with the Preparatory Commission for Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) on meteorological aspects of Treaty Verification, and with other relevant international organizations on meteorological aspects of mitigating the major impacts of environmental emergencies related to airborne hazards, as examples, with the International Civil Aviation Organization (ICAO) for volcanic ash, and with the World Health Organization (WHO) on public health protection.

3.1.3.23 Congress noted the well-coordinated supply of useful radioactive atmospheric transport and dispersion prediction products by the RSMCs for Environmental Emergency Response (EER), arising from the Fukushima nuclear incident. Congress also noted the need for information on the interpretation of the prediction, and that the prediction maps should take into account the actual and accumulated emissions into the atmosphere. Congress therefore requested CBS to work with the IAEA and CTBTO to enhance the usefulness of these products, which should assist NMHSs in fulfilling their respective national responsibilities.

3.1.3.24 Congress considered that the nuclear emergency in Japan (March, April 2011) and the volcanic ash events in Europe (April, May 2010 and May 2011) represent important cases where the current collaboration with relevant international organizations (e.g. IAEA, WHO, CTBTO, ICAO, IMO) can be evaluated in order to benefit from the lessons learned. Congress requested the Secretary-General and CBS, in collaboration with other relevant technical commissions (e.g. CAeM), to take appropriate actions to review the existing procedures, taking advantage of similar activities carried out by relevant international organizations. In addition, noting that in such events, in the context of national disaster management practices there are issues associated with the provision of specialized meteorological information to the general public, including proper representation of this information. Congress requested CBS to review the EER procedures to strengthen these aspects in the *Manual on the GDPFS.*

3.1.3.25 Congress noted the successful collaboration with the IAEA on the development of a new IAEA Safety Guide, entitled: “Meteorological and Hydrological Hazards in Site Evaluation of Nuclear Installations”, which represented an important first step to the review requested by Cg-XV of the outdated WMO Technical Note 170, entitled: “Meteorological and Hydrological Aspects of Siting and Operations of Nuclear Power Plants”. This Safety Guide will act as an important guide to essential subject areas where technical methods and best practices should be updated in the revision of the WMO Technical Note. Congress also noted that several programmes and technical commissions should be involved in updating the Technical Note, and encouraged Members to consider nominating suitable experts to carry out this work.

3.1.3.26 The representative from the IAEA expressed its appreciation for the continued good cooperation with WMO, especially on the WWW’s programme on Emergency Response Activities (ERA). Congress noted that this collaboration was demonstrated in the most recent event in Japan to the benefit of all WMO Members and IAEA Member States.

Revision of the* Manual on the Global Data-processing and Forecasting System *(WMO-No. 485)

3.1.3.27 Congress noted the productive work of CBS experts in relation to the Global Data-processing and Forecasting System (GDPFS) as well as the Emergency Response Activities (ERA), including collaboration with other relevant technical commissions that have resulted in Recommendation 7 (CBS-Ext.(10)) to adopt amendments to the *Manual on the GDPFS* (WMO-No. 485). Congress adopted the CBS recommendation through Resolution 5 (Cg-XVI) – Report of the 2010 Extraordinary Session of the Commission for Basic Systems relevant to the Global Data-processing and Forecasting System, and Emergency Response Activities.

3.1.3.28 Congress, noting the importance of the *Manual on the GDPFS* (WMO-No. 485) as the single source of technical regulations and best practices for all operational data-processing and forecasting systems of Members, including their designated meteorological centres, endorsed the request by CBS-XIV (2009) to undertake a comprehensive review of this Manual. It noted the subsequent progress that has been made, including the development of an outline for a new Manual that will facilitate introducing updates as frequently as required to ensure that the content is kept up-to-date. Congress adopted the outline for a revised *Manual on the GDPFS* through Resolution 6 (Cg-XVI) – Revised *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485).

3.1.3.29 Congress further agreed that there were fundamental changes under way in the Basic Systems and that the review of the *Manual on the GDPFS* should be done with the existing system of world, regional and national centres of the GDPFS, and the future evolution of the GDPFS in mind, such as the inclusion of all WMO operated meteorological centres that provide operational data-processing and forecasting services (e.g. anticipated designation of regional centres for Sand and Dust Storm Warning Advisory Assessment System). As well, the review should take into account the developments in WIGOS and WIS, lessons learnt from SWFDP, and anticipated results of, and operational implications from the WWRP/TIGGE project “Global Interactive Forecast System”.

3.1.4 Instruments and Methods of Observation Programme

3.1.4.1 Congress recognized that quality observations that meet state-of-the-art practices, standards and traceability to the International System of Units (SI) were of paramount importance to meet the requirements of all WMO Programmes; to enable them to deliver the services required by Members and that the Instruments and Methods of Observation Programme (IMOP) and the Commission for Instruments and Methods of Observation (CIMO) played a major role in developing and providing the relevant guidance to Members. Congress urged Members to establish calibration laboratories and ensure traceability of their measurements to SI. Furthermore, Congress stressed that Regional Instrument Centres (RICs) and Regional Marine Instrument Centres (RMICs) should provide effective support to Members in ensuring the traceability of their standards and reaffirmed the need to regularly assess their capabilities making use of the evaluation scheme that was developed to this effect. It requested regional associations, in collaboration with CIMO, to monitor these evaluations to ensure RICs and RMICs meet the requirements of the Regions. Congress also requested CIMO and JCOMM to support the further strengthening of RICs and NMHS calibration laboratories, particularly with respect to the technical calibration procedure estimating the uncertainties of the calibrations performed.

3.1.4.2 Congress recognized that the WMO *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8) (CIMO Guide) was the main source of information used by Members to standardize instrument performances and guarantee the quality of observations. Congress was pleased that the seventh edition of the CIMO Guide was now freely accessible on the WMO Website, in English, and that the Commission had set up a CIMO Guide Editorial Board. Congress was also pleased to note that CIMO had approved amendments to the CIMO Guide at its fifteenth session. Congress requested CIMO to put high priority on the development of standards under the WIGOS framework and on the regular update of the CIMO Guide. Congress also requested CIMO to promote the visibility of Instruments and Observing Methods (IOM) reports and to contribute to the development of a user-friendly direct access and on-line search tool for the CIMO Guide and other related WMO regulatory material that would help Members in accessing the information needed to improve and standardize their networks according to WIGOS requirements.

3.1.4.3 Congress noted that it had not been possible to identify funds to translate the CIMO Guide into other languages despite Resolution 26 (Cg-XV) on mandatory publications. As it is an essential source of information for Members, especially of developing and least developed countries, to operate their observing networks according to agreed standards and best practices, Congress strongly requested the Secretary-General to find necessary resources and also

encouraged Members to volunteer to translate the CIMO Guide into other languages and to provide financial contributions to the CIMO Trust Fund or Publication Fund for this work.

3.1.4.4 Congress welcomed the increased collaboration that took place between WMO and the International Bureau for Weights and Measures (BIPM) and the International Organization for Standardization (ISO) that were of particular relevance to improve data quality in the context of WIGOS and for providing effective support to GFCS. Congress appreciated the interest of ISO in developing the siting classification for observing stations into a common WMO/ISO standard and supported this initiative that is instrumental in assessing the quality of observations originating from various networks contributing to WIGOS and in further quality improvements towards better interoperability of data from various WIGOS observing component networks, including co-sponsored and non-WMO networks. Congress agreed that this would be significant for the monitoring of climate variability and change. In view of the costs that may be encountered by Members to implement new standards, Congress recommended that a careful examination of the scientific grounds and cost benefit was needed before a standard is made mandatory for use.

3.1.4.5 Congress noted that CIMO, together with the Commission for Basic Systems (CBS), will take a leading role for the implementation of WIGOS. Congress appreciated that CIMO designated Testbeds and Lead Centres and agreed they would have a significant impact within WIGOS, as they will contribute to the improvement of the quality of observations and to the interoperability of observing systems, in particular the remote-sensing observing systems. Congress requested CIMO to closely monitor their outputs and findings and to organize the wide dissemination of relevant information through inclusion in appropriate WMO documents.

3.1.4.6 Congress appreciated the large efforts made by CIMO in terms of instrument intercomparisons in organizing four major intercomparisons in the intersessional period. Congress commended CIMO for embarking on an Intercomparison of Solid Precipitation Measurements in view of its high relevance to climate monitoring and on intercomparison of weather radar algorithms to specify the quality of radar products, such as Quantitative Precipitation Estimation. Congress further encouraged CIMO to carry out intercomparison activities, such as on the quality of lightning products, visibility, clouds, and more. Congress requested that the results of these intercomparisons be widely disseminated.

3.1.4.7 Congress reiterated the need to organize capacity-building activities of Members related to IMOP, such as the conduction of specific training workshops for developing countries, as well as the organization of Technical Conferences on Meteorological and Environmental Instruments and Methods of Observation that attract large numbers of participants and benefit both developed and developing countries.

3.1.4.8 Congress adopted Resolution 7 (Cg-XVI) – Instruments and Methods of Observation Programme.

3.1.4.9 Following the request from Cg-XV to elaborate the underpinning/cross-cutting roles and responsibilities of CIMO in the context of WIGOS, CIMO-XV adopted Recommendation 2 “Terms of Reference of the Commission for Instruments and Methods of Observation” which proposes new Terms of Reference for the Commission. The revised Terms of Reference clarify how CIMO will collaborate with other technical commissions in matters related to the international standardization, interoperability, and sustainability of instruments and methods of observation in support of WMO cross-cutting activities, such as WIGOS and GFCS.

3.1.4.10 Congress noted the report of the fifteenth session of CIMO and appreciated the significant progress made in the standardization of instruments and methods of observation, in assessing instrument capabilities, and towards capacity-building in developing and least developed countries. Congress was pleased that CIMO had adopted a vision statement and had reviewed its working structure with a view to best meeting the requirements of WMO priority activities.

Congress adopted Resolution 8 (Cg-XVI) – Report of the fifteenth session of the Commission for Instruments and Methods of Observation.

3.1.4.11 Congress appreciated the excellent cooperation developed between CIMO and JCOMM in the development of the JCOMM Pilot Project for WIGOS through the participation of CIMO in the Joint WMO-IOC Steering Group for the IOC Ocean Data Portal (ODP) and the JCOMM Pilot Project for WIGOS. This effort resulted in the proposal for the establishment of a network of WMO-IOC Regional Marine Instrument Centres (RMICs), agreed through Recommendation 1 (JCOMM-III). Congress adopted Resolution 9 (Cg-XVI) – Designation of Regional Marine Instrument Centres, subject to a parallel approval by the twenty-sixth session of the IOC Assembly.

3.1.4.12 Congress recognized the opportunities for closer coordination between CIMO and CBS. Congress requested the presidents of CIMO and CBS to work together to identify areas where mutual benefit would be seen through closer coordination and collaboration.

3.1.4.13 Congress stressed that IMOP was vital to all other WMO Programmes as it provided the guidance to Members for making quality observations on which all programmes rely. Congress recognized that for many years the Secretariat support to IMOP has been insufficient, and requested the Secretary-General to consider adding more staff to remedy this situation.

3.1.4.14 Congress noted that in the context of the RA II Pilot Project to Enhance the Availability and Quality Management Support for NMHSs in Surface, Climate and Upper-air Observations, it was found that the main factors adversely affecting the data quality in the Region were the insufficient calibration and maintenance of observing instruments. Therefore, Congress recommended that education and training should be a priority in observations and should be followed-up through collaboration of CIMO and regional associations.

3.2 GLOBAL ATMOSPHERE WATCH PROGRAMME *(agenda item 3.2)*

GAW – General

3.2.1 Congress noted the approval by CAS of the Addendum to the Global Atmosphere Watch (GAW) Strategic Plan: 2008–2015, containing the updated tasks for the time period 2012–2015. The Addendum reflects the recommendations made by the EC Research Task Team in its report in June 2009 on “Challenges and opportunities in research to enable improved products and new services in climate, weather, water and environment” as endorsed by CAS-XV. WMO Members have long recognized the importance of atmospheric chemistry in their weather, climate and air quality programmes and activities. In its over 20-year existence GAW has evolved into a major WMO Programme implementing the Integrated Global Atmospheric Chemistry Observations (IGACO) strategy. The GAW Strategic Plan has guided the strategic direction of the programme since the first one was published in 1993. WMO Members and contributing partner organizations are invited to act upon the tasks specified in this Addendum and thus foster the implementation and success of GAW. CAS also recognized, at its fifteenth session, the need to strengthen interactions between the GAW Programme and WWRP. Congress urged its Members to ensure that the Working Groups, Expert Teams, and Science Advisory Groups of GAW and WWRP work collaboratively, as appropriate.

GAW Programme Areas

3.2.2 Congress recognized the importance of enhancing the three-dimensional atmospheric chemistry and related physical observations in GAW. Gaps in the GAW station network still exist in particular as regards tropical areas and northern wetlands. Congress requested Members to find ways to establish stations to fill these gaps, and welcomed the plans of the Russian Federation to seek GAW Global station status for the TIKSI station opened in August 2010. Congress also recognized the importance of expanding measurements to vertical profiles, column aircraft and

satellite measurements and near-real-time data delivery. With reference to total column greenhouse gas measurements, Congress noted that the Total Column Carbon Observing Network (TCCON) had joined GAW as a contributing network. It also noted that the GAW Aerosol Lidar Observation Network (GALION) switched from a purely research role into supporting operations during the Icelandic volcanic ash episode in April-May 2010. Congress further recommended that Members participate in appropriate regional initiatives to look for possibilities to further expand potential lidar applications for the monitoring and measurement of volcanic ash into the operational mode. Congress further encouraged Members to exchange such examples of best practice with other Members through the IUGG/WMO Volcanic Ash Scientific Advisory Group (VA-SAG). Observations also need to be strengthened to support multiple scale air quality prediction.

3.2.3 Regarding satellite measurements of atmospheric chemical constituents and related physical parameters, Congress recommended for GAW to set up an ad-hoc Task Team to review the needs for GAW regarding satellite measurements and the IGACO recommendations on these that date back to 2004. Congress further recommended for this work to be done in coordination with the CBS Expert Team on Satellite Systems (ET-SAT) and the Expert Team on Evolution of the Global Observing Systems (ET-EGOS), the Committee on Earth Observation Satellites (CEOS) Atmospheric Composition Constellation group and the Coordination Group for Meteorological Satellites (CGMS) and also taking into consideration GCOS requirements and the vision for the GOS in 2025. Congress highlighted that the required coverage, precision, spatial and temporal resolution called for geostationary and low earth orbit observation capabilities to be implemented and sustained. Congress requested Members operating satellites to include atmospheric sensors of proven capability aboard future spacecraft, and to maintain continuous atmospheric composition measurements for as long as possible, making a selection of data available to all interested users. Congress recognized that such remote sensing observations are meaningful when they are combined with the in-situ observations to produce global three dimensional high resolution and high quality products. The importance of the in-situ observations by Members is not at all reduced by the presence of satellite and aircraft observations.

3.2.4 Near-real-time delivery of environmental data is an important component for instance in forecasting urban air pollution and for inclusion in weather prediction. Congress noted that GAW has been building capacity in this area through WIGOS/WIS pilot projects on near-real-time delivery of ozone and aerosol data and through the GAW Expert Team on NRT Chemical Data Delivery. Congress encouraged for these activities to continue and to be broadened beyond pilot projects.

3.2.5 Congress welcomed the effort of UNEP and WMO to publish an Integrated Assessment of Black Carbon and Tropospheric Ozone. The report shows that reducing the emissions of these two short-lived climate forcers and common air pollutants could slow the rate of climate change markedly over the next half-century. These substances also have harmful effects on human and ecosystem health, thus reducing them will also improve air quality. Congress stressed that this is not a substitute for addressing the long-term warming due to carbon dioxide build up, but a dual prong approach to address the short-term and long-term warming as well as the adverse impact on human health which is also highly meritorious on its own right. Congress encouraged that this work be continued and requested Members to establish appropriate observation and modelling activities in order to be able to deal with this new dimension of black carbon and tropospheric ozone question, to monitor compliance, whether applied measures are effective, and to monitor the eventual success of taken actions. GAW is the only programme to be able to provide this service on a long-term globally.

3.2.6 Congress noted the important collaboration that GAW has with regional and global networks, in particular EMEP, EANET and the NOAA Cooperative Air Sampling Network. WMO should lead a global partnership to link work on the regional/continental long-range transport of air pollution. Members should enhance day-to-day assessment of the long- (and very long-) range transport of air pollution, hindcast and scenario calculations.

3.2.7 Regarding the nitrogen cycle, Congress requested to increase atmospheric nitrogen containing species measurements, noting the recommendations by CAS that Members should support the analysis of the reactive nitrogen cycle with a view to advise and build capacity among the Member States in order to minimize reactive nitrogen loss to waterways and to the atmosphere. It further welcomed the initiative of extending the Working Group 38 of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) for three years in order for it to address nitrogen inputs into the oceans and the effect this has on carbon absorption into the oceans and thus the carbon cycle.

3.2.8 Congress was very pleased with the advancement of reactive gas observations in GAW and requested for Members to continue to support the enhancement of CO, VOC, NOx, NOy and tropospheric ozone measurements. Congress supported the development of a global assessment for major ions in precipitation, combining data from GAW and cooperative regional networks as well as input from simulation models. It noted that the problem of air pollution through deposition is not resolved globally and that large differences exist between regions as per the extent of this problem. It recommended for Members in affected areas to consider adding observational capacity. Congress also recommended GAW to take on board new compounds, such as for instance new replacement chemicals, that are needed to be followed in the atmosphere.

3.2.9 Congress recognized the importance of undertaking a technical analysis of how climate variability and change and air pollution interact both ways on a regional basis, and in combination on a global basis, as these are issues of immediate concern throughout the world affecting societies to an extent that is not well known but could be significant (air pollution events, droughts; water supply, food supply, etc.). It noted that GAW is in the right position to collaborate with regional efforts bringing them together globally.

3.2.10 Congress took note of the requirements expressed by some Members for capacity-building support in greenhouse gas data analysis to allow them to better address environmental issues, including the mitigation of climate change.

3.2.11 Because of the important role in global background monitoring and also the potential role of greenhouse gas (GHG) observations in the future of emissions control and emissions trading, Congress agreed that accurate measurements will be critical in support of carbon mitigation actions. Congress recognized the leadership role that GAW has taken in encouraging and supporting traceability of environmental data and encouraged all Members to ensure that their measurements are traceable to international standards, are accompanied by adequate statements of uncertainty, and meet the data quality objectives that are reviewed every two years by the GAW community.

3.2.12 Regarding the GFCS, Congress recognized that observations of long- and short-lived climate forcers, including GCOS ECVs such as CO_2, ozone and aerosols, are an important part of information provision for climate services.

3.2.13 Congress was pleased with the efforts of Members to establish new central facilities in GAW, in particular during the period 2008–2011 significant progress has been made by designating Central Calibration Laboratories for eight hydrocarbons at the National Physical Laboratory in the United Kingdom, stable carbon isotopes in CO_2 and molecular hydrogen at the Max-Planck Institute for Biogeochemistry in Germany, and SF6 at NOAA/ESRL in the United States; the GAW Regional UV Calibration Center for Europe at PMOD, Davos, Switzerland; World Calibration Centres for CO_2 (audits) at Empa, Switzerland and for NOx at FZ Jülich, Germany; and moving the World Data Centre for Aerosols to NILU, Norway, from JRC, EC, Ispra, Italy. An agreement was signed between WMO and BIPM to nominate laboratories for participation in the key comparisons organized by BIPM. Unfortunately World Calibration Centres for UV and for Aerosol Chemical Properties continue to be lacking, Congress urged Members who have proven capabilities in these areas to consider hosting a centre. Congress recognizes and appreciates the ongoing efforts of GAW in the area of ultraviolet radiation. The activities to improve calibration,

maintain the instrumentation, and integrate the ultraviolet radiation datasets world wide is crucial to understanding the environmental and human health impacts of changes in ozone concentrations as well as changes in climate.

3.2.14 Congress expressed its appreciation to Germany for hosting the GAW Training and Education Centre (GAWTEC) for 10 years, during which time about 240 persons from 56 countries have been trained. It strongly recommended for this activity to continue. Instrument intercomparison campaigns are usually also accompanied by personnel training. Congress urged Members to continue organizing intercomparison exercises, specifically for total ozone measurements, as it is important to carry on well qualified measurements in order to be able to in the future correctly detect the onset of the recovery of the ozone layer.

3.2.15 Congress was pleased with the important publication of the WMO Greenhouse Gas Bulletins and the Antarctic and Arctic Ozone Bulletins and urged Members to assist in developing a WMO Aerosol Bulletin.

GURME

3.2.16 Congress recognized that the GAW Urban Research Meteorology and Environment (GURME) has contributed to improving the capabilities of NMHSs to handle meteorological and related features of air pollution by addressing end-to-end aspects of air quality, linking the observational capabilities of GAW with the needs of chemical weather prediction, with the goal of providing high quality air quality services. Congress noted that international and national collaboration between different agencies and organizations is crucial for this work and urged it to continue.

3.2.17 Congress agreed that forecasting air pollution in urban areas is an important service in order to allow the population to take precautions on a daily basis and to identify policy measures to reduce emissions so that pollution target levels can be met. As the different scales have been merging from urban to regional to global scales, it is increasingly recognized that different scales need to be considered interactively.

3.2.18 Congress further agreed that it is a challenge to couple mesoscale meteorology and air pollution chemistry in a dynamic way in numerical weather prediction and climate models and requested for GURME to continue its collaborative activities with, e.g., European COST Actions to meet this challenge. Furthermore, changes in climate and changes in emissions are likely to change air quality in the future, which further brings challenges to the modelling communities that GURME needs to take into consideration.

3.2.19 Congress requested Members to enhance their activities and capabilities in air quality modelling. The organization of GURME training courses on air quality modelling and forecasting, and use of satellite data, continue to be important. A training event for South Asia was held in December 2008, in Pune, India, another one for Latin American Cities in August 2009, in Mexico City, and a workshop in collaboration with the Acid Deposition Monitoring Network in East Asia (EANET) in Niigata, Japan, in January 2011. These provided training in air quality modelling to support various research and application activities, including forecasting, and included hands-on training using contemporary meteorological and air pollution models.

3.2.20 Congress agreed that it is important for GURME to continue to establish pilot projects, such as the one as part of the Shanghai MHEWS, and the GURME SAFAR (System for Air Quality Forecasting And Research), focusing on air quality forecasting (AQF) in support of the Commonwealth Games (CWG) held in New Delhi, India in October 2010. This is the first AQF system demonstrated broadly to the public in India and successfully operated during the CWG and is becoming nationally operational under the lead of the NMHS. This was established as a follow-up activity from the training workshop held in 2008, demonstrating the importance of the facilitator and catalyst role of GURME.

3.2.21 Congress requested GURME to organize jointly with WWRP a modelling study on the effect that including aerosol information in weather forecast modelling has on the results. Congress is pleased to note that a pilot project with CMA has been recently established that focuses on NRT data delivery for coupled air quality and weather forecasting, including aerosols. Congress further requested GURME, together with relevant other WMO Programmes, to revisit the issue of forest fires, possibly together with other dispersion studies and to include both research and operational aspects to this.

3.2.22 Congress requested that GURME, together with Public Weather Services and other relevant WMO Programmes, look at the challenges being faced by Megacities, which are cities with a population of ten million people or more, and large urban complexes, in order to provide better services. Megacities are often located along coasts or near major rivers and deltas and face many challenges due to their geographical locations as well as high economic, population and building density. Megacities need climate, weather and environmental services in order to be resilient in withstanding environmental hazards. Climate information and services are needed for planning and long term infrastructure building, while weather and environmental information and services respond to the needs of the population in handling severe and high impact events. Activities should be aimed at: (i) development of strategies for megacities to deal with weather, climate and environmental problems and improvement of related services; (ii) enhancement of environmental monitoring and modelling capabilities; and (iii) establishment of case studies for understanding air pollution, health and climate connections in different types of megacities.

3.2.23 Congress endorsed the GAW Programme description as given in Annex II to the present report and adopted Resolution 10 (Cg-XVI) – Global Atmosphere Watch Programme that reflects the elements of work that were in AREP and that have been transferred and subsumed in GAW.

3.3 WORLD WEATHER RESEARCH PROGRAMME *(agenda item 3.3)*

3.3.1 Congress appreciated the completion of the first Strategic Plan for the Implementation of the World Weather Research Programme (WWRP): 2009–2017 (WMO/TD-No. 1505) and recognized it as a major milestone and a significant contribution to efforts to achieve the Expected Results of the WMO Strategic Plan. The WWRP Strategic Plan integrates WMO Member activities in THORPEX, tropical meteorology, mesoscale weather forecasting, nowcasting, verification and societal and economic applications with those of partners in global and regional forecast research and earth observation. The plan maintains and reinforces the traditional strong links with GAW, the World Climate Research Programme (WCRP) and other WMO activities.

3.3.2 Congress urged that the implementation activities outlined in the first Strategic Plan be continued in order to address cross cutting activities at the interface of weather-climate research and research-operations that are related to the delivery of weather and climate services, in particular, ensemble weather prediction systems, tropical convection, polar prediction, and sub-seasonal to seasonal prediction.

3.3.3 Congress noted the CAS-XV decision to establish the WWRP Joint Scientific Committee (WWRP/JSC) to oversee the scientific progress and development of the WWRP.

3.3.4 Congress noted that the foundation for past successes in reducing fatalities and minimizing property losses from hydrometeorological, climate, and environmental disasters included the successes in advancing predictive skill. Congress recognized that additional benefits will arise from the WWRP (including THORPEX) and the WCRP which will result in further improvements in predictive skill for weather, water, climate and environmental disasters. Congress urged that the design of the Disaster Risk Reduction Programme and its deliverables should reflect the research contributions associated with advancing both predictive skill and the utilization of

forecast information for disasters, such as outlined in the EC-LXI Research Task Team (EC-RTT) report “Challenges and Opportunities in Research on Climate, Weather”.

3.3.5 Congress acknowledged the research successes of the WWRP and recognized the increased scope of the WWRP, including THORPEX, and requested CAS and the Secretary-General to prioritize activities according to the overall WMO priorities. Congress also urged Members’ support and assistance in seeking funds from potential research and development partners and from other agencies that stand to benefit from the important results of WWRP activities.

Nowcasting Research

3.3.6 Congress noted that the Forecast Demonstration Projects (FDPs) and Research Development Projects (RDPs) for MAP D-Phase (Switzerland), Beijing 2008 (Summer Olympic Games) and the SNOW V10 RDP (Winter Olympic Games – British Columbia, Canada), were very successful, in meeting their goals in large part due to the work of the international team of research and operational scientists. Congress was pleased with the successful transition of research from these projects into operations and urged the Secretary-General to ensure that the visibility of past successes and the potential value of future WWRP FDPs are widely shared and disseminated.

3.3.7 Congress was pleased with the Russian Federation’s decision to develop an FDP for the next Winter Olympic Games in Sochi (2014) which will build on the success of the SNOW V10 project. Congress encouraged Members and partner organizations such as ECMWF, EUMETNET and EUMETSAT, to share products and expertise so that the FDP would take full advantage of existing capabilities.

3.3.8 Congress recommended that a WWRP project be considered for the Lake Victoria Watershed in East Africa that would include a test-bed for field campaigns to collect data for research to understand the dynamics over the lake in order to reduce disaster from water spouts, waves and wind gusts that affect both lake transport and fishermen who rely on the lake for their livelihoods. Congress further noted the potential linkages with the proposed SWFDP for Eastern Africa and urged the relevant technical commissions and the president of Regional Association I to consider these factors in further development of the project proposal.

3.3.9 Congress noted earlier guidance from CAS and EC that called for possible expansion of the OPERA radar data exchange concept to other regions beyond RA VI and therefore asked CAS, CIMO and CBS to create an inter-commission task team to develop options for possible action. Congress welcomed the CAS-XV decision to develop a joint report with the Joint Nowcasting Applications and Services (JONAS) on the perspectives of expanding radar data exchange.

Mesoscale Forecasting Research

3.3.10 Congress was pleased with the introduction of the Integrated Mesoscale Research Environment (IMRE) into the strategies of the WWRP as testing and improving modelling and assimilation techniques using datasets created by test-beds and past major field campaigns is an extremely efficient path toward the difficult task of improving forecast systems. Congress further urged Members working on improvements in physical parameterizations and assimilation to participate in the implementation of the WWRP IMRE efforts such as the European Coordinated Experiments 2007 that includes the Convective and Orographically induced Precipitation Study (COPS). Congress also encouraged the more rapid introduction of scientific research into operational forecasting.

3.3.11 Congress welcomed the establishment of a new RDP for the La Plata River Basin in South America. Noting the growth in Members who have regional modelling capabilities driven by growing needs for high resolution prediction for urban areas and flood plains with growing

populations at risk, coastal regions and mountain basins, Congress urged that the WWRP, including THORPEX, support this planning effort as it would also benefit five Members in this region and could be considered as a potential component of a regional Severe Weather Forecast Demonstration Project (SWFDP).

Tropical Meteorological Research

3.3.12 Congress noted with appreciation that the updated statement (February 2010) on the impact of climate change on tropical cyclone activity by the Expert Team on Climate Change Impacts on Tropical Cyclones was presented and discussed during the WMO 7th International Workshop on Tropical Cyclone held at La Reunion, France in November 2010. The Expert Team concluded that, if twenty-first century warming occurs as projected, there will likely be an increase, on average worldwide, in the maximum wind speed of tropical cyclones of +2 to +11 % and in rainfall rates of approximately 20 % within 100 km of the storm centre. The Expert Team concluded that the total number of tropical cyclones worldwide will likely either decrease or remain unchanged. Recalling the requests of many Members to organize technical workshops on climate change impacts and vulnerability, Congress noted with interest the planned organization of the Second International Conference on Indian Ocean Tropical Cyclones and Climate Change in late 2011 to early 2012, as a follow up to the first conference held in Muscat, Sultanate of Oman, March 2009.

3.3.13 Congress noted the timely inauguration of the Center for Monsoon Field Campaign Legacy Data Sets at Fort Collins, Colorado, United States and the Center for Extreme Events Monitoring in Asia at Beijing, China. The United States centre will ensure that valuable observation data obtained in tropical field experiments are archived and made available to researchers. The China centre will continue to monitor and archive extreme weather and climate events in Asia.

3.3.14 Congress noted the success of the international field campaign for tropical cyclones (T-PARC and Tropical Cyclone Structure (TCS)-08) over the Pacific in 2008 and the challenges of attempting to draw conclusions from a targeting campaign of limited duration/cases.

3.3.15 Congress noted that two projects, the Typhoon Landfall Forecast Demonstration Project and the North Western Pacific Tropical Cyclone Ensemble Forecast Project, related to the Shanghai Multi-Hazard Early Warning System and jointly organized by Tropical Cyclone Programme (TCP) and WWRP, are currently ongoing. Aimed at providing operational guidance to forecasters, Congress noted that these projects were very helpful to weather centres in Eastern China during the Shanghai World EXPO in 2010.

Societal and Economic Research Applications (SERA)

3.3.16 Congress welcomed the recent full establishment of the WWRP Societal and Economic Research Applications (SERA) Working Group and concurred with CAS on a proposed partnership with the multi-sponsored International Integrated Research on Disaster Risk (IRDR) programme. Congress also welcomed the decisions of CBS and CAS for continued collaboration on topics of mutual interest between the WWRP SERA Working Group and the WMO Public Weather Service (PWS) Forum: Social and Economic Applications and Benefits of Weather, Climate, and Water Services.

3.3.17 Congress emphasized the importance of addressing the social and economic benefits resulting from the provision of meteorological, hydrological and related services, and was therefore pleased to note the plans for a SERA Research and Development Project on “Understanding the societal and economic dimensions of weather-related warning systems”.

Forecast Verification Research

3.3.18 Congress expressed its satisfaction and gratitude for the accomplishments of the WWRP/WGNE Joint Working Group on Forecast Verification Research (JWGFVR), including in

particular the publication of Recommendations for the Verification and Intercomparison of Quantitative Precipitation Forecasts (QPFs) and Probabilistic Quantitative Precipitation Forecasts (PQPFs) from Operational NWP Models, successful completion of the precipitation verification phase of the Spatial Verification Intercomparison Project, disseminating information and conducting training for forecasters on new verification methodologies.

3.3.19 Congress noted the work done by the Group in the planning and execution of the verification component for the Beijing 2008 and SNOW V10 RDPs. It also welcomed the participation of the Group in the Sochi 2014 Winter Olympics project.

3.3.20 Congress welcomed the planned assessment project around tropical cyclone forecasting that addresses user needs for warning information and research questions on the accuracy and effectiveness of warnings and forecasts.

Weather Modification Research

3.3.21 Congress welcomed the plans for the establishment of the International Centre for Weather Modification Research (ICWMR) in the United Arab Emirates. Congress acknowledged CAS plans to assist the Centre in promoting and conducting internationally recognized research on different aspects of weather modification and related scientific fields to the benefit of interested Members.

3.3.22 Congress noted the establishment of the trust fund dedicated to support weather modification research activities. The activity of CAS based on the trust fund support on compiling relevant scientific information on weather modification and its links to other emerging issues such as climate change and geo-engineering were also encouraged by Congress. Congress urged Members and organizations involved in weather modification to contribute to the trust fund.

Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS)

3.3.23 Congress expressed its satisfaction with activities within the SDS-WAS which have led to better understanding of the atmospheric dust process, its impacts on climate and environment and the provision of observation data and forecast product. Two SDS-WAS nodes (for Asia and for Northern Africa, Middle East and Europe) have been established to provide efficient regional cooperation and exchange of products through regional web portals. Congress appreciated the funding contribution of the Spanish Meteorological Agency (AEMET) dedicated to establishing three dust-related measurements in Northern Africa.

3.3.24 Congress supported CAS and CBS efforts to specify an optimal concept of transferring research on numerical dust forecasting to operational activity where possible. Congress also encouraged participation of SDS-WAS in the interdisciplinary project “Meningitis Environmental Risk Information Technologies” (MERIT) in providing information to MERIT partners on dusty weather conditions which are considered to be correlated to meningitis epidemics in the Sahel.

THORPEX

3.3.25 Congress welcomed the activities of the five THORPEX Regional Committees and was pleased that each Regional Committee had developed broad research and implementation plans. Since the Regional and National THORPEX Committees facilitate provision of funding, logistical and other support, planning, coordination and implementation for many THORPEX activities, Congress encouraged Members, the Secretary-General, and the regional associations, to work toward the implementation of these regional plans.

3.3.26 Congress noted the leadership role of Canada, China, France, Germany, Japan, Republic of Korea, Norway, the United Kingdom and the United States in THORPEX, through their continuing financial contributions to the THORPEX trust fund. In this regard, more Members and

national and international funding agencies were urged to commit support to the THORPEX trust fund and to provide financial support, or support in kind, for national and regional THORPEX research initiatives.

3.3.27 Congress recognized that the successful establishment of the THORPEX Interactive Grand Global Ensemble (TIGGE) database was a major achievement and acknowledged the significant contributions of the data providers including nine operational centres (Australia, China, Canada, Brazil, Japan, Republic of Korea, France, United Kingdom, United States) and ECMWF, and three archive centres (China, United States and ECMWF).

3.3.28 Congress was pleased to note that the forecast data from the TIGGE archive can be used as the basis for developing new forecast products. THORPEX is developing the Global Interactive Forecast System (GIFS), designed to provide advance warnings for high impact weather events such as tropical cyclones. Using the global ensemble forecasts in the TIGGE archive, better quantitative forecast guidance on tropical cyclone tracks can be obtained. Congress was pleased to note that the developments of such products by THORPEX is in close coordination with the on-going SWFDP over Southern Africa and the Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project (SWFDDP) over the South Pacific, including tropical cyclone genesis forecasts. This collaboration will be extended to a new planned SWFDP for South East Asia. Congress noted that the GIFS probabilistic forecasts based on the TIGGE database may add additional information for forecasters and thus for decision-makers.

3.3.29 Congress noted the growing links between THORPEX and HyMeX (Hydrological cycle in the Mediterranean EXperiment), led by Météo-France, which includes an emphasis on extreme weather events (heavy precipitation and flash flooding, strong winds and large swell, droughts, etc.) that regularly affect the Mediterranean region causing heavy damages and human loss. Congress also encouraged the WWRP, including THORPEX, contribution to HyMeX and urged Members' involvement in this effort, including those from Northern Africa.

3.3.30 Congress noted the plans for extensive involvement of WWRP, including THORPEX, in weather research and transition of research to operations in Africa (for example the THORPEX Africa and the High Impact Weather Information Portal, HyMeX, SDS-WAS, AMMA, and the development of GIFS-TIGGE products for the SWFDP – Southern Africa) and thanked those Members within Africa for providing comments on the THORPEX Africa Science and Implementation Plans and for naming points of contact for participation by their NMHSs and urged other Members within Africa to support these activities. Congress urged Members and funding agencies within and outside Africa to support the implementation of the THORPEX Africa Plan. Noting the past success of AMMA in improving the observing system, forecast skill and research capacity in West Africa, Congress further urged the role of these research efforts be taken into account in the Strategic Plan of WMO.

3.3.31 Congress noted the leadership of the WWRP THORPEX Data Assimilation and Observing Systems (DAOS) Working Group in reviewing the science and effectiveness of data targeting through Observing System Experiments and the analysis of field campaigns such as ATREC, T-PARC and the United States WSR flights. While it has been demonstrated that extra tropical targeted data are about 2–3 times more valuable than the same number of observations deployed randomly, the benefits of targeted observations for extra tropical cyclones need to be further quantified. Targeted observations aimed at improving forecasts of tropical cyclone track have provided demonstrable positive impact.

THORPEX Polar Prediction Project

3.3.32 Congress acknowledged the success of the ten projects of the International Polar Year (IPY) THORPEX cluster, and supported the CAS recommendation that, as a legacy of the IPY, a THORPEX Polar Research project be established to improve the understanding of the impact of polar processes on polar weather, the assimilation of data in Polar Regions, and the prediction of

high impact weather over Polar Regions. Congress also emphasized the need to have an adequate observational and telecommunication network for the Polar Regions in order to provide the relevant high impact weather services for the region.

3.3.33 Noting the outcome of the first co-sponsored Workshop by WWRP-THORPEX and WCRP (Oslo, October 2010) to develop the CAS recommendation and noting the requirement for effective collaboration in Polar prediction, Congress strongly urged all those concerned to ensure that such a Polar Prediction Research project is established in support of, inter alia, the Global Framework for Climate Services. Furthermore, the World Meteorological Organization's (WMO) Executive Council Panel of Experts on Polar Observations, Research and Services (EC-PORS), at its Second Session in Hobart in October 2010, agreed to the concept of a major decadal initiative to develop a Polar Prediction System (Global Integrated Polar Prediction System – GIPPS). Congress recognized the importance of effective coordination between these various initiatives, and invited Members to contribute as appropriate.

Working Group on Numerical Experimentation (WGNE)

3.3.34 Congress recommended that future WGNE activities place an emphasis on enhancing collaboration between weather, climate, water and environmental prediction research, as proposed by the Executive Council and CAS. Congress noted that the increasing emphasis that WGNE is giving to the representation of parameterization of physical and chemical processes related to weather, climate, water and the environment in numerical models of the Earth-system is timely. Congress concurred with CAS and the Executive Council that a greater emphasis on research is required to improve traditional parameterizations of atmospheric processes such as convection, boundary layer, clouds, precipitation and atmospheric chemistry in climate and weather models and the need for a "seamless" approach to modelling.

3.3.35 Congress noted the importance of WGNE's involvement in reviewing reanalysis and data assimilation projects, which provided the data for numerous retrospective studies and analyses of the Earth system, and in documenting systematic errors in numerical models. Congress urged that Members support the production and evaluation of reanalyses products, which form the basis of numerous investigations in weather and climate, and that funding agencies place a high priority on such activities.

Collaboration at the weather-climate interface

3.3.36 Congress noted the CAS endorsement of the "seamless" approach to coordinate weather, climate, water and environmental modelling research. Noting that EC-LXI recommended:

(a) To develop a unified approach to multidisciplinary weather, climate, water and environmental prediction research, step up high-performance computing investments to accommodate the increasing complexity and detail of models, and to accelerate the development, validation and use of prediction models;

(b) To implement a process to review and rationalize the roles and mandates of the Commissions, and to improve their effectiveness in enhancing WMO Member capabilities in research, observations, prediction and services.

3.3.37 Congress noted the significant progress in the establishment of the Year of Tropical Convection (YOTC) Project that had been developed with the full support of WWRP-THORPEX and WCRP, and the guidance of WGNE and thanked the United States for establishing a YOTC Project Office and funding the development of data analysis tools, and the efforts of major modelling centres and agencies involved in remote sensing from space for making their datasets available to YOTC participants. Noting that research archives are beginning to be well utilized, Congress encouraged funding agencies to provide the necessary resources for related research

initiatives, contributing to bridging the gaps between weather and climate related research and forecasting.

Joint WWRP-THORPEX / WCRP project on sub-seasonal to seasonal prediction

3.3.38 Congress noted that the JSCs of the WWRP and the JSC for WCRP and WWRP THORPEX ICSC set up an appropriate collaborative structure to carry out an international research initiative on sub-seasonal to seasonal forecasting. This initiative should be closely coordinated with the CBS infrastructure for long-range forecasting and with the future developments of climate service delivery and the Global Framework for Climate Services.

3.3.39 Congress was pleased to note that the WWRP-THORPEX / WCRP workshop on "Sub-seasonal to seasonal prediction" (Exeter, December 2010) had recommended the establishment of a Panel/Project for Sub-seasonal Prediction Research and Applications – Panel members being drawn from WWRP-THORPEX, WCRP, CBS, CCl, JCOMM, CHy, CAS and CAgM and their relevant programme bodies. Congress recommended that planned activities should include the establishment of collaboration and coordination between operational centres undertaking sub-seasonal prediction and plans for a number of regional demonstration projects.

Future development of the WWRP

3.3.40 Congress recalled that CAS-XV had requested the THORPEX IPO to conduct a mid-term review of the THORPEX Programme. Congress reiterated the value of such a review and requested it to be conducted immediately. Noting that the ten-year (2005–2014) THORPEX programme was now a major element of the WWRP and recognizing that, together with the WGNE, THORPEX activities covered a wide-range of global weather prediction research, Congress recognized that THORPEX had become an integral component of the WWRP focusing on global scales and that the WWRP should fulfil the THORPEX high priority research activities for the next biennium if and when contributions to the THORPEX trust fund begin to "tail off" towards the end of the ten-year period of the programme.

3.3.41 Congress recognized that the WWRP community needs to participate in the establishment of the international Earth-system Prediction Research Initiative in order to accelerate advances in weather, climate and Earth-system prediction. Elements of the Initiative are introduced in a compendium of papers that appeared in the October 2010 issue of the *Bulletin of the American Meteorological Society* (BAMS) and in the Belmont Report, prepared by scientists associated with the World Meteorological Organization (WMO) World Weather Research Programme (WWRP), World Climate Research Programme (WCRP), International Geosphere-Biosphere Programme (IGBP), Global Climate Observing System (GCOS), and natural-hazards and socio-economic communities. It will build upon the WMO EC RTT Report Recommendations on "Challenges and opportunities in research to enable improved products and new services in climate, weather, water and environment" endorsed by EC-LXI, and partner with the Group on Earth Observations (GEO), the Global Earth Observation System of Systems (GEOSS), the International Council for Science (ICSU) and national operational and research agencies to develop, implement and coordinate the effort across the weather, climate, Earth-system, natural-hazards, and socio-economic disciplines.

3.3.42 Congress noted that the global scope of the effort required to accelerate advances in Earth-system monitoring, prediction and services is inescapable. Unprecedented international collaboration and goodwill are necessary for success. NMHSs have collaborated to advance global observing systems, weather forecasting, climate prediction, communication networks, environmental monitoring and emergency preparedness and response. NMHSs must now extend this collaboration to embrace the full Earth system and the next frontier of socio-economic and environmental applications of our science. The WWRP effort will focus on the establishment of this prediction initiative for timescale spanning a few minutes to sub-seasonal. The extension of this initiative beyond the sub-seasonal timescale is left to the climate community with collaborative opportunities already identified in the BAMS, October 2010, compendium of papers.

3.3.43 Congress recognized that the proposed initiative needs to be aligned and built on the projects already initiated by WWRP and THORPEX on sub-seasonal and seasonal forecasts and polar research or endorsed like HYMEX. Two important components of this initiative have been discussed: (i) Earth-system Interdisciplinary Summer School Program: a first step toward informing the next generation of the excitement and opportunities of the research and multifaceted deliverables at the forefront of society; and (ii) the first WWRP Earth-system Open Science Conference.

3.3.44 Congress noted the concept of an Earth-system initiative as identified as the possible next major WWRP initiative that could build on the legacy of THORPEX.

3.3.45 Congress endorsed the WWRP description as given in Annex II to the present report and adopted Resolution 11 (Cg-XVI) – World Weather Research Programme that reflects the elements of work that were in AREP, which have been transferred and subsumed in WWRP.

3.4 HYDROLOGY AND WATER RESOURCES PROGRAMME *(agenda item 3.4)*

3.4.0.1 Congress reviewed the Hydrology and Water Resources Programme on the basis of the reports presented by the President and the Secretary-General recording, among other things, the actions taken by the Commission of Hydrology (CHy) and the Secretariat in response to Resolution 20 (Cg-XV) – Hydrology and Water Resources Programme; Resolution 21 (Cg-XV) – Strategy for the Enhancement of Cooperation between National Meteorological and National Hydrological Services for Improved Flood Forecasting; Resolution 22 (Cg-XV) – Support to the African Initiatives on Water; and Resolution 30 (Cg-XV) – Towards Enhanced Integration between WMO Observing Systems.

3.4.1 Hydrology and Water Resources Programme: the report of the president of the Commission for Hydrology

Commission for Hydrology

3.4.1.1 Congress took note that the Commission for Hydrology (CHy) decided to adopt the following four themes as the priority areas (thematic areas) for its work in the current intersessional period:

1. Quality Management Framework – Hydrology (QMF–Hydrology);
2. Water Resources Assessment;
3. Hydrological Forecasting and Prediction;
4. Water, Climate and Risk Management.

3.4.1.2 Congress was informed that CHy developed corresponding sets of activities and expected outputs and outcomes for each thematic area and that these areas are supported by Open Panels of CHy Experts (OPACHEs).

3.4.1.3 It was further informed that the Commission also identified five issues that cut across these thematic areas: the transboundary river basins/aquifers issues, the importance of methods for data-sparse areas, the need and outreach of WHYCOS, the capacity-building needs and the economic benefits of hydrological services and has ensured that while developing the activities within thematic areas, these cross-cutting issues would be duly taken into account.

3.4.1.4 Congress appreciated the increasing use of electronic media by the Commission for Hydrology in carrying out its activities. Congress was pleased to learn that it has created an electronic-forum (http://www.whycos.org/chy13) and an electronic-board with the purpose of discussing key issues, debating ongoing CHy activities, disseminating information generated by the Commission and allowing experts, otherwise unable to physically join the session or other meetings of the Commission, to contribute to its work. Congress also noted that this approach

broadened the audience and limited the requirement for physically attending events, and invited CHy to continue and expand the adoption of such processes.

3.4.1.5 Congress adopted the Hydrology and Water Resources Programme as per Resolution 12 (Cg-XVI) – Hydrology and Water Resources Programme and programme description given in Annex II to the present report.

3.4.2 Quality Management Framework – Hydrology

3.4.2.1 Congress was informed that the thirteenth session of the Commission for Hydrology approved a new classification for its publications and a revised peer review process for these publications as part of the Quality Management Framework – Hydrology (QMF-H). Congress noted that the following publications were issued during the fifteenth financial period: 6th edition of the *Guide to Hydrological Practices*, 2nd edition of the *Manual on Stream Gauging*, *Manual on Low Flow Estimation and Prediction*, and *Manual on Estimation of Probable Maximum Precipitation (PMP)*. Congress also noted that the 3rd edition of the *UNESCO/WMO International Glossary of Hydrology* had been published.

3.4.2.2 Congress noted that the cooperation with the International Organization for Standardization (ISO) had increased during the last financial period, especially in the areas of water data transfer formats and Acoustic Doppler Current profilers and encouraged further cooperation in the future. It also appreciated the advances in the implementation and the preliminary outcomes of the project on Assessment of the Performance of Flow Measuring Equipment, as well as the activities on the topic of the expression of uncertainty in measurements and computation of discharge.

3.4.2.3 Congress welcomed the preparation of various forms of guidance material under QMF-H and requested that in order to ensure quality of hydrological products and services, this guidance material should be made available in all WMO languages and widely and effectively disseminated, not only to the NHSs, but also to other professionals in the water sector at national level. It requested that adequate provision of training of the professionals in the NHSs in use of manuals and guidance material should be undertaken. Accordingly, Congress adopted Resolution 13 (Cg-XVI) – Quality Management Framework – Hydrology.

3.4.3 Basic Systems in Hydrology

3.4.3.1 Congress reaffirmed the importance of continuing the Water Resources Assessment activities in the framework of the HWRP as an essential tool in supporting Member States, through their NHSs, in coping with challenges associated with climate variability and change, and socio-economic development. It noted the not so encouraging outcomes of the surveys carried out on hydrological data rescue and on hydrological networks through INFOHYDRO. Congress reaffirmed the importance of continuing efforts to meet the needs of Members to preserve their historical data records and to maintain their basic hydrological networks.

3.4.3.2 Congress was pleased to note the number of HYCOS projects being implemented and under preparation in various regions (Carib-HYCOS, Congo-HYCOS, Hindu Kush Himalaya HYCOS, IGAD-HYCOS, Mekong-HYCOS, Niger-HYCOS phase II, Pacific-HYCOS, SADC-HYCOS phase II and III, SEA-HYCOS, Senegal-HYCOS and Volta-HYCOS). It noted that all these projects were demand-driven and helped in strengthening the regional cooperation in water-related matters. It especially commended the Volta-HYCOS, noting that the implementation of the component contributed, in some instances, to the establishment of a new international river basin authority.

3.4.3.3 Congress noted that, as a legacy of the International Polar Year, Canada has offered to host the next Arctic-HYCOS meeting in the second half of 2011. Arctic-HYCOS is an important component of the work of the Executive Council Panel of Experts on Polar Observations, Research and Services. Congress urged Members to participate in the Arctic-HYCOS meeting.

3.4.3.4 Congress was pleased to note that the implementation of Carib-HYCOS had commenced and that Congo-HYCOS was also imminent and noted the contribution that these would make to improved water resources management and capacity-building in the regions, especially with regards to disaster risk reduction. It expressed its appreciation to the various donors and the other partners for their financial and technical support to the HYCOS components. It was concerned however, that some delays had been experienced in their implementation due to coordination problems with donors and national and regional counterparts.

3.4.3.5 Congress requested the Secretariat to continue its effort in keeping the status of the hydrologic networks of the Member countries under review especially with respect to assistance in developing the HYCOS components. It urged the Secretary-General to continue his efforts for securing funds for the implementation of new components, and invited beneficiary countries and institutions to take appropriate measures to ensure the long-term sustainability of the project achievements. Congress, aware of the contribution of WHYCOS to the implementation of HWRP, reaffirmed the central role of the Secretariat in providing technical and scientific support and advice to the implementation of the components, and of the WHYCOS International Advisory Group (WIAG) in ensuring coordination among components in cooperation with all partners (beneficiary countries, donors, regional and basin institutions, etc.). Accordingly, Congress adopted Resolution 14 (Cg-XVI) – World Hydrological Cycle Observing System.

3.4.3.6 Congress noted with concern that, despite the impending water crisis in Central Asia and the repeatedly expressed interest of the NMHSs in the region, the Aral-HYCOS project has still not made further progress. Congress therefore urged Members of the Central Asian region to step up efforts to obtain donor support to implement the project and likewise assured Members of the continued facilitation efforts by the WMO Secretariat.

3.4.3.7 Congress welcomed the adoption by the Commission for Hydrology of Resolution 6 (CHy-XIII) – WMO Integrated Global Observing System and WMO Information System, and the integration of SADC-HYCOS and the Southern Africa Region Flash Flood Guidance System (SARFFG) as pilot projects under WIGOS/WIS to demonstrate their benefits for the information flows and outputs, including associated metadata, in the realm of hydrology.

3.4.4 Hydrological Forecasting and Flood Management

3.4.4.1 Congress appreciated the progress in the implementation of the Flood Forecasting Initiative (FFI) and commended the proposals formulated for the implementation of the Strategy and Action Plan it had adopted at its previous session through Resolution 21 (Cg-XV). It learned about the regional projects being implemented as part of the WMO/NOAA/USAID/HRC project “Flash Flood Guidance System with Global Coverage”, such as in the Southern African Region (in close collaboration with the Severe Weather Forecast Demonstration Project (SWFDMP)), in the Black Sea and Middle East region, in Central America, the Mekong region, in Mexico and Haiti.

3.4.4.2 Congress expressed its appreciation that a wide range of activities had been undertaken under the framework of the FFI. It noted the development of PROHIMET and its contribution to the FFI via the implementation of pilot projects in Colombia and Uruguay, where meteorologists and hydrologists of most of the Iberoamerican countries are contributing their expertise. It also noted the close collaboration between CHy and JCOMM and the progress in the Coastal Flood Forecasting Project.

3.4.4.3 Cg-XV, through Resolution 21 (Cg-XV), had recognized that Flood Forecasting requires close collaboration between meteorological, hydrological and oceanographic experts. Accordingly, to give effect to Resolution 3 (CHy-XIII), which called for establishing an appropriate mechanism to technically coordinate these initiatives, Congress adopted Resolution 15 (Cg-XVI) – Establishment of an Advisory Group for the WMO Flood Forecasting Initiative.

3.4.4.4 Congress noted the CHy Statement on the scientific basis for, and limitations of, river discharge and stage forecasting. The Statement is available on the Website (http://www.wmo.int/pages/prog/hwrp/chy/documents/CHy_Statement_101008_en.pdf) and provides a perspective on the current state of hydrological forecasting, including an overview and a summary of factors affecting forecast accuracy and lead-time. Congress recommended that publicity be given to the Statement using all relevant opportunities.

3.4.4.5 Congress expressed its satisfaction with the development of various activities under the Associated Programme on Flood Management, especially a number of training courses (including training of trainers) and the implementation of projects aimed at the development of local capacities and capabilities in flood management, such as in Mali, Mauritania and Zambia. It expressed its appreciation to the Governments of Japan, Italy and Switzerland for supporting the programme and to the Governments of Spain for support of its associated activities.

3.4.4.6 Congress welcomed the launching of the HelpDesk for Integrated Flood Management, and appreciated its ability to act as a mechanism for transferring knowledge and skills on flood management issues to managers and decision-makers. It appreciated the approach used in getting the multi-disciplinary inputs through Support Partners that joined efforts to support the initiative and invited the Secretariat to continue its efforts to increase the number and variety of partners. It requested the WMO Secretariat to continue widely publicizing the availability of the HelpDesk in order to increase its utilization by Members.

3.4.5 Capacity-building

3.4.5.1 Congress endorsed the revised Strategy on Education and Training in Hydrology and Water Resources adopted by the Commission through Resolution 5 (CHy-XIII) recognizing that it offered a framework for better responding to the capacity-building needs of Members. Congress invited the Secretariat to pursue its action in providing training according to the guidelines defined by the Commission, and in particular, to further develop distance and blended learning training courses.

3.4.5.2 Congress noted the number of training courses organized during the reporting period, the wide range of topics dealt with and the breadth of the audience addressed. It was particularly appreciative of the positive outcomes of the first WMO/NOAA/COMET distance learning training course which, by making use of modern electronic media, has reached a much larger group of trainees in different countries in a cost-effective manner as compared to the traditional courses and encouraged the Secretariat to further involve interested WMO RTCs in the development and use of this mode of training. It also supported the Commission's approach to develop systematic training for the NHSs and other professionals based on the manuals and guidelines produced as part of the QMF-H.

3.4.6 Cooperation in Water-related Issues

3.4.6.1 Congress took note that through UN-Water the activities of the UN agencies with an interest in water matters were efficiently coordinated and was pleased to learn of the leading role of WMO in coordinating the Water and Climate Change Thematic Priority Area. Congress noted that WMO continued to support and actively participate in the UN-Water/Africa activities and to work together with the African Development Bank and the African Ministerial Council on Water (AMCOW) especially by participating and contributing to the preparations and organization of the Africa Water Week events. Congress noted that in accordance with Resolution 22 (Cg-XV), WMO had continued its cooperation with AMCOW, successfully launching the African Water Facility that provides financial support for hydrological activities in Member countries.

3.4.6.2 Congress also noted the complementarities of action with UNESCO, the coordinating role played by the UNESCO/WMO Liaison Committee and strongly supported the need to update the existing agreement between the two organizations, signed in the seventies. Congress greatly

welcomed the effective and fruitful cooperation between WMO and UNESCO focusing on the provision of technical assistance to Pakistan in direct response to the 2010 flood disaster.

3.4.6.3 Congress also noted the expanding cooperation with IAHS, IAHR, ISO, ICID, GWP and other intergovernmental and non-governmental organizations and noted that this cooperation provided a useful mechanism for pursuing the objectives of the HWRP and also provided a platform for meeting the needs of climate services to the water sector.

3.4.6.4 Congress noted the continued contribution of the HWRP towards the Integrated Global Water Cycle Observations (IGWCO) Community of Practice of the Group of Earth Observations (GEO) through its regular programme activities. Congress welcomed these contributions towards activities in the GEO Societal Benefit Area – Water and in particular support of the Water Tasks described therein.

3.4.7 Water, Climate and Risk Management

3.4.7.1 Congress, recalling that water resources will be significantly affected by potential climate change, recognized the important role that HWRP can play in helping Members in better understanding the impacts of climate change on the management of water resources and the risks linked to hydrological extremes, such as floods and droughts, and in developing adequate response and mitigation measures. It therefore welcomed the various initiatives aimed at fostering cooperation between the hydrological and climatological communities, the development of national adaptation strategies and the reinforcement of natural risks management capabilities. Congress further invited the Secretariat and CHy to continue developing and implementing projects in this area.

3.4.7.2 Congress expressed the continued need for facilitating access to hydrological observations for global studies, particularly in downscaling climate information for water management and recognized the important role played by GTN-H, through the Global Runoff Data Centre (GRDC), International Groundwater Resources Assessment Centre (IGRAC) and the International Centre for the Hydrology of Lakes and Reservoirs (HYDROLARE) and the valuable contributions made by it in the generation of derived products and in support of climate change studies. Congress appreciated the contribution of the Governments of Germany, the Netherlands and the Russian Federation respectively for hosting and supporting these centres. Congress decided to keep Resolution 21 (Cg-XII) – Global Runoff Data Centre in force.

3.4.8 Regional activities

3.4.8.1 Congress took note of the different institutional arrangements adopted by the regional associations for addressing issues relevant to hydrology and water resources in their respective Regions. While appreciating that the diversity of approaches may lead to better responses to regional needs, for example, establishing joint climate and water working groups, it emphasized the benefits to be derived from regional working groups in hydrology that provide a platform for hydrologists within a Region to discuss matters of common concern.

3.4.8.2 Congress was informed that the Commission for Hydrology (CHy), in order to incorporate the regional needs in its current work programme (2009–2012), had conducted extensive consultation with the regional hydrological advisers and invited them to participate in a meeting of the CHy Advisory Working Group. Congress noted that this had allowed better integration and alignment of the activities of the regional associations and the technical commission, and recommended that CHy continue its efforts in this direction.

3.5 WORLD CLIMATE PROGRAMME *(agenda item 3.5)*

3.5.0.1 Congress noted that WCP activities primarily contributed to the Expected Result 2 (Enhanced capabilities of Members to provide better climate predictions and assessments) and were guided by a number of WMO constituent bodies and co-sponsored entities (notably the Commission for Climatology (CCl), the Joint Scientific Committee of the WCRP, and the Executive Council Working Group on Climate and related weather, water and environmental matters). Further noting that aspects of the work of the WCP also are relevant to Expected Results 6 through 9, and that the WCP works closely with other UN and international agencies with shared interests in climate matters, Congress appreciated the enhanced interaction and coordination between the relevant programmes, bodies and partners at global, regional as well as national levels.

3.5.1 Commission for Climatology (CCl)

3.5.1.1 Congress noted that CCl at its fifteenth session in Antalya, Turkey, from 19 to 24 February 2010, had adopted a new structure, with a Management Group with four thematic Open Panels of CCl Experts (OPACEs) and developed a work plan that addresses key priorities of the GFCS, which are reflected within the relevant programmes and activities. Congress noted that CCl-XV had adopted a new Vision and Mission statement and recommended a revised set of Terms of Reference.

3.5.1.2 The Congress noted with appreciation that CCl had finalized the third edition of the *Guide to Climatological Practices* (WMO-No. 100), and recognizing its importance to all Members requested the Secretary-General to expedite the publication and translation of the Guide in the WMO official languages. It placed on record its appreciation to all contributors and reviewers.

3.5.2 World Climate Conference-3 (WCC-3) and its outcome: Global Framework for Climate Services

3.5.2.1 Congress noted with great satisfaction the successful conduct of the World Climate Conference-3 (WCC-3), organized by WMO in cooperation with other UN agencies and international organizations, Governments and the private sector from 31 August to 4 September 2009, in Geneva, Switzerland. Members highly appreciated the participation of Heads of States and Governments, Ministers and senior government officials and about 2500 scientists, sector experts and decision-makers from more than 150 countries.

3.5.2.2 Congress noted the WCC-3 Conference Declaration adopted by the High-level segment which decided to establish the Global Framework for Climate Services (GFCS) to strengthen the production, availability, delivery and application of science-based climate prediction and services. Congress further noted the decision, as part of the WCC-3 Conference Declaration, to set up through an intergovernmental process, a taskforce consisting of high-level independent advisors to recommend on the proposed elements of GFCS.

3.5.2.3 Congress noted the publication of the Report of the WCC-3 “Working together towards a Global Framework for Climate Services” in six languages along with Conference Proceedings on CDs, and appreciated the publication of the papers presented at the Expert Segment of WCC-3 providing open access of the valuable contributions from experts to everyone.

3.5.2.4 Congress expressed its appreciation to all the members of the WCC-3 International Organizing Committee (WIOC) and its sub-committees in guiding the organization of the conference and acknowledged the contribution of all the experts who participated in the WCC-3 and made it successful. In particular, Congress expressed its appreciation for the leadership of the Chair of the WIOC Dr D. MacIver, from Canada and subsequently Dr John Zillman from Australia. Congress greatly appreciated the active role played by partner organizations, *inter alia* UNESCO, UNEP, UNDP, FAO, WFP, WHO, ISDR, UNWTO, IMO, ITU, UN-habitat, ICSU, UNFCCC and UNCCD in the organization and conduct of WCC-3.

3.5.2.5 Congress expressed its deep appreciation to all the sponsors of WCC-3, particularly the Governments of Australia, Canada, China, Finland, France, Germany, India, Japan, Kenya, Norway, Russian Federation, Saudi Arabia, Spain, Switzerland, the United Kingdom, the United States and the European Commission. It also acknowledged the financial and in-kind contribution of Denmark, the FAO, Greece, Ireland, Italy, Namibia, Pakistan, UNEP and the European Space Agency and all those countries and international organizations that supported the participation of their representatives to the organization of WCC-3.

3.5.2.6 Members noted with satisfaction that, as a follow-up to WCC-3, WMO organized an Intergovernmental Meeting of Member States (IGM-GFCS) to approve the Terms of Reference of the High-level Taskforce on the Global Framework for Climate Services (HLT-GFCS), and endorse its composition, as proposed by the Secretary-General. Congress noted the establishment of the HLT-GFCS and considered its report under agenda item 11.1.

3.5.3 World Climate Data and Monitoring Programme

Climate Data

Climate Data Rescue (DARE)

3.5.3.1 Congress reiterated the importance of safeguarding, digitizing and making accessible historical climate archives available on paper format and modernizing obsolete electronic archives, such as those available on old magnetic tapes and floppy disks. These activities underpin the development of climate services by NMHSs and support achieving the objectives of the WMO Data Rescue (DARE) project. It welcomed the efforts by the Members and the Secretariat, through VCP, in making progress in DARE. Congress emphasized the need for further assistance in rescuing old climate records with provision of guidance based on best practices and WMO standards. Congress noted with satisfaction the Caribbean region readiness to work with WMO to develop further DARE in the region and make the region's data available to the international research community. Congress urged Members to continue their efforts in accelerating the digitization process of old climate records.

3.5.3.2 Congress noted with appreciation the organization of regional workshops on data rescue, four in Africa: Niger 2006, Congo 2007, Mauritius 2009 and Kenya 2010, two in South East Asia: Viet Nam 2008 and Indonesia 2009 and two in Europe: Spain 2007 and Cyprus 2010. Congress recognized the high value of these workshops in covering both the Data Rescue, the analysis of climate extremes and indices along with better assessment of data gaps and producing useful climate information. Congress urged Members and the Secretariat to adopt this end-to-end approach and organize similar workshops in all regions. Congress noted with appreciation the international collaboration on data rescue and digitization of old climate records such as the set-up of the WMO Mediterranean Data Rescue initiative (MEDARE) and the support given to the international Atmospheric Circulation Reconstructions over the Earth (ACRE) project. It urged Members to collaborate further in supporting these initiatives and projects and similar ones dealing with DARE activities.

Climate Data Management Systems (CDMSs)

3.5.3.3 Congress was pleased to note the progress made in the migration from obsolete climate data management systems to more robust and modern technology based systems. It noted the increased emphasis laid on the modernization of climate data management. Congress noted with appreciation the increased collaboration of Members through WMO-VCP or through bilateral mechanisms to modernize climate data managements systems in developing countries. It requested CCl to further assist Members, especially developing and least developed countries, to fully benefit from the new CDMS implementation and urged the Secretary-General to further encourage the mobilization of resources for this activity.

3.5.3.4 The Congress welcomed the new ACMAD initiative on climate data for Africa which was endorsed by XV-RA I, Marrakesh 2010 and agreed that this initiative provides a cost-effective operational platform for solving several issues concerning climate data and metadata and related management systems. The Congress urged the Members to support this initiative and develop similar ones in other WMO Regions.

Climatological Normals and World Weather Records

3.5.3.5 Congress noted the establishment of an ad-hoc CCl Task Team to review the existing methodologies for computing climatological normals. The Congress requested CCl to accelerate the work on this important aspect of climate data and provide recommendations for the revision of the *Guide to Climatological Practices* (WMO-No. 100) and the WMO *Technical Regulations* (WMO-No. 49).

3.5.3.6 Congress reiterated the importance of continuously updating the World Weather Records (WWR) data sets for which the compilation started in 1920 and which have been very useful in global climate monitoring and assessment. It requested the Secretary-General and the World Data Centre for Meteorology (NOAA-NCDC) to accelerate the process of collecting WWR data sets covering the period 2001–2010, to complete the data sets for WWR 1991–2000 and to move towards a system of annual updates of the World Weather Records taking advantage of the technological advances and the use of modern CDMSs.

Marine Climatological Summaries Scheme (MCSS)

3.5.3.7 Congress concurred with the JCOMM plans for the Modernization of the Marine Climatological Summaries Scheme (MCSS) and requested JCOMM to make recommendations on improving the infrastructure for data management for the Marine and Ocean Climatological Data interoperable with the WIS, and building from the International Comprehensive Ocean Atmosphere Data Set (ICOADS). Congress stressed that the anticipated benefits would include facilitating the open exchange of historical data with the assurance of recognized international archival which would support the implementation of GFCS.

Requirements for climate data

3.5.3.8 Congress recognized the importance of addressing new and evolving requirements for climate data for improved climate monitoring products and services that would support the analysis and assessment of climate extremes, climate change adaptation at regional and national levels, issuing early warnings and perform climate watches. It agreed that there is a need to assess gaps, opportunities and the new and evolving requirements for climate data aspects. Congress noted the progress of the Surface Temperature Initiative, a cross-disciplinary initiative to create a comprehensive global databank of land surface temperature. Congress expressed satisfaction that the Initiative had been endorsed by the WCRP, CCl and GCOS and requested that the progress on the Initiative be formally reported to WMO through CCl. Congress encouraged Members to contribute to the initiative primarily through the sharing of data and noted that data.submission@surfacetemperatures.org could be used to initiate discussions to this end. Congress adopted Resolution 16 (Cg-XVI) – Climate data requirements.

Climate System Monitoring (CSM)

WMO climate statements and reviews

3.5.3.9 Congress noted with satisfaction the sustained cooperation among Members in providing input and expert review of the WMO annual statement on the status of the global climate, which has been regularly published since 1993. Congress further recognized the value of disseminating these statements during UNFCCC-COP conferences offering an opportunity for delegates to be updated with authoritative information of the status of the global climate, which was

clearly demonstrated by the high attendance at the press conferences during the recent COP events in 2008, 2009 and 2010 and its subsequent media coverage.

3.5.3.10 Congress welcomed the CCl decision during its fifteenth session for improving WMO Climate System Monitoring including related methodologies and dissemination of monitoring reports for timely information on extreme weather and climate events occurring on large scale and having high socio-economic impacts, e.g., the 2009/2010 boreal winter (WMO/TD-No. 1550).

3.5.3.11 Congress urged Members to actively contribute to these efforts and provide monthly, seasonal and annual summaries on extreme weather and climate events regularly. It requested the Secretary-General to continue providing support for the publication of WMO climate statements and promote the development of appropriate platforms for global climate system monitoring, such as the monitoring component of the proposed global seasonal climate update.

Analysis of climate extremes and indices/ETCCDI

3.5.3.12 Congress noted with appreciation the progress made by the Joint CCl/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI). The achievement included the publication of a useful WMO guideline document on the analysis of extremes in a changing climate in support of informed decisions for adaptation (WCDMP-No. 72 – WMO/TD-No. 1500), and the organization of several workshops on climate indices in various regions. Congress further appreciated the support provided by the World Bank, the United Kingdom, France and the Netherlands in the organization of ETCCDI workshops in the Greater Horn of Africa, Central Africa and South East Asia, South Indian Ocean countries and the Indonesian Archipelago respectively. Congress urged Members to further support these activities and requested the Secretary-General to continue to provide support and to facilitate the work of ETCCDI and promote international collaboration and partnership to enhance these activities.

Climate Watch Systems (CWS)

3.5.3.13 Congress appreciated the organization of three regional workshops in RA III (2008), RA II (2009) and RA VI (2010) which helped in adapting the WMO guidelines on climate watches, (WCDMP-No. 58) to the regional needs and requirements, as a follow up to the decision of Cg-XV to implement Climate Watch Systems at national levels. Congress requested the Secretary-General to continue the support for this activity and promote resource mobilization to assist in the organization of more of such regional workshops, particularly for developing and least developed countries.

Measurement challenges for climate change monitoring

3.5.3.14 Congress recognized the value of the steps taken by WMO and the International Bureau of Weights and Measures (BIPM) for organizing a joint workshop on Measurement Challenges for Global Observation Systems for Climate Change Monitoring: Traceability, Stability and Uncertainty, Geneva, 30 March–1 April 2010 (WMO/TD-No. 1557 and BIPM reports No. 2010/08). Congress further agreed that the WMO-BIPM collaboration on climate observations and climate monitoring should continue for the mutual benefits, and requested the Secretary-General to develop further steps in this domain.

3.5.4 World Climate Applications and Services Programme

Climate Information and Prediction Services (CLIPS)

3.5.4.1 Congress acknowledged the significant contributions of the CLimate Information and Prediction Services (CLIPS) project in promoting climate services, particularly at the regional and national levels and in highlighting the need for a user-targeted approach. Congress endorsed the recommendation of the fifteenth session of the Commission for Climatology (CCl-XV) to work

towards the conclusion of CLIPS as a project and agreed that the implementation plan for future evolution of CLIPS should be focused on assimilating its activities into the emerging Climate Services Information System (CSIS) component of the GFCS, including the relevant linkages with the Climate User Interface Platform (CUIP) component.

3.5.4.2 Congress was pleased to note that CCl plans to develop guidance on standard approaches, tools, methods, consistency, common look-and-feel designs for products, etc., which would enhance the successful transition of CLIPS into the relevant components of the GFCS. Congress appreciated the establishment of a CCl Expert Group on Quality Management for Climatology which may facilitate these efforts as part of a CCl-wide Quality Management Framework. Congress urged Members to forge effective partnerships with climate-sensitive user sector agencies and other climate-focused organizations at a national scale and to continue to build and sustain CLIPS activities in close liaison with these partners as part of the implementation of the GFCS.

3.5.4.3 Congress noted the key roles the WCP and CCl, along with other programmes and technical commissions, were expected to play in underpinning WMO's contributions to the GFCS, essentially fostering the authenticity, reliability and consistency of climate information, products and services at global, regional and national scales and enhancement of climate knowledge of users in terms of readiness to use climate information for the benefit and well-being of society.

3.5.4.4 Congress noted that, at national levels, there exists considerable diversity in the way climate services are developed and provided. However, Congress emphasized the critical roles and responsibilities of NMHSs that are common to all national efforts in providing climate services. In this context, Congress encouraged NMHSs to consider and promote national mechanisms to coordinate their activities for basic climate data, diagnostics, climate system monitoring, and in many cases long-range forecasts (LRF) to help align the core products and services of GPCs and RCCs/RCC-Networks. Congress emphasized that in all these areas, the NMHSs would be the most likely source of authentic information, products and services, and as such, agreed that supporting their role in climate services under the GFCS would be a key priority for the WCP.

Climate Services Information System

3.5.4.5 Congress recognized the critical role of WMO in putting in place operational mechanisms for providing climate information, products and services and takes the prime responsibility in their implementation. Congress agreed that the NMHSs, the Regional Climate Centres (RCCs), WMO-designated Global Producing Centres of Long-Range Forecasts (GPCs) and other mechanisms dealing with basic climate data and climate system monitoring at the global level will form the basis for development, production and delivery of climate services, constituting the proposed Climate Services Information System (CSIS) of the GFCS. Congress emphasized that CSIS would be required to have close interaction with users of climate services and contribute to communications and feedback processes under the Climate Users Interface Platform (CUIP) component of GFCS. Taking into account the requirements for operational climate services around the world, WMO would play a major role in ensuring that the operational mechanisms needed for provision of climate information, products and services at different levels are put in place. Accordingly Congress adopted Resolution 17 (Cg-XVI) – Implementation of the Climate Services Information System.

Regional Climate Centres (RCCs)

3.5.4.6 Congress reiterated the importance of RCCs as a key element of the CSIS/GFCS, and particularly in helping participating Member countries develop improved climate activities for provision of a wide range of climate information, and emphasized the need that RCCs be developed as centres of excellence, with adherence to standards and criteria that will ensure the highest quality products.

3.5.4.7 Congress noted the amendments to the Manual on the Global Data-processing and Forecasting System (GDPFS), Volume 1 (Global Aspects), as approved by EC-LXI, which established criteria for formal designation of WMO RCCs. Congress further noted the adoption of Resolution 4 (EC-LXI) on the Establishment of Regional Climate Centres, which provides further guidance on implementation and operation of RCCs, and the roles and responsibilities of the relevant entities. Congress noted with satisfaction that the designation criteria adequately addressed the need for a globally standardized RCC structure, yet allowed for the regional capabilities and priorities through the RCC-Network concept. Congress appreciated the joint efforts of CCl, CBS and the regional associations in this regard and was satisfied with the early progress in implementation of RCCs and RCC pilot projects.

3.5.4.8 Congress noted with appreciation that the Beijing Climate Centre (BCC) and the Tokyo Climate Centre (TCC) had started their operation as formally designated WMO RCCs in RA II in July 2009 and had been effectively and successfully carrying out their mandatory responsibilities including operational provision of climate monitoring, long-range forecasting, climate data and capacity-building. It noted that the TCC Website presents a variety of products in accordance with the mandatory functions of the RCCs and could be adopted as a good reference model for the other RCCs to follow.

3.5.4.9 Congress further appreciated the pro-active engagement of regional associations in the implementation of RCCs. In particular, Congress welcomed the commencement of pilot phases of RA VI RCC-Network in 2009, NEACC (RA II) in 2010 and ACMAD and ICPAC (RA I) in 2011. Congress warmly appreciated the more recent decisions by regional associations to initiate pilot phases of RCCs in RA I (North African and ECOWAS RCC-Networks; SADC RCC, and CEMAC RCC), RA II (India; Islamic Republic of Iran; and Saudi Arabia), RA III (CIIFEN; Northern South American RCC-Network; and Southern South American RCC-Network). Congress urged the respective regional associations to expedite the preparations to commence the pilot phases at the earliest.

3.5.4.10 In this regard, Congress urged the Members and the Secretary-General to promote rapid expansion of the RCC coverage, and in particular to place high priority on meeting the climate-related needs of developing and least developed countries. Congress appreciated the support of the Korean International Cooperation Agency (KOICA) for enhancing the capacity of existing regional institutions in Africa to help them meet the requirements for designation as WMO RCCs, and urged the Secretary-General to facilitate such opportunities for voluntary support for RCC development.

3.5.4.11 Congress noted the document on “How to establish and run a WMO Regional Climate Centre (RCC)” (WCASP No. 80, WMO/TD-No. 1534, available in E/F/S), which clarifies the process for the establishment and implementation of RCCs and RCC-Networks, and the associated guidance for establishing and operating RCCs and RCC pilots, and requested the Secretary-General to facilitate the application of these procedures by all the potential RCC applicants. Congress recognized the need to establish standardized processes for development of RCC products including LRF, their presentation/style (appearance, formats, etc.), as well as delivery (including through web pages) to NMHSs and other relevant climate institutions in the region and their verification/assessment.

3.5.4.12 Congress further noted that there are large areas cutting across the domains of regional associations with common climate information needs (e.g., Polar Regions, Mediterranean Region, Southeast Asia). Congress therefore encouraged initiatives to develop such cross-regional RCCs. In particular, Congress noted the recommendation of the EC Expert Panel on Polar Observations, Research and Services (EC-PORS) to define the scope of Arctic and Antarctic RCCs, noting their potential contribution to improve the quality, of climate products in these regions

3.5.4.13 Congress noted the need for continued collaboration between CCl and CBS on the establishment, implementation, designation and operations of RCCs/RCC Networks, and

appreciated the formation of a focused CCl-CBS Expert Team on RCCs to help expand and enhance the RCC coverage around the world.

Climate Outlook Forums (COFs)

3.5.4.14 Congress noted with appreciation that Regional Climate Outlook Forums (RCOFs) are established around the world in Africa, Asia, South America and the South Pacific Islands which are being held regularly, and welcomed the initiatives by Members to establish and sustain new RCOFs in South-eastern Europe, South Asia, Southeast Asia, Northern Eurasia, the Caribbean and Polar Regions. Congress urged Members to continue their support to these efforts and expand the RCOF process that serves as an excellent interface with the users of climate information in various sectors and gives wider exposure to the activities of NMHSs. In this connection, Congress also recognized the importance of National Climate Outlook Forums (NCOFs) as a logical extension of the RCOF process for NMHSs interaction with national users, and encouraged Members to develop efficient mechanisms to organize NCOFs through appropriate partnerships with national user sectors.

3.5.4.15 Congress noted the recent survey conducted by the EC-PORS Services Task Team (STT) on weather, water, and climate products and services available in the Polar Regions, which brought out the extremely limited availability of climate products and services in these regions, and agreed that Polar Climate Outlook Forums (PCOFs) might serve to bridge this gap, and encouraged concerted efforts towards their establishment.

Global Seasonal Climate Update

3.5.4.16 Congress expressed satisfaction with the coordinated and sustained efforts by WMO and its partners to issue consensus-based WMO El Niño/La Niña Updates. It recognized the widely felt need for developing such products more generally on the seasonal climate and welcomed the concept of expanding these updates to include the influence of other planetary-scale oscillations and at the same time include large-scale climatic potential impacts of such seasonal predictions.

3.5.4.17 Congress noted the recent initiatives for the development of Global Seasonal Climate Updates (GSCU), through a broad-based scoping process under the guidance of CCl and CBS and appreciated that the developmental process of this new product is being carefully taken up through a pilot phase. Congress emphasized the need to ensure reliability and effectiveness of GSCU by appropriately qualifying the seasonal climate outlooks in consideration of the associated predictability limits. Congress agreed that the aim of such Updates would be to assist the NMHSs as well as RCCs and RCOFs in the interpretation, characterization and assessments of the reliability of seasonal predictions. Congress endorsed the new initiative, and urged all GPCs, RCCs, RCOFs, NMHSs and other relevant institutions to provide the required inputs and actively support the development of GSCU.

Research support for operational climate services

3.5.4.18 Congress appreciated the outcomes of the CCl-WCRP joint session during the Technical Conference (February 2010), and highlighted the need to sustain these linkages on a continuing basis to expedite the application of research advances in operational climate services and to ensure ongoing improvement to the GFCS operational practices and outcomes. Congress encouraged the development of a joint CCl-JSC/WCRP-CAS mechanism for operationalizing research advances and urged enhanced interaction between the WCRP CLIVAR regional panels and the RCCs and RCOFs.

3.5.4.19 In this regard, Congress noted with appreciation that the WCRP/CLIVAR Asian-Australian Monsoon Panel (AAMP) provided support for the Forum on Regional Climate Monitoring, Assessment and Prediction for RA II (FOCRAII), in close collaboration with the Sub-Group on Climate Applications and Services of the RA II Working Group on Climate Services, Adaptation and Agrometeorology.

Capacity-building

3.5.4.20 Congress recognized that, in order to set up operational mechanisms to provide climate services, and to ensure their quality, Members will need to share best practices for establishing suitable climate service mechanisms at the national level. Congress noted the results of an online Survey on the "Role of NMHSs in Adaptation to Climate Variability and Change" published as WMO/TD-No. 1562, to help to better understand the present status and identify the gaps in the capacity of NMHSs in supporting their role in the provision of public policy advice in climatic change adaptation at the national level.

3.5.4.21 Congress was pleased to note that CCl is developing a comprehensive strategy on capacity-building for improving delivery of climate services at the national level, and has established an Expert Team on Capacity-building Strategy for Climate Services. Congress suggested that the strategy should include, among others, the issues of institutional mandates, climate infrastructure evolution, human resource development, qualification and certification of climatologists, etc. Congress urged CCl to give priority to the development of the capacity-building strategy and draw up an implementation plan to underpin the capacity-building component of the GFCS.

3.5.4.22 Congress noted that several Members and international organizations had actively contributed to the training activities under the CLIPS project over the years. Congress agreed that in view of the expanding needs of GFCS the current components of the CLIPS Curriculum needed to be further developed into a set of complete, self-contained comprehensive modules that could be integrated into regular training activities at WMO RTCs, and urged Members and the concerned bodies to formulate a coordinated strategy to meet this need. Further, Congress urged the WMO RTCs to conduct regular sustainable training activities to ensure that the Members have technical experts with relevant qualifications and competencies for delivering climate services.

3.5.4.23 Congress recognized that RCCs are also expected to play an important role in capacity-building. It noted with appreciation that TCC had regularly organized training seminars for experts of NMHSs, and encouraged RCCs and RCC candidates to enhance such training activities in the climate field.

Climate information for adaptation and risk management

3.5.4.24 Congress noted that key sector representatives present at WCC-3 had supported the establishment of climate user interface mechanisms focused on building linkages, between providers and users of climate information at all levels. Congress recognized that the CUIP of the GFCS which serves such a purpose would help develop functional partnerships between climate scientists; sector-specific and multi-disciplinary scientists; academia; sector-focused agencies and ensure availability of interdisciplinary data, information and knowledge needed for development of user-targeted products. It also recognized that various UN agencies, inter-governmental organizations and non-governmental organizations would take the lead in development sectors according to their mandates.

3.5.4.25 Congress recognized the important role played by Climate Outlook Forums and sector specific forums (e.g., Malaria Outlook Forums, Hydrologic Outlook Forums, etc.) at regional and national levels in providing an opportunity to work closely with experts from climate-sensitive sectors to help understand user requirements, and encouraged Members and CCl to make effective use of these mechanisms to enable a greater role for NMHSs and WMO as a whole in the CUIP.

3.5.4.26 Recognizing the increasing food and water crisis accentuated by the climate variability and change and the unique strengths of WMO in dealing with agriculture, and water sectors with the advice and guidance of CAgM and CHy, Congress asked the Executive Council to set up a Joint CCl/CAgM/CHy Expert Group on Climate Food and Water. The Joint Expert Group should

work in close collaboration with, for example, the Food and Agriculture Organization (FAO), the World Food Programme (WFP) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), and serve as CUIP for food and water sectors.

3.5.4.27 Acknowledging that the effective assessment and management of climate risk requires an understanding of the complex interplay between the climate factors and the vulnerability of the affected sector, Congress asked the CCl to consider developing interdisciplinary knowledge, based on vulnerability information, to support its work related to Climate Risk Management and adaptation in collaboration with other technical commissions and UN agencies. Congress further encouraged CCl to, *inter alia*, develop guidance material to demonstrate the benefits of the use of climate information in decision-making in the four priority sectors (i.e. water, health, agriculture and disaster risk reduction) identified by HLT. It also encouraged CCl to develop the requisite education, training and awareness-raising material for both providers and users of climate information, including aspects of communication.

3.5.5 World Climate Research Programme

Congress recalled that the World Climate Research Programme is a core element of the World Climate Programme and would play a crucial role in providing climate services under the GFCS.

3.5.6 World Climate Impact Assessment and Response Strategies Programme (WCIRP)

Congress was apprised that the World Climate Impact Assessment and Response Strategies Programme (WCIRP), coordinated by UNEP, had not been active for several years, and was further informed that UNEP has recently initiated a Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA), conceived as a coordination mechanism for international research on vulnerability, impacts and adaptation. Congress took note of UNEP's request to replace the WCIRP component of the WCP with this new programme. The objectives of the programme include plans to boost the capacity of the scientific community in providing timely information on climate vulnerability, impacts and adaptation. Congress noted that PROVIA in conjunction with the Global Adaptation Network (GAN), another UNEP initiative, is expected to fulfil some of the objectives of the Climate User Interface Platform (CUIP) component of GFCS.

3.5.7 Climate Coordination

Support to Climate Change-related activities and Conventions

3.5.7.1 Congress noted with satisfaction that during the fifteenth intersessional period the role and contribution of NMHSs within their national delegations, particularly in the work of the UNFCCC and its subsidiary bodies, has considerably increased. It further noted with pleasure that the Permanent Representative of Mali with WMO was re-elected chair of the Subsidiary Body for Scientific and Technological Advice (SBSTA), at COP 15, Copenhagen in 2009 for two years. Congress appreciated the actions taken by the Secretary-General to further strengthen the role of WMO in the UN system coordinated response to climate change, and contribution to the UNFCCC process. It requested the Secretary-General to continue these efforts and provide support to the implementation of the Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change.

3.5.7.2 Congress further noted the Agreements, adopted at COP 16, at Cancún Mexico, 2010, especially the decisions on adaptation and finance that have significant implications and opportunities for the WMO community. Congress encouraged the NMHSs to make use of these opportunities and highlight as appropriate, support for implementation of the GFCS at national level by timely submissions by them to the UNFCCC respective Parties. Congress appreciated the call of UNFCCC for implementation of the Cancún Adaptation Framework which would greatly benefit from various WMO activities including those associated with GFCS. The Cancún Adaptation

Framework includes a call for strengthening and establishing regional centres and networks which could very well collaborate with the WMO RCCs. Congress requested the Secretary-General to provide all necessary support to relevant actions and plans set in the Cancún Agreements.

3.5.7.3 Congress welcomed the progress made under the UN Delivering as One initiative, noting that WMO and the United Nations Educational, Scientific and Cultural Organization (UNESCO) have been given the leading role on "Climate Knowledge: science, monitoring and early warning" and requested the Secretary-General to follow up on this initiative and further strengthen development of knowledge and tools for informing decisions related to adaptation to climate change.

3.5.7.4 Congress noted that WMO has actively participated and contributed to scoping process of the IPCC Fifth Assessment Report (AR5). It further noted with pleasure the increasing number of experts of the CCl, WCRP, NMHSs and the meteorological community in general serving as lead authors, contributors and Bureau members of the Intergovernmental Panel on Climate Change (IPCC). To that effect, it encouraged the CCl and other WMO experts to continue their contributions to the AR5 process.

Climate Agenda

3.5.7.5 Congress noted the conclusion of EC-LXII, based on the proposal of the Executive Council Working Group on Climate and Related Weather, Water and Environmental Matters (ECWG-CWE), that the GFCS subsumes the objectives of the Climate Agenda which until now had provided the integrating framework for international climate-related programmes. Congress endorsed the recommendation that the Climate Agenda, along with its coordination mechanisms, should be formally retired and replaced by the GFCS and its governance mechanisms, and recommended to the partnering agencies that the Inter-Agency Committee on the Climate Agenda (IACCA) be brought to a formal closure.

3.5.8 Future structure of the World Climate Programme

3.5.8.1 Congress recalled that the World Climate Programme, founded in 1979 following the first World Climate Conference, is currently composed of four key component programmes, namely the World Climate Data and Monitoring Programme (WCDMP), the World Climate Applications and Services Programme (WCASP) including the CLimate Information and Prediction Services (CLIPS) Project, the World Climate Research Programme (WCRP), and the World Climate Impact Assessment and Response Strategies Programme (WCIRP), the latter being coordinated by the United Nations Environment Programme (UNEP). It noted the essential role played by the WCP since its inception in climate science, research and modelling, observation, management of climate data, monitoring and in applications and services.

3.5.8.2 Congress agreed to the request of UNEP for the formal closure of WCIRP component of WCP. Congress authorized the Executive Council to assess UNEP's request to replace WCIRP with PROVIA, duly considering its scope, governance structure, funding arrangements, priorities vis-à-vis its relation with GFCS, and take appropriate decision in this regard.

3.5.8.3 In the light of the decision on GFCS (see agenda item 11.1) and to optimally support the implementation and operation of its various components, Congress considered the need for restructuring the WCP. Congress decided that the new WCP would include GCOS, WCRP and a new World Climate Services Programme (WCSP), merging the existing activities under WCDMP, WCASP and the CLIPS project, as shown in Annex II to the present report, and adopted Resolution 18 (Cg-XVI) – World Climate Programme.

3.6 WORLD CLIMATE RESEARCH PROGRAMME (*agenda item 3.6)*

3.6.1 Congress noted with satisfaction the achievements made by the World Climate Research Programme (WCRP) since Fifteenth Congress. Particular advances under the Programme's two objectives, improving climate prediction and enhancing understanding of human interactions with climate, included progress in improving the quality of seasonal forecasts by continuing to explore multi-model ensemble tools and developing state-of-the-art data assimilation systems and better understanding of key processes that are likely to contribute to improved seasonal forecasts, such as the Madden–Julian Oscillation, El Niño Southern Oscillation (ENSO) and Asian Monsoons. WCRP was also actively engaged in improving climate projections with the launch of the Climate Model Intercomparison Project (CMIP5) that provides the framework for climate change modelling research and the basis for the next IPCC Assessment (AR5).

3.6.2 Congress was also pleased to note that, as part of the CMIP5, WCRP was exploring the potential of decadal predictions that could provide useful information for developing adaptation strategies. Congress appreciated WCRP's efforts to improve regional climate predictions through a coordinated regional climate downscaling experiment (CORDEX) that is producing regional climate projections for many areas of the world with an initial focus on Africa. Congress also noted the many other regional WCRP research projects and encouraged Members to take note of and engage with these activities, especially with respect to the regional analyses, education, training and capacity development workshops that WCRP is sponsoring with major regional programmes and organizations.

3.6.3 Congress was pleased to note that WCRP had developed an Implementation Plan for its Strategic Framework 2005–2015 (WCRP 2009, WMO/TD-No. 1503, http://www.wcrp-climate.org/documents/WCRP_IP_2010_2015.pdf) that addressed priorities identified in the ICSU/WMO/IOC/IGFA independent review of WCRP and that outlined how WCRP would deliver the best available state of knowledge on climate variability and change to the decision-makers, in a manner consistent with the challenges and opportunities associated with prediction of weather and climate across all time and space scales. The Plan describes how WCRP would focus its activities and partnerships on fulfilling the existing and emerging societal needs which include climate/weather extremes, sea-level variability and change, drought predictability and prediction, and seasonal to multi-decadal predictability of Polar climate.

3.6.4 The Congress noted the contribution of WCRP to the implementation of the recommendations of the EC Task Team on the Research Aspects of an Enhanced Climate, Weather, Water, and Environmental Prediction Framework (EC-RTT) *[*. In particular it welcomed the cooperation with the World Weather Research Programme on the Year of Tropical Convection (YOTC), polar predictability, monsoons, sub-seasonal to seasonal prediction and improvement of models that serve both the weather and climate communities.

3.6.5 Congress noted the brief WCRP report on the main outcomes of the recent meeting of the WMO/ICSU/IOC Joint Scientific Committee (JSC) for the World Climate Research Programme that focused on developing the Programme's long-term strategy and the role of WCRP research in the Global Framework for Climate Services and Global Sustainability Research Programme. Congress noted with appreciation that the thirty-first session of the JSC took place in Antalya, Turkey from 15 to 19 February 2010 in conjunction with the fifteenth session of the Commission for Climatology, and that a joint statement had been issued concerning the need for continued collaboration between climate research and services to address the urgent requirements for regional and national climate information in support of adaptation and risk management. Congress welcomed the decision of the JSC to form a new working group on regional climate science and information that would help to transition climate research outcomes to operational climate services and would serve as the main WCRP interface with the GFCS and efforts such as the World Climate Services Programme. Formation of this group addresses the observation made by the joint-sponsor review of the WCRP that strengthened collaboration between WCRP and relevant

activities in WCP would be extremely useful to achieve the objectives of the WCRP Strategic Framework.

3.6.6 Congress recognized that climate research was one of the five key elements of a Global Framework for Climate Services (GFCS) as identified by the World Climate Conference-3, and noted that climate research is essential for improving the quality of the climate services delivery. Congress encouraged WCRP to continue its activities in support of the implementation of the GFCS, while respecting the joint sponsorship of the Programme and the autonomy of the Joint Scientific Committee for the WCRP. Activities supporting the GFCS include: (1) strengthening and mainstreaming research observations to serve as prototypes for future climate observing systems, and to do research on climate observations towards understanding of the climate system; (2) developing climate prediction systems with lead times from seasons to centuries in a seamless manner; (3) ensuring development of reliable high-resolution products needed for climate adaptation and risk management; (4) promoting trans-disciplinary research to develop the necessary climate information for sector and region specific applications; (5) facilitating flow of climate information user requirements to the research community and climate services sectors through user feedback; (6) contributing to the training and development of highly-skilled talent to undertake climate research, operational prediction, and communication, particularly in the developing regions/countries. Congress requested the Secretary-General to ensure that support for climate research is maintained and encouraged the continuing coordination with other research programmes such as the Global Atmosphere Watch Programme (GAW) and WWRP and with CHy, CCl and CBS.

3.6.7 Congress endorsed WCRP's plans for the development of capacity through the promotion of regional analysis of global simulations from seasonal to centennial timescales and the analysis of regional modelling outputs from CORDEX. Congress was also pleased to note that WCRP intended to continue to train as many scientists as possible into its activities, for instance by offering travel grants to students, early career scientists, and researchers from developing countries to attend its scientific and technical workshops, conferences and symposia. Congress noted with appreciation WCRP's ongoing effort to promote research-policy dialogues in order to integrate climate change adaptation in development planning through a collaborative effort that involves the WMO, UNEP, the IPCC, START, the Universities of Ghana and Dar-es-Salaam and the Bangladesh Centre for Advanced Studies.

3.6.8 Congress welcomed the joint WCRP GEWEX and WGNE (CAS/WCRP Working Group on Numerical Experimentation) effort to combine new observations from field campaigns and satellites with results from theoretical and cloud resolving modelling studies and parameterization developments to improve the representation of clouds and moist processes in atmospheric models. Congress anticipated that the close collaboration between WCRP and WGNE would ensure timely transition of these capabilities to the operational meteorological services that benefit the public at the national and international level by saving life and property and effective management of natural resources.

3.6.9 Congress encouraged WCRP, in partnership with the Global Climate Observing System (GCOS), to continue to advocate for the development of global datasets of Essential Climate Variables (ECVs) and related variables, recognizing that such datasets are valuable as a basis for diagnostic studies and particularly for study of long-term trends, detection and attribution of causes of climate variability and change, and the development and evaluation of climate models. WCRP was committed to developing analytical and diagnostic techniques to create and reprocess data records and datasets related to ECVs to enhance their value to the international research community and other users of climate datasets. Congress recognized that there was an urgent need for establishing best practices for documentation and routine cross-comparison of the ECVs of similar parameters to enhance the transparency on methods used to produce them, and their use by the non-expert groups. The Congress acknowledged the joint efforts of WCRP and GCOS in this area.

3.6.10 Congress was pleased to note that WCRP was organizing an Open Science Conference (OSC) with the theme of "Climate Research in Service to Society" and with active engagement of the international climate research community, to be held 24–28 October 2011, in Denver, Colorado, United States, and urged Members to participate. The Conference would build on the outcome of WCC-3 and the report by the High Level Task team by focusing on the role of research and research priorities in support of the GFCS.

3.6.11 The Congress recalled that the Intergovernmental Oceanographic Commission (IOC) of UNESCO had joined WMO and the International Council for Science as a sponsor of the World Climate Research Programme in 1993. The Congress noted that the IOC Assembly, at its 25th session held in June 2009, had "reaffirmed [its] commitment to continue as a sponsor of the WCRP at a level of US$ 125 000 per annum, ideally through Regular Programme budget." Congress, however, expressed the hope that the IOC contribution in the future could increase at a level similar to that of WMO. Member States highlighted WCRP's importance to the IOC lead within UNESCO on the Inter-sectoral Platform on Climate Change, and UNESCO's joint lead with the WMO on the science and observations-based "Knowledge Base" within the UN system-wide response on climate change. The IOC Executive Council at its 43rd session in June 2010 encouraged Member States to support execution of the WCRP Implementation Plan 2010–2015 through the participation of their scientists. IOC noted that as result of the workshop organized in June 2006 by WCRP and IOC, the book "Understanding Sea-Level Rise and Variability" had been published in August 2010. IOC welcomed the establishment of a joint IOC/WCRP Task Group on Sea-level Variability and Change that would be providing assessment of the state of scientific understanding and priorities towards developing the best projections of sea level change and its impact on coastal communities and ecosystems. IOC appreciated the active participation of many WCRP scientists in the OceanObs'09 Conference and was looking to WCRP to help express requirements for the ocean observing system of the future, including for deep ocean observations needed for decadal prediction. IOC also welcomed the strong WCRP focus on ocean-atmosphere research and encouraged the Programme to continue its pursuit of scientific knowledge in support of practical regional applications.

3.6.12 The Congress noted the outcome of the International Council for Science visioning process which was designed to engage the scientific community to explore options and propose implementation steps for a holistic strategy on Earth system research that will encourage scientific innovation and address policy needs. Five "grand challenges" for global sustainability research were identified, namely forecasting, observations, thresholds, responses and innovation. These cover a diversity of topics but are united as elements of a systems approach that examines how the coupled social-environmental system is changing (including the dynamic responses of people and the environment) and what actions and interventions may alter the environmental and social outcomes. A Global Sustainability Research Programme was being developed and the Congress encouraged WCRP to make significant scientific contributions to meeting the goals of this new Programme.

3.6.13 The Congress noted the updated description of the WCRP functions and structure as contained in Annex II to the present report and the original financial arrangements unchanged in the Agreement between WMO, ICSU and IOC and reproduced as Annex III to the present report. Congress approved the continuation of the Agreement between WMO, ICSU and IOC for the conduct of WCRP following on from Resolution 9 (Cg-XIII) – World Climate Research Programme, and urged WMO to continue its strong support for, and guidance to, the World Climate Research Programme. Congress requested the Secretary-General to bring the updated programme description to the attention of the other two sponsors and seek their input and concurrence in revising, as necessary, the original MoU and its annexes.

3.7. WMO SPACE PROGRAMME *(agenda item 3.7)*

Meteorological Space-based Observing System

3.7.1 Congress reaffirmed the importance of integrated satellite systems as a unique source of observational data for monitoring of weather, climate and the environment. It stressed the importance of further advancing instrument intercalibration, data exchange, data management standardization, user information and training, in order to take full advantage of space-based capabilities in the context of the WMO Integrated Global Observing Systems (WIGOS).

3.7.2 It noted with appreciation that operational satellite coverage from the geostationary orbit was currently ensured by China (FY-2D and FY-2E), EUMETSAT (Meteosat-9, Meteosat-7), India (Kalpana and INSAT-3A), Japan (MTSAT-2), the Republic of Korea (COMS-1) and the United States (GOES-11, GOES-12, GOES-13); operational polar-orbiting coverage was ensured by China (FY-3A and FY-3B), EUMETSAT (METOP-A), and the United States (NOAA-18 and NOAA-19). Additional satellites were either in commissioning, such as the polar-orbiting Meteor-M1 and the geostationary Elektro-L N1 from the Russian Federation, or in back-up or secondary mode. Congress furthermore underlined the ocean surface topography monitoring by Jason-2 provided by EUMETSAT, France and the United States. It also recalled the valuable contribution of satellite missions operated by Research and Development agencies of a number of WMO Members including China, France, Germany, India, Japan, the United States and the European Space Agency. Whether these missions are designed as technology demonstrators, or as support to scientific investigations, their data are increasingly used in support of operational meteorological activities and climate monitoring. Congress encouraged the operators of these satellites to maximize the availability of data to Members. Congress emphasized the value of scatterometer wind data products which have become essential to tropical cyclone monitoring.

3.7.3 Congress was informed that new geostationary spacecraft series were planned to be implemented in the 2014–2017 time frame by several satellite operators. It encouraged the relevant regional associations, in collaboration with satellite operators, to prepare the user communities to take advantage of these enhanced capabilities in order to avoid any disruption for operations. It recalled that the CBS had recommended that Members implementing new satellite generations include an appropriate overlap period between current and future systems to facilitate data intercomparison, product validation, and smooth transition into operations.

3.7.4 Bearing in mind that satellite soundings from low-Earth orbits are a crucial input to NWP, Congress expressed concerns that there were no plans towards implementing a sounding mission on an early morning orbit (Equatorial Crossing Time around 5:30) as required in the Vision for the GOS in 2025. It encouraged satellite operators to consider optimizing the orbital distribution of future missions to alleviate this gap.

3.7.5 Congress highlighted that Highly Elliptical Orbit (HEO) missions have the potential to complement geostationary imaging and Space Weather monitoring capabilities to provide quasi-permanent observations over Polar Regions and encouraged Canada and the Russian Federation in their plans to demonstrate the operational benefit of such missions.

Data Accessibility and User Training

3.7.6 Congress stressed the need for improved accessibility of satellite data and products, particularly in developing countries, and welcomed the recommendation from CBS-Ext.(10) to consider among its priorities: (a) to organize the formulation of data requirements and the dialogue between data users and providers; (b) to implement sustainable regional Digital Video Broadcasting by Satellite (DVB-S and DVB-S2) dissemination systems (such as IGDDS or GEONETCast) offering cost efficient access to satellite data and products in every region; (c) to integrate all relevant data types in such broadcast services, including inter-regionally exchanged data; and (d) to support harmonization of future Direct Broadcast Systems as well as

complementary data access and distribution services via the Internet, recognizing the different user needs. Congress welcomed the setting up of regional expert groups in RA I, RA III, RA IV and RA V to review the requirements for satellite data access as well as the Pilot Project in RA II aiming to enhance accessibility of satellite data in the Region.

3.7.7 Congress welcomed the expansion of the Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) that included 12 Centres of Excellence (located in Argentina, Australia, Barbados, Brazil, China, Costa Rica, Kenya, Niger, Oman, Republic of Korea, Russian Federation and South Africa) sponsored by satellite operators (CMA, CONAE, EUMETSAT, IMD, INPE, JMA, KMA, NOAA, and ROSHYDROMET) which allowed organizing satellite training in all WMO Regions and all WMO official languages. It welcomed the VLab widening its scope and audience through partnerships with other training-related initiatives such as the COMET Programme of the United States. Congress recalled the usefulness of regional conferences (such as the EUMETSAT Meteorological Satellite Conferences, the GOES Users and Direct Readout conferences, and the recent Asia-Oceania Meteorological Satellite Users Conference) to raise user awareness on satellite systems and their utilization. It encouraged satellite operators to further organize such events and facilitate participation of WMO Members. It commended China, Japan and the Republic of Korea for their decision to jointly sponsor and rotate hosting future Asia-Oceania Meteorological Satellite Users Conferences.

3.7.8 Congress welcomed the setting-up of the Sustained Coordinated Processing for Environmental Satellite Data for Climate Monitoring (SCOPE-CM) and expected that this initiative would soon reach an operational stage and be expanded. It invited the Space Programme to consider similar initiatives to coordinate the delivery of satellite derived products responding to the requirements of other application areas including severe weather forecasting, precipitation estimation, or volcanic ash detection. Congress welcomed the orientation taken by the Commission for Climatology (CCl) to further incorporate satellite products in climate monitoring and its plan for enhancing linkages with the Space Programme and the SCOPE-CM initiative. It expected that this collaboration would bring substantial benefits to WMO global and regional climate monitoring activities. It recommended using existing mechanisms such as workshops, seminars or expert meetings coordinated by the CCl or within SCOPE-CM to address gaps in satellite-derived products for use in the WMO Climate System Monitoring (WMO-CSM).

Architecture for climate monitoring from space

3.7.9 Noting the request from EC-LXII, Congress agreed that an architecture for sustained climate monitoring from space should be defined and implemented, based on the requirements established by the Global Climate Observing System (GCOS) for the Essential Climate Variables (ECVs) that can be monitored from space. It welcomed the effort initiated to formulate a concept for such an architecture as included in the annex to Resolution 19 (Cg-XVI), noting that the architecture should enhance, and be modelled after, the system which has been developed for weather monitoring and forecasting over the last fifty years, to the extent possible. Congress further noted the importance of enhancing synergies between in-situ and space-based observing systems, and recommended that this be taken into account in the development of the architecture. Specifically with regard to ocean observations, it recognized the potential importance of the existing JCOMM Observing Programme Support Centre (JCOMMOPS) to provide some coordination mechanism, and to the enhancement of such synergies.

3.7.10 Congress agreed that such architecture should be defined as an end-to-end system, involving the different stakeholders including operational satellite operators and R&D space agencies, the Coordination Group for Meteorological Satellites (CGMS), the Committee on Earth Observation Satellites (CEOS), the Global Climate Observing System (GCOS), the World Climate Research Programme (WCRP) and the Group on Earth Observations (GEO). Within the WMO context, the architecture shall be part of the space-based component of WIGOS. Other components of this end-to-end system would include the intercalibration activities of the Global Space-based Inter-Calibration System (GSICS), additional calibration and validation activities to be conducted in

coordination with the Commission for Instruments and Methods of Observation (CIMO), the product generation efforts as done within the SCOPE-CM and the training and capacity-building activities of the VLab. Congress therefore adopted Resolution 19 (Cg-XVI) – Development of an architecture for climate monitoring from space.

Space Weather

3.7.11 Congress noted with appreciation that the Inter-Programme Coordination Team for Space Weather (ICTSW) involved experts nominated by 13 WMO Members and six international organizations, and had adopted an initial work plan focusing in priority on the review of Space Weather observing requirements and data management standardization issues, in consultation with relevant CBS expert groups. It encouraged Members to provide extrabudgetary financial and staff resources to support this coordination activity, given the severe impact of Space Weather on observation and telecommunication infrastructure and on aviation safety, as well as the potential synergy between Space Weather warnings and meteorological service delivery. Congress noted the outcome of a Side Event on Space Weather, as summarized in Annex IV to the present report. It noted that a coordinated effort by Members is needed to address the observing and service requirements to protect against the global hazards of Space Weather. It invited the WMO Space Programme, in coordination with the Inter-programme Coordination Team on Space Weather and with the support of the relevant technical commissions, to develop near-term and far-term action plans, including education and training, and work with the WMO Regional Associations to implement a coordinated strategy for Space Weather.

Radio Frequency Coordination

3.7.12 Congress appreciated the substantial efforts made by Members in protecting the radio frequency bands allocated to meteorological systems and environmental satellites. It urged all Members to ensure continuous coordination with their national radio communication authorities, and to participate actively in national, regional, and international activities involving radio communication regulatory issues for the defence of radio frequency bands for meteorological and environmental activities. It also supported the Council's request to the Secretary-General to give priority to this subject. Congress also noted with appreciation the effective work of the CBS Steering Group on Radio Frequency Coordination (SG-RFC) in addressing radio frequency issues of concern to the Space Programme, and the need to maintain this effort at a high level.

Consultative Meetings

3.7.13 Congress noted that the Consultative Meetings on High-level Policy in Satellite Matters (CM) had convened during the Congress time frame, as recommended by the Executive Council, and took due note of the outcome of this meeting. Congress expressed its high appreciation to Dr A.I. Bedritskiy who has provided outstanding leadership as Chair of CM over the past eight years. It reaffirmed the importance of having the CM chaired at the highest level of the Organization. Congress thanked Germany and Japan for seconding staff resources to the Space Programme, EUMETSAT, and NASA for its contribution to the Space Programme Trust Fund.

3.7.14 Congress agreed with the Space Programme description as provided in Annex II to the present report.

4. SERVICE DELIVERY *(agenda item 4)*

4.1 PUBLIC WEATHER SERVICES PROGRAMME *(agenda item 4.1)*

4.1.1 Congress commended the successful implementation of the Public Weather Services Programme (PWSP) during the fifteenth financial period according to the WMO Strategic Plan. Congress emphasized that services provided to the public through the national PWS programmes

represented the most visible part of the work of NMHSs, and as such had a significant contribution to their credibility. The PWS Programme contributed to the achievement of the WMO Expected Result (ER) 7, by concentrating on the importance of user-focus, quality management and building capacities in NMHSs for the continual improvement of quality in the delivery of weather, and related environmental services to user communities, and in particular, to the public. Congress recognized that the strength of the PWS Programme lay in developing a multi-agency approach whereby the strengths of the meteorological community were complemented by other skills through partnerships. Congress requested that the PWS Programme be strengthened to enable full realization of potential benefits of national PWS programmes, particularly in the developing and Least Developed Countries (LDCs). The full description of the PWS Programme can be found in Annex II to the present report.

WMO Strategy for Service Delivery

4.1.2 Congress supported the action taken by the Secretary-General to develop the "WMO Strategy for Service Delivery" for adoption by Congress, to evaluate and guide the development of service delivery practices by Members. Service delivery is a continuous, cyclic process for developing and delivering user-focused services. It is further defined in four stages: Stage 1: User Engagement – identifying users and understanding their needs, as well as understanding the role of weather-, climate-, and water-related information in different sectors; Stage 2: Service Design and Development – process between users, providers, suppliers, and partners of creating, designing, and developing services, ensuring user needs are met; Stage 3: Delivery – producing, disseminating, and communicating data, products and information (i.e., services) that are fit for purpose and relevant to user needs; and Stage 4: Evaluation and Improvement – process to collect user feedback and performance metrics to evaluate and improve upon products and services. The Strategy is based on "WMO Guiding Principles for Service Delivery" which had been endorsed by EC-LXII (Geneva, June 2010). The Strategy is WMO-wide and applicable to all activities and programmes that have a role in service delivery, although the PWSP had been tasked by the Executive Council Working Group on Disaster Risk Reduction and Service Delivery (EC-WG DRR & SD) under whose direction the Strategy was drafted, to take the lead in coordinating the development of the Strategy. Congress particularly noted that inputs from regional associations and technical commissions and their subsidiary bodies, the EC subsidiary bodies and the WMO Programmes had been sought in developing the Strategy. Congress expressed its appreciation to all those who had contributed to the development of the Strategy. In approving this Strategy for Service Delivery, Congress emphasized its synergy with the Global Framework for Climate Services (GFCS) and requested that an implementation plan be developed to guide Members' efforts at national level.

4.1.3 Noting that while much had been done by WMO Members to build infrastructure and improve modelling capabilities to enhance products, developments in service delivery had not always matched the improvement in technical capabilities. Congress fully acknowledged service delivery as one of the Strategic Thrusts of the Organization in the Strategic Plan 2012–2015. It stressed that implementation of the Strategy should be used by NMHSs to improve their relationships with users, thus increasing the relevance of NMHSs products and services to decision-making processes and ultimately demonstrating the role and position of NMHSs in the national socio-economic development processes of Members.

4.1.4 Expressing its strong support for this initiative, Congress adopted the "WMO Strategy for Service Delivery" as presented in Annex V to the present report. It requested that the regional associations make full use of the Strategy in developing specific plans appropriate to their own Regions, and engaging in regional partnerships. Congress further urged Members to seek every opportunity to transfer knowledge through advanced capacity-building approaches and in documenting best practices. Congress requested the Secretary-General to take the steps necessary for the implementation of the Strategy.

Members' priority areas for PWS delivery

4.1.5 In the context of the PWSP, Congress emphasized that well-run and credible national PWS programmes provided a critical interface between NMHSs and users and were the major conduit for the delivery of the benefits of meteorological and hydrological services to the entire community. As such, they were critical in assisting NMHSs secure the long-term trust of user communities. This long-term trust was best established through the provision of high quality daily forecast services delivered through media partners and strengthening the confidence of the public in NMHSs. This, in turn, was crucial to the effectiveness of warnings of much less frequent severe weather events.

4.1.6 Congress stressed that Members were strong proponents of multi-hazard, multi-scale early warning systems. To be efficient, these systems need to be embedded within an operational end-to-end-to-end service delivery framework. Congress agreed that the meteorological community needed to embrace this approach as it would help enable NMHSs to demonstrate their commitment to continual improvement, a cornerstone of a QMS.

4.1.7 Congress endorsed the strategic objectives recommended by the International Symposium on PWS: A Key to Service Delivery (Geneva, December 2007), to guide the implementation of the PWSP aimed at enabling NMHSs improve their service delivery, as follows:

(a) Improving early warning services and products and their dissemination as an integral part of PWS;

(b) Engaging in capacity-building and outreach activities;

(c) Improving the reach of NMHSs products and services;

(d) Promoting the application of the science of meteorology, climatology, hydrology and related technology to improve products and services;

(e) Engaging in demonstration projects and collaborative activities as appropriate;

(f) Establishing and promoting best PWS practices;

(g) Researching and providing information on social and economic aspects of weather services;

(h) Engaging in surveys and assessments to better understand user requirements;

(i) Promulgating the results of the work of PWS expert teams and groups.

4.1.8 Congress endorsed the areas of principal focus of the PWSP. These areas, which follow the PWS strategic objectives, are in accordance with the WMO Strategic Plan, and are based on the priorities indicated by Members through the Executive Council, technical commissions, in particular the Commission for Basic Systems (CBS), and regional associations as indicated below:

(a) *End-to-End-to-End Service Delivery* – Working with users, understanding user needs, total quality management, continuous improvement;

(b) *Enhancing the economic and social well-being* – Contributing to national sustainable development efforts by collaborating with and supporting weather-sensitive sectors;

(c) *Education and Training* – Building the required competencies and skills amongst the NMHSs staff on all aspects of PWS delivery to user communities, and, in particular, to the public;

(d) *Dissemination and two-way communication of effectively formulated multi-hazard warnings as the essential first step for an effective Early Warning System (EWS)* – Building effective and timely dissemination and communication system for forecasts and warnings and user feedback;

(e) *Strong communications and media skills* – Developing skills in effective communication of weather and climate information and tailoring of language to specific media and user requirements, as well as the use of all media, including emerging media, and building key partnerships with media organizations as an important element in successful service delivery;

(f) *Public education and awareness* – Promoting awareness among the public to improve their response to NMHSs warnings and forecasts, and the taking of appropriate actions.

4.1.9 Based on the above, Congress endorsed the approach adopted by the PWSP in carrying out its mandate in response to Members' priorities and requested that it should be continued through:

(a) Knowledge transfer through the work of experts;

(b) Capacity-building through training and production of guidance materials;

(c) Implementation of Learning-Through-Doing (LTD) Demonstration Projects.

PWSP implementation in response to Members' priorities

Knowledge transfer

4.1.10 Congress acknowledged that the work of experts in all areas of PWS activities was a crucial component of the PWSP and a major contributor to its success. It expressed its appreciation to all Members who had made their experts available for participation in PWS expert teams and forums and requested that this very effective approach for progressing with the strategic objectives of the PWSP should continue in the sixteenth financial period.

Capacity-building

Publications and guidance materials

4.1.11 Congress acknowledged the publication of seven guidelines and five summary guides during the intersessional period, addressing key aspects of PWS, all of which were freely accessible on the worldwide web (http://www.wmo.int/pages/prog/amp/pwsp/publications_en.htm). Congress encouraged Members to make maximum use of the publications and requested that PWSP continue to prepare such guidance materials.

Training

4.1.12 In stressing the need for specific competencies within NMHSs and the associated education and training requirements for the service delivery tasks in PWS, Congress expressed satisfaction that these competency requirements were being developed through the Commission for Basic Systems (CBS) in close liaison with the Executive Council Panel of Experts on Education and Training. In noting that 26 training workshops and seminars had been conducted for NMHSs from all WMO Regions by PWSP during the intersessional period, a number of which had been in

collaboration with the Tropical Cyclone Programme (TCP) and the Data Processing and Forecasting System (DPFS) Programme, Congress requested that priority continue to be given to training activities in Public Weather Services in a complementary manner to other capacity-building efforts in other Programmes and initiatives, including the GFCS. Congress expressed appreciation to Members who had hosted these training events and made available their experts as trainers and urged developed countries to continue to provide assistance in training of staff from less developed NMHSs. Furthermore, in view of the importance of the Strategy for Service Delivery, Congress stressed that training in service delivery was a crucial element in ensuring the successful implementation of the Strategy and requested the Secretary-General to arrange for training in this area especially in developing and least developed countries.

Network of Focal Points

4.1.13 Congress noted the value of the network of national Focal Points in supporting the implementation of PWS among Members, and requested all Members who had not already done so to nominate national PWS Focal Points and to equip them with adequate skills and resources to carry out PWS tasks.

Demonstration Projects

Learning-Through-Doing (LTD) Projects

4.1.14 Congress endorsed the PWS Learning-Through-Doing (LTD) Demonstration Projects, focusing on assisting NMHSs to increase the quality and range of their products and services through creating partnerships with various socio-economic sectors. It agreed that this approach responded directly to the Madrid Action Plan 2007 (MAP) and the Strategic Thrust of WMO on Service Delivery. It welcomed the fact that a number of Projects had been implemented during the fifteenth financial period in East Africa, West Africa, and Central and Latin America. These Projects, which had targeted the health, agriculture, fisheries and transport sectors, had produced far-reaching impacts with relatively modest resources. Congress expressed appreciation to the National Meteorological Service of Spain (AEMET) for its generous and consistent support to the countries participating in the LTD projects in West Africa and Central and Latin America.

4.1.15 Through the Projects, the participating NMHSs had understood the needs of the user sectors involved and had designed, produced and provided new or improved products to meet those specific needs. In turn, the user sectors had properly articulated their needs, had been helped by NMHSs to master the methods of analysis and interpretation of relevant data provided by NMHSs, and applied the information to their specific sector. Outcomes of these Projects had also included: creation of multi-disciplinary teams with ability to interact effectively with users; extensive collaborative efforts with stakeholders; skills in socio-economic assessment for the quantification of the benefits of the meteorological services; cross-training of the relevant staff and officials; and improved timeliness of delivery of services. Congress endorsed this cost effective approach to capacity-building and requested the Secretary-General to provide the necessary support towards the implementation of further LTD Demonstration Projects.

Severe Weather Forecasting Demonstration Projects (SWFDP)

4.1.16 Congress endorsed the thrust of PWSP as one of the two components in various SWFDP, (including the SWFDDP in the South Pacific) which had helped enhance the capabilities of the participating NMHSs to deliver improved severe weather warnings and forecasts to the disaster management agencies, the media and the public along the lines of the LTD approach. Congress requested the continuation of this collaborative approach between the PWS and DPFS Programmes in all future SWFDP Projects and believed that this set a good model for integration among the various WMO Programmes with inter-related goals including the DRR Programme.

Multi-Hazard Early Warning Systems Projects

4.1.17 Congress welcomed the role of the PWSP in coordinating the World EXPO 2010 Nowcast Services (WENS) Demonstration Project in the framework of the Shanghai Multi-Hazard Early Warning Services (MHEWS). The objectives of the Project were to demonstrate enhancement of short-range forecasts of high-impact weather through nowcasting applications; and to promote the understanding and enhance the capability, as appropriate, of WMO Members in nowcasting services. This Project was successfully implemented over the six (6) months of the EXPO. The experience gained in the Project will be shared in the form of guidelines on the provision of nowcasting services and a capacity-building workshop for Members with a view to transferring the nowcasting skills and technologies, as demonstrated by a number of currently available systems, into operational use by Members in need.

4.1.18 Congress welcomed the collaboration between the PWS and Disaster Risk Reduction (DRR) Programmes in the implementation of the WMO Caribbean Regional Programme on MHEWS. The focus of the PWSP is to assist the NMHSs of the Caribbean Region to enhance their capacities for delivering services to the Disaster Risk Management (DRM) agencies, the media, social and economic sectors and the public. It will contribute to the implementation of the activity by leading the training of the DRM agencies, NMHSs and the media in communication protocols and website development and management.

International exchange of public forecasts and warnings

4.1.19 Significant accomplishments had been made to further strengthen the recognition of NMHSs as official authoritative sources of warnings and public weather forecasts and to improve access by the public and other users to official information sources. Congress agreed that, with 12 million page visits per month, the World Weather Information Services (WWIS) Website (http://worldweather.wmo.int) had evolved from a project to a mainstream activity of Members that communicated official forecasts for over 1340 cities. It noted that WWIS had upgraded graphics for easier use, and that it was hosted in nine languages (Arabic, Chinese, English, French, German, Italian, Portuguese, Russian and Spanish). Congress commended all the Web hosts and especially Hong Kong, China, for coordinating and leading the activity. It urged all Members to continue to contribute to the WWIS.

4.1.20 Congress noted with appreciation a presentation by Hong Kong, China, on the challenges and opportunities for WWIS, highlighting the need for:

(a) Official forecasts for more cities where available;

(b) Longer forecast duration where available;

(c) Inclusion of more forecast elements, e.g., relative humidity, wind, where available;

(d) Higher temporal resolution in the forecast;

(e) Mobile telephone version.

4.1.21 Congress agreed that the above enhancements to the WWIS, especially the development of the mobile version of WWIS, would bring even better access by the public and the media to the authoritative weather information as issued by NMHSs, and would further increase the visibility of WMO and its Members, and that they should be actively pursued by the PWS Programme.

4.1.22 Congress noted that the Secretary-General, with the concurrence of the Executive Council, had approved access to WWIS data to various organizations to develop other media products.

4.1.23 Congress noted the creation of a partnership between WMO, a private-sector partner and Hong Kong, China, to promote access to official tropical cyclone warnings by the public and the media through the Severe Weather Information Centre (SWIC) Website (http://severe.worldweather.wmo.int). Congress agreed that this effort greatly enhanced the status of SWIC as the portal to official tropical cyclone warnings from Members. Congress also recalled its discussions on the DRR Programme during this Session (genda item 11.5) and supported that standardization of severe weather information, especially tropical cyclone advisories and warnings, should be pursued so as to improve the accessibility and understanding of the information by the public and the media through the Internet.

4.1.24 Congress cited as an example of best practice in international cooperation, the European Multi-hazard Meteorological Awareness (EMMA) Project and the Meteoalarm Website established under this Project. Collaborating through EMMA, 27 European countries present warning information in a harmonized manner and facilitate a more effective communication of warnings to European citizens.

4.1.25 Congress also endorsed the PWS initiative of launching the online "Register of WMO Members Alerting Authorities" (http://www-db.wmo.int/alerting/edit.asp), and noted that the introduction of the Register was an important step towards achieving a "single official voice for dissemination of weather warnings", a priority area identified by Members. It requested Members to contribute to the Register, to keep it updated, and to refer to their membership of this Register when asserting their authoritative role with respect to issuing national warnings.

4.1.26 Congress welcomed the implementation of the Common Alert Protocol (CAP) as a joint collaborative effort between PWSP and the WMO Information System (WIS). This would facilitate communication of all warnings through all forms of media to the public and all user communities.

Social and economic applications of PWS

4.1.27 Congress strongly supported the activities of the PWS Programme in assisting Members in the evaluation and demonstration of the social, environmental and economic benefits of their products and services to user communities. It emphasized the vital contribution of the socio-economic benefits to society that result from meteorological and hydrological services and requested the Secretary-General to continue to pay attention to this area of work of NMHSs, including the organization of training and capacity-building in quantifying socio-economic benefits. Congress requested that the WMO Forum on Socio-Economic Benefits of Weather, Climate and Water Services, which was established by the Secretary-General under the PWSP to help implement the MAP, to intensify its work on socio-economic issues related to service delivery. In this regard, Congress expressed the desirability of organizing a second international conference on the theme of social and economic benefits of meteorological and hydrological services to further progress the work which was begun in Madrid in 2007. Congress also endorsed the close collaboration between the PWSP and the THORPEX Social and Economic Research and Application (SERA) Working Group, and encouraged the continuation of this collaboration during the sixteenth financial period.

4.1.28 In noting the benefits to be derived by Members from evaluation of user satisfaction through surveys, Congress was pleased to learn that guidelines on developing user satisfaction surveys had been developed by the PWS Programme and these together with sample surveys had been made available on the PWS Website at http://www.wmo.int/pages/prog/amp/pwsp/surveys.htm.

4.1.29 Congress recognized the challenges in maintaining high-quality PWS in regions where weather forecast services and products are commercialized and recommended that Members not lose sight of the overall benefits to society of freely available, high-quality public weather services.

Media relationships

4.1.30 Congress supported the continued beneficial engagement of the PWSP with the International Association of Broadcast Meteorology (IABM) and welcomed the role of IABM in various capacity-building activities of WMO. It supported greater focus on the use of social media as a channel for the enhanced communication and delivery of services. Congress requested the Secretary-General to continue supporting the work of networks of professional weather and climate communicators as important partners and a conduit for PWS products to the public.

4.1.31 Congress noted that various media channels needed to be used to ensure effective communication of information to different users. Recognizing the growth of new media, especially social media, Congress emphasized that effective use of these channels of communication by NMHSs was very important in improving delivery of services and strengthening links with the public. Congress also recognized that RANET, as an established communication method, had been very successful in bringing critical weather information to rural communities in some less developed countries.

Megacities and WMO

4.1.32 Megacities are cities with a population of ten million people or more. By 2007 there were 19 megacities, in both developing and developed countries. It is expected that there will be about 26 megacities by 2025. Megacities are often located along coasts or near major rivers and deltas and face many challenges due to their geographical locations as well as high economic, population and building density.

Challenges facing megacities

4.1.33 Congress acknowledged that weather, climate, water and environmental events can have a high impact on: health; transport; energy; and water sectors. Consequences of severe weather such as floods associated with tropical cyclones, severe thunderstorms or monsoons, heat waves and cold spells, severe snow storms; and traffic congestion associated with severe weather are some of the major challenges facing megacities. Health impacts are normally associated with: (a) increased mortality and morbidity; and (b) aggravated pulmonary, respiratory and cardiovascular diseases, due to poor air quality, heat or cold stress. Severe weather can be the source of the so-called “domino effect” in megacities. A severe snow storm around and in a megacity, for example, may cause power lines to collapse under the weight of snow and ice, depriving the city of essential energy while the road and rail traffic chaos further complicating the usually heavy traffic may lead to lack of food or fuel delivery to the city and may prevent emergency services such as police, fire fighting and ambulances to gain necessary access to areas where those services are needed. Almost all megacities face major fresh water challenges because of excessive groundwater withdrawal, salt-water incursions into aquifers, floods and droughts disturbing water supply, and increasing demand.

Responding to challenges

4.1.34 Megacities need climate, weather and environmental services in order to be resilient in withstanding environmental hazards. Climate information and services are needed for planning and long-term infrastructure building, while weather information and services respond to the needs of the authorities and the population in handling severe and high-impact events. Congress agreed that improving the capacity of NMHSs in megacities to develop partnerships and collaboration with the city government authorities responsible for provision of services to the population is an essential first step in responding to the many of the challenges cited above.

4.1.35 Congress emphasized that it is crucial for NMHSs to deliver user-relevant services with targeted improvements in communication and client relations. It is equally essential for meteorologists, hydrologists, atmospheric and climate scientists to work together and with

agencies that are responsible for meteorological forecasts and flood forecasts and control. These initiatives will lead to a shift from reaction to impact of hazards to prevention of impact of hazards. Access to nowcasting systems to provide forecasts of severe thunderstorms leading to flash flooding is a vital element of addressing environmental challenges as is a robust multi-channel system of dissemination and communication of information to all partners and the public in a megacity. An example of how the megacity of Shanghai has successfully responded to numerous challenges posed by its size and population density is through the establishment of an Integrated Public Weather Services operations platform in 2009 to strengthen the integration between the Shanghai Meteorological Bureau (SMB) of the Chinese Meteorological Administration (CMA), other agencies and specialized users. The goals of the Platform are to transform PWS delivery into routine work by specialized duty officers and to provide highly targeted and tailored services to a variety of institutional, governmental, specialized users and the public. Under the direction of the Chief Service Officer (CSO), the Platform develops products for decision-making for 26 sectors which include government departments, emergency response agencies, the public, and weather sensitive users.

WMO activities in megacities

4.1.36 Congress noted that WMO has been involved in a number of projects specifically designed to respond to challenges faced by megacities, including the World Expo Nowcast Services (WENS) Demonstration Project to respond to severe and high impact weather hazards during the Shanghai Expo. The GAW Urban Research Meteorology and Environment (GURME) Project is concerned with meteorological and related features of air pollution. GURME Pilot Projects were implemented in several megacities, including: Beijing; Mexico City; Moscow; New Delhi; Santiago; and Shanghai. GURME is also involved in the EU MEGAPOLI and MACC Projects. Along with the World Health Organization (WHO) and other organizations, WMO is also involved in the nascent Shanghai Health Forecasting Program, which is a path finding initiative to develop early warning and detection systems for a variety of weather and climate sensitive diseases in the megacities of Shanghai, London and New York.

4.1.37 Congress recognized that effectively addressing issues associated with megacities will require a coordinated effort across a broad spectrum of activities, from research to service delivery, in support of a wide range of user groups. This effort will draw on the expertise of a number of WMO Programmes in addition to PWS, such as Global Data-processing and Forecasting System (GDPFS) and Atmospheric Environment Research (AER) as well as other organizations involved in complementary efforts such as the WHO. Congress requested the Secretary-General to consolidate present efforts addressing megacities into a coherent form with the necessary support to urgently address this emerging concern. Congress further requested that CBS and CAS provide collaborative leadership on this issue to ensure a highly effective link between the relevant research and operational service delivery programmes.

4.1.38 Congress adopted Resolution 20 (Cg-XVI) – Public Weather Services Programme.

4.2 AGRICULTURAL METEOROLOGY PROGRAMME *(agenda item 4.2)*

The report of the president of CAgM

4.2.1 Congress noted with appreciation the progress achieved in implementing the Agricultural Meteorology Programme (AgMP) since Fifteenth Congress in 2007 and the report of the fifteenth session of the Commission for Agricultural Meteorology (*Abridged Final Report with Resolutions and Recommendations of the Fifteenth Session of the Commission for Agricultural Meteorology* (WMO-No. 1062)). It expressed its satisfaction with the successful implementation of the Programme according to the direction provided in the Strategic Plan and by the Fifteenth Congress.

4.2.2 Congress noted that as per the decisions adopted by the Commission for Agricultural Meteorology (CAgM), at its fifteenth session held in Belo Horizonte, Brazil from 15 to 21 July 2010 the activities of the Programme are being implemented in three Open Programme Area Groups:

(a) Agrometeorological Services for Agricultural Production;

(b) Support Systems for Agrometeorological Services;

(c) Climate Change/Variability and Natural Disasters in Agriculture.

4.2.3 Congress acknowledged with appreciation the work of the Secretariat for the organization of the International Workshop on Addressing the Livelihood Crisis of Farmers: Weather and Climate Services that preceded the CAgM-XV session. Congress thanked the Government of Brazil for hosting the workshop and the many organizations for their co-sponsorship.

4.2.4 Congress noted with appreciation the progress made in the establishment of the Drought Management Centre for South-Eastern Europe (DMCSEE), identifying consensus indices for meteorological, agricultural, and hydrological drought, increasing interactions between NMHSs and the agricultural community, increasing donor support for agrometeorological projects, and increasing interactions with UN agencies and NGOs.

4.2.5 Congress further noted that the CAgM has set the priorities for the next intersessional period: support agrometeorological training at regional, national and local levels; develop enhanced services for the agricultural, livestock, forestry and fisheries communities and partner agencies; encourage development of a knowledge sharing interface between forecasters/scientists, extension services and the agricultural decision-makers; and encourage the sharing of resources among WMO Members and other organizations in order to build synergies and to support human health and economic development, which places it in an excellent position to play a major role in the user interface platform component of GFCS.

Publications

4.2.6 Congress was pleased to note that the activities implemented under AgMP had resulted in several important publications, including special issues of scientific journals such as the *Journal of Agricultural Science* and *Időjárás,* the Quarterly Journal of the Hungarian Meteorological Service and the books entitled *Managing Weather and Climate Risks in Agriculture, Climate and Land Degradation, and Climate Change and Food Security in South Asia* published by Springer. Congress noted with appreciation that CAgM had published several workshop proceedings, three brochures, and eight CD-ROMs. Congress acknowledged and encouraged the publishing of CD-ROMs to facilitate quick access to information by Members and to publish information in as many official WMO languages as possible given the limited financial resources.

4.2.7 Congress noted with great appreciation the completion of the *Guide to Agricultural Meteorological Practices* (WMO-No. 134) and thanked all contributors. Congress requested that the electronic version should be made freely available on the Internet and that CD-ROM versions be widely distributed. Congress requested the Members to mobilize resources to translate the Guide into other languages.

Drought activities

4.2.8 Congress noted the “Lincoln Declaration on Drought Indices” adopted at the Inter-Regional Workshop on Indices and Early Warning Systems for Drought at the University of Nebraska-Lincoln in Lincoln, United States (December 2009) and decided on the use of the Standardized Precipitation Index (SPI) to characterize meteorological drought. Congress adopted Resolution 21 (Cg-XVI) – Use of the Standardized Precipitation Index for characterizing meteorological droughts by all National Meteorological and Hydrological Services. Congress

further noted and supported the ongoing work of WMO and the UN International Strategy for Disaster Reduction (UN-ISDR) on the Agricultural Drought Indices and Hydrologic Drought Indices that will contribute to the chapter on drought risks for the 2011 UN Global Assessment Report on Disaster Risk Reduction (GAR11).

4.2.9 Congress noted that despite the repeated occurrences of drought impacts on different socio-economic sectors, there is a gap in the policy aspects of droughts and there is a need for concerted efforts to initiate a dialogue on the formulation and adoption of national drought policies to provide a clear legal framework. Many governments have not been proactive in the management of droughts because of the lack of such a legal framework. Congress therefore recommended the organization of a "High-Level Meeting on National Drought Policy" and for WMO to closely collaborate with the UNCCD Secretariat, which is also engaged in efforts to support drought mitigation activities in the context of the UNCCD National Action Programmes (NAPs) implementation processes. Other relevant organizations should also be associated using extrabudgetary resources. Such a high level meeting would contribute to a coherent UN system-wide response to drought impacts.

4.2.10 Congress supported the efforts of the Secretariat and the Global Water Partnership in developing the proposed Integrated Drought Management Programme and urged the Secretariat to find other partners for this proposal. The principal approach is to develop a global coordination of efforts to strengthen drought monitoring, risk identification, drought prediction and early warning services and development of drought management knowledge base.

National Agrometeorological Station Network (NASNET)

4.2.11 Congress expressed its support to the establishment of "National Agrometeorological Station Network (NASNET)" endorsed by EC-LX through Resolution 6 (EC-LX). Congress impressed upon the NMHSs and universities or national, regional and international institutes engaged in agricultural research, that the agrometeorological stations maintained by them should be considered as a valuable national resource and that Directors of NMHSs should engage in a dialogue with the above institutions to establish a National Agrometeorological Station Network (NASNET) by bringing all the stations being operated by the different entities under one common umbrella in coordination with the WMO Integrated Global Observing System, where such networks do not currently exist.

Adaptation to climate change

4.2.12 Congress agreed with the recommendations of the Symposium on Climate Change and Food Security in South Asia held in Dhaka, Bangladesh (August 2008) for the creation of a Climate Change and Food Security in South Asia Network (CCFSSANet) and the establishment a South Asia Climate Outlook Forum (SACOF). Congress requested that similar regional workshops be organized in other regions given the availability of financial resources.

4.2.13 Congress agreed with the recommendations of the Workshop on Adaptation to Climate Change in West African Agriculture held in Ouagadougou, Burkina Faso (27–30 April 2009) that called for the establishment of a West and Central African Network on Climate Change and Food Security (ROCACCSA) and a Technical Secretariat, as part of the ECOWAS Sub-regional Action Programme on Climate Change, comprising of competent institutions at the national and regional level in West Africa and with international institutions and organizations.

4.2.14 Congress noted that the activities of the AgMP and CAgM will be further guided by the outcomes of WCC-3 and the relevant elements of the GFCS. In order to enhance the contribution of climate information to land management, agriculture and food security including risk evaluation and information delivery, cooperation and partnerships, adaptation strategies are needed for resilient agricultural systems, and climate change mitigation. Congress recognized that the activities of CAgM will provide a major contribution to the development of the Climate User

Interface Programme (CUIP) of GFCS. Congress further noted that CAgM and AgMP should define a clear set of priorities related to food security, climate services for sustainable agriculture and agricultural risk management for the CUIP of GFCS and develop an approach for pilot projects to achieve desired deliverables.

Implementation of the AgMP – Interactions with other WMO Programmes

4.2.15 Congress noted that WMO's GAW/WWRP and CAS have been developing a Sand and Dust Storm Warning and Advisory System (SDS-WAS). Congress expressed its appreciation that the AgMP had provided input into this project with regards to potential agricultural applications.

4.2.16 Congress noted that the World Bank/WMO project in the Lake Victoria region of East Africa has the goal of enhancing the security of the livelihoods of farmers and fishermen by taking into account historical drought analysis and the development of in-season crop yield forecasts for food security and food aid. Congress acknowledged that the project will support the GFCS and will link with other WMO and World Bank projects, specifically with the Severe Weather Forecast Demonstration Project (SWFDP) which is an activity of CBS. Congress urged the AgMP to continue to provide linkages between NWP forecast products and their application in agricultural decision-making.

4.2.17 Congress encouraged CAgM to contribute to the work of the new CCl-CAgM-CHy Working Group on Climate, Food, and Water.

Regional activities in agrometeorology

4.2.18 Congress noted that the regional associations have established new Working Groups on Climate Services, Adaptation and Agricultural Meteorology or Working Groups on Climate and Hydrology with Sub-groups or Sub-tasks on Agrometeorology. Congress noted that the recommendation at CAgM-XV to reappoint Working Groups on Agricultural Meteorology for all regional associations had been implemented but only two working groups were able to meet due to lack of resources. Congress urged the Member's financial support to ensure that these groups are able to meet in the next intersessional period.

World Agrometeorological Information Service (WAMIS)

4.2.19 Congress urged Members to participate and disseminate their products to the global community through the World Agrometeorological Information Service (WAMIS- www.wamis.org) which has products from over 50 countries and organizations and provides over 77 links of tools and resources to help countries improve their bulletins and services. Congress acknowledged the assistance of Italy and the Republic of Korea in providing WAMIS mirror servers. Congress acknowledged and supported the development of an ISO compatible search engine on WAMIS, which is required to provide WAMIS information as a component of the WIS. Congress noted the important voluntary contributions from the Republic of Korea, Italy and the United States to the development and maintenance of WAMIS. Congress supported the work of CAgM in developing the next phase of WAMIS and urged that any further developments be considered for integration into WIS.

Training and Capacity-building

4.2.20 Congress expressed its appreciation that following the organization of the Expert Meeting on Review of Curriculum in Agricultural Meteorology, the *Guidelines for Curricula in Agricultural Meteorology* (WMO-No. 258) were published. Congress urged the Secretary-General to widely disseminate the new publication and to solicit assistance for its translation into as many official languages as possible. Congress strongly urged Members to widely disseminate these harmonized curricula in agricultural meteorology to national institutions and to encourage their implementation.

4.2.21 Congress stressed the importance of the organization of Roving Seminars on Weather, Climate and Farmers for taking the weather and climate services to the users and expressed its satisfaction that AgMP was able to provide support to the NMHSs of Bangladesh, Ethiopia, India, Sri Lanka, and Peru to support roving seminars in other countries and regions. Congress further stressed the need to disseminate basic knowledge and guidance on the use of weather and climate information to the user communities through interactive events, such as farmer fairs, advance learning system, and climate field schools. Congress also urged all NMHSs to support and widely use these interactive events.

4.2.22 Congress, in particular, was pleased with the financial support provided by the Meteorological Agency of Spain (AEMET) for the METAGRI project which supported West African NMHSs to organize such roving seminars in their countries. Congress urged Members to make use of such mechanisms to support roving seminars in their regions.

4.2.23 Congress noted that the CAgM-XV session endorsed several key priorities including the agrometerological training at various levels and the development of knowledge sharing between scientists/forecasters, agricultural extension services, and agricultural decision-makers. Also, given the close interaction of CAgM with the farming community, especially with subsistence farmers, and the strong linkage with capacity development, Congress urged that further collaboration and resource sharing be encouraged between the Education and Training Programme and AgMP and that AgMP should be further supported though the GFCS.

Partnerships

4.2.24 Congress expressed its appreciation for continued collaborative activities between WMO and a number of international and regional organizations in implementing the Agricultural Meteorology Programme, such as the Convention on Biological Diversity (CBD), the United Nations Convention to Combat Desertification (UNCCD), the Food and Agriculture Organization of the United Nations (FAO), the World Food Programme (WFP), the COST Actions of the European Science Foundation, the Regional Training Centre for Agrometeorology and Operation Hydrology and their Applications (AGRHYMET) and the African Centre of Meteorological Applications for Development (ACMAD). Congress noted that the continued linkages with these organizations will be very useful to the development of the Climate User Interface Programme (CUIP) of GFCS for the agricultural sector.

4.2.25 The Congress noted the programme description as given in Annex II to the present report and adopted Resolution 22 (Cg-XVI) – Agricultural Meteorology Programme.

4.3 TROPICAL CYCLONE PROGRAMME *(agenda item 4.3)*

4.3.1 Congress was pleased to note the achievements of the Tropical Cyclone Programme during the fifteenth financial period. A description of the Tropical Cyclone Programme is given in Annex II to the present report.

Training and Capacity Development

4.3.2 Congress was pleased to note that a number of training programmes were successfully implemented by the Tropical Cyclone Programme (TCP) to upgrade the warning capabilities of developing countries subject to tropical cyclones. Congress noted with appreciation that the TCP/PWS joint training workshops hosted by Météo-France, NOAA and the Bureau of Meteorology in RAs I, IV and V, respectively, made a significant contribution in that regard, covering a wider range of operational forecasting, including service delivery. It welcomed the recent development in the training workshops in RAs I and V in which the TCP collaborated with the DPFS to create a link with the Severe Weather Forecast Demonstration Project (SWFDP) being implemented in these Regions. Congress encouraged the TCP to continue its collaboration with the CBS Severe Weather Forecast Demonstration Project (SWFDP), towards the efficient and effective propagation of Tropical Cyclone forecasts and warnings in developing countries.

4.3.3 Congress noted and supported the request of EC-LXII to the technical commissions to work with the EC Panel of Experts on Education and Training to develop competence standards in their areas of expertise. In light of this, Congress recognized the need for TCP to work closely with these groups and the Commission for Basic Systems to establish top level Tropical Cyclone forecasting competence standards.

4.3.4 Congress also took note of the effectiveness of the attachment training at TC RSMCs which allowed forecasters to acquire practical techniques and expertise through on-the-job experience. Congress was of the view that developing countries, especially SIDSs and the LDCs, continue to be in urgent need of improving the tropical cyclone forecasting skills and competencies required for effective operational capacity. To that effect, Congress recommended that the WMO Secretariat should continue to give high priority to capacity-building in tropical cyclone forecasting.

Support to Operational Forecasting

4.3.5 Congress recognized that the field of tropical cyclone forecasting had been rapidly changing due to increased availability of observational data and advances in NWP models and products, evolving new technologies, and the growing demand of users for greater accuracy and longer lead times of forecasts. These developments have brought new challenges to the forecasters to keep pace with the scientific and technological advances and, in particular, upgrade their forecasting capacities and ability to manipulate and integrate into the forecasting process large quantities of information. In this regard, Congress endorsed the measures undertaken through the TCP to support tropical cyclone forecasters, which was targeted particularly at those of developing countries.

4.3.6 Congress noted that the *Global Guide to Tropical Cyclone Forecasting* (WMO/TD-No. 560) was being updated to provide comprehensive guidance on tropical cyclone forecasting from a multi-hazard point of view. The updated Guide will be web-based with a view to timely updating and easier access. In addition, the WMO Tropical Cyclone Forecaster Website has been developed to provide a readily accessible source of forecast tools and analytical data necessary for operational forecasting. These two information sources would be linked with the TCP page of the WMO Website to serve as a comprehensive source of information/material/data that was expected to be of great value to operational forecasters. In view of the consolidation and usefulness of the overall system, it urged the Secretariat to complete the update of the Global Guide as early as possible and to carry out the enhancement of the Tropical Cyclone Forecaster Website in full consultation with the NMHSs.

Application of Research and Development (R&D)

4.3.7 Congress noted that TCP and the World Weather Research Programme jointly organized various fora where operational forecasters and researchers exchanged their views and shared knowledge and identified the direction of their collaborations for the future. Those included the Workshop on Tropical Cyclone Research in RA I (May 2008 in La Réunion), the 2nd International Workshop on Tropical Cyclone Landfalling Processes (IWTCLP-II; October 2009 in China), the 3rd International Conference on Quantitative Precipitation Estimation and Quantitative Precipitation Forecast (October 2010 in Nanjing, China) and the 7th International Workshop on Tropical Cyclones (IWTC-VII; November 2010 in La Réunion).

4.3.8 Recognizing the growing importance of ensemble techniques and probabilistic forecasts, Congress took note of the Typhoon Landfall Forecast Demonstration Project and the NW Pacific Tropical Cyclones Ensemble Forecast Project as outcomes of the IWTCPL-II, which were implemented jointly with WWRP in the Typhoon Committee region. It acknowledged the significance of improving the utility of Ensemble Prediction System (EPS) products by considering the views and feedbacks of tropical cyclone forecasters.

4.3.9 Congress also noted with interest that the TCP, in response to the recommendation of IWTC-VII, organized the Workshop on Satellite Analysis of Tropical Cyclones in Hawaii, US in April 2011 in conjunction with the 2nd workshop of the International Best Track Archive for Climate Stewardship (IBTrACS) held by the National Climatic Data Center of NOAA. Linking with the effort to produce a globally unified best track dataset, the workshop set out to promote the sharing of expertise in satellite analysis of tropical cyclones between forecasters and researchers and helped facilitate their discussions on its future improvement to meet the emerging needs for homogenization of the tropical cyclone database.

4.3.10 Congress recognized that the feasibility of a consensus among different meteorological services in satellite analysis should be assessed (e.g. through verification of different methods using the best available observations) so that in future a globally unified best track dataset could be attained. As a first step, operational tropical cyclone intensity estimation methods such as the Dvorak method should be reviewed and shared among RSMCs, TCWCs and Members taking into account new and emerging techniques such as microwave satellite observation.

4.3.11 Congress also recognized the need of further research on the impact of tropical cyclone, both for direct and remote impacts.

4.3.12 Congress encouraged the WMO Secretariat to take measures to further strengthen the linkages between operational forecasters and researchers through various gatherings on both global and regional levels to ensure transfer of research and development outcomes to forecasters for enhanced forecasting capability.

Storm Surge Watch Scheme

4.3.13 Congress noted with satisfaction the substantial progress made towards the establishment of the Storm Surge Watch Scheme (SSWS) which was recommended by the Executive Council at its sixtieth session (EC-LX, June 2008) after the devastations by storm surges associated with the Tropical Cyclones *Sidr* and *Nargis* in the Bay of Bengal. EC-LX requested the TCP to cooperate with the Marine Meteorology and Ocean Affairs Programme for extension of the SSWS to all regions exposed to tropical cyclones including incorporating the Scheme in the tropical cyclone advisory arrangements and in regional operational plans and manuals.

4.3.14 Congress was encouraged by the response of Regions to the EC request noting that in RA V, the Tropical Cyclone Committee set up an SSWS Action Team and formulated a regional 1st SSWS plan in December 2008. Congress also took note of the storm surge advisory service implemented by the RSMC New Delhi in 2009 in cooperation with Indian Institute of Technology (IIT). RSMC Tokyo started provision of the storm surge forecast map in 2011. RSMC La Réunion implemented a study on the application of Météo-France's storm surge model to RA I SSWS.

4.3.15 Congress noted with pleasure that TCP also actively worked to raise the storm surge warning capabilities on a national level. TCP collaborated with JCOMM to organize the 5th Storm Surge Workshop in Australia for the Members of RA V Tropical Cyclone Committee (TCC) in December 2008 and the 6th Workshop in the Dominican Republic for the RA IV Hurricane Committee Members in February 2011. TCP continued annual attachment training at IIT Delhi for the Members of the WMO/ESCAP Panel on Tropical Cyclones. Congress emphasized that both regional and national approaches were imperative to assure the establishment of SSWS globally. In that respect, it requested the WMO Secretariat to continue the effort of building capacity in storm surge forecasting to cover every Member subject to tropical cyclones.

Global Coordination

4.3.16 Congress noted that the Sixth Tropical Cyclone RSMCs/TCWCs Technical Coordination Meeting (TCM-6) took place in Brisbane, Australia in November 2009. The Meeting is held every three years for promoting the harmonious development of regional warning services

and the global standardization of the operational procedures. Congress noted with pleasure that TCM-6 completed the study on suitable conversion factors between the wind speeds of different time ranges and its outcome was distributed as a WMO Technical Document (WMO/TD-No. 1555) to all the members of five regional TC bodies in October 2010. Arrangements were underway to include a summary of the report in the regional tropical cyclone operational plans/manuals. Congress recognized that the incorporation of the conversion factors in the regional TC operational plans/manuals should be an important first step towards an international common standard of wind averaging period for TC maximum sustained winds. This is considered essential to ensure harmonized practices in TC forecasting operations and post analysis.

4.3.17 The TCM-6 also established a cooperative relationship with IBTrACS and agreed to support this project by providing regional best track data and adequate guidance for integration of the data. For aviation users, the TCM-6 reaffirmed that it would cooperate with ICAO to change the format of tropical cyclone advisories from the text to the graphic in response to the request of the users. Congress also noted the continued need to work in close collaboration with ICAO to optimize tropical cyclone services in the TCAC areas of responsibility to ensure the most efficient and effective delivery of these services.

4.3.18 Congress recognized that, with the advance of globalization, it is increasingly important to promote the sharing of technologies and expertise and the standardization of procedures and products between the Regions. In this regard, Congress recalled its discussions on the Disaster Risk Reduction Programme during this session (agenda item 11.5) and stressed that there is an urgent need to investigate the feasibility of developing a standardized format for exchange of tropical cyclone advisories issued by RSMCs and TCWCs, so as to improve the accessibility and understanding of the information by members of the public and international media. In that context, Congress underlined the significant role of TCM for securing the coordination among the RSMCs and TCWCs as an essential mechanism to meet the users' requirement from the global point of view.

Regional TC Bodies

4.3.19 Congress recognized that regional TC bodies played an important role in the various regional projects of relevant WMO Programmes such as DRR, DPFS, MMOP, WWRP and HWR in addition to SSWS development. The RA IV Hurricane Committee supported the development and implementation of the DRR Central American Pilot Project on Early Warning Systems and DRR Initiative to Strengthen MHEWS Capacity in the Caribbean. RA V Tropical Cyclone Committee (TCC) developed the basic framework of the Severe Weather Forecast and Disaster Risk Reduction Demonstration Project (SWFDDP). The ESCAP/WMO Typhoon Committee established linkages with the RA II Working Group on Hydrology through joint activities, including for the management of urban floods and flash floods in their region. Pilot projects of Coastal Inundation Forecasting Demonstration Projects (CIFDP) in the Caribbean and the North Indian Ocean would be linked with the activities of the Hurricane Committee and the WMO/ESCAP Panel on Tropical Cyclones, respectively.

4.3.20 Congress noted with pleasure that the regional TC bodies were also active in forming a partnership with international agencies. It is represented by the mutual cooperation between the Hurricane Committee and the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE EWS) and between the WMO/ESCAP Panel on Tropical Cyclones and the Pacific and Indian Ocean Tsunami Warning and Mitigation Systems (ICG/PTWS and ICG/IOTWS).

4.3.21 Congress recognized the growing role played by the regional TC bodies as the platforms for the development of multi-hazard early warning systems in the respective Regions. To carry out such new assignment, Congress emphasized the need for strengthening the link between the three key areas of regional activities – meteorology, hydrology and disaster risk reduction. From that perspective, Congress encouraged the Secretariat to take further actions to promote the

involvement of hydrologists and DRR experts in the activities of regional TC bodies, in particular their annual and biennial sessions, to maximize the synergies between the three areas and thus fully meet the varied regional requirements.

4.3.22 Congress adopted Resolution 23 (Cg-XVI) – Tropical Cyclone Programme.

4.4 MARINE METEOROLOGY AND OCEANOGRAPHY PROGRAMME *(agenda item 4.4)*

4.4.1 Congress noted with appreciation the work accomplished by the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), during the past intersessional period, and congratulated the Commission for its work, including new initiatives taken in many areas for advances in meteorological and oceanographic science and technology. Congress reaffirmed the success of a jointly sponsored technical commission in bringing together the marine meteorological and oceanographic communities, and integrating operational marine activities.

4.4.2 Congress emphasized the importance of the Marine Meteorology and Oceanography Programme (MMOP), implemented through the work of JCOMM. It noted the long-term objectives of MMOP, including its traditional activities for Maritime Safety Services, as well as the new priorities in the implementation of an integrated marine meteorological and oceanographic observing and data management system. Congress also stressed the importance of the emerging requirements for MMOP contribution to the issues of weather and climate prediction, climate services and disaster risk reduction in coastal zones. A description of the Marine Meteorology and Oceanography Programme is given in Annex II to the present report.

4.4.3 Congress congratulated the Commission on the successful expansion of the Global Maritime Distress and Safety System (GMDSS) to include five new Arctic Ocean METAREAs, thus enabling provision of weather and sea ice safety information service. Congress recognized that WMO has worked in very close collaboration with the International Maritime Organization (IMO) and the International Hydrographic Organization (IHO) to expand the Global Maritime Distress & Safety System (GMDSS) into Arctic waters, with Canada, the Russian Federation and Norway acting as meteorological Issuing Services for the five new METAREAs.

4.4.4 Congress noted with appreciation the 2010 Edition of the revised IMO/IHO/WMO Manual on Maritime Safety, in line with the review of the GMDSS. Congress further noted the ongoing development of an IMO/WMO Worldwide Met-ocean Information and Warning Service (WWMIWS) to complement the existing IMO/IHO Worldwide Navigational Warning Services (WWNWS). Congress reaffirmed the importance of the promulgation of internationally coordinated met-ocean information, forecasts and warning services and requested the Secretary-General to continue his efforts in establishing the WWMIWS with the GMDSS Marine Broadcast System as an integral part thereof.

4.4.5 Congress noted the increasingly pro-active approach of JCOMM to address priority issues under the disaster management programmes, in particular related to coastal and marine hazards. Congress further emphasized the importance of an integrated effort for developing and improving forecasting capabilities and service delivery in coastal risk reduction with regional focus. In particular, a Guide to Storm Surge Forecasting was finalized, and the Storm Surge Watch Scheme (SSWS) was being developed through collaborative efforts of JCOMM, the Tropical Cyclone Programme (TCP) regional bodies and the Commission for Basic Systems (CBS). Congress encouraged the Commissions to undertake collaborative and joint activities and projects for accelerated implementation. Congress supported the ongoing joint JCOMM-TCP workshops for SSWS capacity-building, and noted with appreciation the contribution by the RSMCs for Tropical Cyclones in providing experts for training, information sharing and technology transfer for storm surge modelling and operation.

4.4.6 Congress supported ongoing planning and implementation of the joint JCOMM-CHy Coastal Inundation Forecasting Demonstration Project (CIFDP). Congress requested the Commission to further extend its close collaboration with the concerned NMHSs, in particular the maritime continental and archipelagic countries, regional bodies, other Commissions and external programmes such as the UNESCO/IOC Integrated Coastal Area Management (ICAM) and related activities under Regional Tsunami Warning Systems.

4.4.7 Congress recognized the extreme importance of the IOC Tsunami Programme, in coordinating and guiding the development, implementation and operation of tsunami warning systems in all relevant ocean basins, as well as the significant contributions being made by JCOMM, CBS and other WMO bodies to this programme. It noted with appreciation that a Regional Tsunami Watch Scheme had recently been adopted for the Indian Ocean by the IOC Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), which included a set of Standard Operating Procedures (SOPs). Congress urged that these SOPs should, to the extent possible, be adapted to national and local requirements, capabilities, and languages where appropriate, together with training and education on their application, and requested the co-presidents of JCOMM to bring this concern to the attention of the relevant IOC bodies.

4.4.8 Congress noted with satisfaction the Commission's continuing efforts for global wave climate projections in coordination with WCRP/CLIVAR. Congress agreed on the critical importance of the assessments of potential changes in wave climate and encouraged the Commission, in close collaboration with WCRP and the related research community, to further facilitate providing input to the IPCC Fifth Assessment Report (AR5) in terms of impact studies in the coastal zone.

4.4.9 Congress recognized an ongoing requirement to develop operational marine meteorological and oceanographic observing systems, modelling and services, as well as related research activities, in Polar Regions. It noted that an increasing occurrence of freshwater inflow to the oceans in the Polar Regions resulting from sea ice and glacier melt was likely to substantially modify ocean circulation and overturning patterns, with consequent impacts on regional and global climate variability and change, as well as on the polar atmosphere, ecosystems and environment in general. It agreed that this was an important topic for further research, and therefore requested JCOMM to collaborate with the hydrological community through CHy and the World Weather Research Programme (WWRP) under CAS, to support the required scientific and technical development. It further encouraged Members to actively contribute to this work at national, regional and international levels.

4.4.10 Congress expressed its support for the ongoing development of operational capability in ocean analysis, forecasting and associated product delivery, to provide services to support a wide range of applications and societal benefit areas. Noting the rapidly increasing range of existing ocean forecast systems, and the work under way within JCOMM to assist their transition to operational status, Congress recognized the need for a mechanism to assist the further development of fully coupled atmosphere-ocean modelling, aimed at enhancing the quality of both ocean forecasts and NWP products. Congress therefore requested the co-presidents of JCOMM to work with the president of CAS to develop such a mechanism, through their respective subsidiary bodies.

4.4.11 Considering the increased need of ocean observations to address mainly the requirements of GCOS, and to implement the WIGOS, and to achieve the required observing systems in developing future GFCS, Congress urged Members to commit additional resources towards the completion and sustainability of the initial global ocean observing system. It noted the potential benefits of this investment in ocean observing systems, inter alia, in contributing to climate services and disaster risk reduction, and recommended Members to consider identifying operational or sustained funding for the national ocean observing systems components of the

Global Ocean Observing System (GOOS), taking into account the recommendations from the OceanObs'09 conference as well as the updated GCOS Implementation Plan (GCOS-138).

4.4.12 As a contribution to the WIS, Congress requested the Commission to keep its Data Management Plan up-to-date. Congress recognized the importance of collecting and sharing instrument/platform metadata for ocean observations, with a view to enhanced traceability of the observations to standards, bias correction, and improved data consistency. It requested Members to ensure that the metadata are collected, recorded, and distributed in both real-time (for the required sub-set) and delayed mode to the ODAS Metadata Service (ODASMS).

4.4.13 Congress noted the activities undertaken in the framework of the Spanish West Africa Cooperation Programme and the initiation of a Marine Meteorology (Marinemet) pilot Project Monitoring and Services. Congress expressed its satisfaction for the ongoing progress made in the building of operational capability in Marine Meteorological Services in this region, and agreed that the future development should include enhancing coastal marine meteorological observing systems for more countries, particularly in the Gulf of Guinea, which is one of the most vulnerable areas to the impact of climate variability and change. Congress requested the Secretary-General to ensure that the detailed concept of a fully operational regional system be developed as soon as possible and that additional support and donors be found, targeted to finance its early implementation. Congress appreciated the support of the Spanish Meteorological Agency (AEMET) for this effort, as well as of the United States and Morocco for regional capacity-building activities.

4.4.14 Congress noted the planned joint effort by JCOMM and CAgM to develop a mechanism to address marine services and data requirements of fisheries, in view of providing a direct contribution to GFCS. While recognizing the concerns for WMO expertise and available resources for this area, Congress noted the potential value of such a new activity. Therefore it requested both Commissions and the Secretariat to further assess the feasibility and potential value for developing a new mandate in this regard, through the planned workshop on climate and oceanic fisheries (Rarotonga, Cook Islands, in October 2011).

4.4.15 Taking into account the work achieved or underway, Congress noted and supported the ongoing priority areas for JCOMM, as detailed in the Strategic and Operating Plans and under other agenda items:

(a) To enhance support for the WMO Integrated Global Observing System (WIGOS), through continuing implementation of the initial ocean observing system – both in situ and remote sensing – specified by the Global Climate Observing System (GCOS) and endorsed by the OceanObs09;

(b) To develop standards/best practices in the marine community through the IODE-JCOMM Standards Process, as well as update of the related manuals, guides, and catalogues, in support of the WMO Information System (WIS);

(c) To extend marine services for: (1) safety-related marine meteorological services, including provision of sea state and sea ice in MSI; (2) coastal storm surge and inundation forecasting in response to increased risks associated with global climate change; and (3) operational ocean forecasting with clear definition of operational ocean observation requirements; and also to develop a range of marine and ocean climate services in support of the Global Framework for Climate Services;

(d) To continue support for capacity-building through education, training and technology transfer, implemented through all Programme Areas.

4.4.16 Congress reaffirmed its support for JCOMM's project-oriented approach to address specific, defined, and time-bound activities, such as the JCOMM Pilot Project for WIGOS that was successfully completed in 2011. Congress further encouraged enhancing cooperation and joint

implementation with the regional associations and other regional frameworks such as the Global Monitoring for Environment and Security (GMES) of the European Commission.

4.4.17 Congress recalled that the fourth session of JCOMM (JCOMM-IV) would be held in Yeosu, Republic of Korea, from 23 to 31 May 2012. While appreciating the offer made by the Republic of Korea, it noted with considerable concern that the current JCOMM intersessional period would thus be unusually short, in view of the requirement that it be held in conjunction with the Living Ocean and Coast Expo 2012, and the following period unusually long. Congress recognized the pressure for the Commission to achieve its intersessional work in such a short period, and supported its effort to focus on key priority areas to ensure concrete results to be presented to the next Commission session. Congress also emphasized the importance of Members' engagement in the Commission, particularly from the developing nations, and urged Members to actively participate in JCOMM-IV, as well as in intersessional activities.

4.4.18 Congress agreed that additional resources must be made available in order for JCOMM to carry out its ongoing work as well as emerging requirements. It invited IOC to enhance its contributions in support of the joint Commission, and urged Members to provide the additional in-kind and voluntary resources necessary for full implementation, to address the continuing requirements of the maritime and coastal user communities for met-ocean services and information.

4.4.19 Congress adopted Resolution 24 (Cg-XVI) – Marine Meteorology and Oceanography Programme.

4.4.20 Congress recalled the discussion under agenda item 3.1 (Global Observing System) on intentional or unintentional damage to platforms used for ocean observation and marine scientific research. Congress noted UN General Assembly Resolutions 64/71 and 64/72, which expressed concern about the issue, and which called on Member States, UN bodies, and Regional Fishery Management Organizations to take appropriate action to protect such platforms, as well as similar actions to be undertaken in the coming 26th IOC Assembly session. It recognized with concern that the rate of damage was highest in the Indian Ocean, with over half the 36 tsunameters in the newly established Indian Ocean Tsunami Warning and Mitigation System and adjacent seas network suffering at least one damage event in the last four years, resulting in over 18 platform-years of data loss and gaps in early warning coverage across the region. Congress therefore urged Members to help promote understanding of the impacts of such vandalism, which seriously undermined efforts to establish national and regional ocean hazard warning systems, and to coordinate with relevant organizations to take necessary action. It adopted Resolution 25 (Cg-XVI) – Data buoy vandalism: incidence, impact and responses.

4.5 WMO QUALITY MANAGEMENT FRAMEWORK *(agenda item 4.5)*

Follow-up on EC-LXII decisions and recommendations

4.5.1 Congress agreed with the conclusions by EC-LXII (June 2010), in particular:

(a) That the special emphasis of the WMO on service delivery, including climate services, requires a renewed effort in documenting that all relevant processes from physical measurements in observations to forecasts and warnings issued to all user and customer groups are undertaken within a sound Quality Management (QM) Framework (QMF). In particular, the aviation and marine user communities have, or are, formulating clear requirements for the implementation of quality management systems (QMS) for the delivery of services to them. The full description of this Framework programme can be found in Annex II to the present report;

(b) To support the recommendation by the Inter-Commission Task Team (ICTT) on QMF to establish a Pilot Project for the development and implementation of a QMS in the WMO Secretariat. Congress believed that such an implementation would send a strong signal

of WMO's commitment to the adoption of a Quality Management (QM) approach whilst also enhancing the Secretariat's understanding of, and familiarity with quality management principles and practices. The experiences gained in this Pilot Project would directly benefit the implementation of QMS in Members' NMHS's through increased practical expertise in the Secretariat;

(c) On the need for an all-encompassing approach to Quality Management. Congress noted with satisfaction the ongoing commitment of the Aeronautical Meteorology Programme (AMP) and the initiatives being undertaken by the Marine Meteorology and Oceanography Programme (MMOP), and the Hydrology and Water Resources Programme (HWRP) in this regard, as well as the inclusion of QM in the WMO Information System (WIS) and WMO Integrated Global Observing System (WIGOS) concepts;

(d) On the need for effective and economical use of existing QMS guidance. In this respect, Congress appreciated the updating of the WMO-No. 1001 *"Guide on the Quality Management System for the Provision of Meteorological Services for International Aviation"* and progress made in producing a generic "Guide on the Adoption of a Quality Management Approach to the Delivery of NMHS Services" that is fit for purpose of all WMO Programmes with additional sections that include, but are not restricted to:

(i) Selecting a QM consultant (if required);

(ii) Developing and producing a quality manual;

(iii) Selecting and developing appropriate staff as internal auditors;

(iv) Developing procedures and conducting internal audits;

(v) Selecting an organization to perform the International Standardization Organization (ISO) certification.

4.5.2 Congress recognized that the diversity in size and operational complexity of Members' National Meteorological and Hydrological Services (NMHSs), including many Small Island Developing States (SIDS) and some Least Developed Countries (LDCs), will require a cooperative and mutually supportive approach to the implementation of a QMS. Congress strongly supported the EC-LXII recommendation to the ICTT to identify and obtain a commitment from Members operating a well developed QMS to form twinning partnerships with Members currently planning or developing a QMS. Congress noted with appreciation the support from the Finnish Government for QMS training in the Small Island Developing States (SIDS) in Pacific and Caribbean areas as well as training organized in SADC countries in Southern Africa. These projects can be seen as a practical and highly successful example of twinning style cooperation.

4.5.3 Congress noted with appreciation the progress achieved in the updating, modernizing and transformation of the QMF Website (http://www.wmo.int/pages/prog/amp/QMF-Web/home.html) into an interactive tool for Members. This initiative will greatly facilitate the exchange of existing resource material, such as documentation examples, templates, sample Quality Objectives and suitable contents for Quality Manuals. It therefore requested the Secretary-General to continue along this path and keep Members informed of milestones achieved and measures of usage and benefits of this Website. Congress agreed that each NMHS should make efforts to improve its service, e.g., through the implementation of the Plan-Do-Check-Action (PDCA) cycle in the QMS. Congress further agreed that Members should strike a balance between the resources invested in the introduction of QMS and those to be put to work to improve the quality of their output, by using QMS as a tool to ensure high quality of services are delivered to the community.

4.5.4 Congress noted with appreciation the progress achieved in developing and updating of the publication of Volume IV of the *Technical Regulations* (WMO-No. 49): "Quality Management", and agreed that the series of publications (generic QMS Guidance Document, WMO-No. 49, Technical Regulations, Volume IV, and a sample Quality Manual) would constitute "living documents", with regularly updated best practice examples and references. Congress commended the efforts of the ICTT-QM and others involved in preparing Volume IV of the Technical Regulations and its recent review (December 2010) and acknowledged the importance of this step in support of the WMO-QMF.

Establish a Pilot Project for Quality Management System (QMS) implementation in the WMO Secretariat

4.5.5 Congress debated a number of options for such a Pilot Project that would demonstrate the determination of the Organization to not only support Members in their quest for implementation of a QMS, but to also benefit from the introduction of such a system in the day-to-day running of the Secretariat. Congress strongly supported the introduction of a Quality Management System, while requesting that the implementation of such a system should be done in a simple and un-bureaucratic manner, thus increasing the efficiency of the Secretariat.

4.5.6 Whilst the adoption of the *ISO 9001:2008 Standard for Quality Management Systems* was considered the "gold standard" and preferred option, Congress also debated other options, such as the possibility of implementing the "*ISO 9004:2009 Standard, Managing for the sustained success of an organization – A quality management approach "as a first step.* ISO 9004:2009 provides guidance for the continual improvement of an organization's overall performance, efficiency and effectiveness based on a process-based approach. It focuses on meeting the needs and expectations of customers and other relevant stakeholders, through a long term balanced approach. It also provides an overarching internationally recognized and accepted management framework that enables an organization to establish the effectiveness or otherwise of its corporate governance and day-to-day activities. Other management approaches such as a QMS based on ISO 9001:2008 in combination with a Balanced Score Card (BSC) management system were also considered, taking into account different management cultures and corresponding management tools. Congress, after some discussion, considered that a Pilot Project of QMS in the Secretariat would have to:

(a) Complement and enhance the effectiveness of the existing and emerging management systems (Enterprise Risk Management, Results Based Management, and Monitoring and Evaluation) to form a holistic, coherent and thus resource-effective system;

(b) Encompass some of the typical service delivery areas, e.g., PWS, but may also be extended to administrative and support units, including IT/information resources;

(c) Demonstrate through a business case that its application would result in a net benefit for Members by reducing overheads and inefficiencies.

4.5.7 Congress thus requested the Secretary-General, in whose remit the organization of the Secretariat falls, to undertake a gap analysis with help of Member's experts in QMS and present a business case to EC-LXIV for the implementation of a QMS Pilot Project.

Establishing a "QM Twinning Partnership" Framework

4.5.8 Congress agreed that such a framework would link Members who are currently ISO 9001:2008 certified with Members commencing the development and implementation of a QMS based approached to the delivery of services. Congress identified the following strategies as the most promising to achieve the widest possible implementation of QMS among Members:

(a) Identify Members in each Region commencing or contemplating adopting a QM approach and who would welcome a twinning partnership approach;

(b) Identify suitable Members with a well-developed QMS preferably within the Region prepared to enter into a twinning partnership;

(c) Develop a comprehensive protocol for engagement of partners;

(d) Establish a set of criteria including qualifications for personnel offering assistance and guidance to other Members;

(e) Building on the extensive training, that has been delivered in close cooperation with ICAO and Members, undertake an initial gap analysis. This analysis could potentially utilize the Self-Assessment Tool component of the ISO 9004:2008 "Managing for the sustained success of an organization – A quality management approach" international standard or a comparison of goals and status in the framework of other management approaches based on strategic planning and controlling;

(f) Identify the budget and associated resources to implement the programme and secure funding;

(g) Establish an implementation schedule for the "QM Twinning Programme" and implement.

Additional Strategies in QMF

Monitoring the implementation and ongoing development of the QMF

4.5.9 Congress noted that the ICTT – QMF has operated for the past five years developing the WMO – QMF and enhancing the profile of QM within the WMO community. Congress recognized that future development, monitoring and review of the QMF requires enhanced input from experienced QMS practitioners. Congress thus requested the Executive Council to establish an appropriate mechanism with the task to promote, oversee and guide the further implementation of the Quality Management Framework in as simple and an efficient manner as possible.

Quality Management Services Provider Register

4.5.10 Congress noted that one of the significant concerns of implementing a QMS and achieving compliance with ISO 9001:2008, is the associated costs that can be largely attributed to consultancy fees. Congress thus discussed and supported the notion of creating a QM Services Provider Register which would be available to all Members. This should provide a comprehensive list by WMO Region of:

(a) Quality management consultants;

(b) Quality management training organizations;

(c) ISO 9001 Quality management certification bodies that comply with *ISO/EC 17021:2006 Conformity assessment – requirements for bodies providing audit and certification of management systems* and can demonstrate a positive track record in assisting Member NMHSs in developing and implementing QMS.

Such a Register would be established through a mechanism of the Executive Council and built upon collective experiences of Members having gone through the implementation and certification process.

Continued improvement of the WMO QMF Website

4.5.11 Congress noted with appreciation the considerable support from the Australian Bureau of Meteorology (BoM), who had kindly provided the necessary expertise and human resources to re-build a new, interactive and user-friendly QMF Website for the WMO Secretariat, and encouraged all Members to make any of their guidance, best practice examples and know-how that would be suitable for inclusion in this site available for the wider community. The website will incorporate contributions from the different WMO Programmes and technical commissions as they become available, and provide useful guidance for their implementation activities.

4.5.12 Congress, after some discussion, adopted Resolution 26 (Cg-XVI) – WMO Quality Management Framework.

5. PARTNERSHIPS *(agenda item 5)*

5.1 COOPERATION WITH THE UNITED NATIONS SYSTEM AND OTHER INTERNATIONAL ORGANIZATIONS *(agenda item 5.1)*

5.1.1 Congress noted with appreciation that the Organization had participated in the preparations and deliberations of a number of international summits and conferences convened by the United Nations, as well as the regular sessions of the United Nations General Assembly, the Commission on Sustainable Development, the United Nations Framework Convention on Climate Change and the United Nations Convention to Combat Desertification. In that connection, Congress noted the arrangements made for follow-up actions to the above events. Congress welcomed the WMO involvement in such activities and requested the Secretary-General to contribute to the implementation of the programmes for action and to the relevant resolutions or decisions adopted by such summits and conferences, especially those with specific relevance to the future priorities of the Organization.

5.1.2 In this respect, Congress welcomed on-going initiatives to strengthen and develop new partnerships to support the implementation of the Global Framework for Climate Services (GFCS), the Education and Training Programme, the Programme for the Least Developed Countries, the implementation of WIGOS and WIS, the Disaster Risk Reduction, the Agricultural Meteorology Programme, and the Aeronautical Meteorology Programme.

Resolutions addressed to specialized agencies by the United Nations

5.1.3 Congress requested Members and the Secretary-General to ensure appropriate follow-up to those resolutions addressed to WMO. In that context, Congress noted with appreciation the circular letters sent by the Secretary-General to Members informing them of the major outcomes of the United Nations General Assembly that were of direct relevance to WMO. Congress encouraged the Secretary-General to inform Members of any additional information that might facilitate mainstreaming of the activities of National Meteorological and Hydrological Services in the relevant national implementation action plans.

Follow-up to the 2010 World Summit on the Millennium Development Goals

5.1.4 Congress noted that the principal decisions on climate change, natural disasters and other important issues contained in the 2010 World Summit on the MDG's Outcome were closely related to the mandate of the Organization. Congress invited Members to actively participate in any relevant follow-up to the 2010 World Summit Outcome in order to enhance the contribution of WMO as well as National Meteorological and Hydrological Services to the sustainable development of Members and to the implementation of the internationally agreed development goals.

5.1.5 Congress recognized that advances in the implementation of the Summit Outcome would require coordination within the United Nations organizations, funds and programmes and their respective governing bodies. While that was largely in the hands of Member States, the Secretary-General was invited to support the process through continuous active participation in inter-agency activities, by raising the awareness on WMO expertise and sharing knowledge across the UN system.

United Nations inter-agency cooperation

5.1.6 Congress also noted that WMO had participated actively in the activities associated with the inter-agency coordination of programmes through the United Nations Chief Executives Board for Coordination. It agreed that the Organization should continue to be deeply involved in the work of the Board and its subsidiary mechanisms. It also shared the view expressed by the Executive Council on the need to promote WMO and UNESCO's leadership role in developing the 'Climate Knowledge'. It welcomed the actions taken to further strengthen the role of WMO in the UN system coordinated response to climate change, and contribution to the UNFCCC process, and to proactively pursuing, through UN inter-agency mechanisms and other international partnerships, enhanced cooperation on climate knowledge, including in support of adaptation in climate sensitive sectors. Congress appreciated the active involvement of UN system entities and other international organizations in the World Climate Conference-3, convened under the brand "UN Delivering as One on Climate Knowledge", and their continuous engagement in and support to the development of the Global Framework for Climate Services.

5.1.7 Congress noted with appreciation the proactive and fruitful work of the Organization in the area of environment, coordinated through the United Nations Environment Management Group, which had resulted in substantial input to the sixteenth, seventeenth and eighteenth sessions of the Commission on Sustainable Development. The sessions focused on agriculture, rural development, sustainable land management, drought, desertification, Africa, transports, chemicals, waste management, mining and ten year framework of programmes on sustainable consumption and production patterns.

5.1.8 Congress noted that WMO, as a member of the United Nations Development Group implementing "UN Delivering as One", had been more actively involved in United Nations multilateral coordination on development which maximized the United Nations system support for the actions of WMO and for country-led development policies and strategies, and requested that more coordinated efforts by the WMO Members and Secretariat be pursued in the future to further enhance the benefit of such involvement. Following the establishment of United Nations joint country Offices lead by United Nations Resident Coordinators and comprising representatives of United Nations specialized agencies and programmes, Congress was informed that several Permanent Representatives of Members with WMO (PRs) had been mandated by their respective governments to work with United Nations joint Offices located in their countries on matters concerning the work of WMO. Congress invited Members and requested the Secretary-General to facilitate the participation of PRs in United Nations joint Offices with due consideration of WMO priority needs in United Nations country programmes by informing of the presence of the PR in Member countries through the local UNDP offices so as to be fully recognized by UN resident offices and Resident Coordinators. Congress requested the Secretary-General to report on the experiences of Members, in particular on the use of UN development funds in meteorology, hydrology and adaptation to Climate Change national programmes and to make recommendations for sustaining this process.

5.1.9 Congress appreciated the active participation of WMO in the follow-up and implementation of the World Summit on the Information Society plan of actions and its contributions to the WSIS forums. It was informed on the WMO participation in the United Nations Group on the Information Society and was pleased to register progress with respect to the free and unrestricted access to environmental information in support of disaster management and other societal and economic decisions for development consistent with WMO policy. Congress

welcomed also the collaboration with the Department of Economic and Social Affairs of the United Nations secretariat in charge of the UNData initiative and of the access given to the WMO standard normals provided through the National Climatic Data Center of the National Oceanic and Atmospheric Administration of the United States Department of Commerce. Congress encouraged the Secretary-General to expand the availability and access to relevant statistical data through both the WMO Website and other relevant portals.

5.1.10 Congress urged the Secretary-General to continue efforts that ensure WMO maintains a lead role in areas falling within its mandate, particularly in disaster risk reduction and productive engagement in the International Strategy for Disaster Reduction and related issues. Congress also urged the Secretary-General to continue his efforts in the area of food security and nutrition, as recognized in the Memorandum of Understanding signed between the WMO and the World Food Programme, and water through its active participation in UN-Water. Congress was informed of development of the General Assembly informal consultative process on the institutional framework for the United Nations environmental activities. Congress recommended that any reform should ensure better coordination supporting WMO's own efforts in delivering its mandate and requested the Executive Council to provide further guidance to the Secretary-General with respect to United Nations reform.

Cooperation with other organizations

5.1.11 Congress noted with satisfaction the actions taken by the Executive Council and the Secretary-General regarding the establishment and entry into force of the working arrangements with the International Organization for Standardization (ISO) and the Parliamentary Assembly of the Mediterranean (PAM), of an agreement with the "Office International de la Santé Animale" (OIE), and of a cooperation agreement with the European Organization for Nuclear Research (CERN). Congress noted that following the 2010 international BIPM–WMO workshop on Measurement Challenges for Global Observation Systems for Climate Change Monitoring: Traceability, Stability and Uncertainty and the signature of the Mutual Recognition Arrangement signed between WMO and the International Committee of Weights and Measures (CIPM), three laboratories had been designated to represent WMO in CIPM activities. Congress also noted the efforts made to strengthen cooperation with national meteorological and hydrological professional societies, and encouraged the Secretary-General to take further measures to support and cooperate with them.

5.1.12 Congress encouraged the development of common WMO/ISO standards and authorized the Secretary-General to negotiate with ISO modifications of the procedures specified in the existing working arrangements, as needed.

5.1.13 Congress authorized the Executive Council to consider, when appropriate, the advisability of concluding formal working arrangements and consultative status, as might be necessary, with other international organizations, subject to the provisions of Article 26 of the Convention of the World Meteorological Organization.

5.1.14 Congress welcomed the growing collaboration with other international organizations, such as the World Bank, and Regional Development Banks noting, particularly, the importance of on-going cooperation in support of DRR national and regional initiatives leading to the modernization of National Meteorological and Hydrological Services and on the estimation of their role in the development of the national economy. Congress encouraged the Secretary-General, as well as the Officers of the Organization, to continue high-level dialogue with other international organizations so as to strengthen cooperation in order to further benefit WMO and National Meteorological and Hydrological Services.

5.1.15 Congress noted the actions taken by the Executive Council and WMO Members to reinforce the guidance issued by Cg-XV regarding participation in the Group on Earth Observations (GEO). Congress noted that contributions to the Global Earth Observation System of System

(GEOSS) should be on the basis of mutual benefit that maximizes synergies and avoids duplication, and thereby reaffirmed its endorsement of GEOSS and its 10-Year Implementation Plan. Congress was informed of the benefits reported from involvement in GEOSS including, but not limited to, enhanced data access and delivery, increased leveraging of national investments and capacity-building through support to developing and Least Developed Countries (LDCs) and Small Island Developing States (SIDS) participants for workshop attendance. Congress further encouraged WMO Members to engage fully with national GEO coordination mechanisms in order to reinforce the role of NMHSs in understanding national-level needs for information and services, and their responsibilities for delivering such services in the areas of weather, climate, water and disaster risk reduction.

5.1.16 Congress further noted the results of the discussion at EC-LXII regarding WMO's participation in GEOSS including: the fact that there were different points of view regarding the benefits to WMO and NMHSs of participation in GEOSS and of the expanding mandate of GEO from observation into information; the need to maintain a high-level coordination with GEO; and, the need to document the programmatic relations and contributions of the WMO Secretariat to GEOSS.

5.1.17 Congress acknowledged the close cooperation of WMO with the International Council for Science (ICSU), for example through joint sponsorship of the World Climate Research Programme (WCRP), the Global Climate Observing System (GCOS) and the International Polar Year 2007–2008 (IPY). This cooperation fosters progress in observations, modelling, analysis and research required to better understand and predict the Earth's climate variability and change (WCRP, GCOS), as well as the benefits of a multidisciplinary approach for environmental predictions on short and long timescales (IPY). The Congress noted the important outcomes of the ICSU visioning process and the engagement of the CAS, WWRP/THORPEX, GAW, WCRP and GCOS scientific communities in exploring options and proposing implementation steps for a holistic strategy on Earth system research that will encourage scientific innovation and address policy needs. At this occasion GCOS was also presenting the views of the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS). WMO Programmes and programmes co-sponsored by WMO, all contributed in shaping the future environmental research, especially under the emerging Global Sustainability Research Programme. Congress also noted that WMO programmes WWRP/THORPEX, GAW, WCRP and GCOS and possibly other WMO technical commissions and programmes are well positioned to make significant contributions to the goals of this new programme, and to benefit from the global expanded research effort, and encouraged them to do so.

5.1.18 Congress was informed of the achievements made by the Executive Council to enhance and re-establish cooperation with those organizations with which cooperation had been dormant for several years. It requested the Secretary-General to continue enhancing and strengthening their implementation to the benefit of WMO and National Meteorological and Hydrological Services. Congress noted with appreciation the work entailed to review the status of all cooperation agreements and encouraged the Secretary-General to continue re-establishing cooperation during the sixteenth financial period with those organizations whose cooperation remained dormant, should this be of the interest of the Organization.

5.1.19 Congress noted with satisfaction that the visibility of WMO and awareness on its work, as well as that of NMHSs, had improved through representation at and contribution to sessions of other international organizations. Congress invited Members to continue their efforts in ensuring representation of WMO and National Meteorological and Hydrological Services, where possible, in events of relevance to the development of meteorology and hydrology and to their application to sustainable development. Congress urged the Secretary-General to continue efforts in ensuring that WMO plays a leading role in areas falling within its mandate and in developing relevant projects with specialized agencies, intergovernmental organizations and non-governmental organizations in the implementation of the Millennium Development Goals and the 2010 World Summit Outcome as well as other relevant regional and global strategies and plans of action.

5.1.20 Congress requested the Secretary-General to further strengthen and support the external relations activities in line with the WMO's strategic priorities and within the approved maximum expenditure for the sixteenth financial period, so as to strengthen cooperation with other international organizations, including regional and national meteorological/hydrological professional societies.

5.2 INFORMATION AND PUBLIC AFFAIRS PROGRAMME *(agenda item 5.2)*

Global Communication Strategy and Activities

5.2.1 Congress noted with appreciation actions taken during the fifteenth financial period to enhance the WMO Information and Public Affairs (IPA) Programme in accordance with the WMO Global Communication Strategy defined by the Fourteenth World Meteorological Congress and its increasing productive promotional and constituency-building activities in support of the scientific and technical programmes and for the benefit of NMHSs. A more focused outreach policy, closer interaction between the WMO Secretariat, NMHSs and the United Nations system had increased public awareness of the importance of weather, climate and water services and products provided by NMHSs, and of international cooperation in these fields. In this respect, Congress supported the decisions taken by the Executive Council with respect to its monitoring of the WMO Global Communication Strategy and urged the Secretary-General and Members to further strengthen support to WMO communication activities and to enhance resources for communication activities, including extrabudgetary resources for high-quality communication products and events.

5.2.2 Congress was satisfied with the numerous activities and products implemented under the WMO Global Communication Strategy. Congress recalled that objectives of the Strategy were: projecting a unified and consolidated image of WMO and NMHSs; strengthening constituencies both at the national and regional levels; spreading key messages giving a local voice to a global undertaking and vision; fostering strategic alliances with the media; and promoting a communication culture throughout WMO. Congress requested that the Strategy be reviewed and updated and that a targeted and integrated communications plan be put together to further guide the communication activities of WMO. Congress urged Members and the Secretary-General to assist with the work of the IPA and communications activities with the aim to position WMO and NMHSs in a manner which plays to their unique strengths and raises the Organization's visibility as a key player in international cooperation and in contributing to sustainable development of Members. In this regard, Congress requested Members to enhance their own information and public affairs activities and to provide support to the IPA Programme, in particular through close interaction among national IPA focal points and the Secretariat, such as by sharing feature stories about national and regional benefits which can enrich the WMO Website online "News from the Members" and attract global media attention, as well as by exchanging information on the technical components of their communication activities, such as Web based projects. It further requested Regional and Subregional Offices to play a more active role regarding public information activities. It noted the successful workshops on regional communications organized in 2010 in Costa Rica by the Spanish Meteorological Agency (AEMET) and in 2008 and 2011 by the Polish NMHS jointly with WMO, the latter attended by IPA Focal Points from all continents, which allowed to exchange ideas between participants, to compare communication procedures and practices and to provide a good communication strategy that will serve all NMHSs. Taking into consideration the fruitful outcomes, this initiative should be continued.

5.2.3 Congress called for a greater involvement of NMHSs in developing strategic alliances with the national media for the purpose of disseminating key messages and providing greater visibility for all activities of the NMHSs. It further called on NMHSs for a closer interaction with United Nations Offices in the field in order to increase recognition of NMHSs' contribution to disaster prevention and mitigation and other areas.

5.2.4 Congress appreciated the successfully implemented capacity-building initiatives and reiterated its support for further upgrading NMHSs presentation and communication skills and for enhancing their visibility through training workshops and closer collaboration with the print, broadcast and online media. Congress encouraged close collaboration between the IPA and PWS Programmes in organizing media workshops. Congress recognized the importance for the NMHSs of presenting a credible image to the public. Such credibility should be based not only on solid technical knowledge but also on good communication skills. In order to promote the latter, Congress requested the Secretary-General, in collaboration with interested partners, to endeavour to conduct more training activities in the field of communication for both WMO Secretariat and NMHS staff, for directors and others frequently solicited by the media. Congress welcomed the booklet entitled "Getting your message across" which provided basic guidance for NMHS media communications.

5.2.5 Congress noted with satisfaction the significant increase in media coverage of WMO, achieved through outreach to media to foster and build on increased awareness of climate and climate change. It noted the enhanced WMO online News Centre, wider and targeted dissemination of public information materials, numerous press releases and Information Notes on specific WMO topics, proactive media campaigns organized on major themes, such as El Niño occurrences, ozone layer depletion, the annual launch of the Status of the Global Climate, and the Greenhouse Gas Bulletin. Congress requested the Secretary-General to pursue his efforts in keeping the press fully briefed on major issues involving WMO and the NMHSs. In this regard, in order to allow for timely outreach to the public, Congress underlined the importance of the prompt transmission of WMO information materials to NMHSs. It further urged Members to communicate newsworthy information to the Secretariat. Congress also expressed high appreciation for the communication events organized in the context of the successive Conferences of the Parties (COP) of the UNFCCC and UNCCD and other summits.

5.2.6 Congress renewed its satisfaction regarding the WMO Bulletin, a magazine with concise and attractive articles for the broader informed public, and MeteoWorld, a newsletter with regular news updates of the work of WMO and Members. Congress welcomed the availability of the Bulletin electronically in CD-ROM format for free distribution at relevant events, as well as online distribution in html and pdf format, to better exploit its potential as a public information tool, and more generally all efforts to increase the availability of WMO communication material online. Congress also expressed its appreciation to the Russian Federation and Spain for continuous in-kind support for the production and the dissemination of the WMO Bulletin in Russian and Spanish, and for France for initializing support for the production and the dissemination of the WMO Bulletin in French.

5.2.7 Congress further called for wider activities, when appropriate, under public-private partnerships that have made possible the production of fully sponsored WMO calendars and publications such as *From Weather Gods to Modern Meteorology – A philatelic journey*, *Elements for Life* and *Climate Sense*.

5.2.8 Congress expressed appreciation to the Secretariat for assisting NMHSs in the celebration of World Meteorological Day as a significant opportunity to increase the visibility of NMHSs. It welcomed the various products and activities undertaken on the occasion of the WMO 60th anniversary, including the booklet entitled *60 ways WMO makes a difference*, as well as brochures for the public such as *Weather extremes in a changing climate*.

5.2.9 Congress agreed on the potential impact of WMO outreach through video materials and called for further development and collaboration within the WMO community at large in this area. It welcomed Public Service Announcements aired by leading broadcast media (such as CNN International) at the initiative of WMO and WMO video material, such as newsfeeds, video news releases and B-rolls, drawing on WMO film materials, for use by television networks at various occasions.

5.2.10 Congress recognized that the Website has been playing an increasing role in WMO communications and urged further development in this regard. It urged all Members to establish a link to the WMO Website, to identify themselves as an integral part of the WMO system and to make full use thereof. It also requested the Secretary-General to set-up a team composed of WMO Members and WMO Secretariat staff to define and implement a project aiming at consolidating the WMO web presence, maximizing the potential of social media and mobile phone technology to reaching out to the world, especially youth and audiences in developing countries.

5.2.11 Congress was pleased with the worldweather.wmo.int and severe.worldweather.wmo.int Websites' development coordinated within the Public Weather Service Programme in close collaboration with all WMO Member contributors and the WMO Secretariat, and thanked the Hong-Kong Observatory (Hong Kong, China) for the hosting, maintenance and development of those websites. Congress also recognized the improvements of the meteoalarm.eu and of the weather.gmdss.org Websites. Congress emphasized the importance of such websites contributing to the safety of the world population as a key demonstration of the value of NMHSs' activities.

5.2.12 Congress requested the Secretary-General to continue to explore ways and means of nurturing public support for IPA activities. It encouraged the availability electronically of high resolution photos and of other public information materials produced under the IPA Programme for reproduction and use by NMHSs, enhancement of IPA's photo library, video archives, and editing facilities and to develop state-of-the-art educational products for the general public, including specific materials for children and the youth as well as efforts to reach people with disabilities. In this respect, Congress welcomed the development and implementation of the "Youth corner" (http://www.wmo.int/youth/) on the WMO Website.

5.2.13 Congress urged the Secretary-General to continue to take advantage of major international events, international fairs and exhibitions to promote the image of WMO and NMHSs and to enhance cooperation with other United Nations agencies, in particular within the framework of the United Nations Communications Group. In this regard, the Congress expressed its deep appreciation to the China Meteorological Administration for the outstanding support for the organization and operation of the joint WMO-CMA Pavilion "MeteoWorld" at the World Expo 2010 in Shanghai (May-October 2010), which was inaugurated at the special World Expo 2010 Day of Honour on 9 May 2010, as well as for the active development of the Multi-Hazard Shanghai Early Warning Project, both provided exceptional opportunities for promoting the societal benefits of the work of WMO and NMHSs. It also urged Members to highlight the role of WMO and NMHSs at relevant regional and global conferences.

5.2.14 Congress invited the President and Officers of the Organization, in collaboration with the Secretary-General and the NMHSs, to contribute further to the promotion of the role and activities of WMO and NMHSs in the various global and regional fora to which they had access. It encouraged the Officers of the constituent bodies and all its individual Members to contribute, within their various capacities, to the joint effort of promoting WMO and its key roles in weather, climate and water.

Branding of the Organization

5.2.15 Congress recognized the value of the "branding" of the Organization and the fact that the subtitle "weather, climate and water" featured prominently on all official documentation, correspondence and publications, including on-line, as requested at its fourteenth session. It expressed its satisfaction for the modernization of WMO publications and called for the further development of an editorial policy.

5.2.16 Accordingly, Congress endorsed the IPA programme description as given in Annex II to the present report and adopted Resolution 27 (Cg-XVI) – Information and Public Affairs Programme.

5.3 INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE *(agenda item 5.3)*

5.3.1 Congress expressed its appreciation to the Chair of the IPCC, Dr R.K. Pachauri, for his leadership of the work of the Panel, and for his report on the current status of the work of the Panel.

5.3.2 Congress expressed its continued appreciation of the key role of the IPCC in preparing and disseminating high quality assessments in support of national and international policy formulation on the climate change issue, and reiterated WMO's commitment to assist IPCC in delivering its work programme, including through financial, administrative and operational support.

5.3.3 Congress stressed the continued need for Members to efficiently contribute to the content and quality of the IPCC Fifth Assessment Report and Special Reports and the benefits which can be expected in return in enhancing the value of those activities. It urged Members to find ways to strengthen the involvement of scientists and experts from NMHSs in the activities of IPCC.

5.3.4 Congress welcomed the progress made in the scoping and preparation of the Fifth Assessment Report (AR5), with active participation of governments and relevant organizations including WMO.

5.3.5 Congress expressed appreciation at the distribution of AR5 authors in terms of gender and geographic origin, congratulated newly appointed Lead Authors and Coordinating Lead Authors from a large range of Member States, and encouraged them to carry out their task to the highest standard possible.

5.3.6 Congress expressed its appreciation to the WMO Members who are actively participating in IPCC, through direct financial contribution or by supporting Technical Support Units (TSUs), the support of AR5 authors and/or the organization of meetings and other activities, and encouraged them to continue their support to IPCC throughout the fifth assessment cycle.

5.3.7 Congress stressed the continued need for WMO Members to efficiently contribute, through a large range of climate activities, to the work of the IPCC and more specifically to the content and quality of the AR5, and the benefits which can be expected in return in enhancing the value of those activities.

5.3.8 Congress noted with appreciation the involvement of the WCP, WCRP and GCOS in the work of the IPCC and encouraged strengthened participation of CCI and other WMO technical commissions to contribute to the IPCC assessments and to work closely with the IPCC in developing their programmes and enhancing information dissemination, while encouraging the IPCC to consider scientific information resulting from WCP, WCRP and GCOS in its assessments.

5.3.9 Congress noted the relevance of the work of the IPCC for the establishment of the Global Framework for Climate Services (GFCS) and invited IPCC to explore ways to contribute to its implementation.

5.3.10 Congress supported the IPCC's plans to develop and implement a holistic communication strategy for outreach and media communications. Congress invited IPCC to give more recognition of the WMO and UNEP role in its outreach materials and events and to use the WMO media centre to target a wider audience for providing up-to-date assessments of the latest authoritative science related to climate change.

5.3.11 Congress endorsed the IPCC decisions for strengthening coordination and oversight of the IPCC administration and communications and decided to maintain WMO's role as founding and co-sponsoring organization in governance and management of the IPCC, including selection of key Secretariat positions.

5.3.12 Congress welcomed the release of the Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN) and the on-going work on the Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX), which are both providing important conclusions for the benefit of Members.

5.3.13 Congress expressed satisfaction at the progress made on setting up the IPCC Scholarship Programme with the funds received as part of the Nobel Peace Prize, gathering support from donors, and launching the first round of scholarships in 2011 for scientists from LDCs and SIDS, with the aim to develop knowledge and expertise in those countries in the domain of climate change.

5.3.14 Congress welcomed the action by the IPCC in response to the review of IPCC processes and procedures conducted by InterAcademy Council which was requested jointly by the UN Secretary-General and the IPCC Chair, and supported by the IPCC co-sponsors WMO and UNEP.

5.3.15 Congress urged the Secretary-General to mobilize support for capacity-building activities for NMHSs to interpret future climate scenarios at regional and national scales in order to better support communities and national decision-makers. Congress urged all Members to contribute to the wide dissemination and interpretation of the IPCC Assessment Reports and their key findings.

5.3.16 Congress noted that in 2010 the InterAcademy Council (IAC), upon request of the UN Secretary-General and of the Chair of IPCC and with the support of WMO and UNEP, conducted the review of the processes and procedures for the preparation of IPCC assessment reports. The IPCC considered the report of IAC at its 32nd and 33rd Plenary sessions. Congress expressed support for IPCC actions for implementation of the IAC Review recommendations on Procedures, Governance and Managements, Conflict of Interest Policy and Communication Strategy.

5.3.17 Congress reaffirmed that the IPCC should continue its fundamental mission for providing objective scientific-technical assessments of available factual information on issues related to climate change and adopted Resolution 28 (Cg-XVI) – Intergovernmental Panel on Climate Change.

5.4 GLOBAL CLIMATE OBSERVING SYSTEM (*agenda item 5.4*)

5.4.1 Congress welcomed the report by Professor Adrian Simmons, Chair of the GCOS Steering committee, on progress with the implementation of the GCOS Programme (as described in Annex II to the present report). It expressed particular appreciation to the past Chair, Professor John Zillman, for his outstanding contribution during his tenure.

5.4.2 Congress noted with appreciation the Progress Report on the Implementation of the Global Observing System for Climate in support of the UNFCCC 2004–2008 and the 2010 update of the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC. Congress welcomed the strong support of the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA) for the implementation and operation of GCOS in support of the research and systematic observation requirements of the UNFCCC.

5.4.3 Congress noted that the continuing requests of the UNFCCC to report on the adequacy and progress of GCOS has led to the establishment of an improvement and assessment cycle of the global observing systems for climate. Congress recommended strengthening this process and adopting this cycle as a priority activity. Congress also recommended studying how this cycle can support climate requirements in addition to the needs of the UNFCCC.

5.4.4 Congress expressed serious concern at the continuing difficulty in establishing adequate sustained climate observing networks, particularly in developing countries. It was pleased, however, to note the significant progress that had been made in tackling implementation,

planning and coordination activities throughout all domains and involving all sponsoring organizations and partners.

5.4.5 Congress expressed appreciation for the voluntary contributions of several Members to the Climate Observing System Fund and the GCOS Cooperation Mechanism, which had enabled a number of deficiencies in the functioning of in-situ meteorological networks to be addressed, but stressed the urgent need for additional support to improve the availability and quality of data across the GSN, GUAN, and other networks.

5.4.6 Congress, noting the important role of the satellite component of GCOS, welcomed the update of the report on Systematic Observation Requirements for Satellite-based Products for Climate. It commended the ongoing collaboration with space agencies through the WMO Space Programme and the Committee on Earth Observation Satellites (CEOS) and the Coordination Group for Meteorological Satellites (CGMS) with the objective of establishing, and ensuring continuity of, the space-based climate data record, and of its delivery with improved spatio-temporal resolution.

5.4.7 Congress was pleased to note the continuous support of the Ocean Observations Panel for Climate by IOC in the last years, and in particular, that the 43rd Session of the IOC Executive Council in June 2010 noted the necessity of sustained ocean observations for climate research and services and for national climate adaptation strategies in the coastal zone. The IOC Executive Council urged IOC Member States to address identified priorities and gaps and to ensure the sustained long-term operation of essential in situ and space based ocean observing networks. At the 18th session of the GCOS Steering Committee in 2010 (GCOS SC-XVIII), IOC reaffirmed to continue its support to GCOS as an important co-sponsored programme delivering on IOC High Level Objective 2, which concerns mitigation of the impacts of and adaptation to climate change and variability. With regard to UNEP, Congress noted that at GCOS SC-XVIII, UNEP stated that it attached great importance to the work of the GCOS. The actions in the GCOS Implementation Plan are very relevant to a number of UNEP activities, including environmental observing, monitoring, scientific assessment, and alerts of emerging issues and trends, especially in the areas of climate change and adaptation and early warning. Congress also noted that at GCOS SC-XVIII, ICSU affirmed that it attached great importance to the work of GCOS, including its Secretariat, Panels, and Steering Committee and stressed that the provision of a long time series of in situ and satellite climate observations is fundamental for the advancement of earth system science and its related disciplines.

5.4.8 Congress recognized the vital role of the GCOS Secretariat in facilitating and supporting the work of the Steering Committee and the various WMO and other constituent bodies and agents for implementation in their efforts to achieve the full and successful implementation of GCOS. It commended the Secretariat for its work over the past four years, but concluded that a substantially enhanced effort is needed in support of planning, coordination, communication and implementation if GCOS is to succeed in meeting its objectives and the high expectations of Members. While expressing great appreciation for the significant voluntary resources contributed to date by Members and international organizations in support of GCOS, Congress appealed urgently to Members, GCOS co-sponsors, IOC/UNESCO, ICSU and UNEP, and other international organizations to consider all available means for substantial strengthening all programme activities and the joint Secretariat.

5.4.9 Congress recognized and appreciated the role that GCOS has played in facilitating the launch of the Climate for Development in Africa Programme. More generally, it appreciated the regional activities in which GCOS has been engaged, including its assistance in helping developing regions prepare Regional Action Plans. Noting the importance of observations to broader sustainable development issues, Congress encouraged the GCOS Secretariat to continue its work to improve climate observing networks in developing regions and Small Island Developing States.

5.4.10 Congress recommended that WMO consult with the current Sponsors of GCOS to consider the potential pros and cons of adding the UN Food and Agriculture Organization as a fifth sponsor of GCOS, given its leading role in the GTOS related to the provision of both in situ and space-based terrestrial observations.

5.4.11 Congress requested the Secretary-General to bring the updated scope and objectives of GCOS to the attention of other co-sponsors and revise the MoUs as required.

5.4.12 Congress adopted Resolution 29 (Cg-XVI) – Global Climate Observing System.

5.5 FUTURE RESEARCH PRIORITIES: VISIONING OF THE INTERNATIONAL COUNCIL FOR SCIENCE (*agenda item 5.5)*

Towards a new ten-year initiative on global sustainability research

5.5.1 Congress noted that ICSU, in cooperation with the International Social Science Council (ISSC), has been leading a strategic visioning process to engage the scientific community to explore options for a holistic strategy for Earth system research, involving the full range of sciences and humanities and actively engaging stakeholders and decision-makers.

5.5.2 In the first phase of the process, a large consultation led to the identification of five Grand Challenges in Earth System Science for Global Sustainability. The second phase established that a new overarching structure was needed for integrated research to respond effectively to those Grand Challenges. During the third phase, ICSU, ISSC and the Belmont Forum convened a meeting to start designing the new initiative. The meeting agreed on the definition of a new joint strategy for global sustainability research (as given in Annex VI to the present report), which would build on and encompass current structures of the global change landscape. The initiative is expected to unify DIVERSITAS, IGBP, IHDP and ESSP, fully engage START, and possibly integrate strategically some components of WCRP.

5.5.3 Congress appreciated the strong historical relationship with the ICSU in co-sponsoring Programmes in the past and appreciated the continued commitment to continuing and strengthening such partnership in the future. Congress recognized the important potential contribution of the new ICSU initiative on global sustainability research to the Global Framework on Climate Services (GFCS).

5.5.4 Congress reiterated the support of WMO, as an organization with a strong mandate in research, to the WCRP and expressed appreciation for its leadership of the research agenda on climate, working in close collaboration with other WMO Programmes such as the WWRP and co-sponsored IPCC and GCOS.

6. CAPACITY-BUILDING *(agenda item 6)*

6.1 TECHNICAL COOPERATION PROGRAMME *(agenda item 6.1)*

Overview

6.1.1 Congress reviewed the progress made in the implementation of the Technical Cooperation Programme (TCOP) during the fifteenth financial period, as well as the actions taken by the Secretary-General as follow-up to its decisions and those of the Executive Council and regional associations related to the Programme.

6.1.2 It recognized that many Members continued to benefit from the activities carried out under the Technical Cooperation Programme, which covered a wide spectrum of development support, including the assessment and evaluation of the status of the National Meteorological and Hydrological Services, the identification of requirements for enhancing capacity, support for

institutional development, infrastructure upgrades, strengthening regional networks and the preparation of national meteorological development plans, the formulation of project proposals, as well as the mobilization of the related resources.

6.1.3 Congress welcomed and strongly supported various measures taken by the Secretary-General to strengthen technical cooperation and better service Members, in particular through the reorganization of the Development and Regional Activities Department (DRA), establishment of the Resource Mobilization Office within it, integration of the Education and Training Programme and the Least Developed Countries Programme into DRA, and improved coordination across these and the Regional Offices and WMO Subregional Offices. Congress noted that these measures were taken in response to the WMO Strategic Plan (2008–2011) and contributed to the progress towards a more comprehensive approach to capacity-building (refer to item 11.2).

6.1.4 Congress noted that the TCOP has been implemented during the fifteenth financial period with various functions funded by the regular budget under Expected Results 7 and 9 as decided by Cg-XV, the Voluntary Cooperation Programme, the Emergency Assistance Fund, external financing for regional and national development projects and leveraging strategic partnerships.

Voluntary Cooperation Programme

6.1.5 Congress noted with satisfaction the achievements of the Voluntary Cooperation Programme (VCP), in particular the number of NMHSs of LDCs and developing countries supported during the period 2007–2010 in that 88 separate projects were supported in 58 Member countries covering 83 per cent of all the requests received during the period. The streamlining of the VCP process has allowed the VCP to support projects through the Trust Fund and respond to the requests in shorter timeframes. Regions I and II benefited most from VCP projects (24 projects and 33 projects respectively).

6.1.6 During 2007–2010, 11 Members (Australia, China, Ireland, Japan, Kenya, Maldives, Mauritius, Myanmar, Norway, Pakistan, Republic of Korea) made cash contributions to the VCP Trust Fund (VCP-F) amounting to approximately US$ 1,098,253 while 23 donor Members and 3 private companies provided support through VCP Equipment and Services (VCP-ES) amounting to approximately US$ 5,501,855. The contributions overall supported mainly expert services, short-term fellowships and training activities, surface observing stations, improvement of telecommunication systems, climate database management systems and climatological activities, operational hydrological activities, and emergency assistance activities and in accordance with the guidelines for the utilization of VCP(F) as modified by the Executive Council (EC-LVIII).

6.1.7 Congress expressed its appreciation to VCP donors Members for their valuable efforts in supporting the Programme and for their willingness to continue to do so. Noting further the continued and increased needs of Members for this type of support, Congress encouraged Members to expand this network by creating more linkages among NMHSs, bringing more Members in to support the VCP Programme, strengthening the spirit of cooperation within the WMO through more active participation in the Programme.

6.1.8 Congress decided that the programme of assistance under the Voluntary Cooperation Programme should be continued during the sixteenth financial period. Noting the description of the Voluntary Cooperation Programme (see Annex II to the present report**)** and that the rules and procedures for the implementation of the Voluntary Cooperation Programme were still relevant and valid, Congress adopted Resolution 30 (Cg-XVI) – Voluntary Cooperation Programme.

Emergency Assistance

6.1.9 Congress recognized that during the period 2007–2010, substantial emergency assistance had also been provided to Members affected by disasters for the restoration of

meteorological and hydrological networks through the WMO Emergency Assistance Fund, the VCP and bi-lateral assistance from Members facilitated by the Secretariat. Congress expressed satisfaction with the response to natural disasters, including the Haiti earthquake and the floods that affected Pakistan in 2010, the Pacific Tsunami in 2009, and storm surge in Bangladesh, Yemen and Seychelles in 2008 and Cook Islands in 2007 and requested the Secretary-General to continue to enhance the provision of timely and coordinated assistance to Members affected by disasters. Congress noted in particular the coordination efforts of the Secretariat and the bi-lateral contributions of Members in relation to the ongoing support to Haiti.

6.10 Congress further expressed its appreciation to Members for their contributions in cash and in-kind for emergency assistance activities. It encouraged Members affected by natural disasters and those emerging from conflicts to utilize the mechanism for the rehabilitation of their services and urged supporting Members to continue their engagement in these mechanisms and to contribute to the Emergency Assistant Fund specifically.

6.1.11 Congress was advised that the WMO Revolving Fund was reviewed during the financial period and was retired as it had not been utilized in the last few years by developing country Members. The remaining funds were transferred to the Emergency Assistance Fund.

Resource Mobilization and Strategic Partnerships

6.1.12 Congress commended the Secretary-General on the establishment of the Resource Mobilization Office and the Resource Mobilization Strategy 2008–2011, supported by the Executive Council (EC-LXI, paragraph 6.29). It welcomed the focus of the RMO and RM Strategy on supporting the Technical Programmes, Regional Offices and National Meteorological and Hydrological Services to enhance the level of support and funding to activities aimed at development of NMHS to reach the levels of services needed to support the protection of life, property and food security, with particular emphasis on the developing countries, Least Developed Countries (LDCs) and Small Island Developing States (SIDS) and in keeping with the Regional Strategic/Operating Plans and Strategic Development Plans.

6.1.13 Congress further recognized that the total financing for technical assistance (other than VCP) through Trust Funds through the Secretariat for the period was approximately US$ 29 million with financing from various sources (Governments, World Bank, European Commission, Foundations and other sources).

6.1.14 Congress noted with satisfaction that during the period 2007–2010 various agreements were signed between WMO and NMHSs of Member countries and with funding and developing agencies for the implementation of regional cooperation programmes. Projects totalling some 40 M USD in support of NMHSs regional programmes were committed for capacity enhancement of NMHSs in West Africa, Sub-Saharan Africa and East Africa, South Eastern Europe, Central Asia, the Pacific and the Americas covering some forty or more countries as well as many single country projects. Congress also recognized that this capacity enhancement is in cooperation with WMO Members (including the Republic of Korea, Spain, Finland, Italy and the United States) and with the major partners such as World Bank (WB), various Directorates of the European Commission, Overseas Development Assistance Agencies of various Member countries, UN System Partners in particular UNISDR, WFP, and UNDP, and Rockefeller Foundation. Congress also supported the efforts to better institutionalize project management arrangements within the Secretariat for these cross-cutting regional projects.

6.1.15 Congress further noted the active engagement of the regional networks of advisers to Permanent Representatives on international cooperation and external relations in RA I (INTAD-I (Africa)), RA II (INTAD-II (Asia)) and RA V (INTAD-V (South-West Pacific)). Recognizing the usefulness of the INTAD networks for cooperation, especially among NMHSs of developing country Members, Congress urged Members to actively support this INTAD initiative with support from the Secretariat. In this connection, Congress noted that the International Training Seminar on

South-South Cooperation on Weather and Climate (Nanjing, China, 8–12 November 2010) had facilitated the active engagement of the INTADs in RAs I, II and V. Congress further encouraged the Secretary-General to secure funding to further enhance the capacity of INTADs.

6.1.16 Congress was very pleased to learn of the accreditation of WMO in December 2010 as Multilateral Implementing Entity by the Adaptation Fund, opening an excellent opportunity for significant funding of projects in the field of adaptation to climate change in support of and with participation of NMHS and supported the Secretariat`s approach to securing a similar status with the Global Environment Facility and possibly the Green Fund once the operating mechanism of this fund is decided. Congress took note that WMO will put forward several regional projects for consideration of the Adaptation Fund Board.

6.1.17 Congress considered that the Global Framework for Climate Services (GFCS) and the recommendations of the High-Level Taskforce (HLT) provide a strong platform for future financing of NMHSs development projects. In this regard, Congress encouraged the Secretary-General to utilize national/regional projects to promote further development of climate services.

6.1.18 Congress recalled that, as requested, the Executive Council at its fifty-ninth session established through its Resolution 4 (EC-LIX) an Executive Council Working Group on Capacity-building (EC-CB) for the fifteenth financial period, and that the TOR were amended and approved through Resolution 10 (EC-LX) to better address the challenges in development cooperation.

6.1.19 Congress noted that in 2009 and 2010 the EC-CB assisted the Executive Council in consideration of a number of issues relating to capacity development activities including, resource mobilization and strategic partnerships; service delivery to NMHSs; interaction with the EC Panel on the Education and Training needs of Members; volunteerism; and the preparation of a Strategy for Capacity Development intended to provide an umbrella for the capacity development activities under the five priority areas for the sixteenth Financial Period (refer to item 11.2).

6.1.20 Considering the valuable work of the EC-CB, Congress requested the Executive Council to continue to address in a comprehensive manner the future challenges in capacity development.

6.1.21 In this regard, and in view of the proposal to prepare a WMO Strategy for Capacity Development, Congress agreed that the TCOP and related activities be integrated into the Strategy.

6.1.22 Considering that the use of volunteers could be an instrument to support developing countries requiring assistance under normal and emergency situations, Congress welcomed ongoing discussions with UN Volunteers and the Volunteer Programmes of Overseas Development Assistance Agencies to see if WMO can partner with these programmes to secure support for developing country NMHSs.

6.2 EDUCATION AND TRAINING PROGRAMME *(agenda item 6.2)*

Overview

6.2.1 Congress was informed that during the intersessional period, the Education and Training Programme (ETRP) assisted WMO Members by providing guidance and advisory services on the education, training, qualification and competence requirements for personnel of National Meteorological and Hydrological Services (NMHSs), particularly those associated with aeronautical meteorological personnel. Activities included organizing short-term training events in specialized subjects; organizing the Eleventh WMO Education and Training Symposium; awarding and implementing long- and short-term fellowships for basic and specialized training; facilitating communication and exchange of information and training materials between Members; promoting distance learning, and school and popular education in weather, climate and water subjects.

6.2.2 Congress thanked the EC Panel of Experts in Education and Training for its strong leadership and encouraged the Executive Council to continue the Panel in the next financial period. Congress also encouraged the EC Panel to review the timing of its meetings and the Education and Training Symposium to facilitate input into the budget and planning processes for the 2016–2019 financial period.

6.2.3 Congress recalled its discussions on the Technical Cooperation Programme during this session (agenda item 6.1) and noted its deep appreciation to Members for their direct and indirect contributions to the Education and Training Programme under the Voluntary Contribution Programme. Congress noted with pleasure that this funding included South–South funding as well as the more traditional North–South funding. Whilst the full value of the contributions was not known, it was estimated that the total sum of direct funds (provided by Members to the Secretariat to implement education and training activities) and indirect funds (waiving or reduction of tuition fees, assistance with stipend and/or accommodation, insurance, book fees, airfare, provision of short term training and advocacy with aid agencies in the area of education and training) was in excess of two million francs each financial period. Whilst this level of voluntary support was heartening, Congress recognized that even more voluntary support would be required in the sixteenth financial period to assist Members, particularly those from developing and least developed countries, begin to address the education and training issues associated with implementing activities associated with the five high priority areas. Congress called upon Members to work with aid agencies and other bodies in their region and countries to attract this additional support.

Education and Training Programme

6.2.4 Congress reviewed the Programme activities proposed in the WMO Strategic Plan and budget for 2012–2015, and agreed that during the sixteenth financial period the ETRP should continue to be given high priority by the Organization, in order to pursue its support to Member countries in human resources development of their NMHSs under Expected Result 6 (ER 6).

6.2.5 Congress recommended that particular emphasis should be placed on the following approaches which will support each of the high priority areas identified for the next financial period:

(a) Providing increased assistance to least developed countries (LDCs) in planning, management and implementing human resources development (HRD) activities in their NMHSs;

(b) Promoting international cooperation in order to exploit more efficiently the wealth of education and training resources available worldwide in multiple languages; and supporting distance and e-learning activities in meteorology, hydrology and other relevant topics;

(c) Encouraging quality education by stimulating national/international accreditation of training institutions and programmes, and professional certification of NMHS personnel;

(d) Supporting school and popular education in meteorology and hydrology, and contributing to the increase of public awareness on disaster risk-reduction, prevention and mitigation as well as climate change science, adaptation and mitigation options.

6.2.6 Noting the description of the Education and Training Programme (see Annex II to the present report) Congress adopted Resolution 31 (Cg-XVI) – Education and Training Programme.

Definition of Meteorologist and Meteorological Technician

6.2.7 Congress recalled the decisions taken by EC-LXII regarding the definition of a Meteorologist and the replacement of the fourth edition of WMO Publication No. 258, "Guidelines to the Education and Training of Personnel in Meteorology and Operational Hydrology" Vol. I: Meteorology with new Guidelines.

6.2.8 Congress noted the draft text prepared by the EC Panel of Experts on Education and Training to be included in the WMO Technical Regulations defining the terms Meteorologist and Meteorological Technician and their associated Basic Instruction Packages; and, the draft guideline publication to assist Members implement the revised Basic Instruction Packages. Congress further noted that the proposed text for the Technical Regulations and the Guidelines publication sought to clarify the meaning of the term "degree or equivalent" in the definition for a Meteorologist agreed to by the fiftieth session of the Executive Council in 1998. Congress noted that throughout the publications, a clear distinction is made between classification of personnel and job tasks carried out within National Meteorological and Hydrological Services (NMHSs). Classification is related to qualifications whilst job tasks are related to competencies. Congress recalled that it is the prerogative of individual Members to decide how they allocate particular tasks to the different classifications provided that the personnel have the required knowledge, skills and behaviours for the tasks they are undertaking.

6.2.9 Congress recognized that the documents, included as Annexes 1 and 2 to Resolution 32 (Cg-XVI), provided Members with an objective framework to assess the compliance of their education and training programmes against the learning outcomes specified in the Basic Instruction Package for Meteorologists (BIP-M) and the Basic Instruction Package for Meteorological Technicians (BIP-MT). Congress recognized that the wording of the Meteorologist definition was a matter of keen interest to all Members and had to reflect the requirement for professional recognition whilst providing Members with flexibility for national implementation. Recognizing the varying requirements of Members, Congress revised the Meteorologist definition suggested by EC-LXII to include the phrase "at university degree-level" to explicitly address the needs of some Members to reflect the university level of the studies, whilst reflecting the needs of other Members to allow education and training gained at non-accredited education and training institutions to also be recognized. Congress suggested that consideration could be given to replacing the term "Basic Instruction Package (BIP)" with the term "Core Learning Outcomes (CLO)" to better reflect the content and use of the revised and updated publications. Congress adopted Resolution 32 (Cg-XVI) – Definition of a meteorologist and meteorological technician with an implementation date of 1 December 2013 to allow Members time to update their education and training programmes and for consistency with the introduction of the Aeronautical Meteorological Personnel Competency Standards. Congress advised Members that the terms WMO Meteorologist and WMO Meteorological Technician were synonymous with Meteorologist and Meteorological Technician respectively, and henceforth only the terms Meteorologist and Meteorological Technician should be used.

6.2.10 Congress noted that the BIP-M requirements will usually be satisfied through the successful completion of a university degree in meteorology or a postgraduate programme of study in meteorology (after acquiring a university degree that includes the foundation topics in mathematics and physics – such topics are typically covered in science, applied science, engineering or computational courses). In instances where this is not the case, educational institutions will have to demonstrate that their programme of study provides the characteristic learning outcomes associated with a university degree course. Permanent Representatives are expected to take the lead in consulting with the appropriate national and regional bodies to define the academic qualifications required by Meteorologists in their country. Permanent Representatives should also work with their national education and training establishments to regularize or formalize the accreditation of their education and training institutions and certification of their courses according to Quality Management Framework principles, thus ensuring that their meteorological graduates meet the BIP-M requirements. Congress requested the Executive

Council, through the EC Panel of Experts on Education and Training, to provide further guidance to Members on options to allow them to demonstrate that their training institutions and courses meet the required Standards and, where requested, within the limited available regular budget and voluntary funds, provide assistance to Regional Training Centres and national training institutions to do so.

6.2.11 Congress requested the Commission for Hydrology (CHy) to review the definitions for Hydrologists and Hydrological Technicians and their associated Basic Instruction Packages at its next session.

WMO Regional Training Centres

6.2.12 Congress considered the nominations for new WMO Regional Training Centres (RTCs) in Indonesia, Peru and South Africa and the assessments of the RTCs in India and the Philippines. Based on the assessment reports and regional association endorsements for each of the institutes, the EC Panel of Experts on Education and Training concluded that Peru and South Africa fulfilled the criteria that the Executive Council required for a training institute to be recognised as an RTC. Congress approved Peru and South Africa as new WMO RTCs and reconfirmed Madagascar and the Philippines as WMO RTCs.

6.2.13 Congress welcomed Qatar to the Regional Training Centre network and thanked all Members hosting Regional Training Centres for sharing their education and training facilities with Members, particularly those from their Region. Congress recalled that Regional Training Centres are approved to meet the expressed training needs of Members in the Region and this required the regional association, Regional Training Centres and Members to engage in ongoing discussion regarding the high priority regional education and training needs and the available education and training opportunities. Congress reminded Members of their obligation to provide adequate support to the RTCs in their Region to ensure their sustainability. Congress was advised by Members from RA I island and coastal countries of the need for education and training in marine observations and forecasting. Congress suggested that the regional association raise the issue with its Regional Training Centres and asked the Secretary-General to assist, if required. Congress noted that the EC Panel of Experts on Education and Training had not yet received the reports on the assessment visits to the RTC in India and the proposed RTC in Indonesia. The EC Panel of Experts on Education and Training expects to present the outcomes of the assessment visits to Indonesia and India to EC-LXIV in June 2012.

Competence Standards

6.2.14 Congress appreciated the work being undertaken in the ETRP and the various technical commissions to develop competence standards for the core job-tasks in meteorology and hydrology. Congress recommended that all technical commissions make this a high priority activity and incorporate this task into their current work programmes. Congress requested that the technical commissions follow the model developed by the Commission for Aeronautical Meteorology in providing top-level competence standards that could be incorporated into the WMO Technical Regulations, as required. More detailed guidelines to assist Members to adapt, implement and assess the top level competence standards according to their national requirements (see http://www.caem.wmo.int/moodle/) should also be published. The Executive Council was requested to engage its Panel of Experts on Education and Training to assist the technical commissions in the development of the competence standards and links with the ETRP.

6.2.15 Congress noted with appreciation the initiative shown by the Australian Bureau of Meteorology in sharing with other Members its expertise and experience in the development of meteorological personnel competencies, particularly for Aeronautical Meteorology. Congress recognized that such sharing of best practise examples reduces development time for Members' respective competence frameworks and encouraged Members to take advantage of this expertise

and also to share their own competence development and assessment examples with other Members.

Fellowship Activities

6.2.16 Congress was informed about the measures taken in the Secretariat to enhance fellowship activities and to improve their effectiveness and transparency. Ongoing reforming measures included: increased communication with Members, fellows and training institutions; more timely processing of requests for fellowships; monitoring and evaluation of fellows during and after the completion of studies; reviewing the policies and procedures for nomination and selection of WMO fellows. Congress was pleased to note the satisfactory collaboration of the training institutions in the monitoring and evaluation of the fellows studying in those institutions, but expressed concern about the relatively low-level of response from some beneficiary countries in providing feedback on the fellows' performance upon their return home. The Congress reiterated its support for the decision taken by EC-LVIII (June 2006) that no further fellowship awards would be considered for the Members whose Permanent Representatives (PRs) did not provide the required post-fellowship reports.

6.2.17 Congress recalled the Executive Council Criteria for selection of fellows noting that these included, amongst other considerations, Member development status, fellow's gender and age, clear connections between the NMHSs human resource development plan and the intended outcomes of the requested fellowship, and offers of cost-sharing, such as airfares. Given the high demand for fellowships, Members are encouraged to seek all means to contribute towards cost sharing of fellowship expenses in an effort to stretch the limited resources further. Congress appreciated that a review of the WMO Fellowship Manual was underway and requested the Executive Council, through the Executive Council Panel of Experts on Education and Training, to consider options for fellowship support of fellows within their own country. Under the current directions, this was not possible.

6.2.18 Congress expressed the need for additional funding for the fellowships programme to meet the increasing demand. It noted with appreciation the generous contributions of VCP donor countries in providing support for fellowships, and appealed to all Members to increase their contributions.

School and Popular education

6.2.19 Congress welcomed advice from the GLOBE Programme from the United States regarding their Student Climate Research Campaign to be run from late 2011 to 2013 (http://globe.gov/scrc). Congress encouraged all Members to actively participate in the GLOBE Programme and to work with their GLOBE country coordinators as part of the School and Popular Education activities, so that the meteorological and climatological concepts can be covered adequately. This is to encourage the next generation of young scientists to take up the challenges and opportunities offered through atmospheric and environmental science, as suggested by EC-LXII (WMO-No. 1059, paragraph 6.16, (o)).

6.3 PROGRAMME FOR THE LEAST DEVELOPED COUNTRIES *(agenda item 6.3)*

6.3.1 Congress recalled that the Least Developed Countries (LDCs), including those which are SIDS, are low-income and the most vulnerable countries suffering from severe structural impediments to growth which are considered so pervasive as to prompt the international community to extend special support measures to LDCs beyond those available to other developing countries, through successive ten-year Programmes of Action for LDCs.

6.3.2 Congress further recalled that it is within the framework of the Brussels Programme of Action for the LDCs for the Decade 2001–2010 whose goals and targets are closely linked to the Millennium Development Goals (MDGs) that the WMO Programme for the Least Developed

Countries was established with the main objective of enhancing and strengthening the capacities of the National Meteorological and Hydrological Services concerned to contribute efficiently and in a timely manner to the sustainable development of these countries.

6.3.3 Congress recognized the efforts made by the Secretary-General and Members in the implementation of the WMO Programme for LDCs, and appreciated the guidance of the Executive Council in the implementation of activities, under Expected Result 9 "Enhanced capabilities of NMHSs in developing countries, particularly LDCs, to fulfil their mandates" under the WMO Strategic Plan 2008–2011.

6.3.4 Congress noted that all the scientific and technical programmes gave higher priority to LDCs including those which are SIDS in their assistance and capacity-building activities, as reported under the respective corresponding agenda items.

6.3.5 Congress further noted that specific value-added and dedicated activities were undertaken to develop the institutional and human resource capacity of a number of LDCs through strengthening the infrastructure, management and operational capabilities of their NMHSs, Congress considered that the achievements made would lead towards:

(a) Integration of NMHSs activities and products into socio-economic development frameworks, strategies and priorities at national and regional level, thereby raising their profile;

(b) Enhancing the beneficial use of weather, water and climate information and services in support to LDCs productive capacity in key sectors, particularly agriculture, food security and rural development; health; disaster risk reduction; transport; energy; environment; water resources; tourism; and managing climate change.

6.3.6 Congress stressed that NMHSs in most LDCs and SIDS do not yet have the necessary capabilities to provide sustainable access to essential climate services and information to decision-makers and communities. Congress, therefore, requested that a high profile programme of fast-track projects be established to build the necessary capacity of concerned countries, in accordance with their needs and priorities, including ICAO QMS requirements in aeronautical meteorology to be met by 2012, and in line with the Global Framework for Climate Services (GFCS), other internationally and regionally agreed development goals and initiatives, including the MDGs, the Declaration of the First Conference of Ministers responsible for Meteorology in Africa, and the Mauritius Strategy for Implementation of the Programme of Action for the Sustainable Development of SIDS.

6.3.7 Congress expressed its thanks to Members which provided assistance to LDCs, made contributions to the Trust Fund for NMHSs of LDCs, or announced support measures for the LDCs.

6.3.8 Congress encouraged the Secretariat and Members to promote and support initiatives in LDCs that seek to foster strong relations between NMHSs and the private sector whose activities are often impacted by hydrometeorological and climatic factors. Congress recognized that such relations may support the development of products and services that reduce risks, encourage growth, and ultimately innovations in the private sector, potentially producing benefits to NMHSs in the areas of funding for education and training and sustainability of weather, climate and water monitoring networks.

6.3.9 Congress noted that the Fourth United Nations Conference on the LDCs was held in Istanbul, Turkey, 9–13 May 2011, with the main objective of undertaking a comprehensive appraisal of the implementation of the Brussels Programme of Action, sharing best practices and lessons learned, identifying new and emerging challenges and opportunities, reaffirming the global commitment to address the special needs of the LDCs made at the major United Nations conferences and summits, and formulating and adopting a renewed partnership between the LDCs

and their development partners. Noting WMO's active participation in the preparatory process and the organization of the Conference, Congress considered that the Conference represented the will of the international community to continue to place support for the group of poorest and most vulnerable countries at the top of the international agenda.

6.3.10 Congress recalled that the overarching goal of the UN Programme of Action for the LDCs for the decade 2011–2020 is to overcome the structural challenges faced by the LDCs in order to eradicate poverty, achieve internationally agreed development goals and enable graduation from the least developed country category.

6.3.11 In this connection, Congress underscored the specific objectives of the Programme of Action for the LDCs for the decade 2011–2020 with the aim of enabling half the number of LDCs to meet the criteria for graduation by 2020, including the following objectives that require contribution and support from WMO and NMHSs:

(a) Build viable national productive capacity in all sectors, particularly infrastructure, energy, transport, and other weather and climate sensitive sectors;

(b) Promote agriculture, food security and rural development strategies that strengthen support for smallholder farmers and contribute to poverty eradication;

(c) Invest in basic services for health, education, water and sanitation;

(d) Strengthen the resilience of LDCs by reducing their vulnerability to economic, natural and environmental shocks and disasters, as well as climate change and, enhancing their ability to meet these challenges, particularly climate change adaptation and mitigation;

(e) Promote science and technology for peaceful and development purposes, including strengthening national and regional institutions, as appropriate and in line with LDCs' national development priorities;

(f) Strengthen the global partnership and public-private partnerships for inclusive economic growth and sustainable development of LDCs.

6.3.12 Noting that climate change disproportionately affects the socio-economic development of LDCs, Congress recalled that the global nature of climate change calls for the widest possible cooperation in an effective and appropriate international response. It also noted that the effects of Climate Variability and Change threaten to reverse some of the development gains that have been achieved to date in LDCs, some of which have been compelled to divert resources away from other broader development goals to overcome the adverse impacts of climate change.

6.3.13 Considering that most of the LDCs, are forecast to fall short of achieving the MDGs, and that these countries need additional and adequate technical and financial support from the UN System and other development partners, Congress underscored the importance of the WMO Programme for the LDCs and the high priority to be continually attached to it.

6.3.14 Congress decided to continue and enhance the WMO Programme for the Least Developed Countries to address the obstacles and constraints limiting NMHSs in LDCs to provide relevant weather, water and climate information and services and to strengthen their capabilities to meet the demands and requirements of the priority areas for action in the Istanbul Programme of Action for the LDCs for the decade 2011–2020 as appropriate (see the Programme Description given in Annex II to the present report).

6.3.15 In this regard, Congress adopted Resolution 33 (Cg-XVI) – WMO Programme for the Least Developed Countries.

6.4 REGIONAL PROGRAMME *(agenda item 6.4)*

General Overview

6.4.1 Congress reviewed the progress of the Regional Programme (RP), during the fifteenth financial period, as well as the actions taken by the Secretary-General as follow-up to its decisions and those of the Executive Council and regional associations (RAs) related to the Programme. It noted that the Regional Programme (see Annex II to the present report), implemented by the six RAs and supported by the WMO Regional Offices and WMO Offices in the Regions (formerly called Subregional Offices), continued to implement relevant Congress and Executive Council resolutions and coordinate Member's activities in their respective Regions. Promoting the implementation of the various WMO Programmes, strengthening the NMHSs and improving their capacity to provide better products and services, continuous assistance in resolving identified technical and institutional issues, have been pursued through cooperation and partnership with Members, international organizations and financial institutions. Members have benefited from the organization of a number of regional technical conferences, seminars, workshops and other fora involving experts, Directors of NMHSs and high-level decision-makers.

6.4.2 Relevant information on the attained results and identified priorities and challenges by the regional associations is provided under agenda item 2.4.

Regional activities and regional offices

6.4.3 Congress welcomed various measures taken by the Secretary-General to strengthen the Secretariat support to the Regional Programme. With the new structure implemented in January 2008, the Development and Regional Activities (DRA) Department was tasked to implement programme activities towards Expected Results 7 and 9 (2008–2011), which included the implementation of the Regional Programme. Within the DRA Department, the regional activities are being closely coordinated with principle capacity-building programmes (ETRP, VCP, TCOP, LDCP) and with the Resource Mobilization Office (RMO).

6.4.4 Congress was pleased to note the increasing role of the Regional Offices (RO) as a focal point for information on regional activities and for assisting Members develop their NMHSs. Congress commended the continued efforts by the ROs and WMO Offices in the Regions in supporting the work of the RAs, their presidents and subsidiary bodies, as well as in providing assistance to Members in implementing the various technical and scientific programmes in the Regions. Congress stressed the need to strengthen project management within the ROs and urged the Secretary-General to ensure that project management skills of the ROs are enhanced. Congress noted further that the focus on capacity-building in the DRA Department allowed the ROs to enhance their role in supporting resource mobilization and implementation of projects with various partners. In this regard, Congress agreed that the Secretary-General should sustain and further optimize the internal capacity-building structure with a strong participation of the ROs and the WMO Offices in the Regions.

6.4.5 Congress recognized that ROs have been playing successfully their role as point-of-contact between Members, and WMO Programmes/Secretariat. ROs monitor the needs of the subregions and individual Members and facilitate the provision of appropriate advice and assistance through relevant technical departments in the Secretariat. Congress noted further that ROs, in close collaboration with the RMO and utilizing all available possibilities for technical assistance (e.g., VCP and technical cooperation mechanisms), have assisted in a number of cases to resolve critical deficiencies which could have compromised the ability of some NMHSs to provide essential data and services as per their mandate.

6.4.6 Congress noted that a major focus for all ROs has been the need for promoting the role of NMHSs to increase their visibility as crucial stakeholders in the national and regional development agenda. ROs have conducted their advocacy role through missions to Member

States and representation at relevant regional events. Congress agreed that the Secretary-General should strengthen this assistance to Members, in particular, in promoting the socio-economic benefits from weather-, climate- and water-related services to governments, economic sectors and societies.

6.4.7 Congress noted that the Regional Offices for Africa, for Asia and the South-West Pacific, and for Europe were located in Geneva, and that the WMO Offices in the Regions continued to fulfil their functions and responsibilities as an integral part of the Secretariat. Congress noted further that the relocation of the Regional Director for the Americas to Paraguay in January 2010 has brought some benefits for Regions III and IV by fostering closer collaboration with Members and between the two Regions.

6.4.8 Congress noted further that the fifteenth session of RA I expressed concern with regard to the capacity challenges faced by the Regional Offices and WMO Offices in the Regions, and identified the following key priorities and responsibilities for these Offices: (a) carry out gap analysis of NMHSs; (b) assist in the processes of strengthening the NMHSs; (c) effective support to the implementation of WMO Programmes in the Region; (d) enhance WMO and NMHSs visibility in the Region; (e) prepare and assist Members update information in the planned Country Profile Data Base; and (f) maintain liaison with regional economic groupings and international organizations. Congress also noted that RA I urged the Secretary-General to explore relocation of the Regional Office for Africa to the Region in order to improve the communication with Members and partner organizations, and enhance its effectiveness in the governance and coordination of the regional activities.

6.4.9 Considering the concerns of RA I and the benefits for Regions III and IV achieved through the relocation of the Regional Director to the Region, as well as opinions that the location of the Regional Directors and Offices in Geneva has advantages in terms of coordination with the WMO Secretariat and Programmes, Congress recommended that the Secretary-General consider, in consultation with the presidents of RAs concerned, conducting a comprehensive review of the regional offices resources and location and propose measures to enhance their efficiency and effectiveness. Congress also supported the call by several regional associations to their Members to consider strengthening the respective ROs and WMO Offices in the Regions through national secondments and other appropriate means.

6.4.10 Congress noted the important role of the WMO Offices in the Regions in bringing the WMO Secretariat close to Members, especially in strategic and operational planning and assessment of societal benefits, thereby raising the profile of NMHSs. Congress noted further the concern of many Members that these Offices have been understaffed and requested the Secretary-General to strengthen them. Congress also recommended other options for strengthening the regional presence of WMO, such as establishment of project offices and appointing staff through various projects implemented in the Regions.

6.4.11 Congress was pleased to note the success of various forms of subregional cooperation and collaboration between Members, such as the Interstate Council on Hydrometeorology of the Commonwealth of Independent States (ICH/CIS), which has been very instrumental in developing common strategy and implementation approaches by the Members in the subregion. Congress supported such subregional frameworks, in particular for areas with similar climate characteristics and disaster regimes, in order to harmonize the cross-border exchange and cooperation. Congress noted that South-East Asia is one of those subregions which would require stronger inter-regional cooperation between RA II and RA V.

6.4.12 Congress stressed that, along with the other capacity-building programmes of the WMO, the Regional Programme should put strong emphasis on the assistance to the developing and least developed countries. In this regard, Congress was pleased to note the successful implementation of regional pilot projects in RA II, including those proposed and championed by Hong Kong, China. Congress encouraged the promotion of similar pilot projects in other regional

associations to build the capacity of Members and that collaboration between regional associations and relevant technical commissions should be further developed.

WMO Country Profile Data Base

6.4.13 Congress reviewed the process towards the development of an integrated Country Profile Data Base (CDB) requested by Cg-XV and EC-LX and noted the progress made, including the purchase of needed survey and collaboration software. Congress also expressed its appreciation to the Government of Spain for the secondment from the Agencia Estatal de Meteorología (AEMET), who worked on the CDB among other duties.

6.4.14 Recognizing the potential for such a capability to improve coordination, as well as the efficiencies for surveys and knowledge management across programmes and regions, Congress agreed with the importance of continuing the development of the CDB with the involvement of the EC Working Group on Capacity-building or its successor, and the assistance of those Members willing to do so. Congress anticipated that the CDB would be an important tool to track the needs for assistance and development of the NMHSs to better target development resources and in applying for additional resources. A holistic CDB would help in monitoring and evaluation of regional strategic/operating plans, in minimizing the number of WMO surveys and to get information on the needs and status of the Members. In this connection, Congress noted progress towards the development of a version of WMO Publication No. 5 using the CDB collaboration software, which will provide the core for future development of the CDB.

6.4.15 Congress stressed that the usefulness of the database depends on regular updates of the information provided by the Members. It is important that Members have access to the information contained in the database, especially with regard to their own country and NMHS and that the mechanism for reviewing and updating the CDB information and requirements would require regular feedback from Members. In this regard, Congress recommended that the Secretary-General evaluate Members' experiences with the WMO Publication No. 5 module and the survey tool with a view to improving their usefulness and determining any future development of the CDB.

Regional Programme in the sixteenth financial period

6.4.16 Noting the description of the Regional Programme (see Annex II to the present report) Congress adopted Resolution 34 (Cg-XVI) – WMO Regional Programme.

7. PROGRAMME AND CONSTITUENT BODIES SUPPORT *(agenda item 7)*

7.1 CONFERENCE SERVICES *(agenda item 7.1)*

7.1.1 Congress noted that 18 constituent body sessions and 1093 other meetings were held during the fifteenth financial period, both in and away from Geneva. It examined the information submitted by the Secretary-General and additional information provided by delegations on the invitations extended for hosting sessions of constituent bodies during the sixteenth financial period (2012–2015). It recalled the policy laid down by previous Congresses that as many sessions as possible would be held outside Geneva, and that Fifteenth Congress requested the Executive Council to ensure an even distribution of constituent body sessions during a given financial period. This would respond to wishes expressed by the Members who at times cannot attend several constituent body sessions scheduled almost back-to-back, as was the case during 2009 and 2010. In that context, Congress established a provisional programme of constituent body sessions with fixed dates for those meetings, as given in Annex VII to the present report.

7.1.2 Congress agreed that a firm timetable for constituent body sessions would help Members to better evaluate their ability to host a session during a specific period, and that

adherence to the approved timetable would also enable the Secretariat to determine precisely when it should begin the pre-session preparatory work and thus ensure the timely delivery of documentation. In accordance with Annex I to Regulation 18 of the General Regulations (2011 edition), however, if no invitation is received at least 300 days before the scheduled opening of the session concerned, the session is to be held at WMO Headquarters. While Congress recognized the clear advantages of holding constituent body sessions in Geneva, it noted that a renewed commitment to scheduled meeting dates should help increase the effectiveness of efforts by Members and the Secretariat to control the costs of these sessions.

7.1.3 Congress noted that the Executive Council considered possible improvements in the efficiency of constituent body meetings. Congress expressed concern about the decreased number of Members, especially those from developing countries, participating in sessions of technical commissions, leading to often marginal quorum. Congress discussed possible measures to optimize the work of constituent bodies under agenda item 7.4.

7.1.4 Congress noted with appreciation a variety of efficiency measures already introduced, such as increased use of video-conferences, electronic distribution of pre-session documentation, radically reduced printing requirements both in documentation and in publications, off-site translation and online distribution of in-session documents, which, along with improved decision-focused documents, enabled a reduction in the number of days of some constituent body sessions and other meetings. Congress requested that online distribution of correspondence be introduced as soon as possible which would not only reduce the dispatch costs, but also allow for immediate and simultaneous distribution to all Members that have easy access to Internet. Nevertheless, Congress recalled that some Members cannot access Internet easily and might still require more traditional support, such as CDs. It encouraged the Secretariat to continue introducing similar environment-friendly and efficiency measures in addition to those listed in the budget document.

7.2 LANGUAGES (agenda item 7.2)

Congress noted that language services (translation, document processing and editing) made a significant contribution to the success of the WMO constituent body sessions and other conferences. In spite of uneven spread of the workload during the financial period, the targets set were met. Congress encouraged Members to actively contribute to the improvement of language and conference services during sessions by providing feedback to the Secretariat through completing surveys distributed at the sessions and through other means. Congress welcomed the posting on WMO Website of the METEOTERM terminology database in the six languages, as a significant tool for external users.

7.3 PUBLICATIONS *(agenda item 7.3)*

7.3.1 Sixteenth Congress noted the efforts of the Executive Council to streamline the planning for and management and implementation of the Organization's publications programme. The Congress agreed that the list of programme-supporting publications and the list of mandatory publications be merged into a single list of WMO publications and that the publications on this new list, which would supersede all previously existing series and categories, be grouped into two categories:

(a) **Governance and technical publications**: those listed under basic documents, operational publications, official records and WMO guides in the Annex to Resolution 26 (Cg-XV), and those listed in Annex 4 to Resolution 13 (EC-LVI) as "regular WMO programme-supporting publications", with the exception of those mentioned under item B.7 (booklets, including those on the subject of the World Meteorological Day);

(b) **General information publications**: outreach publications targeting the general public, policymakers and decision-makers.

The Congress recognized concerns expressed by the Executive Council regarding the continuing lack of regular budget funds for issuing the full list of mandatory publications in a particular financial period. Following the suggestion of the sixty-first session of the Executive Council, and with a view to addressing this problem, Sixteenth Congress approved a list of WMO publications that comprises only those publications that have been recommended by WMO constituent bodies, and for which funds have been secured for the financial period (see the annex to Resolution 35 (Cg-XVI)). All other publications will be produced using voluntary resources.

7.3.2 At the request of the sixty-first session of the Executive Council, the presidents of technical commissions reviewed the concept of mandatory publications and proposed to the sixty-second session of the Executive Council a definition which, in principle, was endorsed. However, it was decided at the 2011 Meeting of the Presidents of Technical Commissions that the categories listed under (a) and (b) above were sufficient and that the term “mandatory publications” should be dispensed with to avoid possible confusion.

7.3.3 The Congress agreed with the Executive Council on the importance of WMO publications for the development of the Global Framework for Climate Services (GFCS). In this regard, it welcomed the efforts by the Secretary-General to carry out the proposal of the Council to “compile a list of relevant publications (published as early as the late 1980s) and explore means of making these publications available to Members in a cost-effective manner”. A list of all publications issued between 1970 and 2005 was compiled and the publications have been made available to Members at a 70 per cent discount.

7.3.4 The Congress commended the efforts of the Secretary-General to pursue the expansion of electronic publishing and the new distribution policy approved by the sixty-second session of the Executive Council, which helps to promote the objectives of the Organization and its Members through the provision of online access to WMO publications free of charge. The Organization was commended for its efforts to make rich information resources available online to Members and the general public and noted, however, that a better search engine and easier access on the WMO Website would make such resources even more useful. The new scheme for the free distribution of publications reflected a change in policy, with Web distribution now being given preference over the distribution of hard-copy versions, which are reserved only for exceptional cases. These cases include countries with limited access to high-speed Internet, and public information products and supplements to some Manuals and Guides that have not yet been revised and are therefore kept in paper form only until a new edition is prepared.

7.3.5 Congress adopted Resolution 35 (Cg-XVI) – Publications for the sixteenth financial period.

7.4 IMPROVEMENT OF WMO PROCESSES AND PRACTICES *(agenda item 7.4)*

7.4.1 Congress was informed of EC decisions on improving WMO processes and practices to increase the efficiency and effectiveness of WMO constituent bodies, particularly technical commissions and regional associations, noting concerns such as low quorum at sessions, rising costs of sessions in a diminishing budget environment and the Cg-XV proposal to reduce future Congress sessions amongst other measures. Congress stressed that such measures should not be driven by the objective of cutting costs, but rather by the need to increase the overall efficiency of the Organization. In addition, Congress requested the Executive Council to monitor the effects of these measures on the participation of Members in constituent body meetings by all Regions, particularly Members from developing and least developed countries and Small Islands Developing States (SIDS).

7.4.2 Congress considered that the continuous improvement of the WMO’s processes and practices should lead to:

(a) Improved visibility of the WMO;

(b) A closer alignment between user requirements as reflected in the priorities of the regional associations and the work programmes of the technical commissions;

(c) Meetings that generate more concrete actions;

(d) WMO becoming more of a catalyst for development projects that in turn provide added benefits to Members.

7.4.3 Congress was further informed that technical commissions, particularly CAeM, CBS, CCl, CHy, and CIMO, implemented various measures including on-line e-discussion forums for some pre-session documents, reduced duration of sessions, reduced duration of the intergovernmental part of sessions requiring UN language interpretation, reduced volume of printed materials, increased access to documents on-line, and holding of technical conferences conjointly with constituent body sessions (e.g. JSC and CCl). Congress was pleased to note the contribution of EC to these efficiency and effectiveness measures.

7.4.4 Congress took note of the decisions of EC-LXI (paragraphs 8.23–8.26 of the Abridged Final Report) and EC-LXII (paragraphs 8.5.1–8.5.5 of the Abridged Final Report), and subsequent work of the EC Working Group on WMO Strategic and Operational Planning on specific measures for improvement of the processes and practices of the WMO. Congress requested the Executive Council to continue this work, and to implement, in particular, the following measures:

(a) The development of simplified documentation for constituent body sessions to improve decision-making (aiming for a trial at EC-LXIV);

(b) The establishment of a mechanism that facilitates joint implementation of projects and activities of mutual interest to ensure the feeding of the priorities from the regional associations into the work programmes of the technical commissions. Where possible, include experienced members of the various technical commissions who are also active in the work of their regional associations in these conjoint projects and activities.

7.4.5 Congress agreed that the issue should be viewed as a long-term activity directed at continuous improvement of the processes and practices of the WMO's constituent bodies and its Secretariat, and should start with changes that would make a difference. It requested the Executive Council to continue to work on, and implement as appropriate, continuous improvement of WMO processes and practices, and bring back to the next Congress specific proposals, which may include changes to General Regulations or the WMO Convention as necessary, focusing on a number of areas where further work is required, including, but not limited to:

(a) The review of WMO constituent bodies, their strategic alignment and their processes and practices for continuous improvement to better deliver the priorities of the Strategic Plan, and in particular that of Capacity Development;

(b) The identification of regional priorities and action lists by regional associations and their alignment with and to technical commission activities. These priorities should be the driving force of the activities of the technical commissions;

(c) The catalytic role of WMO in resource mobilization for development efforts through potential partners such as the World Bank, African Development Bank and other regional development banks, European Commission, Climate Adaptation Fund and other international and national funding agencies;

(d) Efforts to increase recognition of WMO as a visible flagship of weather, water and climate expertise with its Members;

(e) The practicalities of reducing the intergovernmental part of constituent body sessions and redirecting the savings to increased technical activities;

(f) The possibility of fewer meetings focusing more on the preparation of action plans and follow-up of earlier agreed actions;

(g) Optimize further the scheduling of technical commission and regional association meetings.

8. STRATEGIC PLAN AND BUDGET *(agenda item 8)*

8.1 WMO STRATEGIC PLAN (2012–2015) *(agenda item 8.1)*

8.1.1 Congress recalled its decisions on strategic planning (Resolutions 27 and 28 (Cg-XV)) and noted that the strategic planning for the period 2012–2015 represented the second phase of the Results-based Management (RBM) Strategic Planning Framework for WMO and builds upon the previous long-term planning process and the experience and lessons in RBM during the 2008–2011 period that had enabled it respond to the changing needs of Members and society in general.

8.1.2 Congress noted with appreciation the work accomplished by the Executive Council through its Working Group on Strategic and Operational Planning in preparing the Strategic Plan, which EC recommended to Congress for approval. Congress also noted that the WMO Strategic Plan (SP) for the period 2012–2015 is based on the need to address three broad global societal needs through five Strategic Thrusts that lead to the achievement of eight Expected Results through the associated Key Outcomes. The strategic priority areas of the SP represent major focuses of the Organization for the benefit of Members. The contributions of the WMO Programmes to achieving these Expected Results are presented in Annex VIII to the present report.

8.1.3 Congress appreciated the active involvement of regional associations, technical commissions and the Secretariat, including Secretariats of WMO joint programmes, in the development of the WMO Strategic Plan 2012–2015, which ensured that the document reflected the collective view of all WMO constituencies.

8.1.4 Congress reaffirmed the importance of the Strategic Plan for the WMO RBM as the foundation for the planning of activities and resource allocation for the Secretariat in the sixteenth financial period as reflected in the WMO Operating Plan (OP) and Results-based Budget (RBB) for the period 2012–2015.

8.1.5 Congress agreed that although its primary focus was on the Sixteenth WMO Financial Period (2012–2015), the Strategic Plan takes into consideration the challenges beyond the period that may influence the achievement of expected results. It should determine collective and coordinated activities of regional associations, technical commissions and Secretariat through well-defined Programmes, projects and initiatives, as well as guide and motivate activities of Members and their National Meteorological and Hydrological Services.

8.1.6 In that connection, Congress adopted Resolution 36 (Cg-XVI) – WMO Strategic Plan (2012–2015).

8.2 WMO OPERATING PLAN (2012–2015) *(agenda item 8.2)*

8.2.1 Congress appreciated the work of the Council through its Working Group on Strategic and Operational Planning in developing the draft WMO-wide Operating Plan (2012–2015) as a component of the WMO's Result-based Management (RBM) framework. Congress noted that the draft WMO-wide Operating Plan (2012–2015) provided details on key outcomes, deliverables and activities, which have been used to guide resource estimates and allocations as presented in the Secretary-General's Budget Proposal for the sixteenth financial period. Congress appreciated the contributions of the technical commissions and regional associations, as well as EC working groups and panels of experts in particular, the Panel of Experts on Education and Training, and the

Working Group on Disaster Risk Reduction and Service Delivery to the development of the WMO Operating Plan 2012–2015.

8.2.2 Congress noted the draft WMO Operating Plan 2012–2015 and requested the Secretary-General to finalize the Plan taking into account all the decisions of the Sixteenth Congress and to make the final version of the Plan available on-line for use by all management groups, the Executive Council and the Secretariat as a monitoring tool. Congress requested the Executive Council to further improve the Operating Plan consistent with the guidance provided by Congress regarding the future strategic and operational planning discussed under agenda item 8.5.

8.3 BUDGET FOR THE SIXTEENTH FINANCIAL PERIOD (2012–2015) *(agenda item 8.3)*

8.3.1 Congress considered the budget proposal from the Secretary-General for the sixteenth financial period (2012–2015). Under the present agenda item, Congress considered and decided on the broad expenditure levels for the eight Expected Results. The detailed discussions of various scientific and technical programmes and other activities, and the decisions of Congress thereon, were recorded under their respective agenda items.

8.3.2 Congress noted that the budget proposal for the sixteenth financial period was linked to the draft WMO Strategic Plan 2012–2015, as mandated by the Executive Council at its sixty-second session (EC-LXII) and previous sessions, and was prepared in accordance with the guidance provided by EC-LXII.

8.3.3 Congress welcomed the new integrated budget format, covering regular and voluntary resources. Congress reiterated that the effective implementation of the results-based budget concept had to be regarded as a continuous optimization process. It stressed the need for continuous improvement in the further development of adequate and measurable performance indicators at the strategic and programme levels and the introduction of an effective system for monitoring programme performance and assessing the results achieved. Congress requested that a strong system of evaluation be developed which would link to results and establish quantitative base lines for use as key performance indicators.

8.3.4 Congress decided to fund additional activities from the regular budget at an estimated cost of 1,200,000 Swiss francs. This includes the cost of the staff support for AMDAR coordination at an additional cost of 370,000 Swiss francs, increase support to radio frequency activities by 150,000 Swiss francs, and Global Cryosphere Watch (GCW) by 350,000 Swiss francs under Expected Result 4. In addition, support for the GFCS management unit is increased by 330,000 Swiss francs under Expected Result 1. Of the additional amount required, 600,000 Swiss francs are to be accommodated within the regular budget in the course of budget implementation. Furthermore, an amount of 600,000 Swiss francs are to be released from the budget of the support departments through additional efficiency measures.

8.3.5 Congress requested the Executive Council and the Secretary-General to continuously seek efficiencies and closely monitor expenditure throughout the sixteenth financial period, in particular, using IPSAS accounting to identify further areas of savings, and focusing on priority activities. Congress further requested the resulting savings be re-directed into enhancing the implementation of the WMO Scientific and Technical Programmes.

8.3.6 After discussion, Congress decided to approve a regular budget of 276,000,000 Swiss francs for the sixteenth financial period (2012–2015), and adopted Resolution 37 (Cg-XVI) – Maximum expenditure for the sixteenth financial period (2012–2015), which includes assessed contributions of 261,000,000 Swiss francs, and voluntary resources estimates of 175,000,000 Swiss francs.

8.3.7 Congress considered the Compendium of Project Initiatives to be funded from voluntary resources for the sixteenth financial period (2012–2015). Congress noted with appreciation the pledges made by India, Norway and Switzerland in support of projects and project initiatives.

8.4 MONITORING AND EVALUATION *(agenda item 8.4)*

8.4.1 Congress took note of the progress in the development and implementation of the WMO Monitoring and Evaluation (M&E) System and agreed with the decisions of the sixty-second session of the Executive Council (EC-LXII, paragraphs 7.2.12–7.2.15) that the development and implementation of the WMO M&E system focus on:

(a) Activities of WMO and issues on which there is a direct impact;

(b) Those activities of NMHSs that help society to adapt to climate variability and change;

(c) A simple system, which would report programme performance with clear targets for success.

8.4.2 Congress emphasized that the M&E System was an important component of Results-based Management (RBM) that provides essential information for evaluating the performance of the Organization and for management/control purposes in the Secretariat. It noted that the time-bound specific programme activities and projects in the WMO Operating Plan to be implemented to achieve results defined in the WMO Strategic Plan, within the resources provided under WMO Results-based Budget, are the focus of the WMO Monitoring and Evaluation. It further noted that the funded activities and projects in the compendium will be included in the Operating Plan to facilitate their monitoring and evaluation. It requested the Executive Council and the Secretary-General to continue with the further development and implementation of the M&E System, with a particular focus on the following:

(a) The M&E System should be precisely defined and correctly applied;

(b) The M&E System should be simplified to the extent possible to reduce the workload associated with its implementation;

(c) Financial information should be incorporated into the M&E System to ensure that the relationship between expended resources and achieved results is transparent to all stakeholders;

(d) Since not all indicators of high-level results are easily measurable or quantifiable, qualitative measures should also be considered with a standardized rating scheme.

8.4.3 Congress agreed that full implementation of the M&E System should start in 2012 and encouraged the technical commissions and regional associations to continue to contribute to its further development and implementation. Congress requested the Secretary-General to ensure that all staff are well trained in the M&E methodology and have ownership of the M&E System. It requested the Secretary-General to promote the sharing of experiences on M&E Systems within the Secretariat.

8.4.4 Congress requested the Secretary-General to provide information regarding the purposes of M&E and its implementation processes to Members, particularly in developing and least developed countries, to enable them effectively contribute to the development and implementation of the WMO M&E System.

8.5 PREPARATION OF THE STRATEGIC PLAN FOR 2016–2019 *(agenda item 8.5)*

8.5.1 Congress reiterated the importance of the strategic planning process and the WMO Strategic Plan 2012–2015 for the appropriate and coordinated implementation of the WMO Programmes in the forthcoming financial period. It saw the need to put in motion a mechanism for the preparation of the Strategic Plan for the seventeenth financial period taking into consideration the need to have stable Strategic Plans that focus beyond the planning period.

8.5.2 Congress noted that the WMO Strategic Plan provides a high-level statement on the future direction and priorities for the Organization to be achieved through the implementation of activities in the WMO Operating Plan, which translates the Strategic Thrusts, Expected Results and Key Outcomes into time-bound specific programme activities and projects implemented by technical commissions, regional associations, and the Secretariat, including support services for constituent bodies with oversight provided by EC during the intersessional period. The Strategic and Operating Plans provide the foundation for developing WMO Results-based Budget (RBB), which identifies regular resources that are needed to implement the Operating Plan, as well as voluntary resources for project initiatives that enhance key outcomes in priority areas.

8.5.3 Congress agreed that the Global Societal Needs (GSNs) that form the basis for the Strategic Plan for the period 2012–2015 and the Strategic Thrusts (STs) together with the Expected Results (ERs) represent relevant issues and directions that could still influence the focus of the Organization beyond the period 2012–2015 and should form the basis for the WMO Strategic Plan for the period 2016–2019.

8.5.4 Congress further agreed that the strategic and operational planning for the period 2016–2019 should:

(a) Follow the structure of the Strategic Plan 2012–2015 (GSNs, STs and ERs) and the overall planning process, taking into account the evolution of the societal and economic needs of the Members, relevant international initiatives, and the challenges of climate variability and change;

(b) Build on programme and management related experiences gained in the implementation of the two phases of strategic planning (2008–2011 and 2012–2015) and from the strategic planning process as a whole;

(c) Further improve the linkage between the Strategic Plan, Operating Plan and Results-based Budget to facilitate efficient implementation of the WMO Results-based Management (RBM) framework;

(d) Improve the Key Performance Indicators to facilitate efficient monitoring and evaluation of the progress to achieve expected results.

8.5.5 In light of the above, Congress adopted Resolution 38 (Cg-XVI) – Preparation of the Strategic Plan for 2016–2019.

9. ADMINISTRATIVE AND FINANCIAL QUESTIONS *(agenda item 9)*

9.1 FINANCIAL MATTERS *(agenda item 9.1)*

Proportional contributions of Members – Scale of assessments

9.1.1 Congress recalled its decision under Resolution 40 (Cg-XV) — Assessment of proportional contributions of Members for the fifteenth financial period, that the latest United Nations scales approved by the United Nations General Assembly should be adopted as the basis for the calculation of the WMO scales of assessments, duly adjusted for differences in membership.

9.1.2 Congress noted that the United Nations scale of assessments for the years 2010 to 2012 was approved by the sixty-fourth United Nations General Assembly in December 2009 and, that for the years 2013 to 2015, they would be approved by the sixty-seventh United Nations General Assembly (anticipated in December 2012). It is recognized that the WMO scale of assessments for the year 2013 would only be available in January of that year.

9.1.3 Congress decided that the minimum rate of assessment of 0.02 per cent, as adopted for the fifteenth financial period, be retained as the minimum for the sixteenth financial period.

9.1.4 Congress authorized the Executive Council to adjust the WMO scale of assessments for the year 2014 to 2015, so that the changes in the United Nations scale of assessments to be adopted by the United Nations General Assembly at its sixty-seventh session anticipated in December 2012 could be taken into account. Corrections should be made to ensure that no Member's rate of assessment would increase to a level which would exceed 200 per cent of the WMO scale for 2012 to 2013.

9.1.5 Congress took note of the recommendations of the thirtieth meeting of the Financial Advisory Committee on this matter.

9.1.6 Congress adopted Resolution 39 (Cg-XVI) – Assessment of proportional contributions of Members for the sixteenth financial period.

Revisions to the Financial Regulations

9.1.7 Congress recalled its decision, at its fifteenth session, to delegate to the Executive Council during the fifteenth financial period the authority to approve the necessary revisions to the relevant Financial Regulations to ensure compliance with IPSAS and its request to the Executive Council to report to Sixteenth Congress on the actions taken.

9.1.8 Congress noted with appreciation that the Executive Council, at its sixty-first session in 2009, through Resolution 13 (EC-LXI), had approved the necessary revisions to the relevant Financial Regulations of the World Meteorological Organization, as incorporated in Annex IX to the present report, effective from 1 January 2010, concurrent with the adoption of IPSAS. It endorsed the action taken by the Executive Council.

9.1.9 Congress noted that, with regard to fellowships, Financial Regulation 7.5, which states that appropriations required to discharge outstanding legal obligations in respect of fellowships shall remain available until the fellowships are completed or otherwise terminated, is not compromised by the requirement of IPSAS to recognize expenditure on delivery of services because, while expenditure is recognized for the time spent in the fellowship programme, provisions are made for the remainder of time of the fellowships or their termination. Congress noted that such provisions are not reported in the financial statements, but disclosed in the notes to the financial statements, as is the case for other obligations for which goods or services are not received by end of the year.

9.1.10 Congress took note of the recommendations of the thirtieth meeting of the Financial Advisory Committee on this matter.

Financial Report of the Secretary-General for the fifteenth financial period (2008–2011)

9.1.11 Congress examined the financial situation of the Organization for the fifteenth financial period (2008–2011). In particular, the Congress noted the financial situation with regard to assessments, outstanding contributions, status of budgetary appropriations, revenue, other funds and reserves as well as the implementation of International Public Sector Accounting Standards.

9.1.12 The Congress was satisfied that the Secretary-General was taking all necessary steps to administer the financial resources made available to the Organization in a manner consistent with the provisions of the Financial Regulations and the decisions of Fifteenth Congress and the Executive Council.

9.1.13 Congress appreciated the improved results-based budgeting (RBB) format but stressed the need to measure not just how the funds were expended but the extent to which the results were achieved.

9.1.14 Congress also noted that the financial situation was regularly reviewed on an annual basis by the Executive Council, the Audit Committee, and the Financial Advisory Committee.

9.1.15 Congress noted with satisfaction the payment by some Members of their long-outstanding contributions. It nevertheless noted that in some cases, Members were delaying the settlement of their assessed contributions for unduly long periods, which risked depriving the Organization of cash resources required to implement the programmes.

9.1.16 Congress took note of the recommendations of the thirtieth meeting of the Financial Advisory Committee on this matter.

International Public Sector Accounting Standards

Report on implementation of IPSAS

9.1.17 Congress considered the report on the implementation of the International Public Sector Accounting Standards (IPSAS).

9.1.18 Congress noted with appreciation that the WMO Secretariat has successfully implemented the project as demonstrated by the IPSAS-compliant financial statements 2010 and the unqualified opinion by the External Auditor. The Congress appreciated that the project was on track and within budget.

9.1.19 Congress noted the benefits arising from IPSAS, including greater transparency, more effective financial information and consistent treatment for year-on-year comparisons, and requested the Secretary-General to fully exploit IPSAS in continuing to improve the efficiency, effectiveness and financial management of the Organization, and report to Cg-XVII on the benefits achieved.

9.1.20 Congress took note of the recommendations of the thirtieth meeting of the Financial Advisory Committee on this matter.

9.2 STAFF MATTERS *(agenda item 9.2)*

Views of staff on their conditions of service

9.2.1 On behalf of the staff, the president of the Staff Association (SA) expressed appreciation for having the opportunity to address Congress on this occasion. Congress welcomed the presentation, and recognized that hearing directly from the Staff Association at Congress was consistent with Staff Regulation 8.1 “The Secretary-General shall make provision for staff participation in the discussion of policies relating to staff questions”.

9.2.2 Congress was informed that the WMO staff and Management continued to collaborate on a number of initiatives and issues related to the conditions of service, as well as the health and well-being of the staff. Congress noted that the Staff Rules (item 181.1) establish a Staff Committee (SC), which is consulted on questions relating to staff welfare and administration, including policy on appointments, promotions and terminations, and on salaries and related allowances, and is entitled to make proposals to the Secretary-General on behalf of the staff on such matters. Congress welcomed the appreciation of the SA that WMO recognizes its staff and sets out appropriate guidance for staff matters in binding Staff Regulations and Rules, and that mechanisms including the Joint Consultative Committee (JCC) are established and utilized in a collaborative manner in the work of the WMO Secretariat.

9.2.3 Congress strongly endorsed the views expressed by the Executive Council, at its sixty-second session (EC-LXII, June 2010), that an efficient and motivated Secretariat work force is an essential part of the system that supports meeting the needs of the Members, that the staff should be enabled to address, to the extent possible, the scientific and technical work that underpins the Expected Results (ERs); that the WMO Secretariat workload and administrative processes should be considered with the view to increase efficiency to the extent possible, and to protect staff well-being. Noting that the WMO is evolving in many positive ways, necessitating flexibility, learning and adjustments on the parts of both management and staff, Congress agreed with the views expressed at EC-LXII that it was necessary for WMO Management to engage with the staff on a regular basis in the ongoing process of change management, to reinforce the ability of the staff to carry out existing and new programmes providing service to the Members.

9.2.4 Congress was apprised that the issues raised by the staff for discussion in recent years were identified in the 2008 Staff Opinion Survey, through General Assemblies (GAs) of the Staff Association, including the most recent (Geneva, 30 November 2010) and through personal consultations with staff members. A number of these issues are longstanding. Congress noted the progress made to address specific matters, as identified in Annex X to the present report.

9.2.5 Congress appreciated the extensive support of the SA for a recent review of draft text related to revisions to the Human Resources (HR) chapter of the Standing Instructions. Congress further appreciated the work of the Management-Staff Task Force dealing with updates to the Standing Instructions, and noted the benefits of retaining this oversight on an ongoing basis, with a view to keeping them up-to-date and to reinforce the Staff-Management dialogue.

9.2.6 Congress was informed that in addition to the many cultural and fundraising activities undertaken by the SC and other required functions (e.g., boards for staff appointments), it is increasingly difficult for the SC to find adequate time to deal with substantial issues related to staff welfare, given that time spent on the work of the SC is on top of normal work-related duties and responsibilities. This has also unfortunately led to many personnel having to decline opportunities related to staff matters due to their work responsibilities. Congress was informed that the president of the Staff Association may be released from his/her regular duties for 50% of the time, but that no president during 2008, 2009 or 2010 had taken advantage of the said opportunity. Congress was informed that the costs, if any, related to the release of the president of the Staff Association (e.g., for contractors, part-time staff, etc.) must be borne by the department of that staff member.

9.2.7 Congress noted that, as recommended by EC-LXII, the staff would report to EC-LXIII with recommendations for further actions, and that the staff priorities include, inter alia:

(a) Training for staff including, as a priority, for management and supervisory skills and on existing and new Secretariat processes and tools;

(b) Continued development of the relevant internal manuals or information packages and associated training programmes in Secretariat processes and tools;

(c) Development and implementation of introductory programmes for new staff;

(d) Improved engagement of staff in assessment and management of issues related to staff health, including joint analysis of non-confidential but authoritative information provided through professional bodies such as the UN Medical Service;

(e) Completion of the update of the Standing Instructions with continued staff engagement, and implementation of an ongoing staff management oversight on the Standing Instructions;

(f) Continued engagement of staff in the appointments of new staff through participation in the Staff Selection and Appointment and Promotion Boards (SSBs and APBs), taking

into consideration the recommendations of the Staff on vacancy notice policy prior to its final approval and advertisement;

(g) Sustained efforts to address the findings of the 2008 Staff Opinion Survey, and any subsequent concerns related to the health and well-being of staff, including development of a methodology for regular monitoring and evaluation of staff satisfaction and related issues.

9.2.8 Congress recognized the challenges to implement these recommendations in terms of the available resources. Congress encouraged the Secretary-General to support implementation of as many as possible of the recommendations of staff within existing and additional resources, and to continue the ongoing efforts, greatly appreciated by the staff, to work with the SA through the relevant mechanisms to design and maintain a healthy, efficient, productive workplace in the WMO Secretariat.

9.2.9 Congress requested the Secretary-General to make available, within the next financial period and budget, adequate resources in order to provide new supervisors with information and briefing packages for enhancing their ability to ensure the health, well-being and effectiveness of staff. Congress noted with appreciation the agreement of the JCC and the Secretary-General that supervisory experience, preferably in an international setting, should be included in future vacancy notices for staff that would have supervisory duties. Congress further recommended development of a recruitment strategy that would include seeking change-management as well as supervisory skills and experience among qualified candidates.

9.2.10 Congress requested the Secretary-General to carry out a further staff survey in 2012/2013, and four-yearly thereafter, possibly based on staff surveys carried out by other comparable international organizations.

9.3 OVERSIGHT OF THE ORGANIZATION *(agenda item 9.3)*

Report of the Audit Committee

9.3.1 Congress noted with appreciation the continued excellent work of the Audit Committee that contributed to considerable progress made over the last four years in effective oversight, implementation of International Public Sector Accounting Standards (IPSAS), Enterprise Risk Management, and Monitoring and Evaluation system.

9.3.2 Congress took note of the comprehensive reports of the Audit Committee to the FINAC and the Executive Council at its sixtieth, sixty-first and sixty-second sessions, including the recommendations on the various issues under the Audit Committee's mandate and action taken by the Executive Council in considering those recommendations.

9.3.3 Congress appraised the value of the Audit Committee. It requested the Executive Council to continue providing support and reviewing the work of the Audit Committee. In that respect, it kept in force Resolution 38 (Cg-XV) on the Audit Committee.

Report of the Internal Auditor, Annual Accountability Report 2010

9.3.4 The Congress considered the accountability report of the Director of the Internal Oversight Office (D/IOO) for 2010, as well as the comments of the Secretary-General thereupon. The Congress also took into account the report of the Executive Council's Audit Committee in considering the report of IOO.

9.3.5 The Congress considered the summary of oversight findings, recommendations and actions taken in response to these recommendations, and D/IOO's opinion on adequacy of governance, risk management and internal control processes. The Congress noted the progress

on implementation of audit recommendations, and the steps taken by the Secretariat to address the issues raised therein. The Congress acknowledged the substantive progress made in internal audit activity during the last financial period.

Status of implementation of Joint Inspection Unit (JIU) recommendations

9.3.6 Recalling the WMO procedures of follow-up on JIU reports, approved by the fifty-fourth session of the Executive Council in 2002 (Resolution 11 (EC-LIV)), Congress noted with appreciation the report on implementation of JIU recommendations relevant to WMO. Congress also acknowledged with appreciation the work and reports of the JIU on matters concerning United Nations system-wide issues and WMO-specific matters.

9.3.7 Congress noted Recommendation 6 of JIU Report 2009/8 on the "Selection and Conditions of Service of Executive Heads in the UN". This states that "The legislative bodies of Executive Heads in the United Nations system should adopt provisions to limit the terms of their executive heads to a maximum of two successive terms not exceeding five years each, if such provisions have not yet been adopted." Congress considered that, as an organization which was lauded within the multilateral arena for leading in organizational changes that conform to best practices within the UN system, WMO was well positioned to consider further reforms such as updating the term limits on its executive head to be consistent with established practice in the UN system. Congress considered it could be appropriate to move to a maximum of two terms for the Secretary-General with effect from the seventeenth financial period, and requested the Executive Council to further consider the matter and submit a proposal to Seventeenth Congress for any required amendment to General Regulations as appropriate.

Increased transparency and involvement of Members in governance issues of WMO between Congresses

9.3.8 Congress was informed that the Executive Council had taken actions during the fifteenth financial period to increase transparency and involvement of Members in governance issues of WMO between Congresses, including amending relevant Rules of the "Rules of Procedure of the Executive Council" as per Resolution 33 (Cg-XV). Congress considered the report of the Secretary-General on the level of attendance of Members to its sixtieth, sixty-first and sixty-second sessions as well as to the sessions of its Working Groups on Strategic and Operational Planning and on Capacity-Building in 2009–2011 and the impact assessment of such attendance as requested by Fifteenth Congress.

9.3.9 In this connection, Congress decided to continue with these transparency measures and adopted Resolution 40 (Cg-XVI) – Increased transparency and involvement of Members in governance issues of WMO between Congresses.

9.4 SECRETARY-GENERAL'S CONTRACT *(agenda item 9.4)*

9.4.1 Congress decided that, with retroactive effect from 1 January 2011, the net annual salary of the Secretary-General should be US$ 164,650, taking into account the salaries of the Executive Heads of other comparable agencies. Congress also decided to authorize the Executive Council to carry out any readjustment of salary which might become necessary if, during the sixteenth financial period, changes in the salary of comparable United Nations staff should occur.

9.4.2 Congress further decided that during the sixteenth financial period the representation allowance for the Secretary-General should be established in Swiss francs at a level of CHF 29,000 per year.

9.4.3 In that that connection Congress adopted Resolution 41 (Cg-XVI) – Secretary-General's contract to which the contract to be signed by the President of the Organization and the Secretary-General for the sixteenth financial period was attached.

Salaries and allowances of other ungraded officials

9.4.4 With retroactive effect from 1 January 2011, Congress set the net annual salaries of the Deputy Secretary-General and the Assistant Secretary-General at US$ 151,134 and US$ 138,846 per annum, respectively. Those were the levels which applied to Deputy and Assistant Executive Heads of comparable specialized agencies of the United Nations. Congress further decided that during the sixteenth financial period, the representation allowances for the Deputy Secretary-General and the Assistant Secretary-General should be established at CHF 14,500 per annum. In that connection, Congress decided to authorize the Executive Council to carry out any adjustment of salary which might become necessary if, during the sixteenth financial period, an increase in the salaries of comparable United Nations staff should occur.

Pensionable remuneration of ungraded officials

9.4.5 Congress further noted that, in accordance with the provisions of Article 54*(b)* of the Regulations of the United Nations Joint Staff Pension Fund, the scale of remuneration for the Professional and higher categories must be adjusted with the same effective date and by the same percentage as the net remuneration increase. Congress noted that the ICSC had promulgated the consequent revised scale of pensionable remuneration applicable to those categories of staff and that comparable United Nations agencies (ITU and UPU) had consequently adjusted the pensionable remuneration of their ungraded officials. Congress noted that EC-LXI had decided to apply with retroactive effect from 1 August 2008 the following levels of annual pensionable remuneration:

Secretary-General	US$ 321,772
Deputy Secretary-General	US$ 297,381
Assistant Secretary-General	US$ 275,206

9.4.6 Congress also decided to authorize the Executive Council to carry out any readjustment of pensionable remuneration which might become necessary if, during the sixteenth financial period, changes in the pensionable remuneration of comparable United Nations staff should occur.

9.5 INFORMATION TECHNOLOGY SUPPORT *(agenda item 9.5)*

9.5.1 Congress was informed on the key activities undertaken by the Secretariat in advancing information technology support and services.

9.5.2 Congress noted that the Secretariat has continued to make progress in keeping abreast of the latest technology, and continued to be part of the UN system-wide initiative such as cloud-computing, which should be considered and assessed for cost savings, efficiencies and resiliency advantages.

10. GENERAL AND LEGAL QUESTIONS *(agenda item 10)*

10.1 QUESTIONS CONCERNING THE CONVENTION *(agenda item 10.1)*

Congress noted that there was no proposal on amendments of the Convention received six months in advance of the Congress, as stated in Article 28 of the Convention of the World Meteorological Organization.

10.2 MEMBERSHIP OF THE ORGANIZATION *(agenda item 10.2)*

10.2.1 Congress noted with appreciation that the Democratic Republic of Timor-Leste, which became the first new sovereign state of the 21st century on 20 May 2002 and a member of the United Nations on 27 September 2002, had deposited an instrument of accession to the Convention of the World Meteorological Organization with the Government of the United States on

4 November 2009 in accordance with Articles 3 (b) and 33 of the Convention of the World Meteorological Organization. In accordance with Article 35 of the Convention, the Democratic Republic of Timor-Leste became a Member of the Organization on 4 December 2009.

10.2.2 The Government of the United States received on 7 April 2011 from the Government of the Kingdom of the Netherlands, as foreseen in the Article 34 (b) of the WMO Convention, a notification that Curaçao and Sint Maarten will continue the Territory Membership of the former Netherlands Antilles and Aruba, under the group-membership of Curaçao and Sint Maarten. Therefore, the Membership of the Organization remained 189 comprising 183 Member States and 6 Member Territories.

10.2.3 Congress congratulated and warmly welcomed Timor-Leste, and Curaçao and Sint Maarten as new Members of the Organization. The delegations of Timor-Leste and Curaçao and Sint Maarten looked forward to benefiting from, and contributing actively to, the Programmes and activities of the Organization.

10.3 REVISION OF THE GENERAL REGULATIONS *(agenda item 10.3)*

Ordinary session of the Executive Council consecutive to an ordinary session of Congress

10.3.1 On the recommendation of the Executive Council at its sixtieth session in 2008, Congress agreed that the text of Regulation 156 of the General Regulations (2011 edition) must recognize the special nature of the session of the Executive Council consecutive to an ordinary Congress session and agree to limit their role to the consideration of matters not dealt with by Congress or those requiring immediate Council action.

Recording of plenary meetings and approval of summarized minutes

10.3.2 On the recommendation of the Executive Council at its sixty-first session in 2009, Congress confirmed that no minutes of plenary meetings at sessions of the Executive Council, regional associations and technical commissions should be prepared, except where there is a specific request, and also confirmed the decision of Fifteenth Congress to suspend the operation of Regulation 112 of the General Regulations (2011 edition) for the duration of the session. It noted that audio recordings of plenary meetings will continue to be made and will be retained for record purposes, and that the formal government statements will be summarized in the general summary of the work of the sessions. It therefore agreed that it was timely to amend Regulation 112 of the General Regulations (2011 edition) to bring it into line with the practice that had developed.

Gender-neutral language in Basic Documents and use of new terminology

10.3.3 On the recommendation of the Executive Council at its sixty-second session in 2010, Congress considered the need to review the General Regulations for modernization and consolidation with current terminology. It agreed on the importance of gender-neutral language in the Basic Documents of the Organization, whilst recognizing the technical impact and the expense that would be incurred by amending the entire Basic Documents. It also agreed on the need to bring the definition of limits between the WMO Regions in consistency with current geographical and political borders.

10.3.4 Congress accordingly adopted Resolution 42 (Cg-XVI) – Amendments to the General Regulations of the World Meteorological Organization.

Terms of reference of the technical commissions

10.3.5 Congress had before it eight sets of changes to the terms of reference of the technical commissions as follows:

(a) Five proposed by the Executive Council at its sixty-second session in 2010: one from the Meeting of the Presidents of Technical Commissions concerning the general terms of reference of the technical commissions; one concerning the Joint Commission for Oceanography and Marine Meteorology (JCOMM) adopted at its third session; one concerning the Commission for Atmospheric Sciences (CAS) adopted at its fifteenth session; one concerning the Commission for Aeronautical Meteorology (CAeM) adopted at its fourteenth session and one concerning the Commission for Climatology (CCl) adopted at its fifteenth session;

(b) One concerning the Commission for Agricultural Meteorology (CAgM) adopted at its fifteenth session;

(c) One concerning the Commission for Instruments and Methods of Observation (CIMO) adopted at its fifteenth session;

(d) One concerning the Commission for Basic Systems (CBS) adopted at its 2010 extraordinary session.

10.3.6 Recognizing the need to adapt the activities of the technical commissions to the issues addressed by the WMO Strategic Plan and to respond to recent developments in their respective fields of responsibility, Congress adopted Resolution 43 (Cg-XVI) – Terms of reference of the technical commissions, containing the added text concerning the general terms of reference and the revised terms of reference for the four above-mentioned Commissions which held their sessions before EC-LXII, as well as the revised terms of reference for the three Commissions which were submitted directly to Congress, to be included in Annex III to the General Regulations (2011 edition).

Distribution of seats in the Executive Council

10.3.7 Congress considered the request made by Regional Association I (Africa) expressed by its president, Mr Bah, to formalize the distribution of seats between WMO Regions on the Executive Council, based on the distribution established at the Fourteenth and Fifteenth Congresses by means of an informal agreement between the Regions, in line with a practice in use since the Ninth Congress, the content of which being recalled by the Nomination Committee when presenting to Congress its report on the election of the members of the Executive Council.

10.3.8 When making its decision, Congress took into consideration, in particular, the report of the sixty-second session of the Executive Council which had debated the distribution of seats in the Executive Council in relation to any request to increase the number of Council members. The Council noted that no such request, which would have required an amendment to the Convention, had been submitted for discussion at its session, and therefore appreciated the recommendations of the Executive Council Working Group on WMO Strategic and Operational Planning (EC WG/SOP), on a mandate of the Council and which had the opportunity to examine this issue in detail in the context of keeping the number of members at 37, as specified by Article 13 of the WMO Convention.

10.3.9 Congress agreed that the distribution of seats between the Regions should be agreed between them. Congress also acknowledged that a set distribution of seats between Regions would facilitate the selection of the members of the Executive Council.

10.3.10 Accordingly, Congress decided that in order to be recognized at the time of the election of the members of the Executive Council during Congress and of subsequent elections of acting members of the Council, the number of seats per Region should be written into the General Regulations and be covered by a new regulation in Chapter I – General, under the heading “Members of the Executive Council” just before the heading “Sessions of constituent bodies”.

10.3.11 Furthermore, Congress considered the process of EC members' election as established in Regulation 86 (b) of the General Regulations (2011 edition) and decided that the second election should consist of separate elections to fill the remaining places on the Executive Council in order to reach the number of places from each Region as specified by new Regulation 17 in the General Regulations (2011 edition).

10.3.12 Congress also approved the amendments consequent upon the introduction of this new regulation in the General Regulations and adopted accordingly Resolution 44 (Cg-XVI) – Amendments to the General Regulations of the World Meteorological Organization – Distribution of seats in the Executive Council with immediate effect.

10.3.13 Congress acknowledged the proposal made by the presidents of Regional Associations II (Asia), IV (North America, Central America and the Caribbean) and V (South-West Pacific) to increase the number of Executive Council members to enable these Regions to obtain an extra seat with respect to the distribution of seats adopted by Resolution 44 (Cg-XVI) for consideration at Seventeenth World Meteorological Congress, in accordance with the procedures described in the WMO Convention. Congress requested the Executive Council to further consider the enabling of increasing seats in the Council, and if necessary prepare a proposal to Congress to potentially amend Article 13 of the WMO Convention and the General Regulations.

10.4 AMENDMENTS TO THE TECHNICAL REGULATIONS – CONSOLIDATED REPORT *(agenda item 10.4)*

10.4.1 Congress noted with satisfaction the work carried out by the technical commissions and the Executive Council in keeping under review the Technical Regulations in their respective fields of responsibility.

10.4.2 Congress noted that a number of amendments to different volumes of Technical Regulations including their annexes, and Manuals as detailed below, have been approved by the Executive Council in accordance with the authority delegated to it by Fifteenth Congress:

(a) Volumes I, II and III of the Technical Regulations, based on recommendations of CCl-XIV and CCl-XV;

(b) Volume II of the Technical Regulations, based on Amendment 74 to Annex 3 to the Convention on International Civil Aviation, Meteorological Services for International Air Navigation;

(c) Volume I of the *Technical Regulations* (WMO-No. 49), Competence standards for aeronautical meteorological personnel as recommended by CAeM-XIV;

(d) Volume I, Appendix D – Criteria for the selection of WMO Regional Training Centres, of the *Technical Regulations* (WMO-No. 49);

(e) *Manual on the Global Telecommunication System* (WMO-No. 386) Vol. I, Parts I and II, as recommended by CBS-Ext.(06);

(f) *Manual on the Global Telecommunication System* (WMO-No. 386), Vol. I, Part II, as recommended by CBS–XIV;

(g) *Manual on Codes* (WMO-No. 306), Vol. I.1, as recommended by CBS-Ext.(06) and CBS–XIV;

(h) *Manual on Codes* (WMO-No. 306), Vol. I.2, as recommended by CBS-Ext.(06) and CBS–XIV;

(i) *Manual on Codes* (WMO-No. 306), Introduction to Volumes I.1 and I.2 as recommended by CBS–XIV;

(j) *Manual on Global Observing System* (WMO-No. 544), Vol. I Global Aspects, as recommended by CBS-Ext.(06);

(k) *Manual on Marine Meteorological Services* (WMO-No. 558) and the *Guide to Marine Meteorological Services* (WMO-No. 471), as recommended by JCOMM–III;

(l) *Manual on the Global Data-processing and Forecasting System* (GDPFS) (WMO-No. 485) for:

(i) The designation process for the Global Producing Centres (GPCs) for Long-Range Forecasts, including the designation of nine GPCs (Beijing, Exeter, Melbourne, Montreal, Seoul, Tokyo, Toulouse, Washington, and the ECMWF) (as recommended by CBS-Ext.(06));

(ii) Adding two GPCs (Moscow and Pretoria) (as recommended by CBS-XIV) and CPTEC (Brazil) to the list of designated GPCs for Long-Range Forecasts (as recommended by the president of CBS);

(iii) The designation process for the Lead Centre for Multi-Model Ensemble of Long-Range Forecasts (LC-MMELRF), including the designation of Seoul/Washington as LC, and Regional Climate Centres (RCCs), including the designation of Beijing and Tokyo as RCCs (as recommended by CBS-XIV);

(iv) The clarification of the existing text related to Ensemble Prediction System (EPS, Long-Range Forecasts (LRF), and Emergency Response Activities (ERA) (as recommended by CBS-Ext.(06));

(v) For renaming RSMCs designated for activity specialization in ERA to become RSMCs with activity specialization in “Atmospheric Transport Modelling” (ATM) (as recommended by CBS-Ext.(06));

(vi) For the inclusion of standards and procedures for requesting and provision of ATM backtracking, support to CTBT verification and support of other environmental incidents to NMHSs and international organizations as part of the activity specialization for RSMCs for ATM (as recommended by CBS-Ext.(06));

(vii) For the inclusion of new designation and new procedures related to Emergency Response Activities (ERA) (as recommended by CBS-XIV).

10.4.3 Congress also noted that EC-LXII had approved the inclusion of Volume IV (Quality Management Framework) in the WMO Technical Regulations as a dynamic document, with the possibility of adding additional chapters as necessary.

10.4.4 Congress agreed that the WMO Technical Regulations would need to be updated for implementing WIGOS in order to document the structure and requirements of WIGOS operations, adequately reflecting contributions of all observing components. It also noted that EC had encouraged CIMO to pursue its proposal to develop a Manual on Meteorological Instruments and Methods of Observations.

10.4.5 Congress further noted that since WMO is a recognized international standardization body as per ISO Council Resolution 43/2007, WMO Technical Regulations, including Manuals, should be submitted as an enquiry draft or as a final draft International Standard within ISO. It noted that the Executive Council, through its Resolution 8 (EC-LXI), has adopted Procedures to be followed in proposing common WMO/ISO Technical Standards.

10.4.6 Congress also confirmed the usefulness of the provision of Article 14(c) of the Convention and Regulation 9(5) of the General Regulations (2011 edition) in enabling prompt action by the Executive Council or the President in cases of new or amended regulations which

had to be implemented before the next session of Congress or the Executive Council, as the case may be. Congress re-affirmed the authority delegated to the Executive Council to approve amendments to the Technical Regulations through Resolution 45 (Cg-XVI) – Technical Regulations of the World Meteorological Organization.

10.5 REVIEW OF PREVIOUS CONGRESS RESOLUTIONS *(agenda item 10.5)*

In accordance with Regulation 136 (17) of the General Regulations (2011 edition), Congress examined its previous resolutions in order that those which no longer had a purpose or which had been replaced by new decisions should not remain in force. Congress accordingly adopted Resolution 46 (Cg-XVI) – Review of previous Congress resolutions.

10.6 IMO PRIZE *(agenda item 10.6)*

10.6.1 Congress recalled that the International Meteorological Organization (IMO) Prize was the most prestigious prize for outstanding work in the field of meteorology and hydrology offered by the Organization. Since 1956, the IMO prize has been awarded to 57 winners. Congress noted that as of 31 December 2010 the balance of the IMO Fund had decreased to CHF 159,580.

10.6.2 Congress noted that the IMO Fund used for the award and ceremony will likely be exhausted before the end of the sixteenth financial period. Congress therefore decided that the IMO Prize should continue to be awarded from the regular budget. Congress further agreed that the annual awards ceremony should be preferably organized during, or in connection with, sessions of Congress and the Executive Council, and that the lecture given by the winner(s) be published in the WMO Bulletin and on the WMO Website.

11. FUTURE PRIORITIES *(agenda item 11)*

11.1 GLOBAL FRAMEWORK FOR CLIMATE SERVICES *(agenda item 11.1)*

Relevant outcomes from the World Climate Conference-3

11.1.1 Congress recalled the outcomes of the World Climate Conference–3 (WCC-3) (Geneva, Switzerland 31 August–4 September 2009) and its decision to establish a Global Framework for Climate Services (GFCS). It was noted that the overarching theme of the Conference was; "Climate prediction and information for decision-making: focusing on scientific advances in seasonal to inter-annual timescales, taking into account multi-decadal prediction" (http://www.wmo.int/wcc3/theme_en.php), and that it addressed issues relating to the application of climate prediction and information including assisting adaptation to climate variability and change in a wide variety of sectors including agriculture and food security, forestry, energy, water, health, urban and rural settlements, infrastructure, tourism, wildlife, trade and transport that contribute to sustainable socio-economic development.

11.1.2 Congress further recalled that the focus of the Conference included the integration of climate prediction and information in decision-making in relation to user needs, with parallel Conference sessions for sectors that contribute to sustainable socio-economic development such as agriculture and food security, energy, water, health, tourism, disaster management and transport. Congress noted that the technical component of the Conference was attended by around 2500 experts and produced, *inter alia*, 12 "white papers" which were captured in the Conference statement which was subsequently used to inform the work of the High-level Taskforce.

11.1.3 Congress noted that the three-day technical component of WCC-3 was followed by a two-day high level segment attended by, inter alia, 13 Heads of State/Government, 57 Ministers (or equivalent) and 14 Heads of UN agencies or programmes which decided to establish a Global Framework for Climate Services to strengthen production, availability, delivery and application of

science-based climate prediction and services and requested the Secretary-General of WMO to convene, within four months of the adoption of the Conference Declaration, an intergovernmental meeting of Member States of the WMO to approve the terms of reference and to endorse the composition of a task force of high-level, independent advisors to be appointed by the Secretary-General of WMO with due consideration to expertise, geographical and gender balance.

Relevant outcomes from the Intergovernmental Meeting

11.1.4 Congress noted that the WMO convened an Intergovernmental Meeting for the High-level Taskforce on the Global Framework for Climate Services at the Geneva International Conference Centre (CICG) from 11 to 12 January 2010, under the chairmanship of its President, Dr A.I. Bedritskiy.

11.1.5 Congress recalled that the Intergovernmental Meeting provided terms of reference which, inter alia, asked the High-level Taskforce to:

(a) Develop the components of GFCS and define the roles, responsibilities, and capabilities of the elements within the GFCS and clearly illustrate how it will assist the integration of climate information and services into national planning, policy and programmes for, among others, water resource management and development, health and public safety, energy generation and distribution, agriculture and food security, land and forestry management, desertification, eco-system protection, sustainable development and poverty reduction, taking into account the special needs of Africa, Small Island Developing States (SIDS), Least Developed Countries (LDCs), and Land-Locked Developing Countries (LLDCs);

(b) Develop options for governance of the GFCS, ensuring its intergovernmental nature, and provide a reasoning for the preferred option(s);

(c) Outline a plan for the implementation of the GFCS, which includes:

  (i) Ensuring a central role of national governments;

  (ii) Proposing a range of options for immediate and longer-term actions to realize the GFCS;

  (iii) Specifying measurable indicators, with timelines, for the actions necessary to implement the elements of the GFCS;

  (iv) Estimates of costs of implementation of these options, with clear indications of the financial resources and enhanced technological capabilities required, and their likely sources, to ensure effective global implementation;

  (v) A strategy for capacity-building in developing countries, particularly those of the African countries, Least Developed Countries (LDCs), Small Island Countries (SIDS) and Land-Locked Developing Countries (LLDCs);

(d) Make findings and propose next steps in relation to:

  (i) The role of the UN system and other relevant stakeholders, as well as the mechanisms for their contributions;

  (ii) Approaches to global data policy (addressing data gaps, ownership, data protection, confidentiality, exchange, applications, and usage), that would lead to enhanced capability of the GFCS, taking into account Resolution 40 (Cg-XII) and Resolution 25 (Cg-XIII);

  (iii) Improving systematic in-situ observations and monitoring of climate especially in data-sparse areas, in order to increase data availability, including for research and prediction;

(iv) Approaches for reviewing the implementation of the GFCS;

(v) Strategies for building capacity in developing countries in accordance with their needs and priorities, including their access to global and regional climate models output and the underlying technology embedded in the models, and their ability to independently develop/improve in-country climate services capacity;

(vi) A strategy for promoting a common global understanding of the GFCS and for coherent and coordinated messaging and information sharing.

11.1.6 Congress further recalled that the Intergovernmental Meeting endorsed the following composition of the Taskforce:

1. Joaquim CHISSANO (Mozambique)
2. Jan EGELAND (Norway)
3. Angus FRIDAY (Grenada)
4. Eugenia KALNAY (Ms) (Argentina/United States)
5. Ricardo LAGOS (Chile)
6. Julia MARTON-LEFÈVRE (Ms) (Hungary/France/United States)
7. Khotso MOKHELE (South Africa)
8. Chiaki MUKAI (Ms) (Japan)
9. Cristina NARBONA RUIZ (Ms) (Spain)
10. Rajendra Singh PARODA (India)
11. QIN Dahe (China)
12. Emil SALIM (Indonesia)
13. Mahmoud ABU-ZEID (Egypt)
14. High-level representative of indigenous peoples
15. High-level member from Pacific SIDS
16. High-level economist

11.1.7 Congress noted that the Intergovernmental Meeting charged the Secretary-General of WMO with the responsibility of recruiting the individuals to fill the last three positions (numbered 14, 15 and 16 in the previous paragraph). As a result, Ms Fiame Naomi Mata'afa from Samoa agreed to join the Taskforce, thus providing the competence called for by positions 14 and 15, while Dr Emil Salim from Indonesia supplied expertise in economics to the Taskforce, resulting in a Taskforce of 14 members.

The Report of the High-level Taskforce on GFCS

11.1.8 The co-chair of the High-level Task Force on the Global Framework for Climate Services, Dr Jan Egeland/Dr Mahmoud Abu-Zeid briefed the Congress on the Taskforce's Report, noting that the findings of the Taskforce included:

(a) Present capabilities to provide climate services fall short of meeting present and future needs and are not delivering their full and potential benefits. This is particularly the case in developing and least developed countries;

(b) Existing climate services are not focused well enough on user needs and the level of interaction between providers and users of climate services is inadequate. Climate services often do not reach "the last mile", to the people who need them most, particularly at the community level in developing and least developed countries;

(c) To support climate services, high quality observations are required across the entire climate system and of relevant socio-economic variables and further commitment to sustaining high quality observations is inadequate and enhancements to existing networks are required, particularly in developing countries;

(d) Effective climate services will depend on maximizing the potential of existing knowledge, new research developments and strong support from and strengthened collaboration between all relevant research communities;

(e) Efforts to provide effective climate services globally will only be successful if capacity is systematically built to enable all countries to manage climate risk effectively. Current capacity-building activities to support climate services need to be scaled up and better coordinated.

11.1.9 Congress was advised that the Taskforce approached its task through a consultative process along with the outputs from WCC-3. Furthermore, they developed an early outline of their report based around a three-part strategy: Part I to benchmark existing climate services from a provider perspective; Part II to identify gaps in the existing provision, particularly from a user perspective; and, Part III to provide governance options, an implementation plan and next steps as called for in their terms of reference.

11.1.10 It was noted that from the outset that, with one year to report, the Taskforce faced a very tight timetable and so it developed its consultation process based around already scheduled climate-related meetings. As a result the following consultation sessions were conducted in 2010:

• Nairobi, Kenya	12–16 April	First Conference of Ministers responsible for Meteorology in Africa
• Bali, Indonesia	30 April–6 May	Fifteenth session of WMO Regional Association V
• Geneva, Switzerland	18 May	UN Interagency Consultation Meeting
• Geneva, Switzerland	25 May	Diplomatic Club of Geneva
• Geneva, Switzerland	2 June	Briefing to Permanent Missions in Geneva
• Oslo, Norway	8–12 June	Conference on the International Polar Year
• Geneva, Switzerland	9 June	WMO Executive Council
• Beijing, China	17–18 June	Consultation Meeting with Government officials
• Delhi, India	21 June	Consultation Meeting with Government officials
• Belo Horizonte, Brazil	1–4 July	Fifteenth session of the Commission for Agricultural Meteorology
• Mexico City, Mexico	5–7 July	Meeting of Heads of NMHSs on GFCS
• Beijing, China	2–4 August	Consultation Meeting with Government officials
• Bogota, Columbia	22–29 September	Fifteenth session of WMO Regional Association III
• Bonn, Germany	26 September	Consultation Meeting with German climate experts
• Washington, United States	1 October	Consultation Meeting with NOAA and the World Bank
• Geneva, Switzerland	26 October	Briefing to Permanent Missions in Geneva
• Marrakech, Morocco	28 October–4 November	Fifteenth session of WMO Regional Association I
• Windhoek, Namibia	15–21 November	2010 Extraordinary session of the Commission for Basic Systems
• Santiago, Chile	17–19 November	Conference of Directors of the Ibero-American NMHSs
• Cayman Islands, Caribbean	9–10 November	Meeting of Heads of NMHSs and Ministers
• Cancun, Mexico	29 November–10 December	UNFCCC 16th Edition of the Conference of the Parties (COP 16)
• Geneva, Switzerland	17 December	Briefing to Permanent Missions in Geneva

11.1.11 Congress was advised that the Taskforce also made extensive use of the Internet and Web, carrying out a great deal of work via e-mail as well as providing regular updates and reports on the WMO Website. The Taskforce met formally on five occasions to coordinate and advance its work: 25–26 February; 24–26 May; 2–4 August; 25–27 October; and 13–15 December.

11.1.12 Congress noted that the Taskforce had released a draft copy of its report on 1 November 2010 for comment by governments and experts. Around 1700 comments were received over the three-week review period and each of these was considered in the subsequent preparation of the final report. The Taskforce's final report has now been made widely available in hard copy, on CD and via the WMO's Website.

The vision of the GFCS developed by the HLT

11.1.13 The Taskforce proposes that the structure of the Framework be as proposed by the WCC-3, but with the addition of a capacity-building component. The proposed components of the Framework are then as follows:

(a) The User Interface Platform that will provide a means for users, user representatives, climate research and climate service providers to interact, thereby maximizing the usefulness of climate services and helping develop new and improved applications of climate information;

(b) The Climate Services Information System to protect and distribute climate data and information according to the needs of users and according to the procedures agreed by governments and other data providers;

(c) The Observations and Monitoring component that will ensure that the climate observations necessary to meet the needs of climate services are generated;

(d) The Research, Modelling and Prediction component that will assess and promote the needs of climate services within research agendas;

(e) The Capacity-building component that will support systematic development of the necessary institutions, infrastructure and human resources to provide effective climate services.

11.1.14 The Taskforce noted that many of the foundational capabilities and infrastructure that make up these components already exist or are being established, but they require coordination and strengthened focus on user needs and that the role of the Framework should be to facilitate and strengthen, not to duplicate.

11.1.15 Congress was further advised that the Taskforce proposes universal access to reliable, scientifically sound climate services should be the focus of the Framework. To meet this objective the Taskforce further proposes that the Framework should operate at global, regional and national levels, in support of, and in collaboration with global, regional and national stakeholders and efforts:

(a) At the global level, it should focus on producing global climate prediction products, coordinating and supporting data exchange, major capacity-building initiatives, and establishing and maintaining standards and protocols;

(b) At the regional level, it should support multilateral efforts to address regional needs, for example through regional policy development, knowledge and data exchange, infrastructure development, research, training and the provision of services regionally to meet agreed regional requirements;

(c) At the national level, it should focus on ensuring access to data and knowledge products, tailoring information to user requirements, ensuring effective routine use of information in planning and management along with developing sustainable capacities in these respects.

The Recommendations of the High-level Taskforce

11.1.16 Congress noted that the Taskforce had made five Recommendations:

Recommendation 1: We, the High-level Taskforce, unanimously recommend that the international community make the commitment to invest on the order of USD 75 M per year to put in place and sustain a Global Framework for Climate Services. This investment will build upon existing investments by governments in climate observation systems, research, and information management systems to return to the community benefits across all societal sectors but most importantly, and most immediately, in disaster risk reduction, improved water management, more productive and sustainable agriculture and better health outcomes in the most vulnerable communities in the developing world.

Recommendation 2: To ensure that the Global Framework for Climate Services provides the greatest benefit to those who need climate services the most, we recommend that the following eight principles be adhered to in its implementation:

Principle 1: All countries will benefit, but priority shall go to building the capacity of climate-vulnerable developing countries

Principle 2: The primary goal of the Framework will be to ensure greater availability of, access to, and use of climate services for all countries

Principle 3: Framework activities will address three geographic domains: global, regional and national

Principle 4: Operational climate services will be the core element of the Framework

Principle 5: Climate information is primarily an international public good provided by governments, which will have a central role in its management through the Framework

Principle 6: The Framework will promote the free and open exchange of climate-relevant observational data while respecting national and international data policies

Principle 7: The role of the Framework will be to facilitate and strengthen, not to duplicate

Principle 8: The Framework will be built through user – provider partnerships that include all stakeholders

Recommendation 3: We recommend that the UN-system establish, as a matter of urgency, an *ad-hoc* technical group to develop a detailed implementation plan for the Global Framework for Climate Services based upon the broad strategy outlined in this report, this plan to be endorsed by governments through an intergovernmental process prior to its implementation.

The detailed implementation plan should identify high priority projects to advance the Framework in areas where this would assist in reducing vulnerability to climate change and variability. In addition to the fast-track, capacity-building projects, the implementation plan should describe a sustainable programme to underpin the coordination needed to maintain the operational capabilities of the Framework. The implementation plan should set targets to be achieved over the next ten years, further elaborate the roles and responsibilities of components of the Framework that contribute at the global, regional and national levels and of the secretariat that supports it, and include a risk assessment.

Recommendation 4: We strongly recommend that governments and development assistance agencies give high priority to supporting national capacity-building that will allow developing countries to participate in the Framework. Further analysis of national needs is required, but in the meantime we recommend a number of fast track projects as outlined above. To ensure effective national access to global climate information by the largest number of countries, we recommend an initial strategy to strengthen rapidly or create the regional elements of the Framework. These regional elements should be led and hosted by countries of the region based upon regional agreements and should be tasked with supporting information flow and assisting national capacity-building at national level.

Recommendation 5: The Taskforce is unanimous in recommending the following two options be considered for governance of the Framework:

Option A An Intergovernmental Board on Climate Services would be established to provide leadership and direction for the Framework. It would report to the World Meteorological Organization Congress. The Board would be open to membership of all countries and would meet in plenary session periodically, probably annually. It would develop formal mechanisms to engage the United Nations and other stakeholders in its work. It would elect a chair and a small executive committee to conduct the affairs of the Board between sessions as well as designating a number of technical management committees to oversee and contribute to the Framework's implementation work. These management committees would work intergovernmentally and where possible would be based on relevant existing international committees.

Option B A Joint Board of relevant United Nations System entities (agencies, organizations, programmes, departments and independent funds) would be created to provide leadership and direction for the Framework. The United Nations System Joint Board would report regularly to the UN Chief Executives Board as well as to governments through the plenaries of the sponsoring UN agencies and programmes. The Joint Board would establish technical management committees to implement and manage the Framework, these management committees working intergovermentally. Mechanisms to engage non-United Nations stakeholders in the work of the Board would be developed through both the User Interface Programme and, up to the level desired by governments, through participation in national delegations.

The Taskforce recommends that Option A be adopted and that the Secretary-General of the World Meteorological Organization convene the first intergovernmental plenary meeting of the Global Framework for Climate Services by the end of 2011. The World Meteorological Organization should lead the process and put in place arrangements to ensure full participation of all interested UN agencies and programmes.

Response to the Taskforce's Report and the process for its implementation

11.1.17 Congress congratulated the co-chairs and all Taskforce members on the work of the Taskforce and welcomed its Report.

11.1.18 Congress supported the general proposal of the Taskforce that the international community would make, consistent with its ability to do so, a significant investment in the implementation of the GFCS (Recommendation 1).

11.1.19 Congress noted with interest the eight Principles provided in Recommendation 2, encouraging their use in the implementation of the Framework.

11.1.20 Congress appreciated the strong sentiments expressed by the Heads of State and other High-Level Officials present at Congress in support of the work of the Taskforce and their pledges of ongoing support for the implementation of the GFCS.

11.1.21 Congress decided to establish, within the WMO Secretariat, the secretariat of the GFCS.

11.1.22 Congress adopted Resolution 47 (Cg-XVI) – Response to the *Report of the High-level Taskforce for the Global Framework for Climate Services* (WMO-No. 1065).

The central role of National Meteorological and Hydrological Services

11.1.23 Congress noted a guiding principle for the implementation of the GFCS will be to build on many of the existing mechanisms and institutions developed over the years for the provision of climate services. Noting that NMHSs collect meteorological observations, undertake activities directed at improving our understanding of weather and climate, and provide weather, climate and related services in support of relevant national needs, Congress strongly urged NMHSs to play a central role in the development and implementation of the GFCS. Congress urged the Executive Council to review the statement on roles and operation of NMHSs with a view to more clearly reflecting their crucial role in the implementation of the GFCS.

User interface platform

11.1.24 Congress noted that NMHSs have a long history of working closely with a range of user communities and industries within the countries in provision of weather, climate and hydrological information and products to improve decision-making within countries and key development sectors and encouraged the strengthening of these links with climate service users at the national level.

11.1.25 Congress noted that central to the development of user-specific climate information is the recognition that the needs of the user community are diverse and complex. Depending on the financial, technical and infrastructural capacities of the NMHSs, the required in-house expertise to support all the users in application of their climate products for effective decision-making may be limited to varying degrees. As dealing with a full spectrum of individual users at the national level could be resource intensive, Congress encouraged NMHSs to develop partnerships with relevant research institutions, intermediary organizations, specialized sectoral institutions and service providers.

11.1.26 Recognizing that for seasonal timescales Regional Climate Outlook Forums (RCOFs) facilitate the development of so-called “consensus” forecasts, regional networking of NMHSs and interact with users at regional level, Congress emphasized the importance of continuing these mechanisms and extending them to the national level, where appropriate, by considering the establishment of operational periodic National Climate Outlook Forums and/or National Climate Users Platforms.

Climate services information system

11.1.27 Congress recalled that some NMHSs currently participate and benefit from global modelling centres that produce seasonal predictions and climate scenarios on global spatial scales. These global products are exchanged and in some instances downscaled to meet regional and national needs, with some of these outputs being coordinated and made available through research institutes including NMHSs.

11.1.28 In view of the above, the Congress emphasized that a coordinated climate services information system (CSIS), which, through a network of collaborating institutions would: ensure that climate information and products are generated at the global level (through a range of global climate centres) to adequately incorporate the global-scale aspects of the climate system;

incorporate the regional and local climate information at a finer scale (through RCCs); and ensure that they are available and easily accessible for the application to various sectoral uses at the national and local levels. Congress also recognized the important role of Regional Climate Centres (RCCs) in tailoring global climate products to regional needs on a sustainable operational mode, and also in supporting national requirements of NMHSs where needed through mutual arrangements. Congress encouraged Members to support such centres and ensure global coverage of climate services. Consistent with the principle of building upon what is already in place rather than duplicating existing institutions and efforts, Congress expected that the WMO Information System (WIS) could serve as a key dissemination mechanism under GFCS.

Observations and monitoring

11.1.29 Recognizing that the climate services provided through the GFCS will be fundamentally reliant upon the meteorological observations collected by NMHSs, and noting that establishing and operating national weather, climate and water observing systems requires significant human and financial resources due to the range of measurements and the density of stations required, Congress emphasized the need to sustain the observations over many decades, and the need to continuously meet high standards for data quality. Congress emphasized that a key objective of the GFCS must be to ensure that the observation networks that NMHSs currently operate are strengthened and upgraded, with long-term commitment to meet the highest possible quality to serve the needs of climate analyses and prediction. Congress appealed to the Members to provide adequate resources to their NMHSs for strengthening these data networks, and to the development aid agencies to support developing countries in strengthening observing networks where large gaps exist.

11.1.30 Congress also noted that the global climate models and the regional climate models used for development of climate information and products require sharing of climate data and information across national, regional and global boundaries. Recognizing that the exchange of data and products required for making weather forecasts is supported by Resolution 40 (Cg-XII), which identifies a limited set of climate information that should be exchanged, Congress requested the Executive Council to review Annex I of the resolution with a view to ensuring that the climate data and products needed for the GFCS's climate services are included therein.

Climate research, modelling and prediction

11.1.31 Congress recognized that many NMHSs and other national entities undertake or participate in research that contributes to the improvement of understanding of climate systems, the development and improvement of global and regional climate models and developing methodologies for seasonal and annual to decadal predictions. In many countries, NMHSs have actively worked with universities and other academic institutions and act as the nuclei to consolidate the research efforts and improve operational practices. These efforts of NMHSs also contribute to the work of the World Climate Research Programme (WCRP). Additionally many NMHSs also engage in applied climate research in support of national decision-making, while these and others also support other NMHSs in their region to develop capacities to be able to interpret the outputs from the global climate models for downscaling them to regional and national or local levels. Considering that there is considerable disparity in research efforts on regional and national scales, leading to large gaps in climate knowledge at the regional and national levels, Congress stressed that an important role of the GFCS will be to assist NMHSs and other national entities in developing countries to build the capacity to participate in, and undertake the research necessary to address climate problems of national interest.

Capacity-building

11.1.32 Congress noted that the capacity of many NMHSs to adequately meet the user needs for national climate services is currently limited and that the NMHSs need to build skills in climate prediction, modelling and analysis for developing, producing, accessing, interpreting and analyzing

global and regional climate products. Congress also noted that the downscaled projected climate change scenarios for assessing climate change impacts are required at a much finer resolution than present as the climate service provision is made operational in the countries.

11.1.33 Congress emphasized the need for GFCS to promote collaboration between NMHSs, universities, climate research institutions, regional and national training centres, and communities. Congress encouraged Members to support the establishment of sustainable mechanisms for education and training for climate science and services, and to develop appropriate credentials and good practices for operational climate providers to ensure the application of a quality management framework. Partnerships with intermediary organizations that transmit information from providers such as NMHSs to end-users, as well as the various sectoral users within the countries, will undoubtedly supplement these efforts.

11.1.34 Congress recognized that for the implementation of the Framework, the skills for developing climate services are technology- and knowledge-extensive and intensive. Congress therefore emphasized the need for improved computing capabilities; upgraded communications to make best use of the WIS; robust, high quality instruments for climate-related observations; systematically archived and managed climate data; and enhanced access to the services to the users through the WIS as a part of the GFCS CSIS.

Roles of the WMO's constituent bodies

Executive Council

11.1.35 As noted earlier in this report, Congress requested the Executive Council to provide support for, and guidance to the development of the GFCS. The Congress also requested the Executive Council to establish appropriate mechanisms to provide oversight and guidance to those elements of the WMO that will participate in the implementation of the GFCS.

Regional Associations

11.1.36 Congress recalled that the Taskforce's proposal for the GFCS called for operations to be implemented on three spatial scales; global, regional and national, and that the regional scale will be particularly important in capacity-building and in building capabilities that are beyond the resources of single nations. Congress urged the regional associations to assist the implementation of the GFCS through the establishment and active support to RCCs, RTCs and appropriate regional centres by developing regional/subregional collaborative capacities, in the development of user requirements, in the identification of experts to assist in implementation activities, and through support to implementation projects. Congress stressed that delivery of climate services is a national and even sub-national/local activity, and that the detailed implementation plan must be driven by the need to improve the capability of NMHSs to fulfil this operational role through the close linkage of regional to national to meet user requirements.

Technical Commissions

11.1.37 Congress recognized that while the Commission for Climatology will have a central role in the implementation of the GFCS other technical commissions will also have important roles to play: CBS in the areas of service delivery strategies, observation systems, information systems and data-processing and forecasting systems; JCOMM for marine observations, for marine climate data management and for services to marine sector; CIMO for the advice and support in developing new and improved instrumentation for collecting climate-related data; CAS in terms of research for improved climate services; CHy and CAgM in terms of the full range of interactions with users in water and agriculture sectors; and CAeM in working with the aeronautical sector to meet its requirements for climate services. Congress urged each technical commission to assist in the development of the detailed implementation plan. Congress also urged the technical commissions to keep under review their work plans as the implementation of the GFCS proceeded

so that they could give effective support to the initiative and also take advantages of the opportunities that it offered.

The Roles of the WMO's Technical Programmes

11.1.38 Congress recognized that a range of technical activities within ten major Programmes, and five co-sponsored programmes directly or indirectly contribute to the objectives of GFCS:

WMO Programmes:

- The World Weather Watch (WWW) Programme;
- World Climate Programme (WCP);
- Atmospheric Research and Environment Programme (AREP);
- Applications of Meteorology Programme (AMP);
- Hydrology and Water Resources Programme (HWRP);
- Education and Training Programme (ETRP);
- Technical Cooperation Programme (TCOP);
- Regional Programme (RP);
- WMO Space Programme (SAT);
- Disaster Risk Reduction Programme (DRR).

Co-sponsored Programmes:

- Intergovernmental Panel on Climate Change (IPCC);
- World Climate Research Programme (WCRP);
- Global Climate Observing System (GCOS) – led by WMO;
- Global Ocean Observing System (GOOS) – led by IOC;
- Global Terrestrial Observing System (GTOS) – led by FAO.

11.1.39 Congress noted that each of these Programmes would have a part to play in the implementation of the GFCS and urged managers and experts involved in the work of these Programmes to keep under review their work plans as the implementation of the GFCS proceeded so that they could give effective support to the initiative and also take advantages of the opportunities that it offered.

11.1.40 Congress noted that the GFCS has been identified as one of the five priority areas under the Strategic Plan and that a number of activities that are expected to contribute to the proposed GFCS implementation plan have already been included under the regular budget while others are planned to be taken through extrabudgetary resources. Congress encouraged Members to financially support the implementation of these proposed projects.

11.1.41 Congress adopted Resolution 48 (Cg-XVI) – Implementation of the Global Framework for Climate Services to facilitate the range of activities that needed to be undertaken by the WMO throughout the sixteenth financial period in support of the implementation of the GFCS.

11.2 WMO STRATEGY FOR CAPACITY DEVELOPMENT *(agenda item 11.2)*

Capacity Development Strategy (CDS) – Background

11.2.1 Recognizing the importance of capacity-building activities in a wide range of WMO Programmes (Resolutions 2, 5, 8, 12, 13, 18, 19, 20, 21, 25 and 32 of Fifteenth Congress), Congress noted that a coordinated and cohesive approach for capacity development would be needed to enhance capabilities of NMHSs in developing countries, particularly those with economies in transition, Least Developed Countries (LDCs) and Small Island Developing States

(SIDS), to meet growing Societal Needs at different levels. Noting that LDCs and SIDS are especially vulnerable to the negative impacts of climate variability and natural disasters, Congress further recognized the importance of contributing to a wide range of development activities for these countries, including early warning, disaster risk reduction, poverty reduction and climate change adaptation. Congress recalled that, in addition to technical assistance, capacity development activities included assisting Members with advocacy to national, regional and global leadership, resource mobilization efforts, management and institutional change processes and education and training, in line with national priorities, policies and needs.

11.2.2 Congress noted that capacity-building is a crosscutting activity and contributes to all Expected Results (ER), especially ER 6 and Strategic Thrust 3 of the 2012–2015 Strategic Plan.

11.2.3 Congress noted that the third meeting of the Executive Council Working Group on Capacity-building (EC-WG/CB) in October 2010 discussed the advancement of a Capacity Development Strategy (CDS) and possible mechanisms to support articulation of a CDS within WMO.

11.2.4 Congress further noted the report by the Task Group on WMO Reform stressing that the bodies associated with implementing capacity-building activities within WMO should be oriented to direct and support the strategic thrusts of the WMO Strategic Plan in a holistic and sustainable manner rather than by way of a number of uncoordinated, one-off activities.

11.2.5 Congress was of the view that the preparation and implementation of a Capacity Development Strategy would greatly assist WMO in the coordination and priority setting of capacity development activities, based on the Members' needs, arising from the global high priority areas as well as requirements of the regional associations and the technical commissions.

Overall objective

11.2.6 Congress agreed that the overall objective of WMO capacity development should be to facilitate sustainable development of NMHSs to support the needs of its Members in relation to the Strategic Thrusts and Expected Results in the Strategic Plan. Congress supported the elements of "capacity development" described in the annex to Resolution 49 (Cg-XVI) as being representative of WMO goals and future direction for its capacity development efforts.

11.2.7 Congress agreed that the CDS should address how WMO governance and coordination of capacity-building could be enhanced to ensure appropriate strategic guidance and comprehensive delivery of development assistance to Members.

11.2.8 Congress expected that, given the co-dependence of neighbouring NMHSs to meet their respective mandates, all Members would benefit from the successful implementation of the CDS.

General Considerations

11.2.9 Congress noted that the CDS would build upon, and contribute to, the implementation of major international initiatives, including MDGs, the 4th UNLDC Conference, GFCS and regional programmes. Congress further noted that the CDS would fulfil the purposes of the Organization listed in Article 2 (a, b, d, and f) of the Organization's Convention.

11.2.10 Recognizing the importance of continuing the capacity-building efforts under each WMO Programme, especially, LDCP, TCOP, VCP, ETRP and Regional Programmes, Congress noted that the CDS should promote improvements in coordination between these programmes and thus better contribute to building and developing capacities and capabilities of NMHSs in developing countries, in particular those with economies in transition, LDCs and SIDSs, according

to their needs and requirements. In this regard, Congress called on more Members and agencies to become involved in the VCP.

11.2.11 Congress further noted that the CDS should facilitate stronger national political ownership, development of relevant policies and legal frameworks, and enhance sustainability by linking regional, subregional and national planning processes.

11.2.12 Congress stressed that successful delivery of the Expected Results would require improved internal collaboration and consistency of the development efforts within the Organization, including regional associations (RAs), technical commissions (TCs), WMO and WMO co-sponsored Programmes, and across all Departments within the Secretariat. Congress agreed that the CDS should provide such a framework.

11.2.13 Congress noted the importance of providing guidance and oversight during the development and subsequent implementation of the CDS and agreed that the Executive Council could play such a role. Building on the work of the EC-WG/CB, Congress requested the Council to consider governance mechanisms to oversee and further harmonize capacity-building activities of the WMO.

11.2.14 Congress recommended that the following areas be considered in the development of the Capacity Development Strategy:

(a) How to assess the capabilities of Members to accurately identify existing gaps, non-compliance to WMO standards and assist in the long-term monitoring of the success of the Capacity Development Strategy. Congress considered that this could be part of the Country Profile Database;

(b) How to improve compliance to WMO standards, and to maintain political support for the development of NMHSs. Stronger advocacy by WMO bodies and officers to encourage compliance and support may be an important aspect of the CDS;

(c) How to ensure national ownership as part of the capacity development process and ensure that NMHSs development plans are consistent with National Adaptation Programmes of Action (NAPAs), where applicable, and with the respective WMO Regional Association Strategic/Operating Plan;

(d) How to ensure that tailored NMHSs products and services would be relevant for national decision-makers, development agencies, civil society and the general public. Congress noted that the WMO Service Delivery Strategy identified that early consultation with stakeholders in the capacity development process was an important aspect of achieving national buy-in of new products and services;

(e) How to evaluate sustainability and impact of project outputs and outcomes;

(f) How to ensure that capacity development activities are scalable, based on the level of voluntary contributions from Members and support from other sources such as aid organizations;

(g) How to include WMO strategic priority areas in the use of the CDS to support decision-making on the setting priorities for the use resources. For the 2012 to 2015 financial period, these priority areas are the development of the GFCS, aviation, WIGOS/WIS and DRR activities;

(h) How to recognize the key roles of RAs, TCs, WMO co-sponsored Programmes and Regional Offices (ROs) in integrating the requirements of the Region, provision of advice from technical perspectives and realization of stronger regional presence through coordination and advocacy activities;

(i) How to provide and encourage volunteerism and bilateral cooperation in work of the WMO to developing countries.

11.2.15 Recognizing the importance of strategic partnerships and shared execution of capacity development activities, Congress stressed that the facilitative role of the Organization should be enhanced under the Strategy. Congress urged the Secretary-General to continue to play an active coordinating role in Strategic Planning, Advocacy, Pilot Projects and especially Resource Mobilization because the capacity development effort will require external resources.

11.2.16 Congress noted that WMO must move beyond a capacity development strategy toward a plan that has clearly articulated goals, timelines and resource requirements. These plans should be informed by Regional Operating Plans developed by regional bodies and approved by regional associations through their management teams. Congress further noted there needs to be more balance between resources available in Regions or subregions and those at WMO Headquarters in order to plan and execute projects. Congress agreed that the successes achieved by the consortium of Members that re-established warning services in Haiti should be analysed as a case study for the CDS.

11.2.17 Congress adopted Resolution 49 (Cg-XVI) – WMO Strategy for Capacity Development.

11.3 WMO INTEGRATED GLOBAL OBSERVING SYSTEM *(agenda item 11.3)*

11.3.1 Congress recognized the significant progress that meteorology had made in the last few decades as a result of impressive advances in research, numerical modelling, observing capabilities (in-situ and satellite), computer and communication technologies, which have led to a substantial increase in quality and diversity of services. Further progress, however, will depend on adopting a new, integrated approach to upgrading the WMO observing system that is WIGOS.

11.3.2 Congress reiterated that the current WMO observing systems had been developed and administered separately in the past to meet diverse sets of requirements. Congress stressed that such multiplicity of observing systems operated for different WMO Programmes had, however, resulted in incompatibilities and deficiencies, duplication of effort and higher overall costs for Members. In sharp contrast to this, Congress noted an increasing demand to provide a wide range of high-quality data, products and services to satisfy the multifaceted requirements of end-users for the benefit of society, sustainable development and environmental protection. Congress recognized that enhanced synergies, including systems interoperability and compatibility, would help meet evolving requirements of Members and their national and international partners.

Concept development

11.3.3 Congress recalled its decision on the WIGOS concept made at Cg-XV (Resolution 30 (Cg-XV)) and noted with appreciation that the report on the integration of WMO observing systems had been completed. The report contains consolidated overall assessment of results achieved during the WIGOS Test of Concept Phase (2007–2011).

11.3.4 Congress was pleased to note the successful completion of most of the tasks specified in the WIGOS Development and Implementation Plan (WDIP). It appreciated the successful collective work of the Executive Council, its Working Group on the WMO Integrated Global Observing System and the WMO Information System, Members, regional associations (RAs), technical commissions (TCs), partner organizations and the Secretary-General for testing and developing the WIGOS concept, addressing the WIGOS objectives.

11.3.5 Congress noted with appreciation the WIGOS documentation, in particular, the WIGOS Concept of Operations (CONOPS) specifying WIGOS basic characteristics, and the WIGOS Development and Implementation Strategy (WDIS) defining steps that WMO, in cooperation with partner organizations, will follow. These documents will provide guidance on how to improve

governance, management, and integration of WMO observing systems and their contributions to co-sponsored systems, in order to satisfy evolving observing requirements of WMO Members and partner organizations in a coordinated, cost-effective and sustained manner.

11.3.6 Congress noted the good progress achieved in the WIGOS Pilot and Demonstration Projects. It appreciated the role and input of TCs and partners in implementing Pilot Projects. It also expressed its gratitude for efforts of Kenya, Morocco and Namibia (RA I), Republic of Korea (RA II), Brazil (RA III), the United States (RA IV), Australia (RA V) and the Russian Federation (RA VI) in implementing their WIGOS Demonstration Projects. In all cases there were a significant number of lessons learned, experiences gained, feedback and perspectives received on the potential benefits, value and impact of the WIGOS implementation process at the national and regional levels. Congress invited Members to take them into account when implementing WIGOS.

Vision

11.3.7 Congress agreed with the WIGOS vision specified in the WDIS that calls for an integrated, coordinated and comprehensive observing system to satisfy, in a cost-effective and sustained manner, the evolving observing requirements of Members in delivering their weather, climate, water and related environmental services. WIGOS will enhance the coordination of WMO observing systems with those of partner organizations for the benefit of society. Further, WIGOS will provide a framework for enabling the integration and optimized evolution of WMO observing systems, and of WMO's contribution to co-sponsored systems. Together with the WMO Information System (WIS), this will allow continuous and reliable access to an expanded set of environmental data and products, and associated metadata, resulting in increased knowledge and enhanced services across all WMO Programmes.

11.3.8 Congress recognized that the WIGOS vision provides a roadmap to guide the orderly evolution of the WMO observing systems operated by Members into an integrated system. Establishing the effective and sustained organizational, programmatic, governance and procedural structures is needed for a common standardization process facilitating interoperability of WIGOS observing components, and for implementation of quality management procedures. It will enable those user requirements for various application areas to be met at national, regional and global levels.

Benefits

11.3.9 Congress confirmed that WIGOS will enable all Members and the WMO Programmes to provide timely, quality-assured, quality-controlled, and well-documented compatible long-term observations for enhanced and extended services.

11.3.10 Congress agreed that WIGOS will significantly enhance observing capabilities of Members by maximizing their administrative and operational efficiencies, through a more coordinated, collaborative and cost-effective approach to the planning and operation of an integrated global observing system. In addition, it will enable Members, especially those of LDCs, LLDCs and SIDS, to better respond to natural hazards; improve weather, water, climate, and related environmental monitoring and forecast services; and adapt to, and mitigate climate change. In doing so, Members will be able to meet expanding national mandates while achieving higher national visibility for NMHSs with other environment related agencies. Congress also agreed that WIGOS will provide a framework for improved collaboration and coordination between NMHSs and relevant national and regional organizations.

11.3.11 Congress also underlined that WIGOS will be essential for the Global Framework of Climate Services (GFCS), aviation meteorological services, disaster risk reduction, and capacity-building as WMO priorities. It will also ensure a coordinated WMO contribution to the co-sponsored GCOS, GOOS, GTOS, and to the Global Earth Observation System of Systems (GEOSS).

Implementation

11.3.12 Congress decided that the WIGOS implementation be undertaken in an active and prudent manner in the sixteenth financial period and will focus on a framework for improved governance, management, integration and optimization of the multiple observing systems coordinated by WMO, so as to achieve a smooth transition, and no effort should be spared to make WIGOS operational by 2016.

11.3.13 Congress emphasized that the implementation of WIGOS should build upon and add value to the existing WMO observing systems with emphasis on integration of surface- and space-based observations in an evolutionary process to satisfy requirements of WMO and WMO co-sponsored Programmes. Congress noted that, since all WMO Programmes would benefit, each should actively participate and contribute its own expertise and resources in implementing WIGOS.

11.3.14 Congress agreed that in implementing WIGOS, it is imperative that the current management, governance and support activities be reviewed and aligned with WMO priorities. This alignment would promote cooperation and coordination at the technical, operational and administrative levels.

11.3.15 Congress recognized the important role of WIS in WIGOS implementation, in relation to data exchange and discovery, and the provision of effective standards and practices for data management. Congress stressed the importance of coordination between WIGOS and WIS implementation activities.

11.3.16 Congress also recognized that meeting the quality requirements and expectations of users will be critical to the success of WIGOS. This would require an in-depth examination of current practices used by WMO observing programmes, specific mission-related requirements that were already in place, and available technological opportunities. The WIGOS implementation strategy would specify all processes of the Quality Management System (QMS) for WIGOS observing components including guidance on effective management of such a component.

11.3.17 Taking into account the ongoing rapid progress in technology that will continue to provide a basis for further improvements in the capability, reliability, quality and cost-effectiveness of observations, WIGOS must utilize international standards and best practices set by WMO and partner organizations.

11.3.18 Congress requested the Council to provide oversight on the implementation of WIGOS as one of the priorities of the Organization. Recognizing the significance of active cooperation and enhanced coordination among TCs, RAs and WMO partners, Congress noted that it would be desirable for an Inter-Commission Coordination Group on WIGOS (ICG-WIGOS) to be established during the implementation process and it should include representatives of RAs and partner organizations.

11.3.19 Congress further requested the Council to give immediate high priority to determining appropriate Terms of Reference for the new ICG-WIGOS and to express the Council's requirements and desired schedule for the development, review and approval of the WIGOS Implementation Plan (WIP).

11.3.20 Congress recommended that an updated concept of operations as a WIGOS functional architecture should be elaborated urgently to be a main reference for the WIGOS Implementation Plan. To avoid any duplication and to ensure consistency and effectiveness, requirements of GFCS and other WMO priorities needed to be reflected in the updated CONOPS and in the relevant implementation plans for global, regional/subregional and national levels to be developed by the WMO Secretariat, RAs and NMHSs, respectively.

11.3.21 Congress emphasized that the commitment and contributions of, and action by Members, in particular, were critical to the success of WIGOS. Congress noted the importance of a comprehensive communications strategy to ensure that Members, regional associations, technical commissions and partners are all informed on their roles in implementing WIGOS and on the status of its implementation.

11.3.22 Congress stressed the importance of the development of an implementation plan for the evolution of WIGOS beyond 2015 including technical guidance on how to design, develop and implement integrated national observing systems to provide comprehensive observations in response to the needs of all WMO Members and Programmes.

11.3.23 Congress agreed that the implementation of WIGOS must be reflected in the revised WMO Technical Regulations, documenting the WIGOS concept of operations and contributions of all observing components. In this regard, the Congress endorsed the inclusion of the Manual on WIGOS in the list of mandatory publications.

11.3.24 Congress emphasized the importance of the development of the WIGOS operational and standardization databases specified in CONOPS as critical WIGOS framework support tools and establishment and management of a WIGOS portal that would provide relevant information to stakeholders on WIGOS and to ensure free access to its databases, noting relevant resolutions on data exchange and any future developments in this area.

Resources

11.3.25 Congress agreed that the timely completion of the WIGOS implementation in the sixteenth financial period directly depended on the available resources. Congress assigned a high priority to the proposed budget allocations for WIGOS activities. Congress also urged Members to continue to provide resources to help support the implementation of WIGOS. Congress recognized that the key role to be played by the technical commissions in WIGOS implementation would require additional resources, and therefore further urged Members to also provide the resources to enable this role to be fully realized, as a part of their voluntary contributions.

11.3.26 Congress underlined that WIGOS implementation at national and regional levels would require initial investment. This investment should be a significant component of WIGOS implementation plans of individual NMHSs.

11.3.27 Congress agreed that centralized coordination through the WMO Secretariat was important for the successful WIGOS implementation. It agreed that establishment of the WIGOS Project Office with appropriate project management functions, sufficient staffing and funding will be essential to support the WIGOS implementation.

11.3.28 Congress further agreed that the WIGOS Project Office will:

(a) Deliver the WIGOS Implementation Plan by the end of 2012;

(b) Ensure that the Implementation Plan is scalable allowing components to be implemented by Members on a national or regional basis;

(c) Establish a clear support structure to develop understanding of what is required to implement the Implementation Plan;

(d) Coordinate with Members, the technical commissions and the regional associations to identify needs for nominated experts, including National Focal Points, and to work with Members to fill those needs.

11.3.29 Congress agreed that the full staffing requirement would need to be met primarily through the secondment of experts from NMHSs. In this connection, Congress urged Members to

provide secondment services to the Secretariat during the WIGOS Implementation to ensure its successful completion.

Capacity-building

11.3.30 Congress stressed that an effective capacity-building strategy is an essential component of the WIGOS implementation. Specialized education, training activities and improvement of necessary observing infrastructure should be reflected in the regional, subregional and national WIGOS implementation plans, especially for NMHSs of LDCs, LLDCs and SIDS. Hence, capacity-building is not to be limited to scientific and technological concerns, but also to strategic and management consideration including human resources development, resource mobilization and communications and outreach activities.

Collaboration

11.3.31 Congress emphasized that strong support and close collaboration among Members were needed to advance scientific knowledge and technical infrastructure to meet the WIGOS requirements. Within the Regions, it would be desirable to strengthen cooperation and partnership through region-wide organizations or subregional groupings overseeing the WIGOS observing components. It specifically refers to enhanced cooperation among meteorological, hydrological and marine/oceanographic institutions/services where they are separated at the national level.

11.3.32 In conclusion, Congress agreed that the impact of WIGOS on Members' responsibilities and resources appeared to be commensurable with the development that would be needed to face the general evolution of observing technologies and Members' requirements. It requested the Executive Council, RAs and TCs involved in the WIGOS implementation to give particular attention to the impact on Members with a view to optimizing the overall WIGOS functionality and efficiency for the benefit of society.

11.3.33 Congress requested the Secretary-General to provide documentation on the benefits, efficiency and cost-effectiveness of WIGOS, as well as guidance on the implementation activities by Members, to be available also to funding agencies, such as the World Bank and EU to gain their support.

11.3.34 Congress adopted Resolution 50 (Cg-XVI) – Implementation of the WMO Integrated Global Observing System.

11.4 WMO INFORMATION SYSTEM *(agenda item 11.4)*

WIS implementation progress, designation of WIS centres

11.4.1 Congress recalled that Fifteenth Congress defined three fundamental types of services to be provided by the WMO Information System (WIS), and agreed that the WIS implementation plan had two parts that would be developed in parallel: Part A – the continued consolidation and further improvement of the GTS for time-critical and operation-critical data, including its extension to meet operational requirements of WMO Programmes in addition to the World Weather Watch; and Part B – an extension of the information services through flexible data discovery, access and retrieval (DAR) services to authorized users, as well as flexible timely delivery services.

11.4.2 Congress expressed its gratitude to Members who have declared their interest in implementing new WIS functionalities. It noted that as of December 2010, the number of candidate centres identified lies at 15 GISCs and 111 DCPCs. It encouraged those Members to make their best implementation and preparatory efforts in compliance with the functional and technical specifications defined in the Manual on WIS and the Guide to WIS, paying attention to the requirements for interoperability, especially among GISCs. Congress stressed the importance for each candidate WIS Centre to establish WIS functionality and be ready for operation, and to demonstrate to CBS those capabilities, in particular as regards to metadata harvesting, metadata

publishing, discovery of data, supporting ad-hoc requests, user authentication and access authorization.

11.4.3 Congress noted with satisfaction the significant progress achieved by Members in implementing WIS. It recalled that 18 Members/organizations entered into the first round of the demonstration process for a total of 13 GISCs and 56 DCPCs. It expressed its appreciation to those Members who have already enabled WIS functionalities and demonstrated these abilities to the sixty-second session of the Executive Council and CBS-Ext.(10). It noted that some of these centres had been in pre-operational mode since May 2010. It accepted the recommendation by CBS on the designation of the initial set of WIS centres, and adopted Resolution 51 (Cg-XVI) – Designation of Centres of the WMO Information System. Congress requested that after the initial designation of WIS centres, further designation will be performed by EC through the review of the Manual on WIS.

11.4.4 Congress noted with appreciation that the regional WIS training workshops successfully hosted by Japan and China provided practical information on the new information system to many Asian countries. Congress stressed the necessity of more capacity development projects for WIS National Centres in developing countries, and the promotion of the use of WIS, together with WIGOS. Congress felt that the area of responsibility of each RA II GISC should be officially agreed upon at the next session of RA II, now scheduled in 2012. However, to allow the Members of RA II to benefit from the new system before this, Congress encouraged RA II to initiate the coordination and consultations as a tentative solution so that each National Centre should be linked to a principal GISC and to a secondary GISC, taking into account the efficiency of options, the cost effectiveness for both NCs and GISCs, data distribution capacity of the GISCs, and the current structure of the GTS.

11.4.5 Congress noted the contribution of JCOMM to WIS and WIGOS through the establishment of an IOC Ocean Data Portal (ODP). It requested Members to engage in negotiations with oceanographic institutes holding ocean data sets relevant to WMO applications, with a view to having these datasets become interoperable with ODP or WIS. It requested JCOMM to continue its collaboration with IOC in order to realize full interoperability between ODP and WIS. Recognizing the need for further enhancing interoperability between data systems, Congress invited Members to actively participate in the JCOMM Standards process for ocean data management.

11.4.6 Congress noted that the proactive support from the Secretariat for WIS implementation, which is necessary for the international coordination that underpins all Members core activities, has been largely due to the generosity of Members through in-kind contributions, staff secondments and through contributions to the WIS Trust Fund. Congress expressed its appreciation to those Members who made contributions to the WIS Trust Fund or hosted WIS related training activities, and to Australia, the United States and Germany for their staff support to the WIS Project Office. It noted that WIS is now in a critical implementation and operational stage, and encouraged Members to maintain these contributions which are crucial to the effective and sustained WIS implementation over the next financial period, noting that the Project Office in its present form is no longer appropriate, but substantial coordination activity will still be needed from the Secretariat staff.

11.4.7 Congress noted that WIS has moved from a development stage into an operational stage. Congress noted that WIS activities in 2012–2015 should be: (1) complete WIS implementation across all WMO Centres; (2) capacity-building to ensure support of all WMO Members; (3) leverage WIS advantages for all WMO Programmes; and (4) take advantage of WIS in all WMO Data Management.

Complete WIS implementation across all WMO Centres

11.4.8 Congress noted that WIS implementation is now on track for new centres to be operational following Cg-XVI. Congress emphasized that although the implementation of the new

functionality of WIS will then be operational in a few core centres, many Members will still have to begin their implementation. Thus, the full implementation of WIS by all Members will take at least the whole of the next financial period.

11.4.9 Congress noted and supported the following major activities and implementation target dates, and urged all Members and the Secretary-General to identify the necessary resources for reaching the objectives:

(a) Improving the knowledge and capabilities of Members to benefit from WIS functionality, in particular least developed countries, developing countries and small island states through regional workshops and information sessions: 2012–2013;

(b) Implementation of WIS at all NMHS national centres (NCs): 2012–2015;

(c) Implementation of remaining candidate GISCs: 2012–2013;

(d) Implementation of more DCPCs, i.e. WIS interfaces at WMO Programmes' centres: 2012–2015;

(e) Amendments to the Manual on WIS for enhanced operational arrangements of WIS centres, especially GISCs: 2014.

11.4.10 Congress thanked those Members who offered to make WIS software available and was particularly pleased to see the differing solutions fulfilling WIS interoperability requirements included open source (free) solutions as well as commercial offerings. It noted that several Members including China, Germany, Japan and the OpenWIS Consortium, led by France, Australia, the Republic of Korea and the United Kingdom, have or are planning to make their WIS software available through the CBS software registry and that there are also commercial vendors offering support, installation and maintenance. The Congress was also informed that the Russian Federation, Bulgaria, Saudi Arabia, Serbia, Morocco, Kenya and Indonesia have agreed to support the OpenWIS strategy as a tool for obtaining long-term sustainability of WIS compliance solution worldwide and to recognize that OpenWIS provides an open source platform that allows Members to contribute to WIS deployment and to implementation of standards and, ultimately to join OpenWIS Consortium.

11.4.11 Congress, noting the structure of GTS is evolving to a two-level network architecture, invited the regional associations to coordinate the definition of area of responsibility for each GISC, in particular their Area Meteorological Data Communication Network (AMDCN), taking advantage of the improved performance of data exchange enabled by new technologies. Regional associations should consult with CBS when reviewing AMDCNs, being mindful of potential cost impacts on the remainder of WIS.

11.4.12 Congress expressed its appreciation to the Chair of ICG-WIS and to its participants for their ongoing support and leadership in taking WIS to this implementation stage. Congress emphasized that there is still a strong need for coordinating across technical commissions and regional associations, and CBS will continue to be the main body responsible for technical aspects on the implementation of WIS. Congress requested EC to consider what mechanisms would be appropriate to ensure continued WIS implementation as well as coordination with the needs of WIGOS and other initiatives such as the GFCS. In doing so, the continuation of the ICG-WIS, with revised terms of reference, for an additional two-year period should be considered.

Capacity-building to ensure support of all WMO Members

11.4.13 Congress noted that the priority activities of WIS have moved from development to capacity-building, especially those activities aimed at developing and least developed countries and small island developing States. Congress encouraged Members that have already

implemented WIS functions and interfaces to assist those who will be implementing them in the future. Congress also noted that data and metadata issues are especially critical in many small meteorological services and efforts within those NMHSs should be intensified to achieve the required standardization.

11.4.14 Congress urged all Members and the Secretary-General to identify the necessary resources for training workshops in the period 2012–2015 for developing countries and least developed countries, to assist them in implementing their components of WIS and benefiting from the WIS. It encouraged each GISC to take a leading role in the provision of training for centres in their AMDCN. Noting that the sustainability of WIS is a long-term project, Congress emphasized that regional coordination, utilizing such tools as feasibility studies and gap analyses, is necessary to ensure training and capacity development are targeted to regional needs.

Leverage WIS advantages for all WMO Programmes

11.4.15 Congress highlighted that WIS is an essential component of many WMO high priority initiatives, including Disaster Risk Reduction, Capacity-building, WIGOS and GFCS. Congress encouraged Members to ensure that new projects take advantage of the WIS and its set of interoperability standards, with an aim to increasing their ability to respond to user requirements while reducing the costs of developing and implementing new initiatives.

11.4.16 Congress noted that WIS is a continuously evolving system, improving as new technologies become available. Thus, Congress requested CBS to continue to refine WIS components to increase the efficiency and effectiveness of WIS, paying particular attention to address fully any security issues associated with these new technologies. Congress encouraged Members to interact with the OGC, ISO, OASIS, IETF, W3C, and other standards bodies to ensure those standards on which WIS interoperability is based, better meet the WMO community's needs.

11.4.17 Congress emphasized that WIS must continue to be driven by needs. Congress urged technical commissions and regional associations to actively pursue their contributions to the refinement of WIS user requirements to ensure that the Commissions and regional programmes requirements on WIS are taken into account.

11.4.18 Congress urged all Members and the Secretary-General to identify the necessary resources for training workshops in the period 2012–2013 for WMO Programmes on benefiting from and contributing to WIS implementation.

Take advantage of WIS in all WMO data management

11.4.19 Congress noted that WIS adopted best principles and practices in modern data management, especially where interoperability is necessary among complex systems that are separately managed. Congress urged Members, technical commissions, regional associations, and other bodies associated with WMO to apply such data management principles and practices throughout all WMO data management activities.

11.4.20 Congress emphasized that as an increasing number of Members are committed to the implementation of WIS, special attention should be paid to data and metadata standardization to ensure data interoperability and accessibility for WIGOS, GFCS and other WMO Programmes and initiatives.

11.4.21 Congress recognized the need to consolidate the ongoing WCDMP work in developing climate data management systems (CDMSs) and facilitating regional data initiatives, such as the Mediterranean Data Rescue initiative (MEDARE) and related data services portal. It requested CBS to develop an effective and focused working mechanism with WCP and CCl to achieve modern, robust and interoperable data management systems and to investigate the potential for MEDARE and similar initiatives to be incorporated within the WIS architecture, e.g DCPCs.

11.4.22 Congress further agreed that CCl and CBS collaboration should be extended to seek establishing improved interfaces with other databases, such as hydrological, agriculture, health, environmental and socio-economic databases.

11.5 DISASTER RISK REDUCTION PROGRAMME *(agenda item 11.5)*

Strategic Priorities, Implementation and Project Management Framework of the crosscutting DRR Programme

11.5.1 Congress recalled the endorsement, at its Fifteenth Session, of the crosscutting DRR Programme vision, strategic priorities, underpinned by the Hyogo Framework for Action (HFA), as provided in the DRR Programme Description in Annex II to the present report, and its request to the Secretary-General for the development of: (a) a sustainable and coordinated implementation framework through concrete and well-defined national/regional DRR projects, leveraging Members and their National Meteorological and Hydrological Services (NMHSs), WMO Programmes, technical commissions (TCs), regional associations (RAs) and external partners; and (b) a resource mobilization strategy for development and sustainability of national and regional capacities.

11.5.2 Congress recalled that the long-term objective of the WMO DRR Programme is to contribute to the strengthening of institutional capacities with respect to the provision of meteorological, hydrological and climate services and cooperation in supporting disaster risk assessment, risk reduction and risk transfer for the protection of lives, livelihoods and property, and contributing to sustainable development of Members as given in the programme description referred to above.

11.5.3 Congress stressed the importance of the outcomes of the 2006 WMO DRR Programme country-level survey based on 145 Member responses, as a benchmark for development of national/regional DRR capacity development projects, particularly acknowledging that:

(a) Droughts, flash and river floods, strong winds and severe storms, tropical cyclones, storm surges, forest and wild land fires, heat waves, landslides, sand and dust storms, marine and aviation hazards, as well as rapid melting of the glaciers and potential risks to quality and quantity of water supply, are among the top hydrometeorological hazards of concern to Members;

(b) Nearly 70% of countries require new or revised DRR policies, legislation, planning, and coordination mechanisms with focus on preparedness and prevention and clarity of the role of the NMHS; over 65% of NMHS need modernization or strengthening of their core infrastructure for observation, telecommunication, and operational forecasting; nearly 80% of NMHS need guidelines, as well as management and technical training; and over 80% of NMHS need strengthening of their strategic and operational partnerships with various disaster risk management (DRM) stakeholders.

Lessons learnt: DRR Capacity Development Projects and Good Practices Guidance

11.5.4 Congress noted that a number of Members were making progress in developing their disaster risk reduction capacities such as those in South America, as presented during the Third Global Platform on Disaster Risk Reduction (10–13 May 2011, Geneva, Switzerland). The Congress was pleased to hear of the lessons learnt from a number of WMO initiated on-going national/regional DRR projects (Southeast Europe, The Caribbean, Central America, and Southeast Asia) developed within DRR Programme project management framework and related criteria, approved by EC-LXII. Congress encouraged further expansion of these national/regional DRR capacity development projects to other regions, with consideration for the governments' receptivity and commitment to strengthening DRR, resources and leveraging projects such as the Severe Weather Forecasting Demonstration Project. The Congress particularly noted:

(a) The effective utilization of regional and national DRR platforms, policy dialogues and WMO regional meetings such as tropical cyclone committee meetings, and Regional Climate Outlook Forums as multi-purpose, multi-stakeholder fora to engage the Members, regional associations, regional and international DRM stakeholders and development and funding agencies in the planning of regional cooperation in DRR, development of national and regional work plans, integration of relevant projects and monitoring and evaluation of projects;

(b) A number of Members were actively revising and or developing their national DRR policies, planning, legal frameworks and were benefiting from multi-sectoral coordination, integrated planning and budgeting mechanisms;

(c) NMHS' need systematic capacity development with a sustainability plan that addresses: (i) their engagement in the national to local DRR coordination and planning mechanisms supported by adequate legislation to underpin their role and activities; (ii) strengthening of core observation, forecasting, telecommunication and human capacities; (iii) a number of common basic meteorological, hydrological and climate tools for development of products and services; and (iv) development of operational cooperation and Standard Operating Procedures (SOPs) with various DRM stakeholders from different sectors to support risk assessment, risk reduction through Multi-Hazard Early Warning Systems (MHEWS) and sectoral planning as well as financial risk transfer through catastrophe and weather indexed insurance and other indicators, tools and mechanisms;

(d) Benefits of coordinated and integrated project development, planning, and implementation, leveraging WMO Regional and Technical Cooperation Programmes, WMO Technical Programmes, TCs, Members, operational regional centres, NMHSs and external partners for increased benefits to the Members;

(e) Capacity-building can best be achieved through strategic partnership of WMO with international and regional agencies that influence DRM policies, planning, funding, and institutional development, particularly noting the World Bank, United Nations Development Programme (UNDP), the UN-International Strategy for Disaster Reduction (UN-ISDR), regional inter-governmental DRM agencies and economic groupings as well as development banks taking into account national policies, strategies, priorities and local conditions.

11.5.5 Congress noted the publication of seven examples of good practice in national MHEWS (Bangladesh, Cuba, France, Germany, Japan, Shanghai/China, and United States) and expressed its appreciation to these Members for this important contribution. It noted the success of the resulting guidelines in MHEWS as a basis for the conduct of related workshops on Institutional Coordination in MHEWS that have led to effective knowledge sharing and systematic engagement of executive management of NMHS and DRM stakeholders and other regional and international partners in the planning of national/regional DRR capacity development projects. The Congress requested further documentation of other aspects of MHEWS, particularly noting guidelines to support the NMHSs for their engagement in the policy and legal frameworks as well as Standard Operating Procedures (SOPs) with the Disaster Risk Management agencies and other sectoral stakeholders, building on the good practice experiences. The Congress also encouraged documentation and publications of good practices in other areas including risk assessment, risk reduction and financial risk transfer, the development and sharing of related guidelines and lessons learnt to support NMHS activities and the capacity development of NMHS in these areas.

11.5.6 Congress stressed that effective MHEWS required significant cooperation, information sharing and coordination among NMHS and other agencies at national to local levels to ensure: (i) effective monitoring and forecasting of hazards; (ii) development and issuance of risk-based alerts and warnings; (iii) dissemination of official warnings to authorities, sectors and the public,

using standard formats such as Common Alert Protocols, and addressing uncertainties and follow up in case of false alarms; (iv) activation of emergency preparedness measure and response operations; and (v) provision of other relevant products and services to support emergency relief, response and recovery operations.

11.5.7 Congress noted that increasingly as the governments are taking ownership in the development of multi-hazard early warning systems, warning authority varies from nation-to-nation and in some countries is shifting from technical agencies, to multi-hazard warning authorities that incorporate risk information for development of warnings (e.g., disaster risk management agencies, health authorities, etc.). In this emerging framework, NMHSs are critical service providers of "authoritative" science-based hydrometeorological hazard analysis, forecasts, alerts, warning guidance and advice. The Congress stressed the need for fostering strong relationships between NMHSs and Disaster Risk Management agencies and that the development of NMHS communication strategies related to alerts and warning, should be in alignment with the national warning protocols.

11.5.8 Congress noted that regional and global sites, such as the WMO's Severe Weather Information Centre (http://severe.worldweather.wmo.int/) and EUMETNET's MeteoAlarm, provide opportunities for users to access official national information and warnings. Congress further noted that the establishment of publicly accessible web portals that hold relevant observations, forecasts, advisories, warnings and other information is an important communication tool. Congress encouraged the evaluation of these portals to ensure that they achieve their stated purposes and reach their target audiences. Congress also encouraged the active participation of NMHSs with their counterpart national disaster risk management authorities, in the further development of portals such as these.

11.5.9 Congress was informed of the coordination efforts of the WMO Secretariat with the Members, UN and other development partners and the RAs for realizing opportunities for development of NMHS capacities through post disaster funding mechanisms, such as the UN-driven Humanitarian Flash Appeal, the UN/World Bank Post Disaster Needs Assessment (PDNA) for reconstruction, and bi-lateral contributions of Members. Congress requested the Secretary-General to document lessons learned, in consultation with partners, including the governments of Haiti and Pakistan, for appropriate follow up and to further strengthen post disaster resource mobilization efforts to support strengthening of NMHSs of affected Members.

Further development of the DRR Programme

11.5.10 Congress encouraged further development of DRR capacity development projects with a strong focus on enhancing NMHSs, Regional Specialized Meteorological Centres (RSMCs) and Regional Climate Centres (RCCs) institutional capacities. In this regard, it requested the presidents of TCs and RAs and the Secretary-General, in coordination with other relevant partners, to support capacity development needs for the thematic topics, operational capacities and coordination mechanisms. Congress noted that resource mobilization in support of DRR should be coordinated through the WMO's broader resource mobilization processes, leveraging emerging DRR funding opportunities, with the objective of supporting:

(a) Development, improvement and sustainability of early warning systems in particular related to scientific and technical infrastructures, systems and capabilities for research, observing, detecting, forecasting and warnings of weather-, water- and climate-related hazards;

(b) Development, improvement and sustainability of standardized hazard databases and metadata, systems, methods, tools and applications of modern technologies such as geographical information systems for recording, analyzing and providing hazard information for risk assessment, sectoral planning, risk transfer and other informed decision-making;

(c) Development and delivery of warnings, specialized forecasts and other products and services that are timely, understandable to those at risk and driven by requirements of disaster risk reduction decision processes and operations engaging socio-economic sectors;

(d) Stimulate a culture of resilience and prevention through strengthening of capacities for better integration of meteorological, hydrological and climate' products and services in disaster risk reduction across all socio economic sectors, such as land use planning and infrastructure design and continued public education and outreach campaigns;

(e) Strengthening cooperation and partnerships of WMO and NMHSs in national, regional and international user forums, mechanisms and structures for implementation of disaster risk reduction.

11.5.11 Congress stressed that the DRR capacity development projects should support the Members in realizing opportunities for:

(a) Reflecting roles of the NMHSs within the national DRR and adaptation policies, legal frameworks, planning, and coordination mechanisms;

(b) Raising resources for strengthening of NMHSs capacities through the national, regional and international DRR and adaptation funds;

(c) Demonstrating principles of effective service delivery with various socio-economic sectors to support their DRR decision-making;

(d) Development of Quality Management Systems (QMS) and Standard Operating Procedures (SOPs) of NMHS with DRR stakeholders in various sectors;

(e) Leveraging regional and national DRR platforms, policy dialogues and other relevant fora for engagement with the DRR stakeholders, identification of their needs, and strengthening partnerships.

11.5.12 Congress stressed the need for: (i) a comprehensive set of guidelines, manuals, and training modules, spanning technical, operational, management and institutional aspects in DRR; and (ii) strengthening of regional training capacities, to support the implementation and expansion of the national/regional DRR projects. It requested the Secretary-General to coordinate such efforts consistent with principles of QMS and prepare a proposal for strengthening of DRR training capabilities by leveraging WMO Programmes, TCs, Members, other DRM, technical, education and training partners, and the Regional Training Centres.

11.5.13 Congress called for a second comprehensive DRR survey towards the end of the sixteenth intersessional period to help assess progress with the development of national and regional DRR capacities to inform discussions at the Seventeenth Congress. Congress noted that the outcomes of such survey could also serve as a critical contribution to the WMO Country Profile database.

11.5.14 Congress was informed that nearly 90% of NMHSs need support and guidelines for the development and/or maintenance of standardized hazard databases and metadata, and hazard analysis tools to be able to report on their meteorological, hydrological and climate related hazards systematically. In this regards, the Congress:

(a) Appreciated the outcomes of a Secretariat study that documented:

  (i) Global disaster databases;

  (ii) Various global reports of hazards and their impacts;

(iii) Examples of selected hazard programmes of WMO Members including Canada, the Russian Federation and Australia;

(iv) Strengths, weaknesses, opportunities and challenges for addressing the Cg-XV request to the Secretary-General to coordinate the collection and dissemination of information on meteorological, hydrological and climate-related hazards and their impacts, when possible and available;

(b) Reaffirmed the importance of systematic monitoring and reporting, and encouraged the Secretariat to:

(i) Issue a "sample" annual report in collaboration with custodians of the global disaster databases focused on meteorological-, hydrological- and climate-related hazards and their impacts, in 2011;

(ii) Establish a special task team to develop a standard outline for a global report, identify good practices from WMO Members, and facilitate a pilot project engaging Members to contribute to the development of a sample report for consideration by the Executive Council;

(iii) Facilitate contributions of WMO Members and Programmes to critical global reports.

Emerging opportunities for the development of Climate Services for DRR

11.5.15 Congress highlighted the outcomes of the Third World Climate Conference (WCC-3) for establishment of a Global Framework for Climate Services (GFCS) and the recommendations of the High-Level Taskforce (HLT) particularly noting the need for applied research and development of seamless operational forecasting and analysis of the changing characteristics of hydrometeorological hazards at different climate timeframes (i.e., seasonal, inter-annual, decadal, and longer climate change time lines) as fundamental input for DRR decision-making. In this regard, Congress stressed the importance of linking the implementation framework of the DRR Programme with the development of the Global Framework for Climate Services (GFCS), in particular, potential contributions of the DRR Programme to the User Interface Programme of the GFCS. In this regard, Congress requested the Secretary-General to utilize national/regional DRR projects for engaging various WMO sponsored and co-sponsored climate programmes, technical commissions, and other research initiatives for development of climate services and capacities to support DRR and climate adaptation.

Response to major hydrometeorological disasters since Cg-XV

11.5.16 Congress highlighted that there have been a large number of major and many smaller disasters during the intersessional period. It particularly stressed the effective coordination of the WMO Secretariat with Members and other United Nations and international agencies in responding to the 2010 Haiti Earthquake for the development of Haiti's meteorological and hydrological alerts and warnings.

11.5.17 Congress also noted that disasters are receiving an increasing level of global attention due to the media's ability to almost instantaneously gather photographic coverage of a disaster occurring anywhere in the World. This media coverage in turn places increasing pressure on NMHSs to respond quickly and accurately in both analysis and prediction of hydrometeorological disasters, for which consistency with the information from other NMHSs is desirable.

11.5.18 Major disasters with an international dimension require coordinated responses from a broader range of agencies and organizations than the WMO community routinely deals with. A significant part of this communication requirement is often between UN agencies and organizations handled through the WMO Secretariat. It also seems clear that as the scale of the disaster increases so the complexity of effective communication increases at a greater rate, in part because

of the cultural and operational differences across the agencies and organizations and in part because there are no pre-established relationships between key decision-makers.

11.5.19 Congress requested the Commission for Basic Systems (CBS) to develop proposals for a framework for communication responsibilities of RSMCs. In addition, Congress noted that there is an urgent need to develop a standardized format for exchange of tropical cyclone advisories issued by RSMCs and Tropical Cyclone Warning Centres (TCWCs) and that the experience of aeronautical meteorological services in establishing standard tropical cyclone advisories for the aviation community could be used as a basis. Such standardized formats would benefit the whole meteorological community as well as members of the public and international media around the world. Furthermore, standardized tropical cyclone advisories would facilitate the display of related graphical information on the Web pages, including those involving private sector providers.

11.5.20 Congress requested the Executive Council, in close cooperation with the technical commissions and regional associations, and the relevant UN and international agencies to urgently review the operational arrangements in place between RSMCs and NMHSs for warning of, and responding to major disasters, focusing particularly on those with an international dimension, taking into account the national accountability for the disaster management and the requirements for regional coordination and support.

11.5.21 Congress noted the DRR Programme Description as given in Annex II to the present report and adopted Resolution 52 (Cg–XVI) – Disaster Risk Reduction Programme.

11.6 AERONAUTICAL METEOROLOGY PROGRAMME *(agenda item 11.6)*

11.6.1 Congress was pleased to note the achievements of the Aeronautical Meteorology Programme during the fifteenth financial period. A description of the Aeronautical Meteorology Programme is given in Annex II to the present report.

Competency of personnel in aeronautical meteorology

Top level competencies and implementation guidelines

11.6.2 Congress was informed that the WMO Executive Council (EC-LXII, June 2010) had approved the inclusion of Competence Standards for Aviation Meteorological Forecasting and Observing Personnel into WMO Publication No. 49, Technical Regulations, Volume I. The Standards were developed and endorsed by the WMO Commission for Aeronautical Meteorology (CAeM) and respond directly to the requirement listed in ICAO Annex 3, paragraph 2.1.5, which states “Each contracting State shall ensure that the designated meteorological authority complies with the requirements of the World Meteorological Organization in respect of qualifications and training of meteorological personnel providing service for international air navigation”. Congress thus endorsed the relevant text in Resolution 53 (Cg-XVI), whilst recognizing that national personnel qualification requirements for Aeronautical Meteorological Personnel could be set at a higher level.

11.6.3 Congress strongly supported the introduction of a competency-based system for personnel in aeronautical meteorology, recognizing that such systems are generally used in the entire aviation sector, where all types of personnel are required to be able to demonstrate their ability to meet the competence standards for their activities. Members will be expected to provide evidence of their personnel’s competence as part of their Quality Management System. Congress thus welcomed the successful development and testing of a comprehensive toolkit for competency assessments of personnel, and congratulated the CAeM for the excellent work completed in a very short time.

11.6.4 Regarding the need for meteorological service providers to aviation to fulfil the Competence Standards, which are driven by the associated ICAO requirements for personnel by 1

December 2013. Congress noted that some Members may experience difficulty in meeting this target date. The implementation guidance which takes into account regional and national differences and notes that the technical infrastructure available will allow a degree of flexibility in the way competency can be demonstrated. Congress considers this new approach has been designed to make it easier for Members to meet the Standards and more pragmatic than a purely qualifications-based system and would give confidence to users that the meteorological personnel would have been assessed on the job with documented results.

11.6.5 Congress noted with appreciation the intention of the Secretariat to distribute information concerning the introduction of the new competency-based system for their staff, including "Frequently Asked Questions" (FAQ) and their plans concerning Supplement 1 of WMO publication WMO-No. 258. The FAQ had been prepared following numerous discussions between experts and representatives of Members present at a number of WMO gatherings, and were created to provide as much clarification as possible on questions raised regarding the new system. Congress stressed that the provision of such information is crucial, considering that Members would need to develop and implement the education and training plans and to prove the competencies of aeronautical meteorological personnel in time for the deadlines.

11.6.6 Congress warmly welcomed the initiative of several Members who had made expertise and time available for this important process, and strongly encouraged these and other Members with the required expertise and resources to be available for continued support and advice to Members in the developing world.

Competency Assessment Toolkit and Application

11.6.7 Congress welcomed the highly useful toolkit for competency assessments and encouraged Members not only to make best use of this facility, but to exchange experiences and best practices, and requested the Secretary-General to ensure that such best practice examples would be made available via appropriate means to all Members.

11.6.8 Congress further requested the Secretary-General to maintain the implementation guidance for competencies as a living document accessible on the CAeM page of WMO Website (www.caem.wmo.int/moodle) under regular review to reflect evolving technology and user requirements.

Governance and partnership in aeronautical meteorology

Requirements for services provided to international civil air navigation- the link to ICAO

11.6.9 Congress recalled the working arrangements between WMO and ICAO which recognize the ICAO Council as the decision-making body on the requirement for meteorological services for international civil air navigation. These decisions are prepared by working and study groups reporting to the Air Navigation Commission, and published in the relevant Annexes to the ICAO Convention. Consistent with these arrangements, all meteorological service providers are required to implement a recognized quality management system as a Standard with applicability date of 15 November 2012, and the recommendation is to obtain a certification according to the ISO 9001:2008 Standard for Quality Management Systems (QMS).

11.6.10 Cg-XV had requested the Secretary-General of WMO to carry out a QMS implementation pilot project in at least one developing or least developed country. Congress was pleased to be informed that this Pilot Project with the Tanzania Meteorological Agency (TMA) was successfully concluded with the certification audit passed by TMA on 17 December 2010, having received not only support from consultancy companies but also from the WMO Secretariat.

11.6.11 While Congress congratulated the TMA for their remarkable success, it was equally aware that the amount of support for this project, which has provided invaluable experiences, best

practice examples and excellent documentation available on the AEM page of WMO Website, http://www.wmo.int/pages/prog/amp/aemp/index_en.html could not be realistically provided to all, or even a large number of Members in the same way. Therefore Members are strongly encouraged to draw benefit from this pilot project through use of its documentation.

11.6.12 Congress further noted with appreciation the excellent provision of expertise, training and resources by the Secretariat with generous support from some Members to regionally based QMS initiatives. To reinforce these efforts, it strongly requested Members with a well-developed QMS in operation to make expertise and resources available on a "twinning basis" in particular to LDCs, SIDSs and developing countries. In this regard, Congress warmly thanked Australia, Finland, Canada, the Russian Federation, South Africa, Spain and the United States, among others, for holding, supporting or resourcing training workshops and necessary follow-up for subregions such as Southern and Eastern Africa, the South-Western Pacific, Eastern Europe, Western Asia and the Caribbean. Such arrangements were considered the most realistic approach to a globally successful implementation of QMS by the target date.

11.6.13 On the subject of provision and issuance of SIGMET, Congress noted with appreciation the current pilot project on the provision of SIGMET advisory messages involving three selected Members (China, for Eastern and South-Eastern Asia, France for Western and Central Africa, and South Africa for Southern Africa) with a view to improving the level of compliance with ICAO regulations. These advisories are following the example of the well-established advisories for Tropical Cyclones and Volcanic Ash.

11.6.14 Congress strongly encouraged Members in the regions concerned to make every effort to use this opportunity to demonstrate their ability of providing reliable, accurate and timely warnings of hazardous weather conditions to aviation. Congress reminded Members that the aviation stakeholders, who were asked to pay for meteorological services, expected a high level of compliance and service quality. Failure to provide services to the expected standards by a minority of service providers would endanger the current model of service provision on a national basis, and strengthening regional and subregional cooperation was seen as the most realistic approach to ensure an acceptable level of service provision globally.

11.6.15 Congress noted with appreciation the successful creation and activity of the joint WMO-IUGG Volcanic Ash Scientific Advisory Group (VASAG) that had been proposed at the occasion of the 5th International Scientific Workshop on Volcanic Ash held in March 2010 in Santiago de Chile and endorsed by both the president of IUGG and WMO EC-LXII in June 2010. This group assumed a key role in the ICAO International Volcanic Ash Task Force. Congress noted with concern different requirements between European air space, for which quantitative ash predictions have been requested from the relevant Volcanic Ash Advisory Centres (VAAC), whereas in other regions the traditional "Ash/No Ash" advisories are deemed sufficient. Congress thus requested the Secretary-General and the VASAG to work closely with ICAO, national and regional Civil Aviation regulatory bodies as well as the Original Equipment Manufacturers (OEM), with a view to clearly define such levels of ash concentration that: (a) could impact the safety of aviation operations; and (b) influence maintenance and air worthiness consideration of aircraft and engines. Congress strongly encouraged Members to make every effort to support this initiative, in cooperation with national volcanological institutes by creating and coordinating a composite observing system (ground, in-situ and space based), that would allow observations of and quantifying such ash concentrations in near-real time and could be used to calibrate ash dispersion and transport models.

Development of new forecast services including those for Air Traffic Management

11.6.16 The rapid growth in air traffic in the recent past, in spite of the temporary slow-down associated with the economic crisis of 2008/2009, is increasing the pressure on the global air traffic system, and requires new concepts to overcome capacity limitations for air routes and airports.

11.6.17 Congress recalled that new Air Traffic Management (ATM) concepts for performance-based air navigation also required increased levels of service from the aeronautical meteorological service providers. In particular, the strong linkage between poor weather conditions in terms of low visibility and ceiling, turbulence, icing and severe convection in the wider approach and departure area around hub airports were found to be a strong contributing factor to flight delays. Congress noted that in the European area, the initiative for defragmentation of airspace (enforced by EU legislation), the so-called Functional Airspace Blocks (FAB) could require a re-organization of service delivery to meet the requirements of FABs encompassing several countries and thus affecting the arrangements between WMO Members/ICAO contracting States. Members concerned are obliged to conclude State Treaties regulating their cooperation, including aspects of sovereignty, liability, and cost recovery. Members, especially those in Developing and Least Developed Countries, were encouraged to observe and where they are able, participate in the development of new services for ATM.

11.6.18 Congress took note with appreciation that an ICAO/WMO Asia/Pacific MET/ATM Traffic Management Seminar was held in Fukuoka, Japan in January 2011, to share the experiences and knowledge and develop understanding of meteorological services in support of Air Traffic Management (ATM). Congress also welcomed the intention of the Japan Meteorological Agency to contribute to the activities related to ATM, based upon its experiences of the establishment and the operation of Air Traffic Meteorological Centre.

11.6.19 Congress, having been informed of the development of Network (Net)-centric new Weather Information Exchange Models (WXXM) developed by Air Traffic Management initiatives such as NextGen (in the United States) and Single European Sky ATM Research (SESAR) (in Europe), which were based on industry-standard forms of data representation such as Extensible Markup Language (XML) and Geography Markup Language (GML), requested the presidents of CBS and CAeM to work with the Secretary-General to expedite the transition of traditional alpha-numeric OPMET data representation to these emerging standards for system-wide information management.

11.6.20 Congress recalled that Cg-XV had already encouraged Members to study how the concept of such regional and subregional cooperation agreements should be used by them to benefit from economies of scale in areas such as research and development, training and infrastructure planning and deployment. Congress agreed that the development, harmonization and regulation of new services for ATM would be a high-priority issue for the Aeronautical Meteorology Programme in close coordination with ICAO. Success in this area was paramount to a continued involvement of aeronautical meteorological service providers in aviation. Congress also noted the participation of South Africa in the ICAO 37th Assembly in Montreal, Canada during October 2010. In this Assembly, South Africa presented a working paper which highlighted the progress made in the Meteorological Association of Southern Africa (MASA) project on regional meteorological cooperation to facilitate the safety of air transport.

11.6.21 Recognizing the expected impact of climate change on all economic sectors, and the transport and aviation industry in particular, Congress encouraged WMO representatives on different ICAO operational and study groups to develop proposals in line with the GFCS for future inclusion in the requirements for meteorological services to aviation.

11.6.22 Congress adopted Resolution 53 (Cg-XVI) – Aeronautical Meteorology Programme.

11.7 WMO STATEMENT ON THE ROLE AND OPERATION OF NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES *(agenda item 11.7)*

11.7.1 Congress recalled its decision at the fifteenth session urging the Secretary-General to proceed with the development and publication of a statement on the role and operation of NMHSs for Directors, which was expected to be particularly helpful for the Directors of NMHSs in working with government agencies and the user sectors. Congress endorsed the statement on the role and

operation of NMHSs developed by the Executive Council, as given in Annex XI to the present report.

11.7.2 Congress requested the Secretary-General to publish the statement and make it available to the Directors of NMHSs to use in working with government agencies and the user sectors. Congress encouraged Members to promote the use of the statement in support of policy development and implementation. To ensure consistency and effectiveness, it emphasized the need to ensure that other outreach materials are in agreement with the content and philosophy of the statement.

11.8 WMO GENDER MAINSTREAMING *(agenda item 11.8)*

11.8.1 Congress recalled that Cg-XV (Geneva, May 2007) had reiterated its strong support to the appeal by the Secretary-General to Governments and Directors of NMHSs to take urgent and positive action to improve gender mainstreaming in their National Services. Noting that gender issues have underlying implications in all strategic activities of Members, Congress advised that equal opportunities in recruitment, retention and promotion at all levels of the National Services and in the delivery of weather, climate and water services would benefit science, NMHSs and society in general.

11.8.2 Congress further recalled that Cg-XV had reviewed progress made in promoting equal opportunities for women and men in meteorology and had approved the WMO Policy on Gender Mainstreaming (as given in Annex XII to the present report) as a mechanism to implement gender mainstreaming at all levels in WMO. In this regard, Fifteenth Congress had reiterated to the Executive Council its desire for the establishment of an Advisory Panel of Experts on Gender Mainstreaming to assist with the implementation of the gender mainstreaming policy within the Secretariat and by Members, technical commissions and regional associations to monitor and evaluate progress. Congress had also urged Members to second qualified experts from their Services to the Secretariat to further assist in the implementation of the gender mainstreaming Policy.

11.8.3 Congress was pleased that the Executive Council (EC-LIX, Geneva, May 2007) had subsequently established an EC Advisory Panel of Experts on Gender Mainstreaming under the leadership of Dr Linda Makuleni (South Africa). Congress expressed its appreciation to the Chair and members of the Panel and to all those who contributed to its work. The Panel's first meeting was held in Geneva, Switzerland, February 2010. The Panel had made a number or recommendations, particularly concerning the expansion of its membership to include more men to ensure balance in the gender representation and more active participation of the Regions in gender mainstreaming.

11.8.4 Congress noted with appreciation the leadership of the South African Weather Service (SAWS) in WMO gender mainstreaming and their assistance in seconding a gender expert to assist the Secretariat move gender mainstreaming efforts forward. Following the example of SAWS, Congress requested other WMO Members to consider seconding gender experts to the Secretariat to assist in the implementation of the WMO Gender Mainstreaming Policy. However, if such secondment was not feasible due to resource limitations faced by some NMHSs, Congress requested the Secretary-General to consider making suitable arrangements within the Secretariat to ensure the continuity and proper implementation and monitoring of the gender mainstreaming activities.

11.8.5 Congress noted that seven technical commissions and one regional association had appointed gender focal points. It encouraged Members to provide equal opportunities in the selection of candidates as members, experts and rapporteurs in WMO constituent bodies and also for training and educational opportunities. Congress further noted that 37 Members had nominated national focal points on gender. Congress strongly recommended that those constituent bodies and Members that had not yet strengthened gender mainstreaming efforts, do so. In reviewing the

statistics on gender in the Secretariat, Congress was pleased to note an increase from 28 to 32% in the number of women in the professional category, and similarly an increase from 20 to 26% in the number of women in the director and above categories, over the last four years.

11.8.6 In highlighting the vital role of women in areas such as agriculture and food security, water resources management, family health and overall family well-being and management, Congress welcomed the inclusion of gender in the WMO Strategic Plan, in particular in activities dealing with service delivery, capacity-building and disaster reduction.

11.8.7 Congress encouraged Members to implement gender mainstreaming activities along the lines of the WMO Policy on Gender Mainstreaming, and making use of guidance provided by the EC Advisory Panel of Experts on Gender Mainstreaming, through the use of the voluntary funds. It further urged the Secretary-General to allow sufficient allocations within the voluntary funds to permit activities to be undertaken in support of gender mainstreaming.

11.8.8 Congress adopted Resolution 54 (Cg-XVI) – WMO gender mainstreaming.

11.9 OTHER CROSS-CUTTING MATTERS *(agenda item 11.9)*

WMO Polar Activities

11.9.1 Congress noted with appreciation the great effort of all Members who have operational activities in the Polar Regions, recognizing that the Polar Regions are extremely important in terms of their global impacts on weather, climate and water. It supported the need to establish an observational framework for Polar Regions, including the "Third Pole" (Himalaya and Tibetan Plateau) that balances space-based observations with in situ measurements while developing a methodology to address new observational requirements, including the identification of key polar variables from both a research and services perspective. Congress noted the success of the IPY Space Task Group (IPY-STG) in coordinating, across research and operational agencies, the planning, processing and archiving of Earth observation data sets supported the continuation of these efforts and requested the Executive Council to create the appropriate structures to oversee these future developments. Congress agreed that operational and research observing networks in Polar Regions should be integrated within the framework of the WMO Integrated Observing System (WIGOS) and the WMO Information System (WIS), be enhanced to include cryosphere related variables and it recognized that a major contribution to this objective will be through development of the Global Cryosphere Watch.

11.9.2 Congress agreed with the Executive Council that it is desirable to integrate all Antarctic networks into an Antarctic Observing Network (AntON) that will comprise all operational stations, all of which should produce climate messages, and adopted Resolution 55 (Cg-XVI) – Antarctic Observing Network. Congress also extended its appreciation to other organizations, such as the University of Wisconsin, who fund and operate over half of these stations as automatic weather stations (AWS). Congress also noted with appreciation that the *Manual on the Global Observing System* (WMO-No. 544) was reviewed and adopted Resolution 56 (Cg-XVI) – Amendments to the *Manual on the Global Observing System* (WMO-No. 544), Volume II, Regional Aspects – The Antarctic.

11.9.3 Congress noted with concern that data from many Antarctic stations funded by research agencies are not available in real-time and, therefore, are not available to NWP systems. It noted that the high communication cost involved in using Iridium satellites is also a limiting factor. Congress requested the Executive Council and the Secretary-General, in collaboration with CBS and JCOMM, to investigate possible ways to reduce such costs through an international forum of users of satellite data telecommunication systems. It also expressed its desire that WIS would provide a suitable environment for collection and dissemination of data from research observing stations.

11.9.4 Congress recognized the importance of the relationship between WMO and the Antarctic Treaty Consultative Meeting (ATCM) and strongly encouraged the Executive Council and the Secretary-General to work with the ATCM on issues of mutual responsibility and to ensure representation of WMO at future ATCM meetings.

11.9.5 Congress noted with interest the decadal initiative to develop a Global Integrated Polar Prediction System (GIPPS), capable of providing information to meet user needs for decision-making on timescales from hours to centuries. It noted the global benefits of such a system in enabling service delivery and developing observing strategies in Polar Regions, and in addressing key uncertainties in weather, climate, water and related environmental variability and change, thereby improving global prediction, contributing to all WMO high priorities, in particular Disaster Risk Reduction, and the Global Framework for Climate Services (GFCS). Congress agreed to embark on a multi-year endeavour towards GIPPS, as an IPY Legacy to benefit the global community. It also agreed that GIPPS shall engage regional associations, technical commissions, and relevant international organizations and academic research communities in the development of such a system. Noting the Concept Paper on GIPPS (see Annex XIII to the present report) and recognizing the importance of this initiative, Congress adopted Resolution 57 (Cg-XVI) – Global Integrated Polar Prediction System.

11.9.6 Congress agreed that "Services" are an important driver that anchors the work of WMO Polar Activities. It appreciated that the Executive Council has completed an initial inventory of existing weather, climate, water and cryosphere services currently provided in the Polar Regions and agreed that further consultations to validate user requirements should be conducted. Congress urged the Executive Council to develop a comprehensive description of the global community's polar service requirements and articulate the value to be delivered, and through mechanisms such as Polar Regional Climate Centres and Polar Climate Outlook Forums contribute to GFCS and by the GIPPS.

11.9.7 Congress noted with appreciation the accomplishments in WMO Polar Activities during the last four years. It noted that WMO Polar Activities were thus far funded from the PORS Trust Fund and encouraged Members to continue providing support to WMO's Polar Activities through this Trust Fund and through supporting activities identified in the Project Compendium for Voluntary Funding (2012–2015). Congress agreed that WMO needs to have a focus on polar observations, research and services to meet its responsibilities on regional and global weather, climate, water and related environmental matters, and adopted Resolution 58 (Cg-XVI) – WMO polar activities.

International Polar Decade Initiative

11.9.8 Congress noted with satisfaction that at the Workshop on International Polar Decade (IPD) Initiative (St. Petersburg, Russian Federation, April 2011) representatives from key international environmental organizations as well as from leading polar associations and institutions had unanimously supported an IPD initiative. Congress also noted the Nuuk Declaration of the Seventh Ministerial Meeting of the Arctic Council (12 May 2011, Nuuk, Greenland), which tasked the Senior Arctic Officials to consider supporting a proposal to arrange an International Polar Decade Initiative. Congress agreed that the IPD planning should continue to maintain the momentum generated by the IPY, to engage existing programmes and available resources, and to align them with the targeted set of objectives that would take a decade to advance.

11.9.9 Congress agreed with the workshop conclusion that any scientific efforts under the auspices of an IPD must be aligned to meeting broad societal needs such as WMO desired societal outcomes and be anchored on delivering better, more reliable scientific information to inform risk-based decision and policy making activities in the Polar Regions. In this light, the climate component of an IPD would have the potential to strongly contribute to the implementation of the Global Framework for Climate Services.

11.9.10 Congress further agreed that the scientific focus of an IPD should include topics such as:

(a) Development of improved polar weather, water, cryosphere and climate prediction systems and their use for service delivery and decision-making support;

(b) Better understanding of the polar climate predictability and the role of Polar Regions in the changes of the global carbon cycle and sea level;

(c) Optimization and development of observational methods, systems and networks in the Polar Regions;

(d) A "peoples, societies and cultures" initiative to integrate new understanding into practices and culture and improve livelihoods and health of indigenous and other northern communities and the ecosystems upon which they depend.

11.9.11 Congress expressed its deep appreciation to the WMO/ICSU IPY Joint Committee for the publication of a comprehensive summary of all IPY activities and its legacies given in "Understanding Earth's Polar Challenges: International Polar Year 2007–2008" (http://www.icsu.org/publications/reports-and-reviews/ipy-summary/ipy-summary) and pointed out that many elements of the IPY networks and initiatives described in the Summary could provide the building blocks for a comprehensive polar observing system in IPD. Congress confirmed that early establishment of data management arrangements and an open and free data access policy should be one of the first steps of IPD preparation if the initiative is to be launched. Continued support for existing data centres and related IPY legacy initiatives such as the Polar Information Commons (PIC) as well as early WIS involvement will be essential and necessary elements of the IPD.

11.9.12 Congress agreed that unlike the IPY, which was mostly a bottom-up collection of research with funding allocated on the basis of scientific merit within themes and focus areas that differed from nation to nation and from one funding agency to another, the IPD should address uniform programme goals that meet specific needs. The goals should be developed through interactions among stakeholders, funding agencies and the scientific community and should be implemented through the coordination and cooperation of funding agencies best equipped to help achieve the negotiated goals.

11.9.13 With respect of the IPD timeline, Congress recognized that there should be a balance between the need to keep the momentum of most important and promising activities developed during IPY and avoiding discontinuation of the current valuable activities, and the need to properly design, plan and support integrated IPD activities. The actual length and initiation of IPD should be determined as a part of the planning process and it should be noted that the IPD duration does not need to be exactly ten years.

11.9.14 Congress agreed that to move the IPD idea forward a consultative process would be needed. A steering group, in which key stakeholders would be represented, should be established in due course to lead the consultation and drafting process. Congress noted with appreciation and accepted the offer by the Workshop co-chairs to serve as initial leaders of such a group. The steering group should be supported by a small secretariat, which will help synthesizing information and preparing drafts of the IPD Concept Document. Congress agreed that WMO Members should further develop this Concept Document and noted with appreciation that the Research Council of Norway had kindly offered to seek some human resources for this purpose, and the International Arctic Science Committee would similarly provide some assistance. Congress agreed that WMO Secretariat will serve as the initial point of contact for such a secretariat. A critical milestone would be the Montreal 2012 IPY Conference "From Knowledge to Action", at which a draft IPD Concept Document would be reviewed, corresponding community decisions recommended, and possible commitments expressed. Congress adopted Resolution 59 (Cg-XVI) – International Polar Decade initiative.

Global Cryosphere Watch (GCW)

11.9.15 Congress stressed the importance of the cryosphere, noting that it is global, existing in various forms spanning all latitudes and occurring in approximately one hundred countries, in addition to the Antarctic continent. It noted the unparalleled demand for authoritative information on past, present and future state of the world's snow and ice resources.

11.9.16 Congress considered the "Implementation Strategy for the Global Cryosphere Watch" developed by the Executive Council's Panel of Experts on Polar Observations, Research and Services (EC-PORS). It noted that countries from all six Regions have expressed their desire to be involved in WMO's cryosphere initiative and especially noted the interest from Members, where snow and ice does not occur, but were concerned about the impact of a changing cryosphere on their nation through changes in weather, climate, water resources and sea level rise. Congress noted with appreciation the efforts of the Norwegian Meteorological Institute in developing a WIS compliant web portal for GCW that would be interoperable with NMHS and external cryospheric data centres.

11.9.17 Congress agreed with the next steps for developing GCW as outlined in the GCW Implementation Strategy (see Annex XIV to the present report). It encouraged Members to participate in the development of GCW and urged Members to support implementation on a shared basis through Project 4.4.1.50 on Implementation of activities of the EC Panel on Polar Observations, Research and Services (EC-PORS) in the Compendium for Voluntary Funding (2012–2015), thus complementing insufficient resources from the WMO regular budget. Congress agreed that WMO needs to have a focus on global cryosphere issues to be able to provide authoritative information to meet Members' responsibilities on regional and global weather, climate, water and related environmental matters, and adopted Resolution 60 (Cg-XVI) – Global Cryosphere Watch. Congress requested the Executive Council and the Secretary-General to oversee GCW's initial development to ensure optimal management of, and support to, the initiative. Congress also noted that GCW would be an important contribution of WMO to a potential International Polar Decade (IPD), if this were to be initiated.

12. ELECTIONS AND APPOINTMENTS *(agenda item 12)*

12.1 ELECTION OF THE PRESIDENT AND VICE-PRESIDENTS OF THE ORGANIZATION *(agenda item 12.1)*

12.1.1 Congress elected Mr David Grimes, Assistant Deputy Minister, Meteorological Service of Canada (MSC), Environment Canada, as President of the Organization.

12.1.2 Congress unanimously elected Dr Antonio Divino Moura, Director of the National Institute of Meteorology of Brazil, as First Vice-President.

12.1.3 Congress unanimously elected Prof. Mieczyslaw S. Ostojski, Director-General, Institute of Meteorology and Water Management (IMGW) of Poland, as Second Vice-President.

12.1.4 Congress unanimously elected Mr Abdalah Mokssit, Director, National Meteorological Service of Morocco, as Third Vice-President.

12.1.5 Congress expressed its deep gratitude to the President of WMO, Dr A.I. Bedritskiy, for his outstanding contribution and leadership to the Organization, to the promotion of meteorology and hydrology and the National Meteorological and Hydrological Services of the world. The Congress spoke with admiration of Dr Bedritskiy's dedication and wisdom as he steadied and steered WMO through the past eight years. Congress therefore decided to accord him the honorary title of "President Emeritus".

12.1.6 Congress also conveyed its indebtedness to the First Vice-President, Dr A.M. Noorian, and to the Second Vice-President, Mr T. Sutherland, for their invaluable contributions and unwavering support to the Organization over the past years.

12.2 ELECTION OF MEMBERS OF THE EXECUTIVE COUNCIL *(agenda item 12.2)*

Congress elected the following Directors of National Meteorological or Hydrometeorological Services of Members of the Organization as members of the Executive Council in accordance with the provisions of Article 13 (c) of the Convention.

Mr M.A. ABDEL GADIR	Sudan
Prof. Gerhard ADRIAN	Germany
Dr Anthony C. ANUFOROM	Nigeria
Dr Gregory Peter AYERS	Australia
Dr Alexander I. BEDRITSKIY	Russian Federation
Mr Seok-Joon CHO	Republic of Korea
Dr Héctor Horacio CIAPPESONI	Argentina
General Costante DE SIMONE	Italy
Mr Juan Carlos FALLAS SOJO	Costa Rica
Prof. Ricardo GARCÍA HERRERA	Spain
Dr Mitsuhiko HATORI	Japan
Dr John L. HAYES	United States of America
Mr John HIRST	United Kingdom of Great Britain and Northern Ireland
Dr François JACQ	France
Mr Camille LOUMOUAMOU	Congo
Dr Linda MAKULENI (Ms)	South Africa
Dr Saad Mohamad S. MOHALFI	Saudi Arabia
Dr Joseph Romanus MUKABANA	Kenya
Mr Carlos NARANJO JACOME	Ecuador
Mr Mactar NDIAYE	Senegal
Mr Jacob NKOMOKI	Zambia
Mr Tyrone SUTHERLAND	British Caribbean Territories
Prof. Petteri TAALAS	Finland
Dr Ajit TYAGI	India
Mr Alipate WAQAICELUA	Fiji
Mr YAP Kok Seng	Malaysia
Dr ZHENG Guoguang	China

12.3 APPOINTMENT OF THE SECRETARY-GENERAL *(agenda item 12.3)*

Congress appointed Mr Michel Jarraud as the Secretary-General of the Organization for the sixteenth financial period.

13. SCIENTIFIC LECTURES *(agenda item 13)*

IMO Lecture

13.1 The twelfth IMO Lecture was delivered at Sixteenth Congress by Professor Brian Hoskins (United Kingdom) on the subject of "Predictability beyond Deterministic Limit". It was noted that the study undertaken by Professor Hoskins would be published by WMO in the series of IMO Lectures.

13.2 Congress agreed that in continuation of the tradition, an IMO Lecture should be delivered at Seventeenth Congress and requested the Executive Council to make the necessary arrangements, including the selection of the lecturer and the theme for the thirteenth IMO Lecture.

Scientific lectures

13.3 A programme of scientific discussions had been arranged by the Executive Council in accordance with the decisions of Thirteenth Congress. The following lectures were presented to the Congress:

(a) From observations to service delivery: challenges and opportunities (Dr Adrian Simmons, ECMWF);

(b) Future of modelling weather and climate in the tropics (Prof. Taroh Matsuno, Japan, 55th IMO Prize winner).

13.4 Congress wished to place on record its thanks for the time and preparation undertaken by Prof. Hoskins, Dr Simmons and Prof. Matsuno in presenting their lectures.

13.5 Congress noted that the texts of the lectures would be published by WMO in a suitable form and requested the Secretary-General to take appropriate action.

13.6 Congress also decided that a programme for scientific discussions should be arranged for Seventeenth Congress and requested the Executive Council to select themes for that purpose and to make the necessary arrangements.

14. DATE AND PLACE OF SEVENTEENTH CONGRESS *(agenda item 14)*

14.1 Congress decided that Seventeenth Congress should be held in Geneva from Monday, 25 May to Friday, 12 June 2015, subject to any change which might be decided by the Executive Council.

14.2 Congress noted the efficiency gains made at its sixteenth session including use of electronic voting and extensive use of electronic documentation and encouraged the Executive Council to consider further utilization in line with its guidance under agenda item 7.4 on improvement of WMO Processes and Practices.

15. CLOSURE OF THE SESSION *(agenda item 15)*

Sixteenth Congress closed at 6.27 p.m. on 3 June 2011.

RESOLUTIONS ADOPTED BY THE SESSION

Resolution 1 (Cg-XVI)

WORLD WEATHER WATCH PROGRAMME FOR 2012–2015

THE CONGRESS,

Recalling:

(1) Resolution 2 (Cg-XV) – World Weather Watch Programme for 2008–2011,

(2) Resolution 64/86 of the United Nations General Assembly – International cooperation in the peaceful uses of outer space,

Noting:

(1) The *Abridged Final Report with Resolutions of the Fifteenth World Meteorological Congress* (WMO-No. 1026), general summary, agenda item 3.1,

(2) The *Abridged Final Report with Resolutions and Recommendations of the Fourteenth Session of the Commission for Basic Systems* (WMO-No. 1040),

(3) The *Abridged Final Report with Resolutions and Recommendations of the Fifteenth Session of the Commission for Instruments and Methods of Observation* (WMO-No. 1064),

(4) The *Abridged Final Report with Resolutions and Recommendations of the Extraordinary Session 2010 of the Commission for Basic Systems* (WMO-No. 1070),

Expresses:

(1) Its satisfaction that progress has been made in the further improvement of the operation of the World Weather Watch (WWW) Programme during the period 2008–2011;

(2) Its concern that deficiencies remain in the implementation of the WWW Programme in some areas;

(3) The need for intensified and coordinated activities for the operation and maintenance of the WWW Programme in support of other WMO Programmes and high-priority areas to meet the objectives of the WMO Strategic Plan and maximize the benefits available to all Members;

Confirms:

(1) That the WWW Programme has the highest priority as the basic WMO Programme on which all other Programmes of the Organization depend and that it provides the basis for the operations of National Meteorological and Hydrological Services;

(2) That the WWW Programme continues to provide an effective mechanism for the application of science and technology in operations;

(3) That the WWW Programme contributes to the WMO Strategy for Service Delivery;

(4) That the WWW Programme should be used only for peaceful purposes, due account being taken of the national sovereignty and security of States, in accordance with the provisions of the Charter of the United Nations and the spirit and tradition of the Convention of the World Meteorological Organization;

Considering:

(1) The absolute importance of weather, climate and water observations for determining the current state of the atmosphere, for weather forecasting, including severe weather forecasting and warning services, for monitoring climate variability and climate change, for climate prediction and as a fundamental underpinning of the Global Framework for Climate Services,

(2) That advanced technology for improving the technical systems of the WWW Programme calls for special efforts in the provision of technical guidance, specialized training and capacity-building,

Decides that the purpose, scope and main long-term objectives of the WWW Programme shall be aligned with the WMO Strategic Plan and high priorities of WMO;

Stresses the role to be played by regional associations in coordinating the WWW Programme implementation, identifying deficiencies, specifying requirements, and planning system support projects on a regional scale;

Invites the regional associations to promote the coordinated implementation of the WWW Programme and to keep under continuous review related regional requirements;

Requests the Executive Council:

(1) To ensure that the further development of the WWW Programme is carried out with the highest priority and in accordance with the WMO Strategic Plan;

(2) To adjust the WWW Programme as necessary, particularly in light of the recommendations made by the Commission for Basic Systems and the regional associations;

(3) To assist Members in all possible ways in meeting their respective responsibilities within the WWW Programme;

(4) To promote the establishment of cooperative arrangements for the implementation, operation and maintenance of WWW Programme component systems, as appropriate;

Requests the Commission for Basic Systems:

(1) To pursue the technical planning and further development of the WWW Programme in accordance with the WMO Strategic Plan, taking into account any adjustments and directives from the Executive Council;

(2) To take a leading role, together with the Commission for Instruments and Methods of Observation, in the technical development and implementation of the Global Observing System (GOS), as the key component of the WMO Integrated Global Observing System (WIGOS), to meet, in an optimal way, the requirements of all WMO and co-sponsored Programmes;

(3) To pursue its leading role in the technical implementation and operation of the WMO Information System (WIS), including the Global Telecommunication System (GTS) as its core

network, for the collection and sharing of information for all WMO and related international programmes;

(4) To pursue its leading role to enhance the implementation of the Global Data-processing and Forecasting System (GDPFS) through increased lead time and reliability of forecasts and warnings, and its critical support to the delivery of services to the general public as well as to all relevant socio-economic sectors;

(5) To maintain close liaison with the other technical commissions, the regional associations, other relevant international organizations and international programmes, in particular the Global Climate Observing System (GCOS), with a view to ensuring that their relevant requirements and recommendations are taken into due consideration;

Urges all Members, especially donor countries, individually and through appropriate multinational arrangements, to cooperate actively in the further development and operation of the World Weather Watch, and in particular:

(1) To continue, to the best of their ability, to further develop, implement, operate and maintain the WWW Programme component systems (observation, information, data-processing and forecasting components) and to ensure that the requirements of Members for the provision of services and products are fully met;

(2) To contribute to the implementation and operation of WIGOS, WIS and GDPFS and participate in their projects;

(3) To coordinate and pool their national efforts and resources in order to establish realistic goals, minimize the implementation and operational costs, and avoid duplication of WWW Programme activities as far as possible;

(4) To participate in the deployment and use of new systems and techniques, including appropriate capacity-building activities, and individually or collectively, to evaluate their effectiveness and their integration into the WWW Programme;

(5) To keep the Secretary-General informed about their plans and activities regarding the implementation of the WWW Programme;

Requests the Secretary-General:

(1) To keep the Members informed of progress and developments in the planning and implementation of the WWW Programme;

(2) To continue to improve the monitoring of the operation of the WWW Programme and the publication of results;

(3) To assist Members, as necessary, in overcoming difficulties that may arise in the implementation of the WWW Programme during the sixteenth financial period;

(4) To propose projects and priorities for the consolidation and further development of key WWW Programme facilities;

(5) To assist the Executive Council, the regional associations and the Commission for Basic Systems in the implementation of this resolution;

(6) To bring this resolution to the attention of all concerned;

(7) To submit a report to the Seventeenth World Meteorological Congress on the implementation of the WWW component systems during the sixteenth financial period, together with proposals for further development of the World Weather Watch.

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Note: This resolution replaces Resolution 2 (Cg-XV), which is no longer in force as of 1 January 2012.

Resolution 2 (Cg-XVI)

TERMS OF REFERENCE OF THE COMMISSION FOR BASIC SYSTEMS

THE CONGRESS,

Having considered the *Abridged Final Report with Resolutions and Recommendations of the Extraordinary Session 2010 of the Commission for Basic Systems* (WMO-No. 1070),

Noting:

(1) The *Abridged Final Report with Resolutions of the Fifteenth World Meteorological Congress* (WMO-No. 1026),

(2) The final reports of the 2009 Meeting of Presidents of Technical Commissions (Geneva, February 2009) and the 2010 Meeting of Presidents of Technical Commissions (Geneva, January 2010),

(3) The *Abridged Final Report with Resolutions of the Sixty-second Session of the Executive Council* (WMO-No. 1059),

(4) The *WMO Strategic Plan* (WMO-No. 1028),

(5) Recommendation 8 (CBS-Ext.(10)) – Terms of Reference of the Commission for Basic Systems,

Considering the new preamble to be incorporated in the WMO General Regulations on the general terms of reference of technical commissions as proposed by the Executive Council,

Recognizing that the terms of reference of technical commissions should be aligned with the long-term priorities of the Organization, the WMO Results-based Management approach and overall Organization objectives and Strategic Thrusts,

Decides that the previous terms of reference of CBS be amended as provided in Annex 2 to Resolution 43 (Cg-XVI) – Terms of reference of the technical commissions;

Requests the Secretary-General to make the necessary amendments to the WMO General Regulations;

Authorizes the Secretary-General to make any consequent purely editorial amendments.

Resolution 3 (Cg-XVI)

GLOBAL OBSERVING SYSTEM

THE CONGRESS,

Noting:

(1) Article 2 of the Convention of the World Meteorological Organization,

(2) Resolution 3 (Cg-XV) – Global Observing System,

(3) Resolution 36 (Cg-XVI) – WMO Strategic Plan (2012–2015),

(4) Resolution 50 (Cg-XVI) – Implementation of the WMO Integrated Global Observing System,

(5) Resolution 48 (Cg-XVI) – Implementation of the Global Framework for Climate Services,

(6) Resolution 40 (Cg-XII) – WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities,

(7) Resolution 1 (Cg-XVI) – World Weather Watch Programme for 2012–2015,

Considering:

(1) That the Global Observing System (GOS) is a unique international observing system consisting of surface-based and space-based components owned and operated by Members which provides unique and sustainable observational data and information on the state of the Earth and its atmosphere to meet evolving requirements of various users,

(2) That GOS, as a core component of the World Weather Watch (WWW) Programme, is a backbone for the implementation of other WMO observational programmes and projects, including the Global Cryosphere Watch,

(3) That GOS will become one of the core components of the WMO Integrated Global Observing System (WIGOS), to be implemented in 2012–2015, and that the evolution of GOS will be closely linked with the evolution of WIGOS,

(4) That investments of Members in the sustainable operation of an evolving GOS have ensured the provision of operational data for a wide range of basic services that Members provide to the user community, such as weather and climate analysis, forecasts and warnings on the national, regional and global levels, to mention a few,

(5) That GOS ensures a continuous acquisition of the majority of Essential Climate Variables for the monitoring and forecasting of climate changes, and for the Global Framework for Climate Services (GFCS), as well as for other international initiatives,

Reaffirms:

(1) That sustainable operation of GOS has a vital role and highest priority for WMO in providing observational data to meet the requirements of weather forecasts and warnings, climate monitoring and other strategic tasks of the Organization;

(2) The need for strengthening GOS to meet the evolving requirements of various users and in particular to provide timely and reliable information for natural disaster prevention and mitigation;

(3) That GOS, through the coordinated efforts of Members, should continue its fundamental mission in providing timely, reliable and consistent meteorological data to meet the requirements of various users worldwide;

Urges Members:

(1) To give all possible support to the implementation of national observational programmes contributing to GOS;

(2) To ensure the sustainable operation of GOS and encourage activities with respect to the optimization of observing elements and development and deployment of the advanced composite system, with priority given to projects in the following order:

(a) Projects aimed at restoring and improving the existing upper-air observational capabilities of the Regional Basic Synoptic Networks/Regional Basic Climatological Networks (RBSNs/RBCNs), with emphasis on Global Climate Observing System (GCOS) Surface Network/GCOS Upper-Air Network (GSN/GUAN) stations, as well as the building of new facilities, especially the activation of silent upper-air stations and the improvement of coverage over data-sparse areas;

(b) Projects aimed at extending Aircraft Meteorological DAta Relay (AMDAR) coverage to developing countries, least developed countries and small island developing States to supplement scarce upper-air observations or to provide a cost-effective alternative to countries that cannot afford costly upper-air sounding systems;

(c) Projects related to the improvement of data quality, regularity and coverage of RBSN/RBCN surface observations;

(d) Projects related to the introduction and/or use of new observing equipment and systems including, where cost-effective, surface-based remote-sensing systems (weather radars and wind profiles), automatic weather stations, AMDAR, the Automated Shipboard Aerological Programme (ASAP) and drifting buoys;

(3) To follow guidelines and recommendations contained in the *Implementation Plan for Evolution of Space and Surface-Based Sub-systems of the GOS (EGOS-IP)*, published as WMO/TD-No. 1267, and nominate/update a national point of contact responsible for reporting progress and plans in their country related to EGOS-IP;

(4) To continue providing contributions to the AMDAR Trust Fund for the support of technical developments and capacity-building related to AMDAR;

Encourages Members:

(1) To keep supporting the Observing System Experiments (OSEs) and Observing System Simulation Experiments (OSSEs) aimed at testing the impact of the individual observing systems on numerical weather prediction (NWP);

(2) To communicate historical data and metadata from their GSN/GUAN stations to CBS Lead Centres for GCOS;

(3) To increase the use of automatic weather observing systems where they enable cost–effective, real-time measurements, compatible with data from conventional systems, with a level of quality and reliability suitable to all climate conditions;

Invites the regional associations to promote the coordinated implementation of GOS in the Regions through sustainable functioning of RBSNs/RBCNs and to keep under continuous review related regional requirements;

Requests the Executive Council to continue its review and constructive guidance in the development of GOS for the benefits of all Members;

Requests the Commission for Basic Systems:

(1) To develop the new Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP) in coordination with the regional associations, taking into account the Vision for the GOS in 2025, WIGOS and GFCS, to guide Members in the implementation of their national observational programmes;

(2) To pursue its leading role in the technical planning and development of GOS in close collaboration with relevant technical commissions in support of all WMO and related international programmes and initiatives;

(3) To assist Members and regional associations in the continued evolution of the global observing systems;

(4) To develop a mechanism to assess the performance of OSEs and OSSEs undertaken by Member countries and to communicate the benefits earned thereby, to other Member countries;

Requests the Secretary-General:

(1) To assist Members, within the budgetary resources available, in the implementation of the GOS Programme during the sixteenth financial period;

(2) To keep the Members informed of progress and developments in the planning and implementation of the GOS;

(3) To consider in future the funding of AMDAR activity from the WMO Regular Budget.

Note: This resolution replaces Resolution 3 (Cg-XV), which is no longer in force.

Resolution 4 (Cg-XVI)

REPORT OF THE EXTRAORDINARY SESSION (2010) OF THE COMMISSION FOR BASIC SYSTEMS RELEVANT TO TECHNICAL REGULATIONS CONCERNING THE GLOBAL TELECOMMUNICATION SYSTEM, DATA MANAGEMENT AND THE WMO INFORMATION SYSTEM

THE CONGRESS,

Having considered the *Abridged Final Report with Resolutions and Recommendations of the Extraordinary Session 2010 of the Commission for Basic Systems* (WMO-No. 1070),

Noting:

(1) Resolution 1 (Cg-XV) – Technical Regulations of the World Meteorological Organization,

(2) Resolution 2 (Cg-XV) – World Weather Watch Programme for 2008–2011,

(3) The decision of the Fourteenth World Meteorological Congress to establish an overarching WMO Information System (WIS) that would be used for the collection and sharing of information for all WMO and related international programmes,

(4) The *Technical Regulations* (WMO-No. 49), Volume I – General Meteorological Standards and Recommended Practices, Section A.3,

(5) Recommendation 1 (CBS-Ext.(10)) – Amendments to the *Manual on Codes* (WMO-No. 306), Introduction Chapter of Volumes I.1 and I.2; Recommendation 2 (CBS-Ext.(10)) – Amendments to the *Manual on Codes* (WMO-No. 306), Volume I.1; Recommendation 3 (CBS-Ext.(10)) – Amendments to the *Manual on the Global Telecommunication System* (WMO-No. 386), Volume I, Part II; Recommendation 5 (CBS-Ext.(10)) – Amendments to the *Technical Regulations* (WMO-No. 49), Volume I, Section A.3; Recommendation 6 (CBS-Ext.(10)) – The *Manual on the WMO Information System* (WMO-No.1060),

Recalling:

(1) That Fifteenth Congress emphasized the need for appropriate WMO Information System (WIS) regulatory documentation and charged the Commission for Basic Systems (CBS) with the development of regulatory documentation,

(2) That the Executive Council, at its sixty-second session, emphasized the importance of appropriate WIS regulatory and guidance documentation and requested the Inter-Commission Coordination Group on the WMO Information System (ICG-WIS) and CBS to prepare amendments to the relevant section of WMO-No. 49 – *Technical Regulations*, and the *Manual on the WMO Information System*, for consideration by Sixteenth Congress,

Decides to take action on each of the recommendations as follows:

Recommendation 1 (CBS-Ext.(10)) – Amendments to the *Manual on Codes* (WMO-No. 306), Introduction Chapter of Volumes I.1 and I.2

Recommendation 2 (CBS-Ext.(10)) – Amendments to the *Manual on Codes* (WMO-No. 306), Volume I.1

(1) Approves these recommendations, with effect from:

(a) 1 July 2011 for applying the procedures for amending the *Manual on Codes* as defined in the Annex to Recommendation 1 (CBS-Ext.(10));

(b) 2 November 2011 for amendments to the *Manual on Codes* for operational use as defined in the Annex to Recommendation 2 (CBS-Ext.(10));

(2) Requests the Secretary-General to make the amendments, as given in the annexes to these recommendations, to the *Manual on Codes;*

(3) Authorizes the Secretary-General to make any consequent editorial amendments;

Recommendation 3 (CBS-Ext.(10)) – Amendments to the *Manual on the Global Telecommunication System* (WMO-No. 386), Volume I, Part II

(1) Approves this recommendation, with effect from 2 November 2011;

(2) Requests the Secretary-General to make the amendments, as given in the annexes to this recommendation, to the *Manual on the Global Telecommunication System;*

(3) Authorizes the Secretary-General to make any consequent purely editorial amendments;

Recommendation 5 (CBS-Ext.(10)) – Amendments to the *Technical Regulations* (WMO-No. 49), Volume I, Section A.3

Recommendation 6 (CBS-Ext.(10)) – The *Manual on the WMO Information System* (WMO-No. 1060)

(1) Approves these recommendations, with effect from 1 January 2012;

(2) Requests the Secretary-General:

(a) To make the amendments, as given in the annexes to these recommendations, to the *Technical Regulations*, Volume I – General Meteorological Standards and Recommended Practices, Section A.3;

(b) To publish the *Manual on the WMO Information System*, in all the WMO official languages;

(3) Authorizes the Secretary-General to make any consequent editorial amendments.

Resolution 5 (Cg-XVI)

REPORT OF THE EXTRAORDINARY SESSION (2010) OF THE COMMISSION FOR BASIC SYSTEMS RELEVANT TO THE GLOBAL DATA-PROCESSING AND FORECASTING SYSTEM AND EMERGENCY RESPONSE ACTIVITIES

THE CONGRESS,

Having considered the *Abridged Final Report with Resolutions and Recommendations of the 2010 Extraordinary Session of the Commission for Basic Systems* (WMO-No. 1070), relevant to

the Global Data-processing and Forecasting System (GDPFS) and Emergency Response Activities (ERA),

Noting Recommendation 7 (CBS-Ext.(10)) – Amendments to the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485),

Decides to approve this recommendation to take effect from 1 July 2011;

Requests the Secretary-General to incorporate the amendments in the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485);

Authorizes the Secretary-General, in consultation with the president of the Commission for Basic Systems, to make any purely editorial amendments to the *Manual on the Global Data-processing and Forecasting System*.

Resolution 6 (Cg-XVI)

REVISED *MANUAL ON THE GLOBAL DATA-PROCESSING AND FORECASTING SYSTEM* (WMO-No. 485)

THE CONGRESS,

Noting the *Abridged Final Report with Resolutions and Recommendations of the 2010 Extraordinary Session of the Commission for Basic Systems* (WMO-No. 1070), general summary, agenda item 4.4,

Considering:

(1) The *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485) as the single source of technical regulations and best practices for all operational data-processing and forecasting systems of Members, including their designated meteorological centres,

(2) That the Executive Council, at its sixty-first session (in 2009), endorsed the request by the Commission for Basic Systems (CBS), made at its fourteenth session, to undertake a comprehensive review of the *Manual on the Global Data-processing and Forecasting System*,

Noting further:

(1) The subsequent progress and productive work of CBS experts in relation to the development of an outline for a new revised Manual,

(2) The fundamental changes in the basic systems, including the WMO Integrated Global Observing System (WIGOS) and the WMO Information System (WIS),

Agrees that the revision of the *Manual on the Global Data-processing and Forecasting System* would facilitate the introduction of updates as frequently as required to ensure that the content is kept up to date;

Decides that the revision of the *Manual on the Global Data-processing and Forecasting System* should take into account:

(1) The existing system of world, regional and national centres of the Global Data-processing and Forecasting System (GDPFS) and the future evolution of the GDPFS, which should include all WMO-operated meteorological centres that provide operational data-processing and forecasting services;

(2) The developments in WIGOS and WIS;

(3) The lessons learned from the Severe Weather Forecasting Demonstration Project (SWFDP);

(4) The anticipated results of, and operational implications from, the Global Interactive Forecasting System project under the World Weather Research Programme/THe Observing system Research and Predictability Experiment (THORPEX) Interactive Grand Global Ensemble (WWRP/TIGGE);

(5) The quality management principles, which would ensure quality assurance and management measures for the GDPFS, as well as its sustainability as part of the WMO Quality Management Framework (QMF);

(6) The annex to this resolution, which should be further improved;

Decides further:

(1) That Volume II of the Manual (Regional Aspects), which has no regulatory status for Members, should be reviewed and the relevant parts, including the Regional Climate Centre (RCC) network composition, as well as a list of products and the possibility of designating one or more Regional Specialized Meteorological Centres (RSMCs) for polar regions, should be incorporated into the revised Manual;

(2) The new revised *Manual on the Global Data-processing and Forecasting System* should be based on the outline given in the annex to this resolution;

Affirms the authority of the Executive Council:

(1) To approve amendments to the current version of the *Manual on the Global Data-processing and Forecasting System* if they need to be implemented before the time of the Seventeenth Congress;

(2) To adopt the new revised *Manual on the Global Data-processing and Forecasting System* if completed before the time of the Seventeenth Congress, noting that the revised Manual would not compromise the operation and development of the GDPFS;

Invites Members to collaborate in, and give all possible support to, the development and implementation of the revised *Manual on the Global Data-processing and Forecasting System*;

Requests the Secretary-General:

(1) To ensure coordination with other components of the World Weather Watch (WWW), primarily with the emerging WIGOS and WIS, so that the observational and data management aspects related to the GDPFS are included in relevant regulatory documentation;

(2) To arrange for coordination among WMO Programmes and relevant technical commissions to ensure that all WMO-operated meteorological centres that provide operational

data-processing and forecasting services are included in the *Manual on the Global Data-processing and Forecasting System*;

(3) To keep the current version of the *Manual on the GDPFS* in force until the completion of the new revised Manual;

(4) To arrange for the revision of the Manual to be continued so as to achieve its earliest possible completion, subsequent adoption and publication in all WMO official languages.

Annex to Resolution 6 (Cg-XVI)

OUTLINE OF A REVISED *MANUAL ON THE GLOBAL DATA-PROCESSING AND FORECASTING SYSTEM*

PART I – PURPOSE AND ORGANIZATION OF THE WMO GLOBAL DATA-PROCESSING AND FORECASTING SYSTEM (GDPFS)

1. PURPOSE OF THE GDPFS

The Global Data-processing and Forecasting System is the worldwide network of operational centres operated by WMO Members, delivering a wide range of products for applications related to weather, climate, water and environment. The functions, organizational structure and operations of the GDPFS are designed in accordance with Members' needs and their ability to contribute to, and benefit from, the system. A key objective is to facilitate cooperation and the exchange of information, thereby also contributing to building capacity amongst Members from developing countries.

This shall be achieved through:

(a) Making available numerical weather prediction products (analysis and forecast, including probabilistic information) and climate modelling and prediction information;

(b) Making available specialized products tailored for specific applications;

(c) Ensuring that the necessary additional information is available for an appropriate use of the above. This includes non real time information such as:

- Systems and products description and characteristics;
- Verification and monitoring results.

The GDPFS is a results-oriented structure, aimed at ensuring that scientific and technological advances made in meteorology and related fields are transferred as efficiently as possible in operational conditions for the benefit of WMO Members. It provides a framework to ensure that products and services delivered within its scope meet stated requirements, agreed at the appropriate level, on operational quality and reliability.

The GDPFS makes full use of the latest research and development in numerical weather prediction. The advances in NWP since the previous full edition of this Manual in 1992 have been tremendous: higher accuracy, higher resolution, longer lead-time, wider range of relevant applications. Consequently the emphasis in operational meteorology has shifted towards the

implementation of more and more sophisticated and diverse numerical models and applications, for an ever increasing variety of users.

The main support for the exchange and delivery of GDPFS products is the WIS. One of the key features of the WIS compared to the GTS is the expansion of the range of centres which can connect to the system; this feature will help to support the continuous increase in the range of GDPFS applications.

2. ORGANIZATION OF THE GDPFS

The GDPFS is composed of a variety of operational centres committed to perform specific operational activities, and to enable WMO Members to benefit from them. The activities can be either for general purpose or specialized for various types of applications; operational coordination activities (often referred to as Lead Centre activities) are also part of the GDPFS. The functions and commitments associated to each category of activity are detailed in part II of the Manual.

– General-purpose activities:
  2.1.1. Global NWP
  Run deterministic global numerical weather prediction operationally and make it available on the WIS
  2.1.2. Limited area NWP
  2.1.3. Global ensemble prediction
  2.1.4. Limited area ensemble prediction
  2.1.5. Nowcasting
  Post-processing of observation and numerical model output
  2.1.6. Seasonal and climate numerical prediction
  GPC business
  2.1.7. Wave and storm surges numerical forecasting

– Specialized activities:
  2.2.1. Coordination of high impact weather forecasts (e.g. Pretoria in the SWFDP for SE Africa)
  2.2.2. Climate prediction and information
  RCC business
  2.2.3. Generation of LRF MME products
  2.2.4. Tropical cyclone forecasting
  2.2.5. Volcanic ash warning and prediction for aviation
  2.2.6. Response to Marine Environmental Emergencies
  2.2.7. Response to Nuclear Environmental Emergencies
  2.2.8. Response to non-Nuclear Environmental Emergencies
  2.2.9. Sand and Dust Storm warning and prediction
  2.2.10. ...

– Coordination activities:
  2.3.0. Coordination of deterministic NWP verification
  Collect standard verification statistics from GDPFS centres producing global NWP and make them available on a dedicated website
  2.3.1. Coordination of EPS verification results
  2.3.2. Coordination of LRF verification results
  2.3.3. Coordination of wave forecast verification
  2.3.4. Coordination of GOS observation monitoring results (surface, upper-air, etc.)
  2.3.5. Coordination of GCOS observation monitoring results (GSN and GUAN)
  2.3.6. ...

A given GDPFS centre can perform several types of GDPFS activities.

Where appropriate, the centres contributing to an activity of a given type can be organized as a coordinated network, or sub-system. A given GDPFS centre can contribute to several sub-systems.

3. COORDINATION WITH OTHER SYSTEMS OR PROGRAMMES

In many cases the activities undertaken by GDPFS centres are constitutive of the operational component of a system developed under another structure or programme, either by WMO on its own or jointly with other international organizations. In such cases, the regulations pertaining to these activities should cover both:

– The specific requirements defined by the relevant structure (e.g. CCl for the Regional Climate Centres (RCCs), ICAO International Airways Volcano Watch Operations Groups (IAVWOPS-G) and International Volcanic Ash Task Force (IVATF) for the Volcanic Ash Advisory Centres (VAACs)); and

– The general GDPFS criteria regarding operational quality and reliability, verification, documentation and compliance (cf. II.1).

The coordination mechanism to that effect is not the same across all the categories of activity; it is specified for each activity in part II of the Manual.

PART II – SPECIFICATIONS OF THE GDPFS ACTIVITIES

1. OVERALL REQUIREMENTS

Description in general terms of the functions which are always required (details to be given in paragraph. 2):

1.1. Acquisition of observational data
   i. Real time quality control
   ii. Non real time monitoring and reporting
1.2. Product dissemination via the WIS
1.3. Products verification *(in accordance with specific procedures where available, e.g. SVS-LRF)*

User oriented

1.4. Providing and keeping up-to-date documentation on system and products *(preferably on a website)*
1.5. Reporting on compliance *(preferably by maintaining appropriate status of implementation information available on a website)*

2. SPECIFIC FUNCTIONS

For every activity listed in Part I (2.1.1 to 2.3.6):

- *Le cas échéant:* designation of the system or network involved (e.g. GMDSS, VAAC, SDS-WAS, RCC-network)
- *Description* of the required functions and implied commitments, or reference to appropriate documentation where it exists:
  - Mandatory functions
    - Geographical area of responsibility where appropriate
  - Mandatory product dissemination
  - Mandatory verification results
  - Mandatory status of implementation information

Additional recommended functions and products to be mentioned in Attachment

Example for activity 2.1.1, global NWP

- The centres participating in activity 2.1.1, global NWP, shall:
  - Prepare global analyses of the three-dimensional structure of the atmosphere
  - Prepare global forecast fields of basic and derived atmospheric parameters
  - Make available on the WIS a range of these products. The minimum list to be made available, including parameters, forecast range, time steps, production time window and frequency, is given in Appendix XXX
  - Prepare verification statistics according to the standard defined in Appendix XXX', and make them available to the centre(s) participating in the coordination of deterministic NWP verification
  - Make available on a website up-to-date information on the characteristics of its global NWP system. The minimum information to be provided is given in Appendix XXX''

Example for activity 2.3.1, coordination of deterministic NWP verification

- The centre(s) participating in activity 2.3.1, coordination of deterministic NWP verification, shall be designated as Lead Centre(s) for deterministic NWP verification
- These centre(s) shall:
  - Provide the facility for the GDPFS Centres producing global NWP to automatically deposit their standardized verification statistics as defined in Appendix XXX, and give all participating Centres access to these verification statistics
  - Maintain an archive of the verification statistics to allow the generation and display of trends in performance
  - Monitor the received verification statistics and consult with the relevant participating centre if data is missing or suspect
  - Provide access to standard data sets needed to perform the standard verification, including climatology and lists of observations and keep this up to date according to CBS recommendation
  - Provide on its (their) website(s):
    - Consistent up-to-date graphical displays of the verification results from participating Centres through processing of the received statistics
    - Relevant documentation including access to the standard procedures required to perform the verification, and links to the websites of GDPFS participating Centres
    - Contact details to encourage feedback from NMHSs and other GDPFS Centres on the usefulness of the verification information
- These centre(s) may also provide access to standardized software for calculating scoring information.

3. PROCEDURES FOR MODIFICATIONS

For every activity listed in part I (2.1.1 to 2.3.5):

- Indication of the body responsible for defining the requirements listed in paragraph 2 In case of joint responsibility: indication of the coordination mechanism (e.g. for RCCs: joint CCl - CBS/DPFS task team; for VAAC: etc.)

Example for activity 2.1.1, global NWP

- The functions required from GDPFS centres running global NWP shall be proposed by the ICT of the CBS OPAG on Data-processing and Forecasting Systems, subject to CBS approval and EC decision

Example for activity 2.3.1, coordination of deterministic NWP verification

- The functions required for the coordination of deterministic NWP verification shall be proposed by the CBS coordination group on forecast verification, subject to CBS approval and EC decision
- Indication of the body responsible for monitoring compliance

Example for activity 2.1.1, global NWP

- The compliance of the GDPFS centres running global NWP shall be monitored by the ICT of the CBS OPAG on Data-processing and Forecasting Systems, who will report to CBS accordingly

Example for activity 2.3.1, coordination of deterministic NWP verification

- The compliance of the centre(s) participating in the coordination of deterministic NWP verification shall be monitored by the CBS coordination group on forecast verification, who will report to CBS accordingly

PART III – GDPFS IMPLEMENTATION

1. *For every activity listed in Part I (2.1.1 to 2.3.6):*

- List of centres and relevant web address with status of implementation information

2. *For every centre contributing to the GDPFS:*

- List of activities undertaken

Resolution 7 (Cg-XVI)

INSTRUMENTS AND METHODS OF OBSERVATION PROGRAMME

THE CONGRESS,

Noting:

(1) Resolution 5 (Cg-XV) – Instruments and Methods of Observation Programme,

(2) That the Commission for Instruments and Methods of Observation (CIMO) at its fifteenth session approved changes to the *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8),

Considering:

(1) The continued need for the provision of high-quality, compatible and homogeneous meteorological data, which are of the utmost importance for operational and research activities of WMO Members,

(2) The need for continuous standardization of instruments and observing methods and worldwide traceability of measurements to the International System (SI) of units,

(3) The need for more robust instruments capable of withstanding severe weather events and measuring associated extreme meteorological, hydrological and related variables and the need for continuous improvement of related observing technologies and methodologies,

(4) The importance of applying new technology for the cost-effective generation of measurements and acquisition of observational data,

(5) The need to ensure interoperability among observing technologies and systems to effectively implement the WMO Integrated Global Observing System (WIGOS),

(6) The continuing need for training of instrument specialists and technicians for the operation, maintenance and calibration of observing technology, especially individuals from developing countries,

(7) The need to continue to carry out intercomparisons of instruments and observing systems,

(8) The need for continuing close collaboration of CIMO with other WMO technical commissions and Programmes, for meeting their requirements and those of all WMO high priorities, such as WIGOS, Disaster Risk Reduction (DRR) and the Global Framework for Climate Services (GFCS), for measurements and observations,

(9) The role of the Regional Instrument Centres, Regional Marine Instrument Centres, and Regional Radiation Centres (RICs, RMICs, RRCs) in promoting instrument calibration, training and capacity-building,

(10) The role that CIMO Testbeds and instrument Lead Centres will play in the integration of various surface-based remote-sensing systems, as well as cost-effective development of conventional and automatic observing systems within the WIGOS framework,

Reaffirms that WMO, in further developing and implementing its Instruments and Methods of Observation Programme, should continue its collaboration with international bodies such as the International Organization for Standardization (ISO), the International Bureau of Weights and Measures (BIPM) and European Cooperation in the Field of Scientific and Technical Research (COST), as well as with the Association of Hydro-Meteorological Equipment Industry (HMEI);

Requests the Executive Council, with the assistance of CIMO and other relevant technical commissions, to promote, guide and assist in the implementation of the WMO Instruments and Methods of Observation Programme;

Urges the regional associations:

(1) To continue providing proactive support for regional aspects of the Instruments and Methods of Observation Programme, especially as regards capacity-building;

(2) To assess, together with CIMO, the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), or a relevant national/international agency, at least every five years, existing RICs, RMICs and RRCs to verify their capabilities and performance;

(3) To organize regular Regional Pyrheliometer Comparisons at one of the RRCs and inter-laboratory calibration tests among existing RICs;

(4) To inform CIMO of their particular requirements and priorities related to the development of guidance material and training needs pertaining to instruments and methods of observation;

Requests the presidents of technical commissions to keep under continuous study and review the aspects of instruments and methods of observation related to their fields of specialization and to communicate their requirements to CIMO;

Urges Members:

(1) To collaborate actively in, and to give all possible support to, the implementation of the Instruments and Methods of Observation Programme;

(2) To continue and, if possible, increase their activities related to the development of new instruments and observing systems with an emphasis on interoperability and cost-effectiveness;

(3) To support and participate in global and regional intercomparisons of instruments and new methods of observation and to apply the results of those comparisons in their observing networks;

(4) To support and participate in the development of new observing standards, such as those for automation of manual, visual and subjective observations, radars and measurement in extreme conditions;

(5) To promote the development of procedures for quality management of observations, instrument maintenance, calibration and operational practices and collaborate with other countries, as needed, in the development and implementation of their own plans;

(6) To promote metrology and to ensure traceability of measurements to SI;

(7) To support CIMO Testbeds and instrument Lead Centres in the development of guidance on integration of ground-based remote-sensing and in situ observations and the development of standard procedures for all aspects of instrument use and operation with a view to promoting worldwide instrument compatibility and interoperability;

(8) To ensure the ongoing training of instrument specialists and technicians;

Requests the Secretary-General:

(1) To take necessary actions to assist WMO bodies, in particular CIMO, in the coordination and implementation of the Instruments and Methods of Observation Programme;

(2) To continue to provide funding for instrument intercomparisons within the regular WMO budget;

(3) To assist Members, as necessary, in overcoming difficulties that may arise in the implementation of the Instruments and Methods of Observation Programme;

(4) To assist the Executive Council, the regional associations and CIMO in the implementation of this resolution;

(5) To report to the Seventeenth Congress on the progress achieved and to submit proposals for future activities;

(6) To arrange for the publication of the amendments to the *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8) as approved by the fifteenth session of CIMO.

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Note: This resolution replaces Resolution 5 (Cg-XV), which is no longer in force.

Resolution 8 (Cg-XVI)

REPORT OF THE FIFTEENTH SESSION OF THE COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION

THE CONGRESS,

Noting the *Abridged Final Report with Resolutions and Recommendations of the Fifteenth Session of the Commission for Instruments and Methods of Observation* (WMO-No. 1064),

Decides:

(1) To note the report;

(2) To note Resolutions 1 to 6 (CIMO-XV);

(3) To take action on each of the following recommendations as follows:

Recommendation 1 (CIMO-XV) – Regional Instrument Centre Capabilities and Communication with Members

(a) Approves this recommendation;

(b) Requests the Secretary-General to bring this recommendation to the attention of Members and regional associations, as well as of technical commissions concerned;

Recommendation 2 (CIMO-XV) – Terms of Reference of the Commission for Instruments and Methods of Observations

(a) Approves the revised terms of reference as given in Annex 2 to Resolution 43 (Cg-XVI) – Terms of reference of the technical commissions and subsequent amendment of the General Regulations.

Resolution 9 (Cg-XVI)

DESIGNATION OF REGIONAL MARINE INSTRUMENT CENTRES

THE CONGRESS,

Noting:

(1) Resolution 50 (Cg-XVI) – Implementation of the WMO Integrated Global Observing System,

(2) The *Abridged Final Report with Resolutions of the Sixty-second Session of the Executive Council* (WMO-No. 1059) and Resolution 4 (EC-LXII) – Report of the third session of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology, approving in particular Recommendation 1 (JCOMM-III) – Establishment of WMO-IOC Regional Marine Instrument Centres,

(3) The *Abridged Final Report with Resolutions and Recommendations of the Fifteenth Session of the Commission for Instruments and Methods of Observation* (WMO-No. 1064),

(4) The relevant sections of the *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8),

(5) Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) Technical Report No. 53/WMO/TD-No. 1564, *The WMO-IOC Network of Regional Marine Instrument Centres (RMICs)*,

Recalling that the terms of reference of an RMIC, including capabilities, and corresponding functions are defined in the *Guide to Meteorological Instruments and Methods of Observation* (2011 edition), Part II, Annex 4.A,

Noting further:

(1) The proposals from the United States of America and China to operate WMO-Intergovernmental Oceanographic Commission (IOC) Regional Marine Instrument Centres (RMICs) at the United States National Oceanic and Atmospheric Administration (NOAA) National Data Buoy Centre (NDBC), and the China State Oceanic Administration (SOA) National Centre of Ocean Standards and Metrology (NCOSM), respectively, for specific suites of instruments,

(2) The approval process for RMICs agreed by the co-presidents of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) on behalf of the Commission, according to Regulation 77 of the WMO General Regulations (2011 edition), and documented in JCOMM Technical Report No. 53,

(3) The successful demonstration provided by the NDBC, United States, and NCOSM, China, regarding their capability to operate an RMIC for Regional Association IV and the Asia-Pacific region, respectively, including statements of compliance in terms of RMIC capabilities and corresponding functions, in accordance with the procedures and criteria established by JCOMM,

Recognizing:

(1) Members' need for high-quality marine meteorological and oceanographic measurements from the world oceans to address the requirements of WMO and UNESCO/IOC programmes and co-sponsored programmes, and in particular those of the Global Framework for Climate Services,

(2) That the RMICs facilitate the fulfilment of these requirements, and help improve adherence and traceability of ocean observations and associated metadata to high-level standards for instruments and methods of observation on a regional basis,

(3) The excellent facilities and long experience of the National Centre of Ocean Standards and Metrology, China, regarding ocean instrument calibration, evaluation and testing,

Decides to establish WMO-IOC RMICs for Regional Association IV at the NDBC in Mississippi, United States, and for the Asia-Pacific region at the NCOSM in Tianjin, China, subject to a parallel approval by the twenty-sixth session of the IOC Assembly;

Requests the Secretary-General:

(1) In coordination with the Executive Secretary of the IOC, to promote a global coverage of Regional Marine Instrument Centres, particularly keeping in view the needs of developing and least developed countries, through resource mobilization efforts with Members/Member States having capacity, relevant partnering agencies in the United Nations system and development agencies;

(2) To update Annex 4.A, Part II, of the *Guide to Meteorological Instruments and Methods of Observation* as follows:

– The addition of the following items (c) and (d) to paragraph 2:

(c) The establishment of RMICs is initiated by JCOMM, and the designation process is coordinated by JCOMM and the WMO and IOC Secretariats according to the process endorsed by JCOMM and documented in JCOMM Technical Report No. 53;

(d) Where more than one RMIC is established within a WMO and/or IOC Region, there should be coordination amongst the Centres to minimize duplication of services;

– The addition of NDBC (Mississippi, United States) and NCOSM (Tianjin, China) to the list of designated RMICs for Regional Association IV and the Asia-Pacific region, respectively, in the table in paragraph 3;

Requests the co-presidents of JCOMM:

(1) To ensure that the RMIC-related content of the WMO Technical Regulations, including the guidelines documents, is reviewed and updated regularly by JCOMM, based on feedback from Members, advances in technology and evolving priorities for the Organization;

(2) To consult with the regional associations and their relevant working groups or other entities responsible for coordination of climate activities within the Regions, on all matters related to RMIC implementation;

Urges all Members to support RMIC activities, to use their facilities and to provide feedback to JCOMM on effectiveness and possible improvement.

Resolution 10 (Cg-XVI)

GLOBAL ATMOSPHERE WATCH PROGRAMME

THE CONGRESS,

Noting:

(1) The *Abridged Final Report with Resolutions and Recommendations of the Fifteenth Session of the Commission for Atmospheric Sciences* (WMO-No. 1050),

(2) Resolution 14 (Cg-XV) – Atmospheric Research and Environment Programme,

(3) Resolution 15 (Cg-XV) – Stratospheric ozone observations,

(4) The WMO Strategic Plan,

(5) The *WMO Global Atmosphere Watch (GAW) Strategic Plan: 2008–2015* (GAW Report No. 172/TD-No. 1384),

(6) The Vienna Convention for the Protection of the Ozone Layer, the Montreal Protocol on Substances that Deplete the Ozone Layer and its subsequent amendments, the United

Nations Framework Convention on Climate Change (UNFCCC), the United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution (CLRTAP), and other conventions related to the environment,

(7) The WMO Integrated Global Observing System (WIGOS) Implementation Plan,

Considering:

(1) The heightened public awareness and concerns for global, regional and local climate, weather and environmental issues in general,

(2) The responsibility of WMO within the United Nations system to provide the authoritative scientific voice on the state and behaviour of the atmosphere,

(3) The central role played by the atmosphere in environmental issues, which has been foremost among societal concerns during the past years and will continue well into this century, including the global increase in greenhouse gases and the effect of aerosols on weather and climate, stratospheric ozone depletion and the related increase in ultraviolet (UV) radiation, long-range pollutant transport, urban and regional air quality, and impacts of pollutant deposition,

(4) The increasing demand by numerical weather prediction (NWP) research and operations for support in adding aerosols, ozone and their gaseous precursors to improve forecasting accuracy, and also to enhance products and services,

(5) The increasing need to move towards environmental predictions, using as a core driver the traditional NWP systems, coupled with other modelling subsystems, with a consideration of the socio-economic impacts, as distinct from strictly traditional weather-only predictions,

(6) The implementation of the WMO Global Atmosphere Watch Programme, taking into account the Integrated Global Atmospheric Chemistry Observations (IGACO) strategy, with the aim of reducing environmental risks to society and meeting the requirements of environmental conventions; strengthening capabilities to predict climate, weather and air quality; and contributing to scientific assessments in support of environmental policy by maintaining and applying global, long-term observations of the chemical composition and selected physical characteristics of the atmosphere, emphasizing quality assurance and quality control, and delivering integrated products and services of relevance to user needs,

(7) That the focus of the GAW integrated atmospheric chemistry and related physical parameters observations is primarily on greenhouse gases, ozone, UV radiation, aerosols, selected reactive gases and precipitation chemistry,

(8) The potential of the National Meteorological and Hydrological Services (NMHSs) to contribute substantially to integrated observations and modelling activities, as they are well positioned through their capacities to perform observations and research, including the development, verification/validation and application of models; to provide for the development of operational models; and to interface with users,

(9) That greenhouse gases, aerosols and ozone are designated “Essential Climate Variables” (ECVs) in the Global Climate Observing System (GCOS) in support of the UNFCCC, that the GAW global CO_2, CH_4 and N_2O monitoring networks are recognized by GCOS as comprehensive networks and that a subset of these networks and the ozone network are recognized as baseline networks by GCOS,

(10) The international coordination role of WMO in environmental issues that are becoming more extensive and complex not only because of greater activity levels, but also because of the need to encompass a broader range of scientific disciplines and partner organizations,

(11) That changes in air pollution, climate and the biogeochemical cycles of trace components in the atmosphere, such as carbon- and nitrogen-containing compounds, give rise to environmental problems that are often strongly affected by meteorological processes,

(12) That the Thirteenth and Fifteenth Congresses concurred with the need for the GAW Urban Research Meteorology and Environment (GURME) activities aimed at improving air quality forecasting, expanding GAW measurements and strengthening partnerships of NMHSs with key sectors, including health,

Decides that the substance of GAW shall comply with the WMO Strategic Plan adopted under Resolution 36 (Cg-XVI) – WMO Strategic Plan (2012–2015);

Urges Members to give all possible support to the implementation of GAW, including GURME, and to contribute to trust funds related to its activities;

Requests the president of the Commission for Atmospheric Sciences (CAS):

(1) To stimulate and coordinate research and development activities and studies to increase the value of environmental prediction for the benefit of WMO Members;

(2) To support the work of the CAS Open Programme Area Group on Environmental Pollution Atmospheric Chemistry;

(3) To work closely with the president of the Commission for Basic Systems (CBS), the president of the Commission for Instruments and Methods of Observation (CIMO) and others as appropriate, in order to ensure that as GAW components become operational, they are integrated into WIGOS and the WMO Information System;

Requests the Executive Council:

(1) To take, within available budgetary resources, all necessary actions towards the fullest possible implementation of GAW, in accordance with the GAW implementation plan and in compliance with WMO Strategic Plan;

(2) To support the work of the Commission for Atmospheric Sciences, and other bodies concerned, in the development of GAW and GURME;

Requests the Secretary-General:

(1) To take all necessary actions, within available budgetary resources, for the implementation of the GAW Programme;

(2) To support GURME and to assist Members from developing nations in building their capabilities to develop and provide activities and products related to air quality modelling and forecasting;

(3) To assist Members in participating in GAW, particularly developing Member countries, by facilitating the training and exchange of scientists, and by providing advice, guidance and services, as required, within available budgetary resources;

(4) To take all necessary actions to develop and maintain collaboration in matters of atmospheric chemistry and related physical parameters, through GAW, between WMO and relevant organizations, agencies, groups and institutions, such as the Group on Earth Observations, the International Council for Science, the United Nations Environment Programme, the World Health Organization, the European Union, the International Global Atmospheric Chemistry Project, and the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe.

Resolution 11 (Cg-XVI)

WORLD WEATHER RESEARCH PROGRAMME

THE CONGRESS,

Noting:

(1) The *Abridged Final Report with Resolutions and Recommendations of the Fifteenth Session of the Commission for Atmospheric Sciences* (WMO-No. 1050),

(2) Resolution 14 (Cg-XV) – Atmospheric Research and Environment Programme,

(3) The WMO Strategic Plan,

(4) The World Weather Research Programme (WWRP) Strategic Plan,

(5) That the skilful prediction of high-impact weather is one of the greatest scientific and societal challenges of the twenty-first century,

Considering:

(1) The heightened public awareness and concerns for global, regional and local climate, weather and environmental issues in general,

(2) That a major task of National Meteorological and Hydrological Services (NMHSs) is weather prediction in particular, forecasting events with high societal and economic impacts,

(3) The responsibility of WMO within the United Nations system to provide the authoritative scientific voice on the state and behaviour of the atmosphere, weather and climate of our planet,

(4) The increasing demand by numerical weather prediction research and operations for support in adding aerosols, ozone and their gaseous precursors to improve forecasting accuracy, and also to enhance products and services,

(5) The increasing need to move towards environmental predictions, using as a core driver the traditional numerical weather prediction systems, coupled with other modelling subsystems, with a consideration of the socio-economic impacts, as distinct from strictly traditional weather-only predictions,

(6) The potential of the NMHSs to contribute substantially to integrated observations via their extensive monitoring system infrastructures and specific scientific expertise in areas such

as numerical modelling with four-dimensional and coupled data assimilation techniques and real-time data delivery,

(7) The international coordination role of WMO in environmental issues that are becoming more extensive and complex not only because of greater activity levels, but also because of the need to encompass a broader range of scientific disciplines (meteorology, atmospheric chemistry, hydrology, oceanography, biosphere sciences and human health) and to involve partner organizations in the resolution of sustainable environmental development issues,

(8) That despite the substantial increase in the forecast skill achieved by improvements in atmospheric observing technology, data-assimilation methods, new numerical model formulations and the use of ensemble techniques, the ability to forecast high-impact weather events still falls below the expectations of society at large,

Decides:

(1) That the substance of the World Weather Research Programme shall be as indicated in the WMO Strategic Plan (2012–2015) adopted under Resolution 36 (Cg-XVI) and in the WMO Operating Plan;

(2) That education and training aspects be included in all components of the World Weather Research Programme;

Requests Members:

(1) To give all possible support to the implementation of the WWRP, including voluntary contributions to THe Observing system Research and Predictability Experiment (THORPEX) Trust Fund;

(2) To encourage members of the Commission for Atmospheric Sciences (CAS) to participate in and contribute to WWRP projects and THORPEX;

(3) To arrange for the provision of assistance and advice with respect to the Education and Training Programme, including an Earth-system interdisciplinary summer school programme;

(4) To pursue coordination regarding the WWRP with other relevant WMO technical commissions and activities through the CAS Open Programme Area Group on the WWRP;

(5) To stimulate and coordinate socio-economic research and development activities and studies to increase the value of environmental prediction outputs for the benefit of WMO Members;

Requests the president of the Commission for Atmospheric Sciences to arrange for the development and implementation of WMO activities in the WWRP, including THORPEX, through appropriate partnerships;

Requests the Executive Council:

(1) To take, within available budgetary resources, all necessary actions, including specific actions on sub-seasonal to seasonal forecasts, polar research and the organization of the first WWRP Earth-system Open Science Conference, towards the fullest possible implementation of the WWRP, in accordance with the WMO Strategic Plan;

(2) To support the work of the Commission for Atmospheric Sciences, and other bodies concerned, in the further development of the WWRP;

(3) To continue its oversight role in new areas of collaborative research across programmes and commissions through an appropriate mechanism;

Requests the Secretary-General:

(1) To take all necessary actions, including specific actions on sub-seasonal to seasonal forecasts and polar research, within available budgetary resources, for the implementation of the Programme;

(2) To support the THORPEX International Programme Office, to assist WMO Members in the international coordination of THORPEX, and to assist Members from developing nations in their utilization of results of WWRP projects and THORPEX-related forecast products;

(3) To assist Members participating in the Programme, particularly developing Member countries, by facilitating the training and exchange of scientists, and the provision of advice, guidance and services, as required, within available budgetary resources;

(4) To take all necessary actions to develop and maintain the collaboration between WMO, through the WWRP, and other agencies, groups and institutions, which can contribute to the further development and implementation of WWRP projects, and to seek further support from such agencies and other national and international institutions and from Members.

Resolution 12 (Cg-XVI)

HYDROLOGY AND WATER RESOURCES PROGRAMME

THE CONGRESS,

Noting:

(1) Resolution 20 (Cg-XV) – Hydrology and Water Resources Programme,

(2) Resolution 7 (CHy-XIII) – Work Programme and Structure of the Commission for Hydrology,

(3) Recommendation 1 (CHy-XIII) – WMO Strategic Plan 2012–2015 and Monitoring and Evaluation of the Hydrology and Water Resources Programme,

(4) Resolution 5 (EC-LXI) – Report of the thirteenth session of the Commission for Hydrology,

(5) The WMO Strategic Plan,

(6) The report of the president of the Commission for Hydrology to Sixteenth Congress,

(7) The report of the High-level Taskforce on the Global Framework for Climate Services, *Climate Knowledge for Action: A Global Framework for Climate Services – Empowering the Most Vulnerable* (WMO-No. 1065), discussed by Sixteenth Congress under agenda item 11.1,

(8) Resolution 25 (Cg-XIII) – Exchange of hydrological data and products,

Considering the need to develop ways to bridge the gap between the climate information being developed by the scientific community on the one hand, and the service providers and the users in the water sector, on the other hand, with a special emphasis on efforts to adapt to global change, and that water resources assessment is an indispensable prerequisite for a sound operational basis for such endeavours,

Urges Permanent Representatives to appoint Hydrological Advisers, duly giving consideration to the fact that hydrological activities are undertaken by various institutions within the countries;

Endorses the WMO Strategy on Education and Training in Hydrology and Water Resources (Annex 1 to Resolution 5 (CHy-XIII) – Capacity-building in hydrology and water resources);

Decides to adopt the Hydrology and Water Resources Programme (HWRP) for the period 2012–2015 as described in Annex II to the Report of the Sixteenth World Meteorological Congress;

Requests the Executive Council and Secretary-General to take all the necessary actions:

(1) To arrange for the implementation of the Hydrology and Water Resources Programme and to assist the Commission for Hydrology and all bodies concerned in its implementation, in accordance with **Decides** above;

(2) To ensure that WMO continues playing an active role in UN-Water, the inter-agency coordination mechanism of the United Nations system on water-related issues;

(3) To continue to provide support to regional activities of the Hydrology and Water Resources Programme;

(4) To support the cooperation between HWRP and other governmental and non-governmental organizations;

(5) To reaffirm Resolution 25 (Cg-XIII) as an essential cornerstone in the efforts to seamlessly address climate and water issues from scientific research to policy development and operational implementation;

Requests the president of the Commission for Hydrology:

(1) To promote cross-technical commission and cross-programme cooperation in areas of concern to the Commission;

(2) To encourage and support active collaboration between the Commission and the regional associations, in particular their groups related to hydrology and/or water resources management;

(3) To fully engage with the governance and implementation of the Global Framework for Climate Services (GFCS);

(4) To ensure that the Commission takes an active part in facilitating the active role of National Hydrological Services and National Meteorological Services in the user interface component of the GFCS, to promote the development and delivery of user-oriented climate information and prediction services meeting the needs of climate variability and change adaptation in the water sector;

(5) To seek to further improve the coordination of the Hydrology and Water Resources Programme with the International Hydrological Programme of the United Nations

Educational, Scientific and Cultural Organization and to collaborate with other UN-Water agencies in areas of common interest;

Requests the regional associations to take into account, while deciding on the structure of their subsidiary bodies, the benefits of regional Working Groups on Hydrology as a platform for hydrologists within a Region to discuss matters of common concern;

Urges Member States to comply with Resolution 25 (Cg-XIII) and thus to jointly address the challenges societies face with regard to climate change and the consequences of global changes;

Invites Members to participate in, and contribute to, technical cooperation activities in hydrology and water resources also by contributing to the Hydrology and Water Resources Trust Fund in support of water-related activities.

———

Note: This resolution replaces Resolution 20 (Cg-XV), which is no longer in force.

Resolution 13 (Cg-XVI)

QUALITY MANAGEMENT FRAMEWORK – HYDROLOGY

THE CONGRESS,

Recalling:

(1) Resolution 32 (Cg-XV) – WMO Quality Management Framework,

(2) Resolution 1 (CHy-XIII) – WMO Quality Management Framework – Hydrology,

(3) Resolution 8 (EC-LXI) – Procedures to be followed in proposing common WMO/ISO technical standards,

Recognizing:

(1) That hydrological observations, hydrological data management and development of hydrological products are undertaken by various institutions within countries, particularly in the case of countries with multiple hydrology-related organizations,

(2) The responsibilities of National Hydrological Services (NHSs) in guiding the development and implementation of their national Quality Management Frameworks for hydrology,

(3) That the Commission for Hydrology (CHy) provides a natural link between the National Meteorological Services and the water-sector users of climate services as part of the User Interface Platform under the Global Framework for Climate Services (GFCS),

Decides to establish a Quality Management Framework – Hydrology (QMF-H), within the overall WMO QMF, covering data observations as well as hydrological products and services in accordance with the recommendation of CHy;

Invites the NHSs to pursue the adoption of Quality Management Systems (QMSs) in their countries in order to ensure the quality of hydrological products and services provided under various national authorities;

Requests the president of CHy in association with the Hydrological Advisers:

(1) To continue the development and promotion of the QMF-H, in cooperation with partners from academia, professional associations and other national and international institutes in the water sector, in accordance with the practices and guidelines established by the WMO Inter-Commission Task Team on Quality Management Framework (ICTT-QMF) and in close cooperation with the International Organization for Standardization (ISO);

(2) To support the development of international consensus on all QMF-H documentation within the CHy terms of reference;

(3) To prepare comprehensive Guides, Manuals and other technical material under the QMF-H and support the development of training programmes for their utilization by National Meteorological and Hydrological Services, and also to promote the use of this material in Regional Training Centres;

(4) To identify, document and promote the required verification, validation, monitoring, inspection and other quality procedures specific to the data; and standardization, calibration and maintenance of equipment and technologies, products, and services required for the implementation of QMSs;

Requests the Secretary-General:

(1) To provide all possible support to CHy from available resources and to seek additional resources for this purpose from external sources;

(2) To support Members in developing effective linkages with water-sector users and in the implementation of QMSs, in particular in the least developed countries.

Resolution 14 (Cg-XVI)

WORLD HYDROLOGICAL CYCLE OBSERVING SYSTEM

THE CONGRESS,

Noting:

(1) Resolution 20 (Cg-XII) – World Hydrological Cycle Observing System (WHYCOS),

(2) Resolution 25 (Cg-XIII) – Exchange of hydrological data and products,

Appreciating:

(1) The continuing potential benefits of enhanced exchange of hydrological data and information within shared river basins and aquifers,

(2) The successful implementation of the WHYCOS programme through eight regional Hydrological Cycle Observing System (HYCOS) components that have been implemented or are presently under implementation,

(3) The financial support of around CHF 23 million provided by the Governments of the Netherlands, France and Finland, the European Commission, and the African Water Facility for the implementation of the regional HYCOS components in the last financial period,

(4) The continued interest of these partners in continuing their support,

(5) The positive impacts of implemented HYCOS components on the strengthening of technical and institutional capacities of National Hydrological Services (NHSs) in a number of countries, including improved international cooperation in transboundary and international rivers basins,

Considering:

(1) That WHYCOS is one of the basic responses by WMO to the recommendation of the United Nations Commission on Sustainable Development to strengthen efforts towards a comprehensive assessment of freshwater resources,

(2) That WHYCOS makes a significant contribution to water resources assessment on global, regional and national scales, supports the assessment of the impacts of climate variability and change on water resources, and assists in identifying appropriate mitigation and adaptation measures under the changing climate,

(3) The continuing need for strengthening the capabilities of NHSs in hydrological and hydrometeorological data collection and management and in the development and dissemination of information products, particularly in developing countries,

(4) The contribution that WHYCOS can make to the strengthening of these capabilities,

(5) That WHYCOS provides a vehicle for implementation of the Quality Management Framework-Hydrology through applying best practices in measurements, enhanced quality of observations and development of water resources information systems,

(6) That WHYCOS can provide essential data to several programmes, such as the Global Climate Observing System, the Global Terrestrial Observing System, the Global Ocean Observing System and the Global Terrestrial Network – Hydrology,

(7) That WHYCOS, as a strong contributor to the WMO Integrated Global Observing System (WIGOS), will benefit from the development and implementation of WIGOS and the WMO Information System (WIS),

Reaffirms the importance of WHYCOS as a priority activity within the WMO Hydrology and Water Resources Programme, with the main objectives of:

(1) Strengthening technical, human and institutional capacities of NHSs of Member States in hydrological data collection and management and in the development and dissemination of information products;

(2) Promoting regional and international cooperation in the sharing of hydrological data and the management of shared water resources;

(3) Adaptation to the impacts of climate variability and change;

Also reaffirms the ownership by WMO of WHYCOS and its HYCOS components and the central role of the Secretariat as a provider of technical and scientific support with a view to ensuring the achievement of the programme goals, consistency among components, and the transfer of data, tools and expertise;

Invites Members and national and international aid agencies:

(1) To continue and broaden their financial support for the implementation of ongoing and planned HYCOS components;

(2) To coordinate the implementation of regional components with the WMO Secretariat in order to maximize benefits from collaboration with, and transfer of tools and products from, other projects;

(3) To encourage other countries in the Regions to, where relevant, join a HYCOS component;

Urges Members and regional institutions involved in the implementation of HYCOS components:

(1) To actively support the project implementation, by, inter alia, making available the required staff for field activities and training courses, ensuring timely implementation of project activities at the national level (including customs clearance and installation of equipment), and performing quality control and validation of data collected within the framework of the project;

(2) To ensure the long-term sustainability of project outcomes through the provision of adequate human and financial support for their continuing operation;

Requests the Secretary-General:

(1) To carry out an independent external evaluation of the WHYCOS programme, as a follow-up to the one carried out in 2005;

(2) To review the mandate, composition and functioning mechanism of the WHYCOS International Advisory Group, to enable it to better respond to the new challenges facing the WHYCOS programme, by focusing in particular on:

   (a) Reviewing and assessing the concept, objectives and progress towards them, expected benefits/costs, and future development of WHYCOS, and proposing strategies for any necessary remedial action to address possible shortcomings;

   (b) Ensuring the efficient relationship of WHYCOS with other relevant initiatives and international programmes, especially its integration with WIGOS and WIS;

   (c) Coordinating the implementation of the various HYCOS components and WMO inputs with stakeholders, especially national and regional partners and donors;

(3) To invite other international organizations to cooperate with WMO to contribute to WHYCOS implementation, and to make use of its products;

(4) To provide all possible support to WHYCOS development from available resources and to seek additional resources for this purpose from external sources;

Requests the president of the Commission for Hydrology to ensure that the Commission provides WHYCOS with the technical advice that it requires.

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Note: This resolution replaces Resolution 20 (Cg-XII), which is no longer in force.

Resolution 15 (Cg-XVI)

ESTABLISHMENT OF AN ADVISORY GROUP FOR THE WMO FLOOD FORECASTING INITIATIVE

THE CONGRESS,

Noting:

(1) Resolution 21 (Cg-XV) – Strategy for the Enhancement of Cooperation between National Meteorological and National Hydrological Services for Improved Flood Forecasting,

(2) The Action Plan that was developed at the request of the Commission for Hydrology (CHy) in December 2009 in support of the Strategy and Action Plan of the WMO Flood Forecasting Initiative,

Recalling:

(1) That both Resolution 3 (CHy-XIII) – Hydrological forecasting and flood management and Resolution 21 (Cg-XV) called on the president of the Commission to establish an appropriate management mechanism in support of the WMO Flood Forecasting Initiative (FFI),

(2) That the objective of the WMO FFI is to: “Improve the capacity of meteorological and hydrological services to jointly deliver timely and more accurate products and services required in flood forecasting and warning and in collaborating with disaster managers, active in flood emergency preparedness and response”,

Considering:

(1) That improved hydrological forecasting, including the provision and promotion of flash floods guidance, seasonal flow prediction and coastal storm surge flood forecasting activities require close collaboration among the experts from various technical commissions,

(2) The need to improve flood early warning system capabilities,

(3) The need to make use of seasonal climate outlooks being produced on an operational basis and being strengthened through the Global Framework for Climate Services,

(4) That an overarching Technical Group is required to provide guidance and advice on the hydrological forecasting elements of these initiatives,

(5) That such an Advisory Group will provide broad-based support to improve collaboration between the meteorological and hydrological communities for improved flood forecasting practices,

Decides:

(1) To define the scope of the WMO Flood Forecasting Initiative to include all the hydrological forecasting activities, such as those related to flash floods and riverine floods, including seasonal forecasts and coastal flooding due to storm surges;

(2) To establish the WMO Flood Forecasting Initiative Advisory Group (FFI-AG) with terms of reference as per the annex to this resolution;

Requests the Secretary-General, as appropriate and within the available budgetary resources, to take all necessary actions to support the establishment of the WMO FFI-AG and its activities;

Requests the president of the Commission for Hydrology to report periodically to the Executive Council on the progress of the activities of the WMO FFI-AG;

Invites Members:

(1) To actively support the tasks of the Advisory Group, including by facilitating the participation of dedicated experts in sessions of the Group;

(2) To ensure that National Meteorological Services and National Hydrological Services work in close collaboration in the provision of critical inputs to the Group;

(3) To promote recommendations of the Group on a national basis;

(4) To contribute to the Voluntary Cooperation Programme Fund and the Hydrology and Water Resources Trust Fund in support of the implementation of activities recommended by the Group.

Annex to Resolution 15 (Cg-XVI)

FLOOD FORECASTING INITIATIVE ADVISORY GROUP TERMS OF REFERENCE AND COMPOSITION

Background

Developed in 2003, the WMO Flood Forecasting Initiative (FFI) is based on an analysis of the weaknesses of current forecasting systems, with a view to enhancing the ability of National Meteorological and Hydrological Services (NMHSs) to cooperate in an effective manner to provide improved flood forecasting services.

The Fifteenth World Meteorological Congress in 2007 endorsed the Strategy and Action Plan for the Enhancement of Cooperation between National Meteorological and National Hydrological Services for Improved Flood Forecasting. At its thirteenth session in 2008, the Commission for Hydrology (CHy) recognized a range of other initiatives associated with the FFI, such as the Flash Flood Guidance System (Resolution 3 (CHy-XIII) – Hydrological forecasting and flood management). Subsequently the Coastal Inundation Forecasting Demonstration Project (CIFDP) was initiated jointly by CHy and the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). Seasonal hydrological flow forecasting based on regional climate outlooks has also been initiated by CHy and the Commission for Climatology.

Both Resolution 3 (CHy-XIII) – Hydrological forecasting and flood management and Resolution 21 (Cg-XV) – Strategy for the Enhancement of Cooperation between National Meteorological and National Hydrological Services for Improved Flood Forecasting called on the president of CHy to establish an appropriate management mechanism in connection with these initiatives. Considering the cross-cutting nature of the guidance required for providing technical oversight, it is proposed to establish an overarching Advisory Group for the Flood Forecasting Initiative (FFI-AG) to advise on the hydrological forecasting elements of these initiatives.

Terms of reference

The WMO Flood Forecasting Initiative Advisory Group (WMO FFI-AG) shall:

1. Consider and advise on the concept, objectives, expected benefits/costs, strategy, action plan and future development of the WMO FFI;

2. Review and assess the status of the WMO FFI and progress towards its objectives, and propose strategies for any necessary remedial action;

3. Review and assess the progress of specific WMO FFI projects upon request;

4. Advise on standards (including, but not limited to, methodologies, techniques, technologies, and so forth) for the robust and sustainable implementation of the WMO FFI;

5. Review the relationship of the WMO FFI with other relevant international programmes, particularly from the point of view of coordination and avoidance of overlap, and propose any necessary actions;

6. Identify and evaluate constraints on, and potential risks to, the future implementation and sustainability of the WMO FFI, and propose strategies to minimize those risks. Risks include, inter alia, those of a financial, technical, operational and institutional/political nature;

7. Consider and propose plans for effective advocacy of the WMO FFI (as appropriate), and ways and means to assure its future sustainability and appropriate expansion;

8. Promote awareness about raising the social and economic benefits and value of flood forecasting systems, including a community development approach;

9. Review and advise on its terms of reference and composition.

Composition

The WMO FFI Advisory Group shall be composed of:

1. The president of the WMO Commission for Hydrology (chair);

2. One representative with flood forecasting experience from CHy, and representatives of other WMO technical commissions as and when needed;

3. One representative from each active financial partner involved in the WMO FFI projects.

Observers

1. Representatives from WMO FFI operational projects invited on an ad hoc basis;

2. Representatives from relevant WMO Programmes as required;

3. Regional Hydrological Advisers and/or representatives of regional association working groups on hydrology;

4. Representatives of potential financial partners that could contribute to the WMO FFI.

The Director of the Climate and Water Department of the WMO Secretariat shall act as secretary to the WMO FFI-AG.

Resolution 16 (Cg-XVI)

CLIMATE DATA REQUIREMENTS

THE CONGRESS,

Noting:

(1) Resolution 12 (Cg-XV) – World Climate Data and Monitoring Programme and the decisions taken and adopted by the Fifteenth World Meteorological Congress and by the subsequent Executive Council sessions relevant to climate data management, data rescue and climate monitoring,

(2) The priorities set by the Commission for Climatology (CCl) during its fifteenth session for climate data and climate monitoring and assessment,

(3) The development of the WMO Information System (WIS), which provides modern architecture and standards for data discovery, retrieval and exchange and for interoperability with other data systems,

(4) The progress made in providing guidance and guidelines on best practices and principles through a series of WMO and Global Climate Observing System (GCOS) publications and reports covering climate observations, climate data management, data rescue and climate indices, among other things,

Recognizing:

(1) That climate as a resource needs to be exploited optimally based on a best use of climate data to support sustainable development and the well-being of societies,

(2) The increased needs for high-quality, timely and accessible climate data for climate monitoring, research, applications and climate change adaptation,

(3) The new and evolving requirements for high-quality climate products and services within the Global Framework for Climate Services,

(4) The need for quality assurance and traceability of climate data to ensure robust and authoritative climate monitoring and assessment at global, regional and national levels,

(5) The need for utilizing climate data from all possible sources encompassing land and marine data and including in situ, space-based and model reanalysis data,

Decides that priority will be given to:

(1) Accelerating rescue and digitization of climate records and promoting global and regional initiatives to collaborate on data rescue (DARE) and the exchange of related scientific knowledge and technological advances;

(2) Promoting the use of improved methodologies and techniques to analyse climate data from various sources, including in situ, remote-sensing and reanalysis data by National Meteorological and Hydrological Services (NMHSs), in particular amongst the developing and least developed countries;

(3) Working towards developing useful and user-friendly climate data applications as a way to draw added value from DARE and implementation of Climate Data Management Systems (CDMSs) in support of WMO Climate System Monitoring (CSM), Multi-Hazard Early Warning Systems (MHEWS) and Climate Watch Systems (CWSs). This would include, for example, tools for the development of climate atlases, databases on climate hazards, and frequency analysis of weather and climate extremes;

(4) Furthering the work on quality assurance for climate data and metadata, with emphasis on standards for the collection of climate data and metadata, including those relevant to solid precipitation and to observations in mountainous terrain;

(5) Producing and making available high-quality global climate datasets for use in global climate monitoring and assessment;

(6) Producing and compiling World Weather Records and WMO climate normals based on improved methodologies and guidelines to assist Members in their computation and dissemination;

(7) Modernizing climate data management and related services, including archiving, discovery, access and retrieval as part of the evolving implementation of the WMO Information System and ensuring interoperability amongst various programme data, as well as with sector application data;

(8) Developing human and technological capabilities of developing and least developed countries to fulfil their mandate in climate data collection, management and exchange;

Requests the Commission for Climatology, the Commission for Basic Systems (CBS) and the Commission for Instruments and Methods of Observation (CIMO), in collaboration with other technical commissions and programmes as appropriate, to facilitate an analysis of the strengths, weaknesses and the opportunities associated with climate data to provide an up-to-date assessment of the existing gaps and shortcomings and propose solutions for improved climate data availability and exchange;

Requests the technical commissions, WMO Programmes and co-sponsored Programmes, to further collaborate with increased synergy, including working mechanisms and scientific and technical events coordinated and/or developed under their mandate with relevance to climate data;

Requests the Secretary-General:

(1) To continue to support the work on the above-mentioned priorities, and to support the work of relevant CCl expert teams and task teams;

(2) To promote collaboration and partnership with international agencies and programmes and mobilize extrabudgetary resources for capacity-building activities relevant to climate data modernization including DARE and CDMS projects;

Urges Members, regional associations and NMHSs to further accelerate DARE activities, and to continue their collaboration to assist developing and least developed countries on DARE and CDMS;

Urges Members and regional associations to enhance their efforts in the provision and dissemination of CLIMAT reports, and in the provision of the data required for the compilation of the World Weather Records, which should move towards a system of annual updates, taking advantage of technological advances and the use of modern CDMSs.

Resolution 17 (Cg-XVI)

IMPLEMENTATION OF THE CLIMATE SERVICES INFORMATION SYSTEM

THE CONGRESS,

Noting:

(1) Resolution 13 (Cg-XV) – World Climate Applications and Services Programme, including the CLIPS project,

(2) Resolution 8 (Cg-XIII) – Climate Information and Prediction Services project,

(3) Resolution 4 (CCl-XV) – Further evolution of the Climate Information and Prediction Services project,

(4) The *Abridged Final Report with Resolutions of the Sixty-first Session of the Executive Council* (WMO-No. 1042),

(5) The *Abridged Final Report with Resolutions and Recommendations of the Fourteenth Session of the Commission for Basic Systems* (WMO-No. 1040),

(6) The *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485),

(7) The *Abridged Final Report with Resolutions of the Twelfth World Meteorological Congress* (WMO-No. 827),

Recognizing:

(1) The progress made in the Climate Information and Prediction Services (CLIPS) project since its establishment by Twelfth Congress in 1995 and the establishment of Regional Climate Centres (RCCs) and the expansion of Regional Climate Outlook Forums (RCOFs),

(2) That many of the CLIPS concepts have been adequately reflected in the development of the Global Framework for Climate Services (GFCS),

(3) The critical role of WMO in establishing the Climate Services Information System (CSIS) component of the GFCS and thereby putting in place operational mechanisms to provide climate information, products and services at different levels,

(4) The need for strengthening capacities at the national level to deliver climate information and prediction products to users, and to enable mainstreaming of this information and knowledge into decision-making,

(5) The need for a systematic, regular and reliable flow of climate-related information and predictions from global to regional and national scales, for the eventual benefit of the research community, decision-makers in all climate-susceptible sectors, and governments,

(6) The interest and contributions of partnering agencies, including those within the United Nations system, with regard to this operational climate capability, in addition to the contributions by WMO to the climate knowledge base and expertise in provision of information related to the management of disaster risks,

(7) The role of the WMO Information System (WIS) and the Global Data-processing and Forecasting System (GDPFS) as the operational infrastructure underpinning the structure of CSIS,

Decides:

(1) To establish a Climate Services Information System with global, regional and national entities providing operational climate information, including data, monitoring and prediction products within the GFCS;

(2) To endorse the proposal made by the Commission for Climatology at its fifteenth session to effect the incorporation of CLIPS activities into the GFCS, and to conclude CLIPS as a project by 2015 at the latest;

(3) That CSIS operations shall adhere to the WMO Technical Regulations and should generate, as needed, new Technical Regulations pertinent to the advancement of operational climate services;

(4) That the implementation of CSIS should be guided by the Commission for Climatology;

(5) That the core operational CSIS products should be standardized in terms of production, presentation, delivery and verification;

(6) That CSIS will promote consensus-based approaches to facilitate common understanding and user appreciation of uncertainties through, inter alia, Climate Outlook Forums;

(7) That CSIS should be guided by the long-term vision of providing an authoritative source of climate information required for climate services at global, regional and national scales;

Requests the Secretary-General:

(1) To promote CSIS and its benefits to partnering agencies, particularly within the United Nations system in the spirit of the United Nations “delivering as one”, and pursue partnerships at all levels to meet the objectives of CSIS within the GFCS;

(2) To raise the requirements for CSIS implementation (infrastructure and human resources aspects) with the relevant institutions and potential sponsors;

(3) To ensure that CSIS takes advantage of, and makes operational, advances in research that improve climate information and predictions, and that effective communications on requirements and feedback be established with the research community;

Requests the Commission for Climatology:

(1) To take the leading role in the implementation of CSIS;

(2) To work towards ensuring the quality of climate information underpinning the climate services, by establishing technical standards in the form of WMO Technical Regulations;

(3) To work closely with the Commission for Basic Systems to ensure that the development and implementation of CSIS takes full advantage of the capabilities of the WWW;

Urges all Members, regional associations and relevant technical commissions:

(1) To support the implementation of CSIS by hosting and operating centres of excellence for providing climate information; supporting the required education and training, hiring and retention of qualified climate specialists; developing and sharing the tools for production of high-quality climate products and predictions; making recommendations on standards for CSIS products; and facilitating the flow of information and feedback across global, regional and national scales;

(2) To help National Meteorological and Hydrological Services and other relevant climate entities to use the products derived from CSIS to address the climate-related information needs of user communities at national and local scales;

(3) To collaborate as needed in inter-commission and interregional efforts required for the effective and seamless operation of CSIS.

Resolution 18 (Cg-XVI)

WORLD CLIMATE PROGRAMME

THE CONGRESS,

Recalling Resolutions 12 (Cg-XI) and 7 (Cg-XII) – World Climate Programme and its coordination,

Noting:

(1) The *Abridged Final Report with Resolutions of the Fifteenth World Meteorological Congress* (WMO-No. 1026, Resolution 8 (Cg-XV) – World Climate Programme and its Coordination; Resolution 12 (Cg-XV) – World Climate Data and Monitoring Programme; and Resolution 13 (Cg-XV) – World Climate Applications and Services Programme, including the CLIPS Project),

(2) The *Abridged Final Report with Resolutions of the Sixty-first Session of the Executive Council* (WMO-No. 1042, agenda item 3.2.5),

(3) The *Abridged Final Report with Resolutions of the Sixty-second Session of the Executive Council* (WMO-No. 1059, Resolution 9 (EC-LXII) – Establishment of WMO mechanisms for oversight on and response to the establishment and implementation of the Global Framework for Climate Services),

Recognizing:

(1) The fundamental role of the World Climate Programme (WCP) in climate science, research and modelling; observations of climate; management of climate information; climate monitoring; and climate applications and services,

(2) The continuing importance of the WCP and its associated activities in making an effective contribution to the Intergovernmental Panel on Climate Change (IPCC), the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention to Combat Desertification (UNCCD); to the work of the United Nations Commission on Sustainable Development and International Strategy for Disaster Reduction (ISDR); as well as to the socio-economic development of nations,

(3) The emergence of the Global Framework for Climate Services (GFCS) and new coordination mechanisms for inter-agency cooperation on climate activities,

(4) The need to refocus the WCP to, inter alia, respond to the needs of the GFCS and to ensure its effective implementation,

(5) The effective long-term partnership and contribution of the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO/IOC), the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP), the International Council for Science (ICSU), and a growing number of other United Nations agencies, funds and programmes, and other international organizations to the WCP,

Decides:

(1) To reconstitute the World Climate Programme to serve the strategic goals of the Organization;

(2) To formally close the World Climate Impact Assessment and Response Strategies Programme (WCIRP) of the WCP, and to recommend to UNEP that relevant WCIRP activities be taken up within the new UNEP Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PRO-VIA);

(3) To structure the WCP in close alignment with the Global Framework for Climate Services, and thereby to include in it the Global Climate Observing System (GCOS), the World Climate Research Programme (WCRP) and a new World Climate Services Programme (WCSP), which would incorporate the existing activities of the World Climate Data and Monitoring Programme (WCDMP) and the World Climate Applications and Services Programme (WCASP);

(4) To invite the co-sponsors of WCRP and GCOS to support this structure;

(5) To establish, based on the recommendations of the High-level Taskforce on the Global Framework for Climate Services, a vision statement and goals for the WCP that would be consistent with its contributions in particular, and those of WMO in general, to the GFCS;

(6) To recommend to the relevant agencies closure of the Climate Agenda, as well as the Inter-Agency Committee on the Climate Agenda (IACCA);

(7) That the WCP will be a key programme in the delivery of the GFCS;

Requests the Commission for Climatology, the WCRP Joint Scientific Committee and the GCOS Steering Committee to ensure close cooperation with each other for the effective implementation of the WCP;

Requests the Executive Council:

(1) To ensure effective coordination among all the bodies responsible for the implementation of the WCP;

(2) To appropriately review/update the relevant Memorandums of Understanding with the co-sponsoring partners of various components, in accordance with their revised scope and objectives;

(3) To assess and take decisions on the UNEP request to include PRO-VIA as a component of the WCP;

Requests the Secretary-General:

(1) To ensure coherent planning and implementation of the WCP;

(2) To promote the WCP at high levels and to foster engagement of the United Nations system in its implementation in close alignment with the GFCS;

(3) To bring this resolution to the attention of all concerned;

Urges Members, regional associations and technical commissions:

(1) To accord high priority to the implementation of WCP activities that fall within their areas of competency and responsibility;

(2) To support the required capacity-building, particularly for developing and least developed countries;

(3) To strive to increase support for global, regional and national climate-related activities, including through Global Producing Centres, Regional Climate Centres and National Meteorological and Hydrological Services, and through increased interaction with users of climate information in support of increased use of climate products and information in climate risk management.

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Note: This resolution replaces Resolutions 8 and 12 (Cg-XV), Resolution 7 (Cg-XII) and Resolution 12 (Cg-XI), which are no longer in force, and Resolution 13 (Cg-XV), which is no longer in force as of 1 January 2012.

Resolution 19 (Cg-XVI)

DEVELOPMENT OF AN ARCHITECTURE FOR CLIMATE MONITORING FROM SPACE

THE CONGRESS,

Noting:

(1) Article 2 of the Convention of the World Meteorological Organization,

(2) Resolution 5 (Cg XIV) – WMO Space Programme,

(3) Resolution 30 (Cg-XV) – Towards enhanced integration between WMO observing systems,

(4) Paragraph 9.2.5 of the *Abridged Final Report with Resolutions of the Fifteenth World Meteorological Congress* (WMO-No. 1026) reaffirming the Executive Council decisions to provide full support for the Group on Earth Observations (GEO) process and resulting Global Earth Observation System of Systems (GEOSS) and to support its implementation to the maximum extent possible within the WMO mandate,

(5) Resolution 3 (Cg-XVI) – Global Observing System,

(6) Resolution 48 (Cg-XVI) – Implementation of the Global Framework for Climate Services,

Considering:

(1) The benefits that have been achieved through the coordinated, collaborative and cost-effective approach to the planning and operation of an end-to-end system for weather observations, modelling, analysis and forecasting,

(2) The increasingly important role that space-based observations are playing in the long-term monitoring of the Earth's environment,

(3) The substantial investment that Members have made in Earth observation satellites to monitor and study weather, water, climate and related natural disasters,

(4) The importance of long-term, sustained and coordinated observations of the Earth's climate, climate change and variability for the world's population, and particularly those at most risk,

(5) The benefits in efficiency, sustainability and cost-effectiveness that could be achieved through increased coordination of efforts among all parties involved in the planning and implementation of space-based observational capabilities and related operational processing activities for climate monitoring,

(6) The underpinning role that observations will play in the Global Framework for Climate Services (GFCS),

(7) The importance of integration of ground-based and space-based observations in the successful implementation of the WMO Integrated Global Observing System (WIGOS),

Appreciating:

(1) The important contributions Members, their satellite operators, international partner organizations and programmes make to observing, and coordinating observations of the Earth from space,

(2) The relevant work undertaken by the Global Climate Observing System (GCOS) to identify the requirements associated with the Essential Climate Variables (ECVs) for the long-term and sustained observation of the Earth's climate system,

(3) The invitation made by the Executive Council at its sixty-second session to the WMO Space Programme, in coordination with GCOS and with the support of relevant technical commissions, to work with space agencies, the Coordination Group for Meteorological Satellites (CGMS), the Committee on Earth Observation Satellites (CEOS), and the Group on Earth Observations in order to develop an architecture for sustained, space-based climate monitoring as a component of the future WIGOS and GFCS, for consideration by the Congress,

(4) The early work done by the WMO Space Programme to develop a concept and initiate a dialogue among interested parties for an architecture for climate monitoring from space,

Recognizing:

(1) That the WMO Space Programme provides Members with an appropriate framework to advance, in partnership with CEOS, CGMS, GCOS, GEO, the World Climate Research Programme (WCRP) and other partner organizations, the development of an architecture for climate monitoring from space,

(2) That the end-to-end system implemented by Members to support weather monitoring and forecasting, which includes the review of observational requirements, satellite observations and intercalibration, as well as product generation, training and user-engagement, can be leveraged for climate monitoring,

(3) The different but complementary roles and responsibilities of satellite operators and their coordinating mechanisms for activities that cover the spectrum of research and development and operational missions,

(4) That, in this architecture, space-based observations have to be supported by surface-based observations,

Decides that an architecture should be developed, using as a starting point the concept given in the annex to this resolution, to provide a framework for the sustained and coordinated monitoring of the Earth's climate from space;

Decides further:

(1) That the development of the architecture, as an important component of WIGOS, should be undertaken as a major initiative of the WMO Space Programme, with the support of relevant technical commissions, and in coordination with satellite operators, CEOS, CGMS, GCOS, GEO and WCRP;

(2) That the results will be made available for deliberation and final approval by the Executive Council;

Requests the Executive Council to monitor, guide, support and consider approving, at its sixty-fourth session, the development of an architecture for climate monitoring from space;

Requests the technical commissions:

(1) To guide the technical aspects of the development activities;

(2) To update WMO regulatory material, including development of the Manual on the WMO Integrated Global Observing System;

(3) To provide the technical lead for the architecture through the Commission for Basic Systems, the Commission for Instruments and Methods of Observation, the Commission for Climatology and the Commission for Atmospheric Sciences;

Requests Members:

(1) To provide experts to participate in the development, implementation and operation of an architecture for climate monitoring from space;

(2) To provide voluntary contributions to the WMO Space Programme Trust Fund for the further advancement of the architecture development efforts;

(3) To share relevant experience and cooperate with one another in leveraging the existing end-to-end weather monitoring system to serve climate monitoring needs;

(4) To continue to enhance and integrate their national climate monitoring capabilities;

Requests the regional associations to support and coordinate efforts of Members in the development and eventual implementation of an architecture for climate monitoring;

Requests the Secretary-General:

(1) To ensure management and support of the architecture for climate monitoring from space development efforts;

(2) To support the review and update of WMO regulatory material, including the development of the Manual on the WMO Integrated Global Observing System;

Invites CEOS, CGMS, GCOS, GEO and WCRP to collaborate with the WMO Space Programme on the development of an architecture for climate monitoring from space.

Annex to Resolution 19 (Cg-XVI)

ARCHITECTURE FOR CLIMATE MONITORING FROM SPACE
CONCEPT DOCUMENT (Version 1.1)

1. Introduction

The purpose of this document is to provide a basis for consultation and, ultimately agreement, on processes and capabilities to be implemented or maintained, and activities to be pursued, in order to monitor climate from space in a globally coordinated and efficient framework.

Section 2 recalls the motivation for such an architecture.
Section 3 describes key building blocks of the architecture in an end-to-end approach.
Sections 4 to 8 describe the contents of each component.
Section 9 suggests roles and responsibilities to lead this process.

2. Motivation

Facing the need to know and understand the evolution of climate in order to alleviate or prepare for its impact, e.g. for programmes like the Global Framework for Climate Services (GFCS), monitoring climate variables is a prerequisite, and space-based observation has an essential role in this respect.

Meteorological satellites have considerably evolved over the past fifty years and are now used for a variety of applications that span time scales from nowcasting to climate prediction, and include land, ocean, atmosphere and environmental applications. Instruments on research satellites have laid the groundwork for the development of operational satellite systems and resultant environmental applications are growing vigorously.

Specific climate payloads have been flown with success by both operational and research agencies over the last several decades. Operational meteorological missions are enhanced with some climate monitoring instruments, for example for Earth Radiation Budget or ozone monitoring. In response to the Global Climate Observing System (GCOS) Implementation Plan and its Satellite Supplement, the Committee on Earth Observation Satellites (CEOS) presented a comprehensive assessment of satellite capabilities for selected Essential Climate Variables (ECVs). There remain, however, challenges regarding the sustainability and/or continuity of selected missions and measurements to provide a continuous, long-term record of climate.

Responding to these challenges requires defining and implementing an architecture through a mechanism that accounts for the different roles and responsibilities of the respective entities while responding to the essential need for continuous and sustained operation. Given the important contribution of R&D programmes to climate observation, compounded with the increasing convergence of operational and research activities, the future space-based observing system has to rely on a strong partnership between research and operational entities.

3. A structured approach

3.1 Functional components

Taking as a starting point the requirements expressed by GCOS, and possible additional requirements in the future, the following functional components are considered:

- Analysis of user requirements;
- Observing capabilities;
- Essential Climate Variable (ECV) product generation and analysis;
- Data management, access and dissemination;
- User interface;
- Coordination and governance.

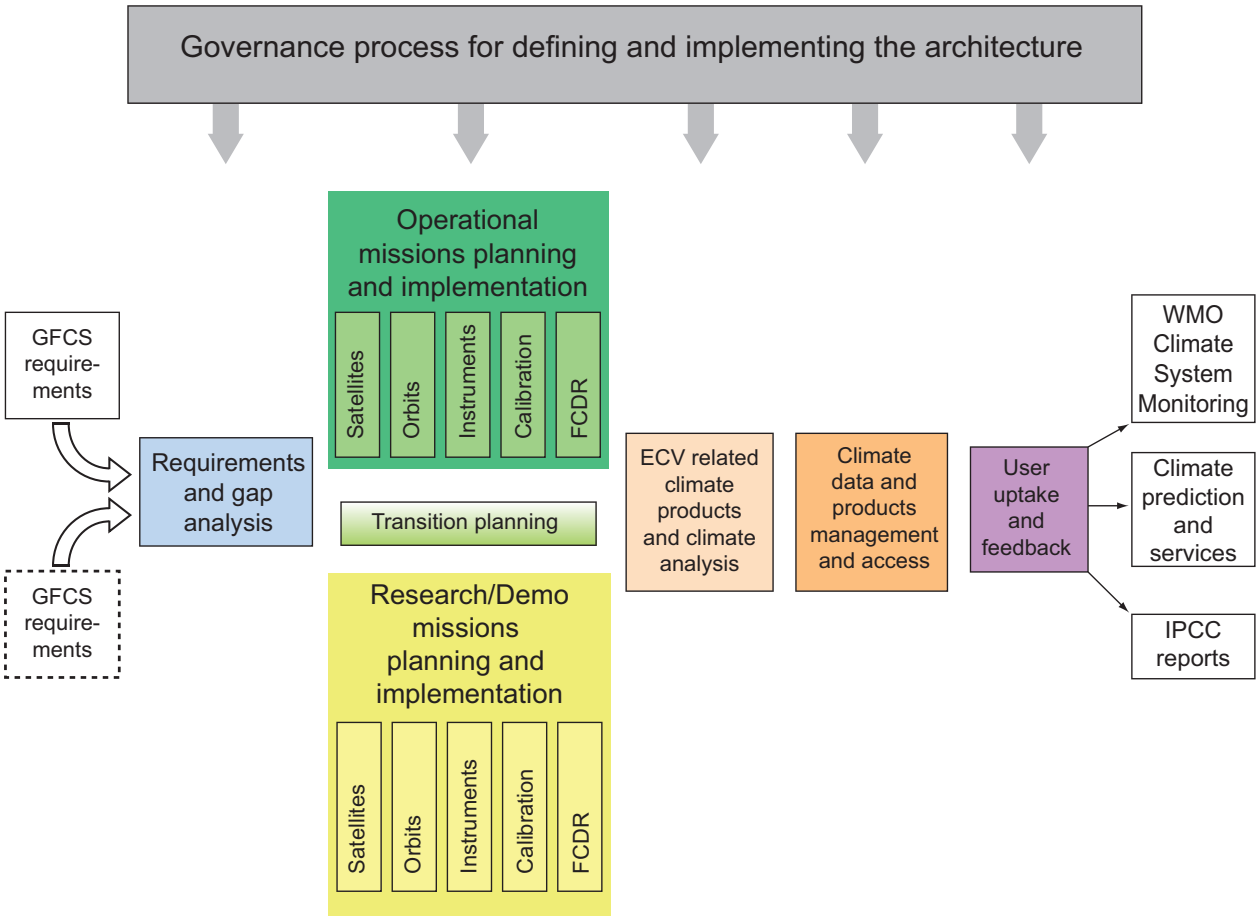

Figure 1: Key components of an end-to-end architecture

3.2 Cross-cutting considerations

The present concept document stays deliberately at high-level, since the detailed design will be developed at a later stage and should be evolving. The architecture should be defined in a long-term perspective. Building on existing assets, and taking into account the currently existing or planned capabilities, it should highlight the incremental effort needed.

In its concept, it should acknowledge:

- The evolving science and the need to ensure linkage with the science community;
- The evolving technology, avoiding being bound to current technical approaches;
- A Research-and-Operations (R&O) process, to be integrated in the evolving architecture.

The architecture should recognize and build upon the leadership exerted by CEOS, the Coordination Group for Meteorological Satellites (CGMS), the Group on Earth Observations (GEO), and the WMO Space Programme. Noting the necessary balance between best-effort and commitment, agreement should be sought on a process, supported by an implementation plan.

The development process should be responsive to evolving user needs. Robustness of systems and processes are necessary to support sustained acquisition and processing of mature observations and products. Quality assurance should be an integral part of each sub-system.

4. User requirements analysis component

4.1 Input

User requirements for observations are expressed by representative user communities, and kept under regular review following well established processes (GCOS Implementation Plan and Satellite Supplement, Rolling Review of Requirements (RRR)).

The requirements address geophysical variables (e.g. ECVs) rather than value-added products. Requirements are not for specific instruments either; they are in principle technology-free, thus not limited to space-based observation. Requirements should specify: variables, units, resolution (space and time), accuracy, continuity. They are consolidated in a database maintained by WMO and linked to the CEOS Missions, Instruments and Measurements (MIM) database.

The GCOS Implementation Plan reflects the needs of the United Nations Framework Convention on Climate Change (UNFCCC). Additional observational requirements for climate monitoring, however, may be driven by the WMO Climate System Monitoring and by climate applications for mitigation and adaptation purposes in the context of GFCS (e.g. for downscaling). The World Climate Research Programme (WCRP) and GAW Programme requirements may also provide a relevant input.

4.2 Requirements analysis

An analysis is needed to select the subset of requirements that can be addressed from space, compare the requirements with the inventory of existing/planned observation capabilities, and perform a Gap Analysis.

5. Observation capabilities component

A comprehensive architecture should encompass operational capabilities and research or demonstration capabilities. In addition to these research and operational capabilities, a process should also be defined to facilitate transition from research to operational status when appropriate, and also recognize both research and operational activities are essential. Quality assurance should be inherent to these elements.

5.1 Operational capabilities

Operational status is understood as offering a clear long-term continuity perspective, which entails the in-principle commitment that the capability, or an equivalent one, will be maintained, enabling to serve an operational community in a sustained manner.

Operational missions should address all ECVs including atmosphere, ocean, land, and cryosphere, to the extent there are mature observation capabilities. They should follow the GCOS Climate Monitoring Principles for satellite observations. An important feature is mission robustness, which may imply provisions for relaunch, contingency planning, and overlap between consecutive missions when appropriate.

CGMS is providing technical coordination of operational programmes. The current baseline agreed by CGMS defines committed elements in geostationary and low-Earth orbit. An evolution of the CGMS baseline is underway to better serve climate monitoring, guided by the WMO Vision for the Global Observing System (GOS) in 2025. The baseline for the space-based observing system can be described in terms of actual constellations (sets of satellites with coordinated orbits), or in terms of virtual constellations (sets of instruments distributed on different satellites but supporting similar missions) mapped with the ECVs. The future CGMS baseline, detailing missions, orbits and

assignments, should ultimately be the foundation of the space-based component of the WMO Integrated Global Observing System (WIGOS).

5.2 Research and demonstration capabilities

R&D missions are twofold: missions for climate research (atmospheric/climate process studies) and missions for technology demonstration. By definition, R&D missions are not bound to any firm perspective of continuity. Research missions respond to a science plan developed in consultation with the climate community.

Space agencies have developed plans at the national level or in international partnerships. CEOS is leading a coordinated response on behalf of space agencies to climate needs, and has implemented several Virtual Constellations mapped with selected ECVs.

5.3 Transition process

Attention is required to avoid misunderstanding of the "Research to Operations" paradigm.

Research and operations are equally important to successfully deliver climate-related measurements. An operational follow-on should be considered for capabilities that have been successfully demonstrated from the point of view of performance, reliability, affordability, maturity, user uptake, and societal benefit. This does not prejudge any transfer of tasks or budgets among entities, which is an internal matter for each agency or country. Joint ventures among R&D and operational entities are strongly encouraged.

The goal is that parties are ultimately in a position to make long-term commitment. The appropriate level for a long-term commitment may be the national government (e.g. WMO Member through its Permanent Representative) since an individual agency may not have the mandate to commit beyond a programme life cycle or a budget cycle.

5.4 Quality assurance: calibration/intercalibration

Quality assurance considerations are applicable to all observation components (See the Quality Assurance Framework for Earth Observation (QA4EO)). The aim should be to generate Fundamental Climate Data Records (FCDRs). This shall build on:

- Global Space-based Inter-Calibration System (GSICS) involving CMA, CNES, EUMETSAT, ISRO, JAXA, JMA, KMA, NASA, NIST, NOAA, ROSHYDROMET and ROSCOSMOS;
- CEOS Working Group on Calibration Validation (including Cal/Val sites);
- GCOS Reference Upper-Air Network (GRUAN) and national initiatives such as the ARM (USA), SADE (France) etc. may support this activity;
- WMO-BIPM collaboration plans addressing measurement challenges in observations for climate monitoring (see proceedings of the first WMO-BIPM workshop, Geneva, 30 March–1 April 2010, WMO/TD-No. 1557).

6. ECV product generation and analysis component

The goal is to ensure sustained provision of validated and quality-controlled ECV products (Thematic Data Records). A number of initiatives are currently contributing to that goal, including:

- Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM);
- Climate Change Initiative (CCI) of the European Space Agency;
- World Data Centres (e.g. GAW DLR Data Centre on Aerosols).

These initiatives, however, are not addressing all the ECVs. There is a need for maintaining a mapping of the available/planned production of ECV products as well as “Additional Climate Variables (ACVs) if required.

For established, peer review validated products, production should be ensured in a sustained mode and quality controlled. New products shall be developed to fill gaps on priority needs, with a process for transitioning to a sustained mode according to their maturity, as assessed by a maturity index. Plans should be made for reprocessing. These products are inputs for climate monitoring analyses as part of, for example, the WMO Annual Statement of the Global Climate or the Intergovernmental Panel on Climate Change (IPCC) Assessment Reports.

7. Data management, access and dissemination component

The scope is to ensure timely accessibility of observations and products in compliance with agreed interoperability standards.

Metadata, catalogue interfacing, and formats should be standardized in compliance with the Global Earth Observation System of Systems (GEOSS) interoperability standards (e.g. the WMO Information System (WIS) standards for WMO Members). Data should be properly catalogued and openly retrievable from data centres. In addition, acknowledging dual use of many data for both climate applications and real-time services, active data distribution should also be considered in accordance with standard practices and protocols (e.g. Direct Readout or rebroadcast).

8. User interface component

User interface should be maintained in order to seek feedback, monitor deliverables and compare with user requirements. Linkages shall be maintained in particular with the science community, the WMO Climate System Monitoring, climate assessment and climate prediction, and the GEOSS user community. Provisions shall be made to support user uptake, through capacity building including training. The annual WMO Statements on the Status of the Global Climate are an example of operational deliverables to the WMO Members, UN agencies and the general public.

9. Coordination functions

At the level of each component, coordination is needed. Tentative leads are suggested below for the respective components:

Function	**Suggested WMO involvement**
Requirement identification	GCOS and WCRP
User requirements analysis	(To be determined, involving CBS)
Observation capabilities	CGMS, GSICS, and CBS and CIMO Working Groups
ECV Product generation	SCOPE-CM
Data Dissemination and Access	(To be determined, involving CBS and WIS)
User Interface	GCOS, WCRP, and GFCS

An overall governance mechanism will be needed in order to:

- Manage evolution of the plan and maintain a long-term Vision;
- Monitor the commitments of each contributor, ensuring a smooth interaction among components;

- Maintain a proper link with GEO/GEOSS, support communication, outreach, and provide visibility to this collaborative endeavour.

Document Change Record		
Version	Date	
Draft Outline 1	14 October 2010	Update for CBS-Ext.(10)/Doc. 4.2(3) discussion
Draft Outline 2	15 October 2010	Creation of document for CGMS discussion as CGMS WMO-WP-09
Draft Outline 3	6 December 2010	Update for CEOS discussion
Version 1	20 December 2010	Creation report for WMO/GCOS Workshop discussion
Version 1.1	March 2011	Update for Cg-XVI/Doc. 3.7 discussion

Resolution 20 (Cg-XVI)

PUBLIC WEATHER SERVICES PROGRAMME

THE CONGRESS,

Noting:

(1) Resolution 16 (Cg-XV) – Public Weather Services Programme,

(2) The *Abridged Final Report with Resolutions of the Sixty-second Session of the Executive Council* (WMO-No. 1059),

Considering:

(1) That the Public Weather Services (PWS) constitute the main conduit connecting National Meteorological and Hydrological Services (NMHSs) to the public, media, disaster management authorities, communities affected by weather-related disasters, and social and economic user sectors,

(2) The continuing need to strengthen the capability of Members to deliver high-quality services for the safety of life and livelihood, the protection of property, and for contributing to sustainable development,

(3) That it is critical for decision-makers to understand and translate meteorological information and especially warnings into effective actions,

Decides:

(1) That the substance of the PWS Programme shall be as indicated in the WMO Strategic Plan (2012–2015) adopted under Resolution 36 (Cg-XVI) and the WMO Operating Plan;

(2) That the WMO Strategy for Service Delivery should guide the implementation of the PWS and other relevant Programmes;

Requests the Commission for Basic Systems:

(1) To continue to provide assistance to the technical planning and further development of the PWS Programme in accordance with the WMO Strategic and Operating Plan;

(2) To enhance its crucial support to the PWS Programme in the delivery of services to the public and to socio-economic sectors;

Invites the regional associations:

(1) To continue to be actively engaged with the PWS Programme;

(2) To keep the PWS Programme under review;

(3) To establish requirements in the light of Members' evolving needs, and technical developments in the delivery of services;

Requests the Executive Council to take all necessary actions to guide the PWS Programme and to enable it to meet the needs of Members in service delivery and thus to achieve its objectives under the WMO Strategic and Operating Plan (2012–2015);

Urges Members:

(1) To take all possible measures to continue to support the implementation of the components of the PWS Programme;

(2) To take all possible steps to strengthen their national PWS through ensuring effective service delivery to user communities and stakeholders, and raising the level of public awareness of, and response to, these services, as well as creating visibility for NMHSs;

(3) To participate in PWS capacity-building activities;

(4) To evaluate the effectiveness of PWS in the delivery of services to users;

(5) To measure the contribution of PWS to the social and economic benefits provided to users through the work of NMHSs, and demonstrate such benefits to governments with the aim of securing due support for NMHSs, and further strengthening their capacity to deliver quality service;

Requests the Secretary-General:

(1) To support Members, as necessary, in their efforts to implement PWS activities at the national level in accordance with the WMO Strategy for Service Delivery;

(2) To collaborate closely with Members to ensure the further development and implementation of the PWS Programme and to establish clear performance metrics so that the Programme is enabled to contribute fully to the realization of the WMO key Strategic Thrust in Service Delivery across the areas of weather, water and climate;

(3) To propose projects for the further development of key PWS components;

(4) To promote collaboration between PWS Programme and other relevant WMO programmes;

(5) To promote collaboration with relevant national and international organizations, as well as with the GFCS;

(6) To develop Implementation Plans for the WMO Strategy for Service Delivery aligned with the budget areas identified by Congress.

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Note: This resolution replaces Resolution 16 (Cg-XV), which is no longer in force.

Resolution 21 (Cg-XVI)

USE OF THE STANDARDIZED PRECIPITATION INDEX FOR CHARACTERIZING METEOROLOGICAL DROUGHTS BY ALL NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES

THE CONGRESS,

Noting:

(1) That the International Workshop on Drought and Extreme Temperatures: Preparedness and Management for Sustainable Agriculture, Rangelands, Forestry and Fisheries, organized by WMO and the China Meteorological Administration (CMA) and held in Beijing, China (February 2009), recommended that WMO make appropriate arrangements to identify the methods and to marshal resources for the development of standards for agricultural drought indices in a timely manner,

(2) That the "Lincoln Declaration on Drought Indices" was adopted at the Interregional Workshop on Indices and Early Warning Systems for Drought held in December 2009 in Lincoln, United States of America,

(3) That the Executive Council adopted at its sixty-second session Resolution 15 – Use of the Standardized Precipitation Index for characterizing meteorological droughts by all National Meteorological and Hydrological Services,

Considering that effective monitoring and early warning systems for the three types of droughts – meteorological, agricultural and hydrological droughts – require standardized indices,

Requests Members to ensure that all National Meteorological and Hydrological Services around the world use the Standardized Precipitation Index (SPI) to characterize meteorological droughts, in addition to other drought indices that are already in use in their service;

Requests the Secretary-General:

(1) To ensure that the comprehensive user manual on SPI, which provides a description of the index, the computation methods, the current application of the index, the strengths and limitations, mapping capabilities and how it can be used, will be published and distributed in all official languages of WMO;

(2) To ensure that the outcomes and recommendations of the Working Groups on Agricultural and Hydrological Drought Indices will be distributed to all Members.

Resolution 22 (Cg-XVI)

AGRICULTURAL METEOROLOGY PROGRAMME

THE CONGRESS,

Noting:

(1) Resolution 17 (Cg-XV) – Agricultural Meteorology Programme,

(2) Resolution 9 (EC-LIX) – Report of the fourteenth session of the Commission for Agricultural Meteorology,

(3) The progress made in the implementation of the Programme, including that on drought and desertification,

(4) The *Abridged Final Report with Resolutions and Recommendations of the Fifteenth Session of the Commission for Agricultural Meteorology* (WMO-No. 1062),

(5) The report of the president of the Commission for Agricultural Meteorology to Sixteenth Congress,

(6) The WMO Strategic Plan (2012–2015),

Expresses its appreciation for steps taken to assist Members in combating desertification and land degradation, alleviating the effects of drought, applying agrometeorology in the development of sustainable farming systems, and improving the adaptive capacity and resilience of agriculture to climate change;

Adopts the recommendations of the fifteenth session of the Commission for Agricultural Meteorology on the implementation of the Agricultural Meteorology Programme;

Urges all Members:

(1) To collaborate actively in, and to give all possible support to, the implementation of the Agricultural Meteorology Programme, ensuring that WMO standards of data collection and data quality are maintained;

(2) To implement the key priorities for the Programme during the intersessional period 2011 to 2014 as decided by the Commission and informed by the WMO Strategic Plan;

(3) To integrate agrometeorological data within the framework of the WMO Integrated Global Observing System (WIGOS) and the WMO Information System (WIS);

(4) To further build and support existing collaboration with other natural resource sciences to ensure that sustainable agricultural systems are developed with a better understanding, valuation and more appropriate application of agrometeorological science;

Requests the Executive Council, with the assistance of the Commission for Agricultural Meteorology and other relevant technical commissions, to promote, guide and assist in the implementation of the Agricultural Meteorology Programme;

Requests the Secretary-General:

(1) To take necessary actions, within available budgetary resources, to support Members in their efforts to implement, at the national level, the priority activities of the Agricultural Meteorology Programme as described in the WMO Strategic Plan, including support for their efforts in the following:

   (a) Combating desertification and land degradation;

   (b) Alleviating the effects of extreme weather events on agriculture (such as drought and floods);

   (c) Ensuring that agrometeorology is appropriately applied in the development of sustainable farming systems;

   (d) Improving the adaptive capacity and resilience of agriculture to climate change;

   (e) Engaging policy- and decision-makers, especially in developing and least developed countries, to ensure that the output of the Programme becomes one of the inputs used by National Meteorological and Hydrological Services to advise on the relevant areas of the national long-term development plans of these states;

(2) To assist regional associations and their subsidiary bodies in implementing the subregional and regional aspects of their priority activities in agrometeorology;

(3) To continue to build and reinforce existing partnerships with other relevant international organizations in the implementation of the WMO Strategic Plan with regards to priority areas relevant to the Programme, especially in the areas of education and training in agrometeorology and the preparation of guidelines on the improvement of management practices in agriculture and forestry;

(4) To report annually to the Executive Council on progress achieved and to submit proposals for the future;

(5) To report to the Seventeenth Congress on progress achieved and to submit proposals for the future.

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Note: This resolution replaces Resolution 17 (Cg-XV), which is no longer in force.

Resolution 23 (Cg-XVI)

TROPICAL CYCLONE PROGRAMME

THE CONGRESS,

Noting:

(1) Resolution 6 (Cg-XV) – Tropical Cyclone Programme,

(2) The thirty-fourth, thirty-fifth and thirty-sixth annual status reports on the implementation of the Tropical Cyclone Programme issued in 2008, 2009 and 2010, respectively,

(3) The WMO Strategic Plan,

Expresses its satisfaction with the progress achieved in the development of the Tropical Cyclone Programme to improve operational tropical cyclone forecasting and its appreciation for the invaluable assistance provided to developing countries to build their capacities through the WMO Voluntary Cooperation Programme, donor Members and bilateral arrangements;

Considering:

(1) That the fundamental role of the Tropical Cyclone Programme is to assist Members in establishing national and regionally coordinated warning systems to ensure that the loss of life and damage caused by tropical cyclones are reduced to a minimum,

(2) That the Members, especially least developed countries and small island developing States, are under the stress of strengthening their capacities to meet users' demands for the delivery of enhanced services with more accurate and timely warnings of tropical cyclones and associated flooding and storm surges, targeted especially at end-users, disaster managers and other decision-makers,

(3) That a high-priority requirement for reducing the socio-economic impacts of tropical cyclones is to establish an effective warning system through a multidisciplinary approach,

Decides:

(1) That the WMO Tropical Cyclone Programme shall be further strengthened to enable the Members to fulfil the expanding role and to address the new challenges;

(2) That the substance of the Tropical Cyclone Programme shall comply with the WMO Strategic Plan;

(3) That the WMO Strategy for Service Delivery should guide the implementation of the Tropical Cyclone Programme;

Urges Members to ensure that their Meteorological and Hydrological and Disaster Risk Reduction Services take whatever steps are within their competence and coordinate with the appropriate authorities:

(1) To promote awareness of the risks associated with tropical cyclones and related hazards;

(2) To continue to strengthen their forecasting and warning capabilities and ensure wide dissemination, understanding and utilization of their products, particularly at the community and local levels;

(3) To ensure that the measures necessary to save human lives and reduce damage are carried out at all levels, including the community level, as a consequence of tropical cyclone forecasts and warnings;

(4) To strengthen the partnerships with other Members and relevant national agencies, such as disaster and emergency management authorities, through the sharing of knowledge, skills, experience and resources to save human lives and reduce damaging impacts from tropical cyclones and other multi-hazard inundation events, such as those arising from tsunamis;

(5) To utilize the WMO Strategy for Service Delivery to further improve their early warning services and products, as well as their dissemination;

Requests the Secretary-General:

(1) To keep Members concerned fully informed of progress and developments in the planning and implementation of the Programme;

(2) To assist Members in their efforts to implement Tropical Cyclone Programme activities for the safeguarding of life and property from tropical cyclones and related hazards, to the maximum extent possible within the available budgetary resources;

(3) To continue to support the capacity-building programmes for developing countries, especially for least developed countries and small island developing States;

(4) To maintain and further enhance the collaboration between the Tropical Cyclone Programme and relevant WMO Programmes and technical commissions, particularly in relation to the development of tropical cyclone forecasting competencies;

(5) To continue close cooperation with other international organizations, as well as relevant national organizations, at the global and regional levels to promote a multidisciplinary and multi-hazard approach towards the attainment of the humanitarian goals of the Programme.

Note: This resolution replaces Resolution 6 (Cg-XV), which is no longer in force.

Resolution 24 (Cg-XVI)

MARINE METEOROLOGY AND OCEANOGRAPHY PROGRAMME

THE CONGRESS,

Noting:

(1) Resolution 19 (Cg-XV) – Marine Meteorology and Oceanography Programme,

(2) The *Abridged Final Report with Resolutions and Recommendations of the Third Session of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology* (WMO-No. 1049),

(3) Resolution 4 (EC-LXII) – Report of the third session of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology,

Considering:

(1) That a continuing concerted effort by National Meteorological Services is needed, in association with national oceanographic agencies and institutions as appropriate, in order for marine meteorological and oceanographic services to meet national, regional and international requirements,

(2) That the scope of the Marine Meteorology and Oceanography Programme (MMOP) is defined in response to the evolving needs of all users of marine data and products, and includes an outreach programme to enhance the national capacity of all maritime countries

to deliver marine data and services to support safety at sea and develop priority applications in coastal area management, disaster risk reduction and climate services,

(3) That these goals should be supported through the application of a vigorous and focused training and capacity-building strategy to enhance the marine capabilities of Members,

(4) That progress in developing and implementing marine meteorological and oceanographic products and services will be achieved through the best use of adequate technology and opportunities such as in situ met-ocean data and emerging remote-sensing platforms,

(5) The ongoing priority areas identified by the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) at its third session,

(6) The role of the Marine Meteorology and Oceanography Programme in supporting all WMO priority areas,

Decides:

(1) That detailed planning and implementation of the Marine Meteorology and Oceanography Programme should form an integral part of the WMO Strategic Plan, and should assist Members in arranging for enhanced services provision, including new operational ocean forecast and warning systems to be developed in close coordination with users;

(2) That the Marine Meteorology and Oceanography Programme should be strengthened and expanded to address new emerging challenges and issues, especially on disaster risk reduction, coastal management and climate services;

(3) That additional funding should be sought for high-priority and emerging activities in the field of training, capacity-building and support for least developed countries and small island developing States;

(4) That the WMO Strategy for Service Delivery should guide the implementation of the Marine Meteorology and Oceanography Programme;

Requests the Executive Council, with the assistance of JCOMM, other relevant technical commissions and the regional associations, to promote, guide and assist in the implementation of the Marine Meteorology and Oceanography Programme;

Urges Members concerned to collaborate actively, by making the time and expertise of their staff available, and by giving all possible support, both direct resources and in kind, to the implementation of the Marine Meteorology and Oceanography Programme and the work of JCOMM through:

(1) Strengthening their marine meteorological and oceanographic services, with priority given to basic services in support of the safety of life and property at sea as required under the International Convention for the Safety of Life at Sea (SOLAS), including supporting the establishment of the Worldwide Met-ocean Information and Warning Service (WWMIWS) under the International Maritime Organization (IMO) and WMO, and the adoption of a quality management approach to the delivery of marine weather and ocean services;

(2) Continuing and/or expanding their contribution to met-ocean data collection and archiving, including associated metadata, making use of modern telecommunication facilities for the collection and dissemination of information, within the concept and developing structure of the WMO Information System, in particular through operational or sustained funding for the national ocean observing systems components of the Global Ocean Observing System

(GOOS), co-sponsored by WMO, the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO/IOC), the United Nations Environment Programme (UNEP) and the International Council for Science (ICSU);

(3) Assisting developing countries to fulfil their responsibilities under, and gain full benefit from, the Marine Meteorology and Oceanography Programme, in particular through strengthening specialized training facilities and programmes in marine meteorology and oceanography;

(4) Supporting an integrated effort to develop and improve forecasting capabilities and service delivery in coastal risk reduction, in particular in cases of extreme events (such as storm surges and high and/or long waves), as well as the analysis of impacts of oceanic response to climate variability and change, through the implementation of regional demonstration projects promoted by WMO, as appropriate;

Requests the co-presidents of JCOMM:

(1) To ensure that the Commission takes the lead in satisfying the technical needs of Members in the area of marine meteorology and oceanography, including by continuing its policy of preparing and updating guidance material on various aspects of marine meteorology and oceanography management, through the collaborative efforts of its experts;

(2) To continue the efforts of the Commission in enhancing the role of WMO in the field of marine meteorology and oceanography;

(3) To arrange for contributions from JCOMM to other WMO Programmes, as appropriate;

Requests the Secretary-General:

(1) To assist in the implementation of the Programme, and in particular to give high priority to training and capacity-building requirements;

(2) To foster the overall integration of the Programme into the priority activities of WMO, in accordance with the WMO Strategic Plan;

(3) To ensure the essential high level of collaboration with the IOC required for the efficient and effective functioning of JCOMM;

(4) To arrange for the coordination of activities under MMOP with other relevant programme activities of the IOC and other international organizations;

(5) To assist in the implementation of these activities;

(6) To seek for further enhancement of cooperation between MMOP and other WMO Programmes and technical commissions;

(7) To seek voluntary financial and in kind resources, as necessary, to facilitate the implementation of the Programme and the work of JCOMM;

(8) To bring this resolution to the attention of all concerned.

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Note: This resolution replaces Resolution 19 (Cg-XV), which is no longer in force.

Resolution 25 (Cg-XVI)

DATA BUOY VANDALISM: INCIDENCE, IMPACT AND RESPONSES

THE CONGRESS,

Noting:

(1) Resolution 64/71 – Oceans and the law of the sea (paragraph 172) and resolution 64/72 – Sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments (paragraph 109), which were adopted by the United Nations General Assembly in 2009 and urged States, appropriate United Nations agencies and relevant organizations to take necessary action and adopt measures to protect ocean data buoy systems and cooperate to address intentional and unintentional damage to platforms used for ocean observation and marine scientific research, such as moored buoys and tsunameters,

(2) The *Abridged Final Report with Resolutions of the Sixty-second Session of the Executive Council* (WMO-No. 1059) which, inter alia, expressed concern about the significant occurrence of intentional or unintentional damage to ocean observing systems, and urged Members to help promote understanding of the impacts of such damage, which seriously undermines efforts to establish national and regional ocean hazard warning systems,

(3) Resolution XXV-13 of the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO/IOC) – Global coordination of early warning and mitigation systems for tsunamis and other sea-level related hazards, which recognized the value of collecting and exchanging data and information, and which called for:

   (a) An inventory and assessment of the problem of ocean observing platform vandalism globally,

   (b) An assessment of the impacts of such vandalism, including on the functionality of tsunami warning systems,

   (c) Information on the annual cost of ocean observing platform vandalism to Member States,

   (d) Recommendations for IOC and Member State action,

(4) The Data Buoy Cooperation Panel (DBCP) and International Tsunameter Partnership (ITP) Technical Document (TD) No. 41, *Ocean Data Buoy Vandalism – Incidence, Impact and Responses,*

(5) Resolution 50 (Cg-XVI) – Implementation of the WMO Integrated Global Observing System,

Acknowledging:

(1) That Members and the global community increasingly rely on a rapidly expanding ocean observing network of critical infrastructure, necessary to detect storm surges and tsunamis and to improve understanding of weather, climate and ecosystems,

(2) That ocean data buoy networks are an integral component of a sustainable, integrated and comprehensive global ocean observing system serving multiple applications, and have proven to be essential in providing timely and geographically specific data for decision-making,

(3) That moored ocean buoy stations are especially susceptible to human-caused damage, which has resulted in extensive outages and data loss, often at critical times,

Recognizing that vandalism and damage to ocean observing networks takes many forms, including from ship impacts, incidental damage, direct exploitation of moorings as fish aggregation devices, intentional damage and theft,

Encouraged:

(1) By recent action of the Western and Central Pacific Fisheries Commission, the Inter-American Tropical Tuna Commission and the Indian Ocean Tuna Commission to protect moored ocean observing systems, including regional and local education and training,

(2) By the Regional Workshop on Establishing a Cooperative Mechanism for Protection of Met-Ocean Data and Tsunami Buoys in the Northern Indian Ocean Region (May 2011), which made important recommendations regarding possible new legal instruments on the topic,

(3) By the fourth meeting of the IOC Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG-IV, Paris, March 2011), which, inter alia, proposed to the twenty-sixth session of the IOC Assembly that it adopt a resolution on the topic of vandalism of ocean data buoys and tsunameters,

Urges Members and **invites** relevant international and intergovernmental organizations:

(1) To develop, in collaboration with educators and the global media, communication plans to raise awareness of the critical value of ocean observation, and to promote education and outreach, especially with recreational and commercial fishers, to broaden support of community stakeholders, enable proactive engagement at regional and local scales, and raise public literacy for ocean observing network-derived services and disaster risk reduction benefits;

(2) To adopt additional strategies for the strengthening of ocean observing networks and systems and other damage prevention and mitigation practices, including the enhanced engineering of station and infrastructure design;

(3) To work with the Food and Agricultural Organization of the United Nations (FAO) and regional fisheries management organizations and bodies, especially those with the competence to manage highly migratory fisheries, to educate and encourage stakeholders to adopt binding measures to prevent and minimize vandalism and damage to ocean observing networks and data systems;

Requests the Secretary-General and **invites** the Executive Secretary of UNESCO/IOC:

(1) To promote collection of more consistent and systematic statistics on vandalism, to increase capture and exchange of damage records and performance measures for ocean observing networks, and to conduct comprehensive cost-benefit assessments and risk-value analyses taking into account life, health, social and economic impacts of vandalism and damage to ocean observing networks and data systems;

(2) To encourage and assist, where appropriate, the development of specific regional efforts and solutions in addressing the vandalism of ocean data platforms;

(3) To present the *Ocean Data Buoy Vandalism – Incidence, Impact and Responses* report to the United Nations General Assembly, with a view to promoting an integrated United Nations approach to addressing this critical issue.

Resolution 26 (Cg-XVI)

WMO QUALITY MANAGEMENT FRAMEWORK

THE CONGRESS,

Noting the increasingly high impact of weather, water and climate information on crucial societal decision-making processes,

Noting further the increased scrutiny of the quality, reliability and accuracy of weather, water and climate products and services by critically important stakeholders,

Having considered recent developments in some application areas, such as aviation or marine meteorology, where partner organizations are mandating the implementation of Quality Management Systems (QMS) for services to them,

Recognizing the high importance of the working arrangements between WMO and the International Organization for Standardization (ISO), including the recognition of WMO as an international standardizing body for technical standards, a rare distinction given to only three organizations worldwide,

Recommends a full integration of the Quality Management Framework (QMF) into the wider WMO strategic and operational planning process as part of a holistic management system encompassing quality management, risk management, results-based management, as well as monitoring and evaluation;

Invites Members with a well-developed QMS in place to share experiences, expertise and documentation with other Members currently developing or planning such systems;

Agrees with the conclusions of the Inter-Commission Task Team on Quality Management Framework (ICTT-QMF) and the Executive Council concerning the need for a twinning partnership system;

Requests the Executive Council to establish an appropriate mechanism with the task to promote, oversee and guide the further implementation of the Quality Management Framework in the simplest and most efficient manner as possible;

Requests the Secretary-General, in cooperation with the Executive Council, to undertake an in-depth gap analysis of the WMO Secretariat in terms of QMS, with a view to developing a business case for a QMS implementation pilot project;

Urges the technical commissions to explore opportunities to develop new common Technical Standards under the Working Arrangements between ISO and WMO;

Encourages Members to provide in kind and extrabudgetary resources to help achieve these goals;

Further encourages Members to subject their QMS to regular monitoring and evaluation to ensure continuous improvement and sustained compliance with ISO 9001:2008.

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Note: This resolution replaces Resolution 32 (Cg-XV), which is no longer in force.

Resolution 27 (Cg-XVI)

INFORMATION AND PUBLIC AFFAIRS PROGRAMME

THE CONGRESS,

Noting:

(1) That good communication is a key success factor of the WMO Strategy,

(2) That the United Nations system, including WMO, was requested to play an important role in increasing awareness and understanding and improving decision-making processes in the face of a changing climate prone to more extreme weather and climate conditions,

(3) That the National Meteorological and Hydrological Services have a major role to play in the socio-economic development of countries, especially as all are concerned by the impacts of climate variability and change,

Considering:

(1) The implementation strategy for the top priorities of the WMO Strategic Plan, and in particular the Global Framework for Climate Services (GFCS) adopted by Sixteenth Congress,

(2) That the activities of WMO and its Members need to be supported by a well-elaborated and clearly articulated communication strategy,

Decides that the Information and Public Affairs Programme shall be continued in the sixteenth financial period with the support of a project team composed of experts from WMO Members and WMO Secretariat staff, with the aim of consolidating the WMO Web presence, including in social media, mobile phone technology and other new media to reach out to people worldwide, in particular to youth, and paying special attention to the needs of developing countries;

Urges Members to participate actively in, and to contribute to the maximum extent possible to, the funding of the Information and Public Affairs Programme;

Requests the Executive Council to monitor progress made and to give advice in the context of its oversight of WMO;

Requests the Secretary-General to review and update the communications strategy of WMO and to report to the Seventeenth Congress on the implementation of the strategy.

Resolution 28 (Cg-XVI)

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

THE CONGRESS,

Recalling:

(1) The *Abridged Final Report with Resolutions of the Fourteenth World Meteorological Congress* (WMO-No. 960), general summary, paragraphs 3.2.2.1 to 3.2.2.6, on the Intergovernmental Panel on Climate Change (IPCC),

(2) Resolution 10 (Cg-XV) – Intergovernmental Panel on Climate Change,

Recognizing the key role of the Intergovernmental Panel on Climate Change in preparing and disseminating scientific, technical and socio-economic assessments to underpin national and international policy formulation on the climate change issue,

Congratulates the Panel for:

(1) The highly successful completion of the Synthesis Report of the IPCC Fourth Assessment Report;

(2) The award of the Nobel Peace Prize in December 2007 jointly with Mr Al Gore "for their efforts to build up and disseminate greater knowledge about man-made climate change and to lay the foundations for the measures that are needed to counteract such change";

(3) The completion of the *Special Report on Renewable Energy Sources and Climate Change Mitigation* (SRREN);

(4) The ongoing work of the Task Force on National Greenhouse Gas Inventories, which continues to assess and develop greenhouse gas inventory methods and practices that are scientifically sound and relevant to all countries;

Expresses:

(1) Its sincere appreciation and gratitude to Mr R.K. Pachauri for his leadership of the activities of the Panel, and to the co-chairs of the IPCC Working Groups and of the Bureau of the Task Force on National Greenhouse Gas Inventories for successfully guiding the activities of their respective Working Groups and Task Force; and to the Secretary of the IPCC, for the support provided to the above;

(2) Its thanks to all the experts who have actively contributed to the writing and reviewing of IPCC reports, in particular the coordinating lead authors, lead authors and review editors;

(3) Its gratitude to governments, institutions and organizations that have generously contributed to the work of the Panel and to the joint WMO/United Nations Environment Programme (UNEP) IPCC Trust Fund;

(4) Its gratitude to the Governments of Germany, Japan, Switzerland and the United States of America for hosting Technical Support Units for IPCC Working Groups and the Task Force;

(5) Its appreciation to the United Nations Environment Programme for its continued co-sponsorship of the Panel;

(6) Its support for IPCC actions for implementation of the InterAcademy Council (IAC) review recommendations on procedures, governance and management, conflict of interest policy and communications strategy;

Noting:

(1) That the preparation of the Fifth Assessment Report is well advanced and progressing according to schedule,

(2) That the *Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (SREX) is to be finalized in November 2011,

(3) That substantial benefits flow to National Meteorological and Hydrological Services (NMHSs) and the Intergovernmental Panel on Climate Change through the active involvement of the Services in the work of the Panel,

Recognizing that the IPCC terms of reference are comprised of decisions by the World Meteorological Congress, the United Nations Environment Programme Governing Council and the Intergovernmental Panel on Climate Change itself, and have served the Panel well in performing its activities,

Encourages:

(1) The Intergovernmental Panel on Climate Change to continue its activities under its existing terms of reference subject to any further requests from WMO and UNEP;

(2) The Panel to continue to work closely with the United Nations Framework Convention on Climate Change and respond to the needs of the Convention for scientific, technical and socio-economic assessments, including through assessment reports, special reports, methodology reports and technical papers;

Requests the Chair of IPCC to continue to report regularly on the progress of the work of the Panel to the Executive Council and Congress;

Requests the Secretary-General, jointly with the Executive Director of UNEP, to maintain financial and organizational support for the IPCC Secretariat, and to assist with publication and dissemination of IPCC Reports;

Further requests the Secretary-General to explore ways to strengthen the scientific capacity of the IPCC Secretariat in consultation with the Chair of the IPCC;

Requests the IPCC to proactively encourage more active participation of NMHSs in the activities of the Panel;

Urges Members:

(1) To actively participate in the work of the Intergovernmental Panel on Climate Change, in particular with the contribution of scientists and experts from the NMHSs;

(2) To promote the outcomes of the activities of the Intergovernmental Panel on Climate Change;

(3) To maintain, and where possible to increase, their financial support for IPCC activities through contributions to the WMO/UNEP IPCC Trust Fund.

Resolution 29 (Cg-XVI)

GLOBAL CLIMATE OBSERVING SYSTEM

THE CONGRESS,

Noting:

(1) The 1998 Memorandum of Understanding between WMO, the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO/IOC), the United Nations Environment Programme (UNEP), and the International Council for Science (ICSU) concerning the Global Climate Observing System (GCOS),

(2) The Terms of Reference for GCOS National Coordinators (Annex XII to the *Summary Report of the Eleventh Session of the WMO-IOC-UNEP-ICSU Steering Committee for GCOS*, GCOS-87, WMO/TD-No. 1189),

(3) Resolution 11 (Cg-XV) – Global Climate Observing System,

(4) Decisions 11/CP.9 – Global observing systems for climate, and 5/CP.10 – Implementation of the global observing system for climate of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), at its ninth session, 1–12 December 2003, Milan, Italy, and tenth session, 6–18 December 2004, Buenos Aires, respectively,

(5) The *Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC* (2010 Update, GCOS-138, WMO/TD-No. 1523),

(6) The report entitled *Systematic Observation Requirements for Satellite-based Products for Climate* (GCOS-107, WMO/TD-No. 1338),

(7) The *Progress Report on the Implementation of the Global Observing System for Climate in Support of the UNFCCC 2004–2008* (GCOS-129, WMO/TD-No. 1489),

(8) The draft conclusions on research and systematic observation (FCCC/SBSTA/2009/L.6 and FCCC/SBSTA/2009/L.6/Add.1), thirtieth session of the Subsidiary Body for Scientific and Technological Advice (SBSTA), 1–10 June 2009, Bonn, Germany,

(9) Decision 9/CP.15 – Systematic climate observations, of the Conference of the Parties to the United Nations Framework Convention on Climate Change, at its fifteenth session, 7–19 December 2009, Copenhagen,

(10) The draft conclusions on research and systematic observation (FCCC/SBSTA/2010/L.22), thirty-third session of SBSTA, 30 November–4 December 2010, Cancun, Mexico,

(11) The 10-Year Implementation Plan of the Global Earth Observation System of Systems (GEOSS) and the Group on Earth Observations (GEO) 2009–2011 Work Plan,

Considering:

(1) The increasing need among Members and international organizations for comprehensive, continuous, reliable climate and climate-related data and information in support of:

   (a) Climate system monitoring,

(b) Climate change detection and attribution (which refers to the process of establishing the most likely causes for the detected change with some defined level of confidence),

(c) Research to improve understanding, modelling and prediction of the climate system,

(d) Operational climate prediction on seasonal-to-interannual timescales,

(e) Assessment of the impacts of, and vulnerability and adaptation to, natural climate variability and human-induced climate change,

(f) Applications and services for sustainable economic development,

(g) Requirements of the UNFCCC and other international conventions and agreements,

(2) The specific observational needs of the World Climate Research Programme (WCRP), the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme on Global Environment Change (IHDP) and DIVERSITAS; the requirements for comprehensive observations in support of the assessment processes of the Intergovernmental Panel on Climate Change (IPCC),

(3) The objectives of GCOS as identified in the Memorandum of Understanding to support all aspects of the World Climate Programme and relevant aspects of other climate-related global programmes, and its essential role in underpinning the full range of climate applications and services provided by National Meteorological and Hydrological Services and other organizations,

(4) The deficiencies in the number and availability of systematic observations of climate,

(5) The need to implement and, as necessary, to update the Regional Action Plans developed through the GCOS Regional Workshop Programme,

(6) The need to incorporate climate information into social and economic decision-making, particularly in support of the Millennium Development Goals in developing countries, with a special focus on Africa,

Recognizing:

(1) The importance of efficient coordination and interoperability across the various component observing systems of GCOS and effective integration of in situ and space-based observations in meeting user needs,

(2) The stringent requirements for long-term observations of the climate system to ensure their adequacy for climate applications,

(3) The unique opportunities for coordinated national and international observation of Essential Climate Variables across the atmospheric, oceanic and terrestrial domains provided through the joint sponsorship of GCOS by WMO, IOC, UNEP and ICSU,

(4) The new opportunities for increased international support, enhanced interoperability and improved integration opened up by the prospect of embedding the GCOS system of systems within the emerging operational structure of the Global Earth Observation System of Systems,

(5) The fundamental importance of GCOS to the Global Framework for Climate Services,

Recognizing with appreciation:

(1) The important contribution of the GCOS Steering Committee and its Panels in providing scientific and technical guidance to WMO and other sponsoring and participating organizations for the planning, implementation and further development of GCOS,

(2) The critical role of the Executive Council, technical commissions and regional associations in coordinating the implementation of the WMO component systems of GCOS,

(3) The substantial achievements of Members in implementing their climate observing systems in support of both national needs and the international objectives of GCOS,

(4) The close collaboration among the co-sponsors of GCOS and with the Steering Committees and Secretariats of their other jointly sponsored observing systems – the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS),

(5) The support provided by a range of national and international donor organizations for GCOS planning and implementation,

Reaffirms the continuing strong commitment of WMO to the objectives of GCOS and support for its implementation in order to meet the full range of user needs;

Decides to maintain GCOS as a programme of the Organization, in partnership with IOC, UNEP and ICSU and such other international sponsors as might be agreed by the Executive Council;

Adopts the GCOS Climate Monitoring Principles for effective monitoring of the climate system;

Urges Members:

(1) To strengthen their national atmospheric, oceanographic and terrestrial climate observing networks and systems, including networks and systems for the hydrological and carbon cycles and the cryosphere within the framework of GCOS and in support of user needs;

(2) To assist other Members to strengthen their observing networks, to improve their capacity to acquire climate-relevant data, and to enhance their provision of climate services by implementing projects in the ten GCOS Regional Action Plans, and by contributing to the implementation of the ClimDev Africa Programme and to similar initiatives in other regions;

(3) To ensure, to the extent possible, the long-term continuity of the critical space-based components of GCOS, including the generation and dissemination of the satellite-based climate data and products based on the Essential Climate Variables that are required to meet the needs of the UNFCCC, IPCC and other users of climate services;

(4) To establish GCOS National Committees and to identify GCOS National Coordinators in order to facilitate coordinated national action on observing systems for climate, taking into account the joint international sponsorship of GCOS and the evolving international arrangements for GEOSS;

(5) To ensure that their delegations to sessions of the UNFCCC Conference of Parties and its subsidiary bodies are properly informed of the key role played by National Meteorological and Hydrological Services (NMHSs) in implementing and operating observing systems necessary to meet national obligations under the Convention, for example through the inclusion in national delegations of representatives of NMHSs;

(6) To encourage their NMHSs to provide effective leadership in the preparation of national reports to the UNFCCC on their activities with regard to systematic observation of the global climate system, including the identification of gaps, using revised UNFCCC reporting guidelines on global climate observing systems that reflect the priorities of the GCOS Implementation Plan updated in 2010 and incorporate reporting on the Essential Climate Variables identified therein;

(7) To enhance their support to the GCOS Secretariat, through secondment of experts and/or through contributions to the Climate Observing System Fund or to specific planning and implementation mechanisms, so as to enable the Secretariat to support the full range of implementation agents in its efforts to establish an effectively operating GCOS;

Requests the Executive Council:

(1) To keep the progress of GCOS under regular review and to provide support and guidance on its further development and implementation;

(2) To advise and assist Members, sponsoring bodies and other international organizations in the implementation of global observing systems for climate;

Requests the technical commissions:

(1) To lead the development and implementation of the components of GCOS for which they are responsible in the light of advice from the GCOS Steering Committee;

(2) To contribute to the UNFCCC five-year Nairobi Work Programme on Impacts, Vulnerability, and Adaptation to Climate Change, in particular to the elements of the programme related to data and observations;

Requests the regional associations to foster effective, coordinated implementation of GCOS at the regional level, in close consultation with the regional counterparts of the other international sponsors of GCOS;

Requests the GCOS Steering Committee to continue to provide broadly based strategic advice to all relevant WMO bodies on the implementation and further development of GCOS;

Requests the Secretary-General, within the regular budget allocation and with possible access to external funding mechanisms:

(1) To support the further planning, development and implementation of GCOS, including the actions in response to the needs of the UNFCCC Conference of Parties and the recommendations of the 2010 update of the GCOS Implementation Plan;

(2) To encourage and assist Permanent Representatives of Members to take the lead in the establishment of GCOS National Committees and the designation of GCOS National Coordinators;

(3) To articulate, at all appropriate forums, the need for broad support by nations of the observational and resource requirements for implementing GCOS;

(4) To continue to provide support for the work of the GCOS Steering Committee and its Panels.

Note: This resolution replaces Resolution 11 (Cg-XV), which is no longer in force.

Resolution 30 (Cg-XVI)

VOLUNTARY COOPERATION PROGRAMME

THE CONGRESS,

Noting:

(1) That the WMO Voluntary Cooperation Programme (VCP) has functioned in the fifteenth financial period in a highly satisfactory manner,

(2) That this Programme is a major element in the implementation of the scientific and technical programmes of WMO and the provision of fellowships,

(3) That this Programme is an appropriate mechanism for the promotion and support of technical cooperation among Members, especially for the delivery of assistance to least developed countries and small island developing States,

(4) Resolution 24 (Cg-XV) – The WMO Voluntary Cooperation Programme,

Commends the Members concerned for their continued support to the success of this Programme;

Considering the continued and increasing needs for support expected during the sixteenth financial period for the implementation of the various technical programmes of WMO,

Decides:

(1) That the WMO VCP shall be continued in the sixteenth financial period;

(2) That the fields of cooperation covered by the VCP during the sixteenth financial period shall include but not be limited to the following:

   (a) The World Weather Watch (WWW);

   (b) The granting of short-term and long-term fellowships and organization of short-term training seminars;

   (c) Support for meteorological, climatological and hydrological applications activities;

   (d) The establishment and strengthening of observing and data-processing facilities;

   (e) The establishment and maintenance of the GAW stations;

   (f) Support for meteorological and hydrological activities related to environmental protection;

(3) That the VCP in the sixteenth financial period shall follow the same general procedures as during the fifteenth financial period;

(4) That special assistance should be provided to new Members of the Organization, including those in South-east Europe and Central Asia, small island developing States, and least developed countries within the framework of the VCP and the Least Developed Countries Programme;

Urges Members of the Organization to contribute to the maximum extent possible to the Programme during the sixteenth financial period in the form of financial support and equipment and services, including fellowships;

Authorizes the Executive Council to review the present rules and procedures for the operation of the WMO VCP, when necessary, bearing in mind the decisions of Sixteenth Congress;

Requests the Secretary-General:

(1) To continue to administer the VCP during the sixteenth financial period;

(2) To report to the Seventeenth Congress on the assistance rendered during the sixteenth financial period, in addition to regular reports on the VCP provided to the Executive Council and made available to Members.

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Note: This Resolution replaces Resolution 24 (Cg-XV), which is no longer in force.

Resolution 31 (CG-XVI)

EDUCATION AND TRAINING PROGRAMME

THE CONGRESS,

Noting:

(1) Resolution 23 (Cg-XV) – Education and Training Programme,

(2) Resolution 19 (EC-LXII) – Terms of Reference of the Executive Council Panel of Experts on Education and Training,

Considering:

(1) That education and training in meteorology, hydrology and related disciplines are major cross-cutting activities of WMO that have had a positive impact on the products and services provided by National Meteorological and Hydrological Services (NMHSs), and have the potential to continue to do so,

(2) That high-quality initial and ongoing education and training of staff are critical to ensuring the required effectiveness of NMHSs and are thus fundamental to the successful implementation of the various WMO Programmes,

(3) That each of the high-priority areas identified in the WMO Strategic Plan 2012–2015 has elements related to education and training,

(4) That the need for specialists in the application of meteorology and hydrology in support of the Millennium Development Goals and social and economic progress remains acute in many developing countries, particularly in the least developed countries and small island developing States,

(5) That the Education and Training Programme (ETRP) is a component of the WMO strategy for capacity development that assists NMHSs in their human resources development with due attention to their development status and to gender equity,

Decides:

(1) That the major thrust of the WMO Education and Training Programme shall continue to be directed towards assisting Members' NMHSs develop competent and qualified staff so as to enable them to effectively meet their relevant national and international obligations and challenges;

(2) That the main strategy of the ETRP to achieve this goal is to collaborate with national and international partners, training institutions, schools, academia, the media, and public and private sectors in order to assist NMHSs to meet their education and training needs in the most cost-effective manner;

(3) That special emphasis should be placed on promoting and supporting the exchange and sharing of training resources and expertise among Members, including e-learning;

(4) That the Education and Training Programme should contribute to the WMO Strategy for Service Delivery and to the Global Framework for Climate Services;

Urges Members:

(1) To collaborate in, and give all possible support to, the implementation of WMO education and training activities, in particular by sharing national education and training opportunities and resources with other Members;

(2) To strengthen their national capacity in the attainment of self-sufficiency in meeting their education and training needs and be gender sensitive in developing their human resources, including through enhanced application of distance and e-learning;

(3) To make maximum use of the training opportunities offered by the WMO Regional Training Centres (WMO-RTCs) for the training of personnel and support those centres to become more efficient and focused on meeting regional education and training needs;

Invites the presidents of regional associations and technical commissions:

(1) To regularly review education and training needs, including peer-review monitoring and evaluation within their Region or Commission, with the aim of assisting in the prioritization of regional and specialized training needs of Members;

(2) To ensure that the RTCs have a regional outlook, particularly in the selection of meteorological and hydrological instructors;

(3) To improve coordination of ongoing activities within and among Regions, and within relevant subject areas;

(4) To establish a policy dialogue among WMO-RTCs, the countries hosting WMO-RTCs, and their respective regional associations, aimed at further development of those centres within the context of addressing Members' needs in the WMO high-priority areas;

Requests the technical commissions:

(1) To assign high priority to the development of job competency standards within the area of responsibility of each of the Commissions, in conjunction with the ETRP, with the aim of linking the service needs of the Members with the technical standards and recommendations of the Commissions through education and training;

(2) To follow the example set by the Commission for Aeronautical Meteorology in setting competency standards for Aeronautical Meteorological Personnel;

Requests the Executive Council:

(1) To take all necessary actions to enable the Education and Training Programme to meet its objectives under the WMO Strategic Plan 2012–2015 and beyond;

(2) To give high priority to ensuring effective overall coordination and leadership of the Programme and ensure that WMO standards are maintained;

(3) To continue to draw fully on the advice and assistance of its Panel of Experts in meteorological and hydrological education and training in the further development of the ETRP;

(4) To further elaborate on the proposal by the EC Panel of Experts on Education and Training to form a consortium of RTCs, NMHSs and other institutions to develop an accredited online course in meteorology, consistent with the Basic Instruction Package for Meteorologists (BIP-M) requirements, to assist Members in meeting their education and training requirements;

Requests the Secretary-General:

(1) To continue to collaborate closely with Members and facilitate collaboration among Members to ensure the effective implementation of WMO education and training activities;

(2) To continue to provide assistance and advice on the education, training, qualification and competency requirements of NMHS staff, as well as on the training tools, materials and methodologies suitable for use by WMO-RTCs and national training institutions of NMHSs, particularly those in developing countries and least developed countries;

(3) To support education and training activities in the WMO high-priority areas;

(4) To maintain close liaison with the Standing Conference of Heads of Training Institutions (SCHOTI) in all areas of interest to education and training development and delivery, particularly with respect to the effective use of distance and e-learning technologies;

(5) To support the promotion of training approaches and methods in education and training through the provision of the necessary resources for their implementation;

(6) To support Members' requests for education and training assistance in meteorology and hydrology, including through multilateral arrangements;

(7) To undertake active mobilization of extrabudgetary resources so as to meet the growing demand for education and training fellowships.

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Note: This resolution replaces Resolution 23 (Cg-XV), which is no longer in force.

Resolution 32 (Cg-XVI)

DEFINITION OF A METEOROLOGIST AND METEOROLOGICAL TECHNICIAN

THE CONGRESS,

Noting the discussion of the Executive Council at its sixty-second session and Resolution 18 (EC-LXII) – WMO definition of a meteorologist,

Noting further:

(1) The revision undertaken by the Editorial Task Force of the Executive Council Panel of Experts on Education and Training of the content of the *Guidelines for the Education and Training of Personnel in Meteorology and Operational Hydrology* (WMO-No. 258), fourth edition, Volume I, Meteorology,

(2) The desirability of maintaining consistency between the definition of a Meteorologist and a Meteorological Technician,

(3) The need for the definition of Basic Instruction Package for Meteorologists (BIP-M) and Basic Instruction Package for Meteorological Technicians (BIP-MT) requirements to be included in the Technical Regulations due to the reference in the Competency Standards for Aeronautical Meteorological Personnel,

Considering the lack of clarity in the formulation of the required qualifications of meteorologists by the term "a degree or equivalent" as reflected in the fourth edition of the *Guidelines for the Education and Training of Personnel in Meteorology and Operational Hydrology*,

Considering further the proposed changes to the description of the requisite topics in the BIP-M and BIP-MT,

Decides:

(1) To amend the definition of Meteorologist and Meteorological Technician to read:

"Meteorologist – a person who has successfully completed the Basic Instruction Package for Meteorologists (BIP-M) requirements at university degree-level";

"Meteorological Technician – a person who has successfully completed the Basic Instruction Package for Meteorological Technicians (BIP-MT) requirements";

The implementation date for the changed definitions and for the Basic Instruction Packages will be 1 December 2013;

(2) To adopt the text in Annex 1 to this resolution, as Chapter B.4, WMO *Technical Regulations* (WMO-No. 49), Volume I;

(3) To adopt the text in Annex 2 to this resolution as the replacement for the *Guidelines for the Education and Training of Personnel in Meteorology and Operational Hydrology*, Volume I, Meteorology;

Urges Members:

(1) To take the lead in consulting with the appropriate national and regional bodies to define the academic qualifications required of meteorologists in their countries;

(2) To work with their national education and training establishments to regularize or formalize the accreditation of their education and training institutions and certification of their courses according to Quality Management Framework principles;

Requests the Secretary-General to arrange for the publication of these documents as soon as possible;

Authorizes the Secretary-General to make any consequent editorial amendments to the annexes to ensure consistency of the relevant documents.

Annex 1 to Resolution 32 (Cg-XVI)

TEXT PROPOSED TO REPLACE CHAPTER B.4 OF WMO *TECHNICAL REGULATIONS* (WMO-NO. 49), VOLUME I

TECHNICAL REGULATIONS

VOLUME I
General Meteorological Standards and Recommended Practices

CHAPTER B.4
EDUCATION AND TRAINING

[B.4.] 1
CHAPTER B.4
Education and training of meteorological personnel

[B.4.] 1.1
Each Member shall ensure that, in the fulfilment of its national and international responsibilities as prescribed in other chapters of these Technical Regulations, the personnel involved are educated and trained to the standards recognized by WMO for their respective duties. The education and training requirements apply both to initial recruitment and to continuing professional development. They apply in line with advances in science and technology, changing service requirements and responsibilities, and the on-going need for refresher training.

[B.4.] 1.2

The education Standards are outlined below and job specific competencies are included with the relevant chapters of these Technical Regulations. Members should maintain records of the education and training of their personnel as part of their Quality Management System to assist them in their human resource development activities and for auditing purposes, where appropriate. WMO publication *Guidelines for the Implementation of Education and Training Standards in Meteorology and Hydrology. Vol. 1: Meteorology* (Publication No. yyy) assists Members in implementing these Standards.

[B.4.] 2

Categories of personnel

The definitions for Meteorologist and Meteorological Technician shall be as follows.

(a) ***Meteorologist*** – a person who has successfully completed the Basic Instruction Package for Meteorologists (BIP-M) requirements at university degree-level.

(b) ***Meteorological Technician*** – a person who has successfully completed the Basic Instruction Package for Meteorological Technicians (BIP-MT) requirements.

[B.4.] 3

Basic Instruction Package for Meteorologists (BIP-M)

Aim of the BIP-M

The overall aim of the BIP-M is to provide an individual with a robust and broad range of knowledge of atmospheric phenomena and processes, together with skills related to the application of this knowledge.

To satisfy the requirements of the BIP-M, it is necessary for an individual to achieve the learning outcomes that cover:

(a) The acquisition of knowledge concerning physical principles and atmospheric interactions, methods of measurement and data analysis, behaviour of weather systems (through the synthesis of current weather data with conceptual models), and the general circulation of the atmosphere and climate variations.

(b) The application of knowledge based on the use of scientific reasoning to solve problems in atmospheric science, and participation in the analysis, prediction and communication of the impacts of weather and climate on society.

It is intended that satisfying the BIP-M requirements will provide an individual with the knowledge, skills and confidence to carry on developing their expertise and provide a basis for further specialization. Individuals wishing to work in areas such as weather analysis and forecasting, climate modelling and prediction, and research and development will need to undertake further education and training to meet the specialized job competencies in these areas. In addition individuals are expected to continue enhancing their knowledge and skills by participating in continuous professional development throughout their careers.

The BIP-M requirements for Meteorologists will usually be satisfied through the successful completion of a university degree in meteorology or a postgraduate programme of study in meteorology (after acquiring a university degree that includes the foundation topics in mathematics

and physics – such topics are typically covered in science, applied science, engineering or computational courses). In instances where this is not the case, educational institutions will have to demonstrate that their programme of study provides the characteristic learning outcomes associated with a university degree course.

Permanent Representatives are expected to take the lead in consulting with the appropriate national and regional bodies to define the academic qualifications required by Meteorologists in their country. Permanent Representatives should also work with their national education and training establishments to ensure that meteorological graduates meet the BIP-M requirements (i.e., all the learning outcomes in the BIP-M are satisfied as part of the academic qualification).

Components of the BIP-M

The main components of the BIP-M are as follows.

(a) ***Foundation topics***. The aim is to ensure an individual has the underlying knowledge and expertise that supports the learning outcomes associated with physical meteorology, dynamic meteorology and numerical weather prediction, synoptic and mesoscale meteorology, and climatology. An individual shall be able to:

- Demonstrate the knowledge of mathematics and physics that is required to successfully complete the meteorological components of the BIP-M.
- Demonstrate the knowledge of other sciences and related topics that complements the development of the meteorological expertise covered in the BIP-M.
- Analyse and utilize data, and communicate and present information.

(b) ***Physical meteorology***. An individual shall be able to:

- Explain the structure and composition of the atmosphere, the processes affecting radiative transfer in the atmosphere and global energy balance, and the causes of optical phenomena in the atmosphere.
- Apply the Laws of Thermodynamics to atmospheric processes, use a thermodynamic diagram to assess the properties and stability of the atmosphere, identify the effect of water on thermodynamic processes and explain the processes leading to the formation of water droplets, clouds, precipitation and electrical phenomena.
- Use knowledge of turbulence and surface energy exchanges to explain the structure and characteristics of the atmospheric boundary layer and the behaviour of contaminants.
- Compare, contrast and explain the physical principles used in conventional instruments to make surface and upper-air measurements of atmospheric parameters, and explain the common sources of error and uncertainty and the importance of applying standards and using best practice.
- Describe the range of meteorological data obtained from remote-sensing systems, explain how radiation measurements are made and the processes by which atmospheric data is derived from those measurements, and outline the uses and limitations of remote-sensing data.

(c) ***Dynamic meteorology***. An individual shall be able to:

- Explain the physical basis of the equations of motion in terms of forces and frames of reference, apply scale analysis to identify the dynamic processes in balanced flows, describe the characteristics of balanced flows, and use the equations of motion to explain

quasi-geostrophy, ageostrophy, and the structure and propagation of waves in the atmosphere.

- Describe and explain the scientific basis, characteristics, limitations of numerical weather prediction (NWP) for short-, medium- and long-range forecasting, and explain the applications of NWP.

(d) ***Synoptic and mesoscale meteorology.***[1] An individual shall be able to:

- Use physical and dynamical reasoning to describe and explain the formation, evolution and characteristics (including extreme or hazardous weather conditions) of synoptic-scale weather systems in (a) mid-latitude and polar regions and (b) tropical regions, and assess the limitations of theories and conceptual models about these weather systems.
- Use physical and dynamical reasoning to describe and explain the formation, evolution and characteristics (including extreme or hazardous weather conditions) of convective and mesoscale phenomena and assess the limitations of theories and conceptual models about these phenomena.
- Monitor and observe the weather situation, and use real-time or historic data, including satellite and radar data, to prepare analyses and basic forecasts.
- Describe service delivery in terms of the nature, use and benefits of the key products and services, including warnings and assessment of weather-related risks.

(e) ***Climatology***. An individual shall be able to:

- Describe and explain the Earth's general circulation and climate system in terms of the physical and dynamical processes that are involved, and describe the key products and services based on climate information and their inherent uncertainty and use.
- Apply physical and dynamical reasoning to explain the mechanisms responsible for climate variability and climate change (including the influence of human activity), describe the impacts in terms of possible changes to the global circulation, primary weather elements and potential effects on society, outline the adaptation and mitigation strategies that might be applied, and describe the application of climate models.

[B.4.] 4

Basic Instruction Package for Meteorological Technicians (BIP-MT)

Aim of BIP-MT

The overall aim of the BIP-MT is to provide an individual with a basic knowledge of atmospheric phenomena and processes, together with skills related to the application of this knowledge.

To satisfy the requirements of the BIP-MT, it is necessary for an individual to achieve the learning outcomes that cover:

(a) The acquisition of basic knowledge concerning physical principles and atmospheric interactions, methods of measurement and data analysis, a basic description of weather systems, and a basic description of the general circulation of the atmosphere and climate variations.

[1] For NMHSs in tropical regions the required knowledge of tropical weather systems is likely to exceed that specified in the BIP-M. The same applies to knowledge of mid-latitudes and polar weather systems for NMHSs in extra-tropical regions.

(b) The application of basic knowledge to observe and monitor the atmosphere and interpret commonly-used meteorological diagrams and products.

It is intended that satisfying the BIP-MT requirements will provide an individual with the knowledge, skills and confidence to carry on developing their expertise and provide a basis for further specialization. Individuals wishing to work in areas such as weather observing, climate monitoring, network management, and provision of meteorological information and products to users will need to undertake further education and training to meet the specialized job competencies in these areas. In addition individuals are expected to continue enhancing their knowledge and skills by participating in continuous professional development throughout their careers.

The BIP-MT requirements will usually be satisfied through the successful completion of a post-secondary programme of study at an institution such as an NMHS Training Institution or College of Further Education.

Components of the BIP-MT

The main components of the BIP-MT are as follows.

(a) ***Foundation topics***. The aim is to ensure an individual has the underlying knowledge and expertise that supports the learning outcomes associated with basic physical and dynamic meteorology, basic synoptic meteorology, basic climatology, and meteorological instruments and methods of observation. An individual shall be able to:

- Demonstrate the knowledge of mathematics and physics that is required to successfully complete the meteorological components of the BIP-MT.
- Demonstrate the knowledge of other sciences and related topics that complements the development of the meteorological expertise covered in the BIP-MT.
- Analyse and utilize data, and communicate and present information.

(b) ***Basic physical and dynamic meteorology***. An individual shall be able to:

- Explain the basic physical and dynamic processes that take place in the atmosphere.
- Explain the physical principles used in instruments to measure atmospheric parameters.

(c) ***Basic synoptic and mesoscale meteorology.***[2] An individual shall be able to:

- Describe the formation, evolution and characteristics of synoptic-scale and mesoscale tropical, mid-latitude and polar weather systems, and analyse weather observations.
- Describe the forecast process and the use made of the associated products and services.

(d) ***Basic climatology***. An individual shall be able to:

- Describe the general circulation of the atmosphere and the processes leading to climate variability and change.
- Describe the use made of products and services based on climate information.

(e) ***Meteorological instruments and methods of observation***. An individual shall be able to:

- Explain the physical principles used in instruments to measure atmospheric parameters.
- Make basic weather observations.

[2] For NMHSs in tropical regions the required knowledge of tropical weather systems is likely to exceed that specified in the BIP-MT. The same applies to knowledge of mid-latitudes and polar weather systems for NMHSs in extra-tropical regions.

[B.4.] 5

Meteorological education and training facilities

[B.4.] 5.1

Members should endeavour to provide national facilities, or participate in regional facilities, for the education and training of their personnel.

[B.4.] 5.2

As not all national training facilities are recognized as regional training facilities, the criteria given in Appendix D shall apply for the designation of a WMO Regional Training Centre.

[B.4.] 6

Status of meteorological personnel

[B.4.] 6.1

Each Member should ensure that meteorological personnel referred to in [B.4.] 1.1 are accorded status, conditions of service and general recognition within that country commensurate with the technical and other qualifications required for the fulfilment of their respective duties.

Annex 2 to Resolution 32 (Cg-XVI)

TEXT PROPOSED FOR THE NEW PUBLICATION *GUIDELINES FOR THE IMPLEMENTATION OF WMO EDUCATION AND TRAINING STANDARDS IN METEOROLOGY AND HYDROLOGY*. VOLUME I: METEOROLOGY

Contents

Foreword

To be provided by the Secretary-General

These guidelines are a companion publication to the chapter on Education and Training Standards in WMO Technical Regulations Publication 49, Vol. 1 and are designed to assist Members in their implementation of the Standards outlined in the Technical Regulations. Whilst some of the Standards material is reproduced in these guidelines users are advised to always refer to the Standards for any regulatory purposes.

1. WMO CLASSIFICATION OF PERSONNEL

The first section of this chapter presents an overview of the WMO classification of personnel in meteorology. The second part of this chapter is devoted to meteorological personnel – their initial qualification requirements and subsequent career progression. In addition a brief description is given of career progression, collective abilities and transferrable skills, and the foundation subjects that support development of meteorological understanding. Finally some general advice is given about the implementation of the required programmes of study.

1.1 Introduction

'There is no doubt that meteorological personnel can be graded in a number of ways, each with its own particular merit and convenience. It is equally certain, however, that no one system will adequately define all types of personnel required. It is therefore necessary to accept a compromise classification, all the while recognizing its deficiencies and limitations. With this in mind, one can develop a system of classification which can be usefully employed as a basis for establishing syllabi for the education and training of meteorological personnel.'

(WMO-No. 258, first edition, page 11)

The above quote from the first edition (July 1969) of WMO Publication 258 "*Guidelines for the Education and Training of Personnel in Meteorology and Operational Hydrology*" still captures the challenges and opportunities of such a publication as this. The challenge is to provide an international framework that is flexible enough to adapt to the needs of Members, whilst being robust enough to ensure the quality of personnel successfully completing courses built around the framework. Many Members are already educating and training their personnel above this minimum level to meet stricter national requirements in response to evolving technology and user needs.

This publication addresses the two issues raised in the quote above: a generic classification system for personnel involved in meteorology, and recommended qualifications for personnel in each of these classifications. These generic classifications and qualifications are intended to provide an international framework that Members can implement, adapt to meet their own specific needs or use as a benchmark against which they can assess their own national schemes.

Throughout the publication a clear distinction is made between classification of personnel and job tasks carried out within National Meteorological and Hydrological Services (NMHSs). Classification is related to qualifications whilst job tasks are related to competencies. It is the responsibility of individual Members to decide how they allocate particular tasks to the different classifications.

The focus of this publication is on the initial education and training required for personnel to qualify for the various classification categories. The additional education and training required to meet the competencies associated with a wide range of common job tasks performed by meteorological and hydrological personnel are outlined in separate publications overseen by the appropriate WMO technical commissions – see http://www.wmo.int/ for the latest listing of such publications.

The implementation of education and training standards will be supported by a companion publication, "*Guidelines for Educators and Trainers in Meteorology and Hydrology*", prepared by the EC Panel of Experts on Education and Training. It will contain guidance about the education and training process (including how to specify and assess learning outcomes and job competencies) as well as identifying the competency requirements for instructors.

1.2 Background information

This section outlines the basic assumptions on which the publication is based and why the classification system and the associated guidelines need to be kept under review.

Drivers for change

The guidelines and the classification system need to be kept under review because:

(a) Important advances in meteorology, as an applied physical science, result from improved understanding of the coupled atmosphere-ocean-land system, improved prediction techniques and the ongoing revolution in Information and Communication Technology (ICT);

(b) Economic, social and political patterns continue to evolve in many parts of the world, resulting in new and changing demands for meteorological and hydrological services in a user-focussed, consistent and quality controlled manner;

(c) Significant changes are taking place in the approach to professional instruction and specialization, particularly as a result of the increasing importance attached to continuing education and training and the specification of competencies (i.e., the knowledge, skills and behaviours required for a specific job).

Assumptions

The development of this publication is based on the following assumptions.

(a) The document should act as an international reference that is, as far as possible, adaptable to national and local needs;

(b) The key requirements to be classified as a Meteorological Technician or Meteorologist should be specified by the Basic Instruction Package for Meteorological Technicians (BIP-MT) and Basic Instruction Package for Meteorologists (BIP-M). These should be specified in terms of learning outcomes (i.e., statements of what a learner is expected to be able to do as proof of knowledge, understanding or skill after completion of a process of learning, rather than content as described in a syllabus). Though the BIP-MT and BIP-M have some topics in common, the learning outcomes are different.

(c) Completion of a university degree-level meteorology programme should be the key factor in differentiating between personnel classified as Meteorologists and those classified as Meteorological Technicians. Following the initial job-entry qualification, career-long continuing education and training would be required for subsequent professional development;

(d) Meteorologists and Meteorological Technicians should progress to higher grades in line with nationally determined career stages, for instance, according to national civil service career schemes. Also a Meteorological Technician could be re-categorized as a Meteorologist, after satisfying the BIP-M requirements;

(e) The requirements to be classified as a Meteorological Technician or Meteorologist should be treated separately from the competencies required to perform a particular job;

(f) This publication should build upon the 4th edition of WMO Publication No 258 "*Guidelines to the Education and Training of Personnel in Meteorology and Operational Hydrology*" to maintain continuity, wherever possible;

(g) For the purpose of these guidelines, the terms atmospheric sciences and meteorology should be treated as having the same meaning.

1.3 Classification of personnel in meteorology

This section describes the WMO classification scheme approved by the WMO Executive Council at its fiftieth session (Geneva, 1998), and endorsed by the WMO Congress at its thirteenth session (Geneva, 1999). A modification to the definitions of a Meteorologist was recommended by the WMO Executive Council at its sixty second session (Geneva, 2010). This was approved by the sixteenth session of the WMO Congress (Geneva, 2011).

Purpose of the classification

The purpose of the WMO system for classification of personnel in meteorology is to:

(a) Provide an international framework for the common understanding of the basic qualifications required of persons performing the meteorological and hydrological functions prescribed in the WMO Convention;

(b) Facilitate the development of reference learning outcomes and the associated syllabi for the education and training of personnel in meteorology;

(c) Assist the NMHSs of individual countries in:

- Establishing personnel classification systems suited to their particular needs;
- Developing education and training programmes applicable to their own structures and needs;

- Ensuring academic and vocational institutions are aware of and can respond to the education and training requirements for staff that are recruited to be Meteorologists or Meteorological Technicians.

Categories of personnel

Two broad categories of personnel are identified: professionals and technicians. For meteorological personnel, these categories are designated as follows.

- Meteorologist – a person who has successfully completed the Basic Instruction Package for Meteorologists (BIP-M) requirements at university degree-level;
- Meteorological Technician – a person who has successfully completed the Basic Instruction Package for Meteorological Technicians (BIP-MT) requirements.

Although the classification is focused on two main categories of personnel, users are expected to adapt it to their specific circumstances, such as their national regulations for civil service classification.

In many cases, being classified as a Meteorologist or Meteorological Technician will be a necessary condition for someone to work as a meteorological specialist within an NMHS. However, further specialized education and training beyond the BIP-M and BIP-MT requirements will be needed for someone to become competent to perform a specialized task such as observing, producing forecasts and warnings, or undertaking research.

Components of the BIP-M

The main components of the BIP-M are:

(a) Foundation topics in mathematics and physics plus complementary subjects dealing with other sciences and related topics, communications, and data analysis and utilization;

(b) Topics in atmospheric sciences:

- Physical meteorology (i.e., atmospheric composition, radiation and optical/electrical phenomena; thermodynamics and cloud physics; boundary-layer meteorology and micrometeorology; conventional observations and instrumentation; remote sensing).
- Dynamic meteorology (i.e., atmospheric dynamics; numerical weather prediction).
- Synoptic and mesoscale meteorology (i.e., mid-latitude and polar weather systems; tropical weather systems; mesoscale weather systems; weather observing, analysis and diagnosis; weather forecasting; service delivery).
- Climatology (i.e., global circulation, climates and climate services; climate variability and climate change).

Besides the basic requirement to successfully complete topics (a) and (b), individuals wishing to obtain a specialization may also study in greater depth subjects such as aeronautical meteorology, atmospheric chemistry, and climate monitoring and prediction.

Components of the BIP-MT

The main components of the BIP-MT are:

(a) Foundation topics in mathematics and physics plus complementary topics dealing with other sciences and related topics, communications, and data analysis and manipulation;

(b) Topics in general meteorology: basic physical and dynamic meteorology, basic synoptic and mesoscale meteorology, basic climatology, and meteorological instruments and methods of observation.

Besides the basic requirement to successfully complete topics (a) and (b), individuals wishing to obtain a specialization may also study in greater depth subjects such as specialized observations and measurements, data quality control and archiving, equipment calibration and maintenance, and communications and computing.

Beyond the BIPs

As well as developing the specializations that go beyond the BIP-M and BIP-MT (as referred to above), many Members will require that their staff have additional knowledge, understanding and skills, which are broader and deeper than what is specified in the BIPs, to meet their specific national requirements. For example:

(a) Some NMHSs have responsibilities that go beyond the provision of services concerning weather and climate (e.g., services dealing with earthquakes, tsunamis, volcanoes, land slides, water utilisation and flooding), so their education and training requirements exceed those in the BIPs that are primarily based on meteorological expertise.
(b) For some NMHSs the provision of specialised meteorological services is a key aspect of their activities (e.g., provision of agricultural services). In that case their education and training programmes would need to address that specific area of expertise in depth, and this may require the acquisition of detailed knowledge about the activities and needs of users of the service.
(c) For NMHSs in tropical regions the required knowledge of tropical weather systems will probably exceed that specified by the BIPs. The same applies to knowledge of mid-latitude and polar weather systems for NMHSs in extra-tropical regions.

In addition, for some NMHSs having a degree may be a requirement for the recruitment or career progression of staff.

The approach taken is designed to allow Members to set national requirements beyond those specified by the BIPs.

Learning outcomes

The BIP-M and BIP-MT are specified in terms of learning outcomes rather than the content. Consequently the emphasis is on the achievements of the learner rather than the intentions of the instructor or the subjects to be covered as specified in a syllabus. Specifying learning outcomes is beneficial both for the instructor and students as they provide clarity about the purpose of the programme of study. Also they provide a more robust basis for assessing whether the required learning has taken place.

There is a hierarchy of learning outcomes used in BIP-M and BIP-MT. Table 1 gives an overview of the various levels and some examples of the associated descriptors. The higher-order cognitive skills of analysing, evaluating and creating are built upon the lower-order skills of remembering, understanding and applying. The learning outcomes for the BIP-M and BIP-MT tend to be associated with remembering, understanding, applying and analysing.

Cognitive skill level	Examples of descriptors
Remembering. The learner recalls information.	describe, define, identify
Understanding. The learner explains ideas or concepts.	explain, interpret, discuss
Applying. The learner uses new knowledge in a familiar situation.	apply, use, relate
Analysing. The learner differentiates between constituent parts and relates the parts to the whole.	analyse, compare, investigate
Evaluating. The learner justifies a decision or course of action.	evaluate, argue, recommend
Creating. The learner generates new products, ideas or ways of looking at things.	create, organise, assess

Table 1. *This table is based on the classification of intellectual behaviour developed by Bloom et al. (1956) which was later modified by Anderson & Krathwohl (2001).*

1.4 Relationship between classification, qualifications and job competencies

The classification of personnel into Meteorologists or Meteorological Technicians is based on the fulfilment of either the BIP-M or BIP-MT requirements. Successful completion of these initial programmes of study does not mean that an individual is immediately able to competently perform a subsequent job.

It is expected that a particular job will have an associated set of competence standards which define the required specialized knowledge, skills and behaviours. Normally acquiring these competencies will require job-specific education and training that goes beyond the BIP-M and BIP-MT requirements.

An NMHS or other agency may put in place an education and training programme that allows the classification and competency requirements to be satisfied as part of the same programme. For example, this approach could be taken for:

(a) Satisfying the BIP-MT requirements and acquiring the competencies to be an agricultural observer or a technician who installs and maintains meteorological equipment;
(b) Satisfying the BIP-M requirements and acquiring the competencies to be a public weather service forecaster.

An NMHS or other agency may also decide, based on national or local guidelines, that a particular job responsible for delivering professional services should only be filled by Meteorologists or Meteorological Technicians.

In 2010, the WMO Executive Council agreed that the technical commissions should be responsible for developing generic job competencies and the associated education and training requirements for personnel undertaking tasks in their areas of interest. Such requirements should appear in publications produced and maintained by the appropriate technical commissions. See http://www.wmo.int/..... for the latest listing of such publications.

The relationship between initial qualifications, job competencies and delivery of professional services is summarized in Figure 1.

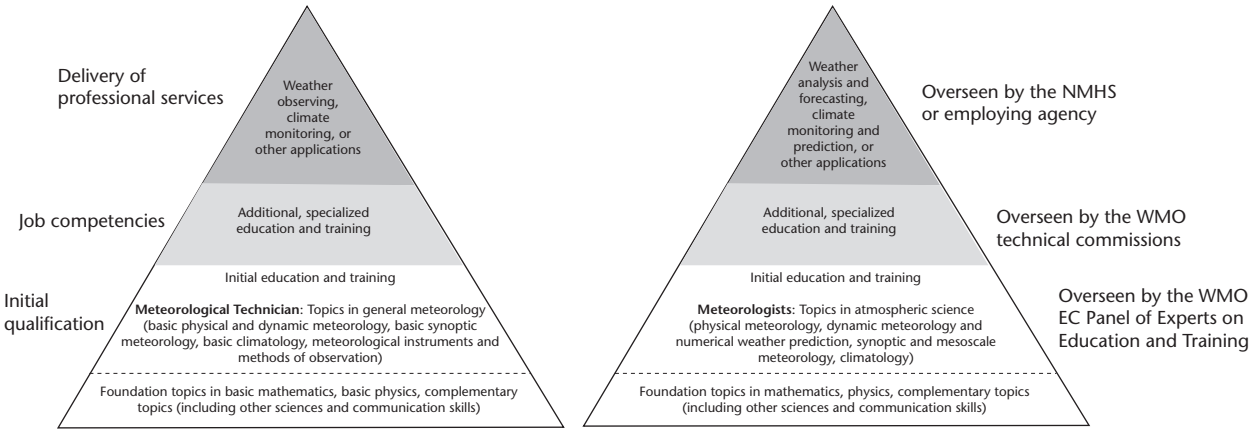

Figure 1. Schematic of the links between initial qualifications, job competencies and delivery of professional service along with the allocation of responsibilities. Note that if a technical commission does not specify the job competencies that responsibility falls to each NMHS.

Qualifications are awards issued by an approved authority certifying that an individual has successfully completed a programme of study or has the expertise to perform a particular job effectively. A qualification signifies the range of knowledge, understanding and skills that has been acquired.

Qualifications fall into two broad categories:

- ***Academic qualifications*** – these are generally awarded by a college or university. They are often specified in terms of a set of learning outcomes that have to be satisfied.
- ***Vocational (professional) qualifications*** – these are generally awarded by a training institution or professional body. They are usually specified in terms of a set of competencies that have to be demonstrated.

Being classified as a Meteorologist or Meteorological Technician is in many ways similar to obtaining an academic qualification as the Basic Instruction Packages are based on satisfying a set of learning outcomes.

1.5 Meteorological personnel

This section briefly elaborates the main thrust of the classification scheme for meteorological personnel.

Initial qualification of Meteorologists

The BIP-M requirements for Meteorologists will usually be satisfied through the successful completion of a university degree in meteorology or a postgraduate programme of study in meteorology (after acquiring a university degree that includes the foundation topics in mathematics and physics – such topics are typically covered in science, applied science, engineering or computational courses). In instances where this is not the case, educational institutions will have to demonstrate that their programme of study provides the characteristic learning outcomes associated with a university degree course and that nationally agreed academic qualification levels have also been met.

Permanent Representatives are expected to take the lead in consulting with the appropriate national and regional bodies to define the academic qualifications required by Meteorologists in their country. Permanent Representatives should also work with their national education and training establishments to ensure that meteorological graduates meet the BIP-M requirements (i.e., all the learning outcomes in the BIP-M are satisfied as part of the academic qualification).

The BIP-M should be delivered in such a way that individuals successfully completing the programme of study are able to:

- Demonstrate systematic understanding of their field of study;
- Accurately deploy established techniques of analysis and enquiry used in their field of study, and apply the learnt methods and techniques to review, consolidate, extend and apply their knowledge and understanding;
- Use conceptual understanding that allows arguments to be devised and sustained and apply the understanding to the solving of problems in their field of study;
- Critically evaluate arguments, assumptions, abstract concepts and data whilst taking into account the uncertainty, ambiguity and limits of knowledge of their field of study;
- Communicate information, ideas, problems and solutions about their field of study to both specialist and non-specialist audiences.

In addition they should acquire transferrable skills concerning the importance of team-work, the management of their own learning, exercise of initiative and personal responsibility, and the ability to make decisions in complex and unpredictable contexts.

(a) University degree in meteorology

A university degree in meteorology, which covers all the BIP-M, is the optimum way to meet the requirements to be classified as a Meteorologist. A meteorology degree will normally cover more than is required for the BIP-M. For example:

- Some topics will be covered in more depth than is necessary to meet the BIP-M requirements (e.g., in tropical regions there will be more emphasis on tropical meteorology);
- Some topics not covered in the BIP-M will be included to allow the acquisition of specialised knowledge associated with (a) the specific economic needs of the country and/or requirements of the NMHS (e.g., agricultural meteorology or hydrology) or (b) the research and development interests of the institution providing the programme of study.

Normally, a university degree programme satisfying the BIP-M requirements would require three or four academic years post secondary schooling, but the actual period may vary between academic institutions. Typically, the first half of the programme will be focused on fundamental science education, while the second half will be dedicated to the meteorological education.

(b) Postgraduate programme of study in meteorology

A postgraduate programme of study in meteorology would usually be delivered via a university course leading to a postgraduate diploma or masters degree in meteorology. The entry requirement would normally be a university degree in a science, engineering or

computational subject (e.g., selected scientific or technical domains such as mathematics, physics, chemistry, electronic or geo-sciences engineering) along with knowledge of mathematics and physics at the level of the BIP-M.

Some education and training institutions (such as some of those run by NMHSs or Regional Training Centres) may provide a postgraduate programme of study that covers all of the BIP-M requirements, but does not lead to a qualification such as a postgraduate diploma or masters degree. In such circumstances the delivery of the programme of study should be as rigorous and intellectually demanding as a course of study at a university. The institutions are expected to be able to demonstrate how their programme is at the required level.

For a postgraduate programme of study the BIP-M requirements are the same as for those completing the programme of study as part of a university degree in meteorology, but the pace of delivery may be considerably faster.

(c) Non-degree education programme

Some education and training institutions (such as some of those run by NMHSs or Regional Training Centres) may provide a programme of study that covers all of the BIP-M requirements, but does not lead to a formal qualification such as a degree, postgraduate diploma or masters degree. These programmes are designed specifically to meet the BIP-M with little or no additional material. The BIP-M requirements are identical whether the programme concludes with a degree or not. In such circumstances the delivery of the programme of study should be as rigorous and intellectually demanding as a course of study at a university. Institutions are expected to be able to demonstrate how their programme is at the required level, especially in terms of its breadth and depth.

The admission requirements for such an institution could include prospective students already possessing the appropriate academic level of mathematics, physics etc. or they may provide these as part of their overall course structure. The key point is not how people enter the programme but whether by the end of the programme they meet the BIP-M requirements.

Initial qualification of Meteorological Technicians

Members have used various education and training approaches to qualify their Meteorological Technicians: from formal education in a technical school, college or university with specific training programmes in meteorology, to vocational and/or on-the-job training in meteorological observations and measurements. Whichever approach is taken, the BIP-MT requirements must be satisfied.

The BIP-MT requirements will usually be satisfied through the successful completion of a post-secondary programme of study at an institution such as an NMHS Training Institution or College of Further Education.

The BIP-MT should be delivered in such that individuals successfully completing the programme of study are able to:

- Demonstrate knowledge of the underlying concepts and principles associated with their field of study;

- Present, evaluate and interpret qualitative and quantitative data to make sound judgements in accordance with basis theories and concepts of their field of study;
- Evaluate different approaches to solving problems related to their field of study;
- Communicate the results of their studies accurately and reliably;
- Undertake further training and development of new skills within a structured and managed environment.

1.6 Career progression

In this section an overview is given of the career progression of Meteorologists and Meteorological Technicians.

Within both categories of personnel, depending on national circumstances, individuals will normally progress from positions of modest responsibility under close supervision, to positions with more responsibility and less supervision. Some individuals will advance to higher positions, with responsibilities for supervision and leadership. Any progression is based on increased experience, continuing education and training, and demonstration of the required job-specific competencies.

The designations job-entry-level, mid-level, and senior-level will be used to denote three generic career progression levels within each main category of personnel.

Career levels for Meteorologists

Upon completion of the BIP-M programme, Meteorologists enter the professional world. After additional preparation aimed at developing competencies for a specific job (which should include an orientation period, on-the-job training and additional training courses), they gradually assume operational duties in weather analysis and forecasting, climate monitoring and prediction, or other relevant applications. Some Meteorologists will become involved in consulting, directing, decision-making and management; others will become involved in areas such as research and development, or teaching. Generic responsibilities for the three career levels may be summarized in Appendix A of Chapter 1.

Career levels for Meteorological Technicians

Upon completion of the BIP-MT programme, Meteorological Technicians enter the professional world. Whilst they have acquired a basic set of knowledge and skills, they then need to develop the competencies required for a specific job (which should include an orientation period, on-the-job training and additional training courses). They gradually assume operational duties that might involve carrying out weather, climate and other environmental observations or assisting weather forecasters in preparing and disseminating products and services. NMHSs typically employ many other types of technicians, such as mechanical, electrical and electronic technicians to install and maintain equipment (e.g., ground receivers for aeronautical meteorological observations, automatic weather stations, weather radar or telecommunication equipment). Generic responsibilities for the three career levels may be summarized as in Appendix A of Chapter 1.

Changing classification mid-career

The requirements specified by the BIP-M and BIP-MT have been presented as if they are normally satisfied by an individual undergoing an initial programme of study either at a university or training institution. This would usually happen before or shortly after taking up employment in a NMHS. In practice, however, satisfying the requirements to be a Meteorologist or Meteorological Technician might be achieved mid-career. For example, Meteorological Technicians who have acquired a substantial knowledge of meteorology based on their initial training, continuous professional development and operational experience, may want to undergo a programme of study that allows them to be classified as Meteorologists. In this case, many of the learning outcomes specified by the BIP-M will have already been satisfied. Provided that prior learning can be formally established and recorded (e.g., by those responsible for training within a NMHS), the programme of study need only cover those learning outcomes that have not already been satisfied. The same approach applies to individuals whose initial training does not cover all the BIP-MT, but later in their careers they want to be classified as Meteorological Technicians.

The specific national or institutional regulations and requirements will determine whether re-categorization that takes account of prior learning is accepted practice in any particular country.

1.7 Collective abilities and transferable skills

In this section consideration is given to the collective abilities and transferrable skills of Meteorologists and Meteorological Technicians.

Meteorologists and Meteorological Technicians should undertake continuing education and training to update/upgrade their professional knowledge and skills, and where appropriate acquire additional competencies. The continuing education and training can take many forms including coaching, self-study (e.g., guided reading and computer-aided learning), secondment/temporary placement, on-the-job training and instructor-led refresher courses. The choice of method will depend upon factors such as the specific development needs, availability of training resources and preferred learning styles.

Meteorologists and Meteorological Technicians often act together as a team within their NMHSs. They need to be competent in their jobs and be able to adapt to changing circumstances whilst also developing their careers. This will require a breadth and depth of relevant knowledge, understanding and experience accompanied by an ability to be adaptable, flexible and independent when working.

Competence can be described as having and being able to apply appropriate basic knowledge and technical skills, but it is also necessary for both Meteorologists and Meteorological Technicians to display transferrable behaviours such as being able to:

- Communicate effectively through written and oral presentations;
- Share knowledge and work effectively with others;
- Apply initiative and take a problem-solving approach to non-routine tasks;
- Exhibit critical thinking when confronted with new information;
- Take responsibility for their own decisions and be prepared to explain the rationale for those decisions;

- Manage several tasks at any one time and prioritize accordingly;
- Manage their own learning and performance;
- Acquire new skills, knowledge and understanding demanded by changes in working practices.

Though these are important capabilities, this publication makes no attempt to define these 'collective abilities and transferable skills', as they will depend crucially upon the type and level of the job, the specific requirements of the organization, and the extent to which individuals are responsible for their own professional development.

1.8 Foundation subjects and atmospheric sciences

In this section the foundation subjects are outlined and the basic meteorological disciplines are identified.

As a physical science, meteorology deals essentially with the physics and dynamics of the atmosphere; it also deals with many direct effects of the atmosphere upon the Earth's surface, the oceans, and life in general. Its ultimate goals are the best possible understanding and prediction of atmospheric phenomena, from local to planetary scale, and from a few seconds, minutes and hours to several days, weeks and seasons (even decades and centuries). The establishment of the BIP-M and BIP-MT requirements is aimed at ensuring individuals have a breadth and depth of knowledge to contribute towards attaining that ultimate goal.

Mathematics and physics

A thorough knowledge of mathematics and physics (and ideally a basic knowledge of chemistry) is required to enable students to understand the relationship between atmospheric phenomena and the nature of matter as expressed in the basic physical principles. Accordingly, when organising basic instruction programmes in meteorology, provisions should be made for co-requisite/refresher courses in mathematics, with emphasis on basic concepts and methods required in studies of fluid dynamics and thermodynamics.

As with mathematics, there may be a need for co-requisite/refresher courses in physics. There is, however, a significant distinction between the study of atmospheric sciences and the common study of physics. In physics the focus tends to be on individual processes, but the study of atmospheric sciences concerns a large and complex system, where effects and interactions may not be fully understood if considered separately from their environment. The ultimate goal is to understand, not only qualitatively but also quantitatively, the coherent functioning of the whole system. Consequently the co-requisite/refresher courses in physics should provide the underpinning knowledge necessary for an understanding of atmospheric sciences.

Complementary subjects

As well as knowledge of mathematics and physics being required to lay the foundation for studying the basic meteorological disciplines, it is also necessary to have a basic knowledge of related sciences (particularly oceanography and hydrology). In addition, having the ability to communicate effectively, and being adept at data analysis and manipulation will underpin the development of meteorological expertise.

Basic meteorological disciplines

The basic meteorological disciplines – distinguished more in the function of the science, rather than of the subject matter itself – may be designated as follows:

- Physical meteorology.
- Dynamic meteorology.
- Synoptic and mesoscale meteorology.
- Climatology.

These are described in more detail in Appendix B of Chapter 1.

Relationship between the basic meteorological disciplines and the BIPs

To some extent there is overlap between the four basic meteorological disciplines. For example, synoptic meteorology could include some topics that might be considered to be part of dynamic meteorology or physical meteorology. Consequently the division into the four subject areas used here should not be considered as the only way in which atmospheric sciences can be partitioned.

For Meteorologists it is convenient to describe the BIP-M learning outcomes in terms of the four meteorological disciplines. On the other hand, because of the kind of jobs that Meteorological Technicians might fill, it is reasonable to put more emphasis on meteorological instruments and methods of observation with less emphasis on the theoretical aspects of physical and dynamic meteorology. This means that the BIP-MT learning outcomes have not been structured according to the four meteorological disciplines. Instead, the learning outcomes associated with physical and dynamic meteorology are combined, whilst those associated with meteorological instruments and methods of observation are treated separately.

1.9 Implementation

In this section some general advice is given about implementing the BIP-M and BIP-MT programmes of study.

The learning outcomes as specified in the BIP-M and BIP-MT are still quite general. It is expected that an institution delivering a programme of study to satisfy the requirements of the BIP-M or BIP-MT will specify learning outcomes that are more detailed whilst being consistent with those specified. In doing that, consideration needs to be given to how the learning outcomes will be assessed.

The learning outcomes for both the BIP-M and BIP-MT have been put into broad categories of knowledge to help the users of this publication assimilate all the information. But the way the learning outcomes have been categorized is not intended to indicate how the programme of study

should be structured. It is for the institution delivering the programme to decide on a structure that takes account of the prior knowledge and preferred learning styles of the participants, the availability of specialized facilities, and the particular needs of the associated NMHS.

A key aspect of classifying individuals as Meteorologists or Meteorological Technicians is to establish robust and transparent arrangements for assessing whether the learning outcomes specified within the BIP-M and BIP-MT have been satisfied. Responsibility for such arrangements lies with the NMHSs in consultation with the institutions providing the programme of study. It is imperative that there is adequate documentation of the process and outcome for an external agency to be satisfied that an individual classified as a Meteorologist or Meteorological Technician has indeed satisfied the requirements specified in the BIP-M or BIP-MT.

Appendix A. Career levels for Meteorologists and Meteorological Technicians

Career levels for Meteorologists

(a) Entry level

Job-entry-level Meteorologists mainly carry out routine duties, to be performed under supervision and, most often, in collaboration with others. Individual autonomy within an established menu of responsibilities is expected.

(b) Mid-level

Mid-level Meteorologists carry out a broad range of activities to be performed in a wide variety of contexts, some of which are complex and non-routine. These activities require the capacity to apply knowledge and skills in an integrated way, and an ability to solve problems. In addition, important personal autonomy and responsibility, including for the control or guidance of others, may also be expected (e.g., directing and managing local operational services and devising creative and imaginative solutions for technical and administrative problems). Some services may require personnel wishing to enter this level to obtain additional qualifications.

(c) Senior-level

Senior-level meteorologists need to be able to apply a significant range of fundamental principles and complex techniques across a wide and often unpredictable variety of contexts. Capacity to proficiently transfer knowledge and skills in a new task and situation and substantial personal autonomy are required. Often, significant responsibility for the work of others is required; this could be associated with analysis and diagnosis, planning and execution, control and evaluation, and training and retraining. Indeed the job might include responsibility for managing a service or branch. Some services may require personnel wishing to enter this level to obtain additional qualifications.

Career levels for Meteorological Technicians

(a) Entry-level

Job-entry-level Meteorological Technicians mainly carry out routine and predictable duties, to be performed under supervision and, most often, in collaboration with others. Usually they specialize

in a particular job (e.g., surface observations, upper-air soundings, radiation measurements, operational data processing).

(b) Mid-level

Mid-level Meteorological Technicians, besides performing standard duties, may also be required to carry out non-routine activities involving certain personal autonomy, in the context of explicit requirements and criteria. Responsibility for the guidance of others may also be assigned to some mid-level technicians. They generally work under the technical supervision of senior Meteorological Technicians or Meteorologists. Some services may require personnel wishing to enter this level to obtain additional qualifications.

(c) Senior-level

Senior-level Technicians require competencies in a wide range of complex technical-level and professional-level work activities, to be performed in a variety of contexts and with a substantial degree of personal responsibility, including responsibility for the work of other staff. They should be able to take technical decisions, and capable of solving all technical problems in their specialized range of activity. Some services may require personnel wishing to enter this level to obtain additional qualifications.

Appendix B. Basic meteorological disciplines

(a) Physical meteorology

Physical meteorology deals with the scientific explanation of the atmospheric phenomena. A thorough knowledge and understanding of the basic physical principles of thermodynamics and of the theory of electromagnetic radiation is essential. This will provide the necessary background for the study of topics such as: the structure and composition of the atmosphere, solar and terrestrial radiation, boundary-layer processes, microphysics of clouds and precipitation, atmospheric electricity, physical processes in small-scale dynamics (e.g., turbulence), and observing technology including remote-sensing methods.

(b) Dynamic meteorology

Dynamic meteorology is concerned with the study of atmospheric motions as solutions of the fundamental equations of hydrodynamics and thermodynamics or other systems of equations appropriate to special situations, as in statistical theory of turbulence. A solid background in higher mathematics and fluid dynamics is required since this provides the scientific basis for the understanding of the physical role of the atmospheric motions in determining the observed weather and climate at all scales – planetary, synoptic, mesoscale and microscale. Eventually, it is this understanding that enables the practical methodology for modern weather forecasting and climate prediction by dynamic methods.

Dynamic meteorology also includes a thorough knowledge and understanding of numerical weather prediction (NWP). This should include how forecast models work, their relative strengths, weaknesses and characteristics, post-processing of model output to create derived parameters and the way the output is used to derive guidance for specific applications.

(c) Synoptic and mesoscale meteorology

Synoptic and mesoscale meteorology has traditionally been concerned with the study and analysis of weather information taken concurrently to identify synoptic-scale and mesoscale weather systems, diagnose their structure, and qualitatively anticipate their future evolution. Today this discipline deals with analysing and forecasting the weather from the mesoscale to planetary scale (e.g., 'weather regimes'); and its sophisticated technical basis includes operational databases, standardized sets of automatically plotted diagnostic meteorological maps and diagrams, NWP outputs, as well as other products and auxiliary material. The traditional interpretation of the synoptic situation was empowered by modern diagnostic tools and new conceptual models. The sharp distinction between dynamic and synoptic/mesoscale meteorology has become rather diffuse.

With the ever-increasing application of objective methods, particularly the continued development of remote sensing, sophisticated data assimilation techniques, nowcasting techniques and operational application of ensemble forecasting, the human forecasters' contribution continues to evolve. Experienced forecasters are expected to have good understanding of the behaviours and performance characteristics of the numerical products and make useful subjective interpretations to add value (e.g., utilize the ensemble forecasts' quantification of forecast uncertainty in conjunction with user-specific needs and constraints, including the risk-taking limitations). Good presentation and communication skills are required in the interaction with the users.

(d) Climatology

Climatology, according to the WMO *International Meteorological Vocabulary* (WMO-No. 182) is the 'study of the mean physical state of the atmosphere together with its statistical variations in both space and time as reflected in the weather behaviour over a period of many years'. Implicit in this definition is the limitation of the concept of climate to the atmospheric setting, a fact that genuinely reflects the emergence and historical development of climatology. However, during the past few decades atmospheric scientists have realized that the climate system must include not only the atmosphere, but also the relevant portions of the broader geophysical system which increasingly influence the atmosphere as the time period under consideration increases. Today's climatologists, while focusing on meteorological processes, increasingly study the role of physical and chemical processes within the oceans and across the multitude of land surface regimes. Integration of data and knowledge from meteorology, oceanography and hydrology becomes essential.

By dealing with the description of past, present and future state of the whole climate system, modern climatology has got a wider scope. Furthermore, it concerns not only the natural climate evolution, but also potential changes in the global and regional climate induced by the aggregate of human activities that change both the concentrations of greenhouse gases and aerosols in the atmosphere, and the pattern of vegetative and other land covers. The goal is to achieve the best possible understanding of the dynamical, physical and chemical basis of climate and climate evolution, in order to predict climate variability/change on seasonal to decadal and longer time scales.

2. BASIC INSTRUCTION PACKAGE FOR METEOROLOGISTS (BIP-M)

This chapter starts with an outline of the aims of the BIP-M and then the learning outcomes associated with foundation topics are specified. The remainder of the chapter deals with the

learning outcomes concerning physical meteorology, dynamic meteorology, synoptic and mesoscale meteorology, and climatology.

2.1 Introduction

The overall aim of the BIP-M is to provide an individual with a robust and broad range of knowledge of atmospheric phenomena and processes, together with skills related to the application of this knowledge.

To satisfy the requirements of the BIP-M, it is necessary for an individual to achieve the learning outcomes that cover:

- The acquisition of knowledge concerning physical principles and atmospheric interactions, methods of measurement and data analysis, behaviour of weather systems (through the synthesis of current weather data with conceptual models), and the general circulation of the atmosphere and climate variations.
- The application of knowledge based on the use of scientific reasoning to solve problems in atmospheric science, and participation in the analysis, prediction and communication of the impacts of weather and climate on society.

It is intended that satisfying the BIP-M requirements will provide an individual with the knowledge, skills and confidence to carry on developing their expertise and provide a basis for further specialization. Individuals wishing to work in areas such as weather analysis and forecasting, climate modelling and prediction, and research and development will need to undertake further education and training to meet the specialized job competencies in these areas. In addition individuals are expected to continue enhancing their knowledge and skills by participating in continuous professional development throughout their careers.

2.2 Foundation topics in mathematics, physics and complementary subjects

The overall aim of the learning outcomes dealing with the foundation topics is to ensure an individual shall be able to:

- Demonstrate the knowledge of mathematics and physics that is required to successfully complete the meteorological components of the BIP-M.
- Demonstrate the knowledge of other sciences and related topics that complements the development of the meteorological expertise covered in the BIP-M.
- Analyse and utilize data, and communicate and present information.

It is expected that the underpinning knowledge can be acquired using one of several approaches or a combination of them.

- Completion of a degree in mathematics or a physical science before studying the atmospheric science topics.

- An introductory programme of study, focussing on the learning outcomes for the foundation topics, that is completed before studying the topics in atmospheric science. This should be taught using practical applications related to atmospheric sciences.
- Integrating the acquisition of the underpinning knowledge into the studying of the topics in atmospheric science.

Mathematics

Learning outcomes – able to:

- *Differential and integral calculus*. Differentiate and integrate basic functions, find maxima and minima, and use a Taylor expansion based on an understanding of the fundamental concepts and methods in differential and integral calculus.
- *Vectors and matrices*. Solve simultaneous equations, find eigenvalues and eigenvectors of a matrix, and carry out calculations and transformations using complex numbers and vectors based on an understanding of the fundamental concepts and methods associated with matrices, vectors and complex numbers.
- *Differential equations*. Perform algebraic manipulation on basic first and second order ordinary differential and partial differential equations, including use of Fourier series and verification of solutions, and identify initial-value and boundary-value problems.
- *Statistics*. Select suitable ways of displaying statistical data, calculate basic statistical indicators (e.g., mean, standard deviation and test of significance) and draw conclusions from statistical data based on an understanding of the fundamental concepts and methods associated with probability theory and statistics.
- *Numerical methods*. Use basic numerical schemes for time and space derivatives and perform a basic stability analysis based on an understanding of the fundamental concepts and methods associated with numerical modelling.

Physics

Learning outcomes – able to:

- *Mechanics*. Apply the fundamentals of mechanics to bodies in motion, including Newton's laws of motion, equilibrium conditions, conservation of momentum and angular momentum, conservation of energy, the effects of rotating systems, and the relationship between Eulerian and Lagrangian frames of reference.
- *Fluid motion*. Explain the basic kinematics of fluids, including the concepts of vorticity, divergence, deformation, streamfunction and velocity potential, and the relationship between streamlines and trajectories.
- *Heat transfer*. Explain the physical basis of heat transfer via conduction, convection and radiation.
- *Basic thermodynamics*. Apply the fundamentals of thermodynamics to gaseous systems, including the gas laws for dry and moist air, First and Second Laws of Thermodynamics, Dalton's Law and the kinetic theory of gases, and explain the physical basis of sensible heat, specific heat, latent heat, vapour pressure and saturation, reversible and irreversible processes, entropy and enthalpy, and the phases of water and the changes of phase.

- *Waves*. Explain the fundamentals of wave motion, including the concepts of reflection, refraction and diffraction, phase and group velocities, wave dispersion and wave breaking.
- *Optics*. Explain the concepts of reflection, refraction, diffraction and scattering of light.
- *Electromagnetic radiation*. Explain the fundamentals of electromagnetic radiation, including the electromagnetic spectrum, black body radiation, Planck's Law, Wien's Law and Stefan-Boltzmann Law, and scattering, absorption and emission of radiation.

Complementary subjects

Learning outcomes – able to:

Other sciences and related topics

- *Historical context*. Outline the scientific and technological advances that have contributed to the development of meteorology and its applications.
- *Basic physical chemistry.* Explain, using chemical nomenclature where appropriate, the basic concepts used in physical chemistry (including elements, molecules, compounds, bonds, chemical reactions and reaction rates), and describe the properties of gases and the key chemical reactions and cycles affecting the chemistry of the troposphere and stratosphere.
- *Basic oceanography*. Describe the general circulation and thermal structure of the oceans, explain the dynamical processes involved in producing ocean currents, tides and waves, and describe how measurements of temperature and salinity are made.
- *Basic hydrology*. Describe the hydrological cycle, explain the factors determining runoff, groundwater and surface water resources and the water balance, describe how hydrological measurements are made (e.g., precipitation, evaporation, soil moisture, river flow, groundwater), and identify the causes of different types of flooding.
- *Basic geography*. Describe the main geographical characteristics of the region of responsibility, including local terrain and local demographics, and describe map projections commonly used in meteorology.
- *Basic ecology*. Describe the major cycles of the biosphere (with emphasis on the carbon and water cycle) and the influence of human activity on those cycles (e.g., destruction of rain forests and melting of permafrost).

Communications and teamwork.

- *Written communications.* Prepare written communications within specified time limits in a concise, accurate and comprehensible way, including use of word processing and presentation programs.
- *Oral presentations*. Make presentations within specified time limits in which the content and style of delivery accurately conveys information in a way that is understood by the audience.
- *Teamwork*. Demonstrate an understanding of the different roles and functions in a team.

Data analysis and utilization

- *Programming*. Use basic computer programming principles, and construct a simple computer programme for analysing or displaying data.
- *Data processing*. Perform data processing and statistical analysis using spreadsheets and databases.

- *Accessing and obtaining information*. Find meteorological information using libraries, databases and internet searches.
- *Geographic Information Systems*. Discuss the components and functionality of a GIS, describe the potential uses of a GIS along with its benefits and shortcomings, and outline data quality issues involved in using a GIS.
- *Creating and publishing online material*. Create, publish and update a basic webpage.

2.3 Topics in atmospheric sciences

To provide structure to the learning outcomes associated with atmospheric sciences, they have been put under the following broad categories of knowledge.

- Physical meteorology.
- Dynamic meteorology.
- Synoptic and mesoscale meteorology.
- Climatology.

It should be noted, however, that this is not intended to specify the structure of a programme of study. There are many ways of structuring a programme that will ensure all the learning outcomes are satisfied. For example:

- A single module of a programme of study could cover several topics (e.g., conventional observations and instrumentation and remote sensing).
- The learning outcomes associated with several topics could be divided up differently (e.g., some learning outcomes listed under atmospheric dynamics could be covered when dealing with mid-latitude and polar weather systems and vice versa).
- The learning outcomes for one topic could be covered in several modules of the programme of study that go into more detail than is required for the minimum qualification (e.g., separate modules on thermodynamics and cloud physics).
- The learning outcomes could be covered in increasing detail as the programme of study progresses (e.g., there could be an initial module on the introduction to meteorology with topics then being covered in more detail at a later stage).
- The learning outcomes could be covered as part of a programme of study that is aimed at preparing participants for a particular role (e.g., a course aimed primarily at training forecasters could cover all the required learning outcomes in the BIP-M in addition to developing deeper and more practical skills).

The priority is for each institution to develop a programme of study that takes account of the prior knowledge of the participants, the best way to structure the programme to meet local requirements, and the purpose of the overall programme of study that may go beyond what is needed to satisfy the learning outcomes specified here.

2.4 Physical meteorology

The overall aim of the learning outcomes dealing with physical meteorology is to ensure an individual shall be able to:

- Explain the structure and composition of the atmosphere, the processes affecting radiative transfer in the atmosphere and global energy balance, and the causes of optical phenomena in the atmosphere.
- Apply the Laws of Thermodynamics to atmospheric processes, use a thermodynamic diagram to assess the properties and stability of the atmosphere, identify the effect of water on thermodynamic processes and explain the processes leading to the formation of water droplets, clouds, precipitation and electrical phenomena.
- Use knowledge of turbulence and surface energy exchanges to explain the structure and characteristics of the atmospheric boundary layer and the behaviour of contaminants.
- Compare, contrast and explain the physical principles used in conventional instruments to make surface and upper-air measurements of atmospheric parameters, and explain the common sources of error and uncertainty and the importance of applying standards and using best practice.
- Describe the range of meteorological data obtained from remote-sensing systems, explain how radiation measurements are made and the processes by which atmospheric data is derived from those measurements, and outline the uses and limitations of remote-sensing data.

Atmospheric composition, radiation and optical phenomena

Learning outcomes – able to:

- *Atmospheric structure*. Describe the vertical structure of the atmosphere in terms of its constituents, temperature and moisture content.
- *Atmospheric composition*. Explain the composition of the atmosphere, including trace gases, aerosols, dust and volcanic ash, and pollutants.
- *Radiation in the atmosphere*. Use a basic knowledge of radiative transfer theory to explain the effect of surface conditions (including snow and ice) and atmospheric constituents (including aerosols, water vapour, clouds, greenhouse gases and reactive gases) on the incoming and outgoing radiation.
- *Global energy balance*. Relate the earth's climate and its latitudinal and temporal variation to the energy balance at the Earth's surface, variations in the solar flux and the earth's orbital characteristics.
- *Optical phenomena*. Explain the transparency of the atmosphere and the origins of common optical phenomena (e.g., rainbows, haloes, coronas, sky colour, cloud colour) and describe the meteorological conditions favourable for their occurrence.

Thermodynamics and cloud physics

Learning outcomes – able to:

- *Applied thermodynamics*. Apply the Laws of Thermodynamics, with emphasis on understanding the concept of an air parcel, describing adiabatic processes and deriving dry and saturated adiabatic lapse rates and the associated conserved quantities.

- *Atmospheric moisture*. Define the parameters used to represent the amount of moisture in the atmosphere, explain their physical meaning, how they are related and how they are measured, explain the change of phase process, and determine the effect of water on the thermodynamic processes within the atmosphere.
- *Atmospheric stability*. Explain the basic features of a stable, neutral, conditionally unstable, potentially unstable and unstable atmosphere, identify the environmental conditions that can produce various stabilities, and explain the physical basis of commonly-used stability parameters.
- *Thermodynamic diagrams*. Use a thermodynamic diagram to analyse atmospheric processes, including assessing atmospheric stability, determining common parameters used to describe the state of the atmosphere (including cloud parameters), and interpreting the key features of a sounding.
- *Clouds and precipitation*. Describe and explain the microphysical processes leading to the formation and dissipation of cloud droplets, the growth and dissipation of warm and cold clouds, and the formation and growth of rain and solid precipitation particles, and describe the macroscopic structure of warm and cold clouds.
- *Electrical phenomena.* Explain the mechanisms causing electrical phenomena that occur in the atmosphere (e.g., cloud-to-ground and cloud-to-cloud lightning), and describe the meteorological conditions favourable for their occurrence.
- *Formation of atmospheric hydrometeors*. Describe the synoptic and mesoscale conditions and local processes that produce the various cloud types, precipitation types, icing, dew, frost and the various types of fog.

Boundary-layer meteorology and micrometeorology

Learning outcomes – able to:

- *Turbulent processes*. Describe the fundamental turbulent processes in the atmospheric boundary, including laminar and turbulent flows, mechanisms for generating turbulence, dissipation, decomposition of the fields into mean and fluctuating parts, statistical description of turbulence, and turbulent transport of mass, heat, moisture and momentum.
- *Surface energy exchanges*. Describe the energy budget near the Earth's surface and explain the energy exchange processes in the surface layer.
- *Boundary layer variations*. Use knowledge of turbulence and surface energy exchanges to explain the evolution and diurnal variation of the boundary layer, with emphasis on the conductive transfer from the underlying surface and the role of radiative transfer in determining the behaviour of the boundary layer.
- *Boundary layer profiles*. Use knowledge of turbulence and surface energy exchanges to explain the typical profiles of meteorological variables in stable, neutral and unstable conditions.
- *Local winds*. Explain the impact on boundary layer flows of the terrain, coastline and urban areas, including thermally induced circulations (e.g., sea and land breezes, lake effects and valley winds).
- *K theory*. Explain how K theory is used to modify the equations of motion to take account of turbulence, explain the origin and significance of the Ekman spiral, and derive an expression for the vertical structure of the wind in the surface layer using the mixing length hypothesis.

- *Measuring techniques*. Describe the techniques used to measure boundary-layer properties, including air quality.
- *Air contaminants*. Describe the common contaminants and pollutants affecting air quality and their major sources and sinks, along with their measurement, behaviour (including chemical and photochemical reactions and dry and wet deposition), and dispersion in the boundary layer, and explain how meteorological conditions, including stability, affect air quality, visibility and the dispersion of plumes.

Conventional observations and instrumentation

Learning outcomes – able to:

- *Surface measurements*. Explain the physical principles used in instruments to make surface measurements of temperature, moisture, pressure, precipitation, wind, cloud height, visibility, sunshine and radiation, and wave height, and the limitations and sensitivities of those instruments, and describe the way cloud and weather types are classified.
- *Upper-air measurements*. Explain the physical principles used in instruments to make upper-air measurements of geographical position, pressure, temperature, moisture and wind as well as ozone and other atmospheric constituents (e.g., dust and volcanic ash).
- *Characteristics of instruments*. Describe, compare and contrast the characteristics of various instruments used to make surface and upper-air measurements of atmospheric parameters.
- *Instrument errors and uncertainty*. Explain the common sources of error and uncertainty in standard instruments and observing techniques, the methods of estimating the confidence in a particular measurement, and the need to take account of the representativeness of an observation.
- *Standards of instrumentation*. Explain the importance of national and international standards of measurement, and compliance with best practice for the accurate calibration of instruments.
- *Use and limitation of observations*. Describe the uses of conventional observations and their limitations.

Remote sensing

Learning outcomes – able to:

- *Radiation measurements*. Describe the principles behind the radiation measurements used for passive and active remote sensing, and how usable information can be derived from remote-sensing data including the limitations and sources of errors/uncertainty.
- *Passive sensing systems*. Explain how passive sensing systems are used to provide digital data (such as visible, near infrared, infrared and water vapour imagery channels) and derived information about surface temperature and lightning, and atmospheric properties (including temperature, humidity, wind and atmospheric constituents).
- *Active sensing systems*. Explain how active sensing systems, such as radar, LIDAR and SODAR, are used to provide quantitative and qualitative information about atmospheric parameters such as temperature, humidity, cloud, precipitation (rate and type), wind speed and direction, turbulence and phenomena such as thunderstorms, microburst and tornadoes.
- *Satellite sounding systems*. Describe the orbital characteristics, accuracy, sampling limitations, use and limitations of various satellite sounding systems.

- *Radar measurements*. Explain the physical principles behind weather radar, including pulsed-Doppler radar, signal characteristics, how the radar information is processed, and the effect of meteorological factors on the propagation and attenuation of radar waves in the atmosphere.
- *Aircraft and marine systems*. Explain how aircraft, ships and buoys can be used to obtain atmospheric and oceanic information using remote-sensing systems.

2.5 Dynamic meteorology

The overall aim of the learning outcomes dealing with dynamic meteorology is to ensure an individual shall be able to:

- Explain the physical basis of the equations of motion in terms of forces and frames of reference, apply scale analysis to identify the dynamic processes in balanced flows, describe the characteristics of balanced flows, and use the equations of motion to explain quasi-geostrophy, ageostrophy, and the structure and propagation of waves in the atmosphere.
- Describe and explain the scientific basis, characteristics, limitations of numerical weather prediction (NWP) for short-, medium- and long-range forecasting, and explain the applications of NWP.

Atmospheric dynamics

Learning outcomes – able to:

- *Equations describing large-scale atmospheric flows*. Explain the physical principles underlying the equations that describe large-scale atmospheric flows (i.e., the primitive equations), including deriving the apparent and real forces acting on a fluid in a rotating frame of reference, and formulating the horizontal equation of motion.
- *Pressure coordinates*. Cast in pressure coordinates the primitive equations that govern the evolution of large-scale atmospheric flows, and state the advantages of using this coordinate system.
- *Scale analysis and balanced flows*. Apply scale analysis to determine the dominant processes operating in various examples of fluid flows, and derive the equations describing balanced flows (including inertial, cyclostrophic, geostrophic and gradient flows), hydrostatic equilibrium and thermal wind balance.
- *Ageostrophic motion*. Use the equations of motion to explain the causes and implications of ageostrophic flow, including the effect of friction.
- *Vorticity and divergence*. Explain the concepts of divergence, vorticity and potential vorticity, describe the mechanisms for generating changes in these parameters, and determine the relationship between divergence in the horizontal wind and vertical motion.
- *Quasi-geostrophic flow*. Explain the approximations and assumptions involved in deriving the quasi-geostrophic system of equations, outline the derivation of the geopotential tendency and omega equations, provide a physical interpretation of the forcing terms in these equations, and use these equations to explain the distribution of vertical motion and geopotential tendency in a developing baroclinic system.
- *Waves in the atmosphere*. Use approximate forms of the equations describing fluid flows to describe the structure and propagation of sound waves, gravity waves and Rossby waves.

- *Baroclinic and barotropic instability*. Explain the conceptual model used to describe baroclinic and barotropic instability.

Numerical weather prediction (NWP)

Learning outcomes – able to:

- *NWP data assimilation*. Explain how information from observing networks and systems is obtained and prepared for use in an NWP model, and the principles behind objective analysis, data assimilation (including 3D-Var and 4D-Var) and initialization.
- *NWP forecast models*. Describe the key components of an NWP model (including the prognostic variables, physical laws, and how physical processes are parameterized) and explain the difference between types of models (e.g., spectral versus gridpoint and hydrostatic versus non-hydrostatic models).
- *Strengths and weaknesses of NWP*. Assess the strengths and weaknesses of NWP and the reasons why there are limits to atmospheric predictability.
- *Ensemble forecasting*. Describe the principles behind ensemble forecasting and how such an approach can be used for short-, medium- and long-range forecasting.
- *Monthly to seasonal forecasting*. Explain the scientific basis of monthly, seasonal and intra-annual forecasting.
- *Downscaling*. Describe the techniques used to provide detailed regional atmospheric information based on the output from global models.
- *Post-processing and applications*. Describe the techniques used for post-processing NWP output (e.g., use of model output statistics) and some of the applications driven by NWP output (e.g., wave and crop yield models).

2.6 Synoptic and mesoscale meteorology

The overall aim of the learning outcomes dealing with synoptic and mesoscale meteorology is to ensure an individual shall be able to:

- Use physical and dynamical reasoning to describe and explain the formation, evolution and characteristics (including extreme or hazardous weather conditions) of synoptic-scale weather systems in (a) mid-latitude and polar regions and (b) tropical regions, and assess the limitations of theories and conceptual models about these weather systems.
- Use physical and dynamical reasoning to describe and explain the formation, evolution and characteristics (including extreme or hazardous weather conditions) of convective and mesoscale phenomena and assess the limitations of theories and conceptual models about these phenomena.
- Monitor and observe the weather situation, and use real-time or historic data, including satellite and radar data, to prepare analyses and basic forecasts.
- Describe service delivery in terms of the nature, use and benefits of the key products and services, including warnings and assessment of weather-related risks.

Mid-latitude and polar weather systems

Learning outcomes – able to:

- *Weather systems*. Explain how mid-latitude and polar weather systems differ from those in the tropics.
- *Modification of bodies of air*. Explain how bodies of air can be modified by the environment, the resulting characteristics of the air, and the ways in which the modifications can affect weather at distant locations through air movement.
- *Fronts*. Use knowledge of physical processes to describe the characteristics of warm, cold and stationary and occluded fronts, how these fronts are related to synoptic fields, and the three-dimensional nature of frontal boundaries.
- *Mid-latitude depressions*. Apply physical and dynamical reasoning to explain the life cycle of mid-latitude depressions in terms of the Norwegian cyclone model, including the three-dimensional structure of a developing depression and the air flow through the depression.
- *Jet streaks and jet streams*. Apply physical and dynamical reasoning to explain the development, structure and impact of jet streaks, and the relationship between the jet stream and the development of mid-latitude depressions.
- *Synoptic-scale vertical motion.* Diagnose synoptic-scale vertical motion in mid-latitude weather systems (e.g., by considering ageostrophic motion, using the Petterssen or Sutcliffe Development Theory or applying the omega equation).
- *Cyclogenesis.* Apply knowledge of dynamical processes to explain cyclogenesis and the factors contributing to explosive cyclogenesis.
- *Frontal structure and frontogenesis.* Explain the structure and dynamical characteristics of fronts, the relationship between frontogenesis and vertical motion, and the processes causing upper-level frontogenesis.
- *Polar weather systems*. Explain the characteristics and formation of polar weather systems, including katabatic winds, barrier winds and polar lows.
- *Extreme weather*. Describe the weather, with emphasis on any extreme or hazardous weather, that might be associated with mid-latitude and polar weather systems and the likely impact of such conditions.
- *Limitation of conceptual models*. Analyse recent and/or historic weather events to assess the extent to which theories and conceptual models of mid-latitude and polar weather systems resemble reality.

Tropical weather systems

Learning outcomes – able to:

- *General circulation in the tropics*. Describe the general circulation in the tropics and its seasonal variation in terms of the temperature, zonal wind, meridional motions, humidity and sea-level pressure.
- *Main tropical disturbances*. Describe the main tropical disturbances and their temporal variability, including the ITCZ, tropical waves, trade inversions, trade winds, tropical/sub-tropical jet streams, cloud clusters, squall lines, tropical depressions, sub-tropical ridges, and upper-level anticyclones.
- *Analysis of tropical flows*. Describe the techniques used to analyse tropical flows, including the depiction of streamlines and isotachs, and identification of areas of convergence/divergence.

- *Weather systems*. Explain how tropical weather systems differ from those in mid-latitudes and polar regions.
- *Tropical waves*. Describe the various types of tropical wave (including Kelvin waves, equatorial Rossby waves and Madden-Julian Oscillation) and their relationship to organized convection and cyclogenesis.
- *Tropical cyclones*. Apply physical and dynamical reasoning to explain the structure and characteristics tropical cyclones, the main dynamical processes involved in their development, and the techniques used to forecast the development and evolution of tropical storms.
- *Monsoon*. Apply physical and dynamical reasoning to explain the structure and characteristics of monsoons and the main dynamical processes involved in their development.
- *Ocean-atmosphere coupling*. Describe the role of ocean-atmosphere coupling with emphasis on the theoretical basis and impact of El Niño-Southern Oscillation (ENSO).
- *Extreme weather*. Describe the weather, with emphasis on any extreme or hazardous weather, that might be associated with tropical weather systems (including tropical cyclones and monsoons), and the likely impact of such conditions.
- *Limitation of conceptual models*. Analyse recent and/or historic weather events to assess the extent to which theories and conceptual models of tropical systems resemble reality.

Mesoscale weather systems

Learning outcomes – able to:

- *Mesoscale systems*. Describe the space and time scales associated with mesoscale phenomena, and the differences in the dynamical processes that drive mesoscale and synoptic scale systems.
- *Mesoscale features associated with depressions*. Explain the mesoscale features associated with depressions (e.g., rainbands, drylines, gust fronts and squall lines).
- *Gravity waves*. Apply physical and dynamical reasoning to explain the structure and formation of mesoscale gravity waves.
- *Convective systems*. Apply physical and dynamical reasoning to explain the structure and formation of isolated convective systems such as thunderstorms and convective storms (including single cell, multicell and supercell storms).
- *Mesoscale convective systems*. Apply physical and dynamical reasoning to explain the structure and formation of mesoscale convective systems.
- *Orographic mesoscale phenomena*. Apply physical and dynamical reasoning to explain the structure and formation of orographic mesoscale phenomena (e.g., lee waves, rotors, up-slope and down-slope winds, valley winds, gap flows and lee lows).
- *Extreme weather*. Describe the weather, with emphasis on any extreme or hazardous weather, that might be associated with convective and mesoscale phenomena, and the likely impact of such conditions.
- *Limitation of conceptual models*. Analyse recent and/or historic weather events to assess the extent to which theories and conceptual models of convective and mesoscale phenomena resemble reality.

Weather observing, analysis and diagnosis

Learning outcomes – able to:

- *Monitoring and observing the weather*. Monitor the weather, make a basic surface observation using remote and directly-read instruments and visual assessments (including identifying cloud types, cloud amount and weather type), explain the reasons for the visual assessments, and explain the underlying causes of a variety of weather phenomena that are visible from the Earth's surface.
- *Processing observations*. Describe how observations are quality-controlled, coded and distributed.
- *Synoptic analysis and interpretation*. Analyse and interpret synoptic charts and soundings plotted on a thermodynamic diagram, and describe the limitations of the observations used in the analyses.
- *Interpreting radar data*. Interpret common radar displays, including use of enhancements and animated imagery, to identify features associated with convective and mesoscale processes.
- *Interpreting satellite imagery*. Interpret satellite images, including use of common wavelengths (infrared, visible, water vapour and near infrared) and enhancements and animated imagery, to identify cloud types and patterns, synoptic and mesoscale systems, and special features (e.g., fog, sand, volcanic ash, dust and fires).
- *Integrating conventional and remote-sensing data*. Integrate remote-sensing data and synoptic observations to identify synoptic and mesoscale systems and diagnose the weather situation through relating features found in radar and satellite imagery to features observed from other data sources.
- *International collaboration*. Describe the role of international collaboration in the making and sharing of observations, with emphasis on the World Weather Watch, WMO Global Observing System and WMO Information System (including the Global Telecommunications System).

Weather forecasting

Learning outcomes – able to:

- *Local weather*. Describe factors affecting local weather (e.g., the effect of orography and large bodies of water on cloud and precipitation, or the effect of land surface types).
- *Forecast process*. Describe the main components of the forecast process, including observation, analysis, diagnosis, prognosis, product preparation, product delivery and product verification.
- *Types of forecasting methods*. Explain the advantages and disadvantages of preparing forecasts based on persistence, extrapolation and numerical weather prediction (NWP), and describe the role of the forecaster.
- *Conceptual models*. Apply conceptual models in making short-range forecasts and interpreting longer-range forecasts.
- *Practical forecasting*. Combine information from various sources to explain the current weather conditions, and use basic forecasting techniques, including the interpretation of NWP output, to forecast atmospheric variables (e.g., maximum and minimum temperature, wind, and precipitation type and intensity) at a specific location.

Service delivery

Learning outcomes – able to:

- *Function of National Meteorological Services*. Describe the function of National Meteorological Services in monitoring and forecasting the weather and the role of other service providers.
- *Service provision*. Communicate weather information, orally or in written form using deterministic and probabilistic approaches, that meets user requirements.
- *Key products and services*. Describe the key products and services, including warnings of hazardous weather conditions, based on current and forecast weather information that are provided to the public and other users, and describe how the products and services are used (e.g., for decision making and managing risk).
- *Hazardous weather*. Describe the extent to which hazardous weather systems affecting the region of responsibility can be forecast, and explain the importance of assessing the risk of hazardous weather, issuing prompt and accurate warnings, and understanding the potential impact of hazardous weather on society.
- *Quality of products and services*. Explain the basic techniques used to assess the quality of products and services.
- *Benefits and costs of meteorological services*. Identify the economic and social impacts of meteorological services upon a country and their key user sectors.

2.7 Climatology

The overall aim of the learning outcomes dealing with climatology is to ensure an individual shall be able to:

- Describe and explain the Earth's general circulation and climate system in terms of the physical and dynamical processes that are involved, and describe the key products and services based on climate information and their inherent uncertainty and use.
- Apply physical and dynamical reasoning to explain the mechanisms responsible for climate variability and climate change (including the influence of human activity), describe the impacts in terms of possible changes to the global circulation, primary weather elements and potential effects on society, outline the adaptation and mitigation strategies that might be applied, and describe the application of climate models.

Global circulation, climates and climate services

Learning outcomes – able to:

- *Components of the Earth system*. Describe the key components of the Earth system (i.e., atmosphere, oceans, land, cryosphere and solid earth).
- *Climate and weather*. Describe climate and how it differs from weather.
- *Climate data*. Describe how climate is measured and the uncertainty inherent in climate data, how climate data is analysed using statistics, and how climate can be measured using remote sensing.
- *Cycling of material*. Describe the main features of the energy cycle, hydrological cycle, carbon cycle and nitrogen cycle.

- *Features of the global circulation*. Explain the main features of the global circulation of the atmosphere and oceans based on an understanding of the physical and dynamical process that are involved, and describe the global energy balance and the role of the atmosphere and oceans in balancing the radiative heating differences between the equator and pole.
- *Regional and local climates*. Assess the factors that determine regional and local climates.
- *Classifying and describing climates*. Describe the techniques for classifying the climate, the principles behind these techniques, and the meaning and use of standard statistical variables used to describe climate.
- *Local climate*. Describe the climatology and seasonal changes of the region of responsibility, and the way climatological information can be obtained and displayed.
- *Key products and services*. Describe the key products and services based on climate information that are provided to the public and other users, describe their inherent uncertainties, and describe how the products and services are used (e.g., for decision making and managing risk).

Climate variability and climate change

Learning outcomes – able to:

- *Data to assess climate variations*. Describe the source and processing of data that is used to reconstruct past climates and assess changes in climate and atmospheric composition.
- *Observed climate variations*. Describe how the climate has changed in the recent past in the context of changes that have occurred in the past and the techniques used for attributing the causes.
- *Atmosphere-ocean interaction*. Describe the various ways in which the atmosphere influences the oceans and the oceans influence the atmosphere.
- *Climate variability*. Apply physical and dynamical reasoning to explain the causes of internally-generated climate variability (including examples of teleconnections, anomalies, and the climatic effects of major regimes such as the Madden-Julian Oscillation, North Atlantic Oscillation, and El Niño-Southern Oscillation).
- *Climate change*. Apply physical and dynamical reasoning to explain the causes of externally-forced climate change (including the influence of human activity), and the source of uncertainty in understanding these causes.
- *Impact, adaptation and mitigation*. Assess the major impacts of climate variability and change, and outline the adaptation and mitigation strategies that are applied in response to current and projected changes in the climate.
- *Climate models*. Explain the differences between climate models and those used for weather prediction, explain why there are uncertainties in climate predictions, describe how climate predictions can be verified, and explain why there are differences between statistical intra-annual forecasts and climate model predictions.

3. BASIC INSTRUCTION PACKAGE FOR METEOROLOGICAL TECHNICIANS (BIP-MT)

This chapter starts with an outline of the aims of the BIP-MT and then the learning outcomes associated with foundation topics are specified. The remainder of the chapter deals with the

learning outcomes concerning basic physical and dynamic meteorology, basic synoptic meteorology, basic climatology, and meteorological instruments and methods of observation.

3.1 Introduction

The overall aim of the BIP-MT is to provide an individual with a basic knowledge of atmospheric phenomena and processes, together with skills related to the application of this knowledge.

To satisfy the requirements of the BIP-MT, it is necessary for an individual to achieve the learning outcomes that cover:

- The acquisition of basic knowledge concerning physical principles and atmospheric interactions, methods of measurement and data analysis, a basic description of weather systems, and basic description of the general circulation of the atmosphere and climate variations.
- The application of basic knowledge to observe and monitor the atmosphere and interpret commonly-used meteorological diagrams and products.

It is intended that satisfying the BIP-MT requirements will provide an individual with the knowledge, skills and confidence to carry on developing their expertise and provide a basis for further specialization.

Individuals wishing to work in areas such as weather observing, climate monitoring, network management, and provision of meteorological information and products to users will need to undertake further education and training to meet the specialized job competencies in these areas. In addition individuals are expected to continue enhancing their knowledge and skills by participating in continuous professional development throughout their careers.

3.2 Foundation topics in mathematics, physics and complementary subjects

The overall aim of the learning outcomes dealing with the foundation topics is to ensure an individual shall be able to:

- Demonstrate the knowledge of mathematics and physics that is required to successfully complete the meteorological components of the BIP-MT.
- Demonstrate the knowledge of other sciences and related topics that complements the development of the meteorological expertise covered in the BIP-MT.
- Analyse and utilize data, and communicate and present information.

It is expected that the underpinning knowledge can be acquired using several approaches or a combination of them.

- Completion of a programme of study in the foundation topics at a school or college before attending an institution to study the topics in atmospheric science.
- Taking an introductory programme of study in the foundation subjects at the same institution where the topics in general meteorology are to be studied.

- Integrating the acquisition of the underpinning knowledge associated with the foundation topics into the studying of the topics in general meteorology.

Mathematics

Learning outcomes – able to:

- *Trigonometry*. Define sine, cosine and tangent, describe their relationship with their inverse functions, and manipulate basic trigonometrical equations.
- *Logarithms and exponentials*. Manipulate logarithms and exponentials.
- *Vectors*. Add and subtract vectors, and multiply a vector by a scalar.
- *Algebra*. Manipulate polynomial equations and solve basic algebraic equations, including quadratic equations.
- *Geometry*. Calculate the areas of right-angled and isosceles triangles, circumference and area of circles, and areas and volumes of rectangular blocks, cylinders and spheres, and describe the relationship between radians and degrees.
- *Coordinate geometry*. Interpret the slope and intercept of a linear graph, recognise standard curves such as the parabola, ellipse and hyperbola, and convert between cartesian and polar coordinate systems.
- *Statistics*. Select suitable ways of displaying statistical data and interpret the results, use different measures of central tendency (mean, median and mode) and variation (range, interquartile range and standard deviation), and explain the concepts of sampling, linear regression by least squares, correlation, normal distribution, percentiles and hypothesis testing.

Physics

Learning outcomes – able to:

- *Kinematics*. Solve problems using the equations describing the relationship between distance, speed, acceleration and time for uniformly accelerated motion in a straight line.
- *Dynamics*. Solve basic problems when a system is in equilibrium, solve basic problems using Newton's Second Law of Motion, and solve basic problems using the principle of the conservation of momentum.
- *Work, energy and power*. Explain the concepts of work, kinetic energy, potential energy, internal energy, and solve problems using the principle of the conservation of energy and the relationship between power, work and force.
- *Motion in a circle*. Explain the concept of centripetal acceleration and describe circular orbits by relating the gravitational force to the centripetal acceleration.
- *Phases of matter*. Describe the physical differences between solids, liquids and gases, explain the concept of latent heat associated with a phase change, and describe the processes associated with changes of phase with emphasis on condensation and evaporation.
- *Temperature and heat*. Explain the concepts of temperature and heat, describe how physical properties of a substance that varies with temperature can be used to measure temperature, and describe how heat is transferred by conduction, convection and radiation.
- *Thermodynamics and kinetic theory of gases.* Solve problems using the equation of state for an ideal gas, give a qualitative description of the First Law of Thermodynamics, explain what is

meant by an adiabatic process with emphasis on the adiabatic expansion of a gas, and describe the concepts behind the kinetic theory of gases.

- *Oscillations and waves*. Describe the properties of oscillations and waves, describe simple harmonic motion, solve problems using the relationship between speed, frequency and wavelength for waves, explain the difference between longitudinal and transverse waves, and explain the concepts of reflection, refraction, diffraction and interference.
- *Electromagnetic radiation*. Describe the characteristics of electromagnetic radiation and the key features of the electromagnetic spectrum, describe the processes of reflection, absorption and scattering of radiation (including reflection and refraction of light), describe what is meant by a black body, and outline the implications of the Stefan-Boltzmann Law and Wien Law.
- *Electricity and electromagnetic induction*. Describe the physical basis of current, voltage and resistance and how these quantities are measured, solve circuit problems (including those with two or more resistors) using Ohm's Law and Kirchhoff's Laws, and describe the process of electromagnetic induction.

Complementary subjects

Learning outcomes – able to:

Other sciences and related topics

- *Historical context*. Outline the scientific and technological advances that have contributed to the development of meteorology and its applications.
- *Basic oceanography*. Describe the general circulation and thermal structure of the oceans, and describe how measurements of temperature, salinity and sea state are made.
- *Basic hydrology*. Describe the hydrological cycle, identifying the key factors determining runoff, groundwater and surface water resources and the water balance, and describe how hydrological measurements are made (e.g., precipitation, evaporation, soil moisture, river flow, groundwater).
- *Basic geography*. Describe the main geographical characteristics of the region of responsibility, including a description of the local terrain.

Communications

- *Written communications.* Prepare written communications within specified time limits in a concise, accurate and comprehensible way, including use of word processing and presentation programs.
- *Oral presentations*. Make presentations within stated time limits in which the content and style of delivery accurately conveys information in a way that is understood by the audience.

Data analysis and utilization

- *Programming*. Use basic computer programming principles, and construct a basic computer programme.
- *Data processing*. Perform data processing and statistical analysis using spreadsheets and databases.
- *Accessing and obtaining information*. Find meteorological information using libraries, databases and internet searches.
- *Creating and publishing online material*. Create, publish and update a basic webpage.

3.3 Topics in general meteorology

To provide structure to the learning outcomes associated with general meteorology, they have been put under the following broad categories of knowledge.

- Basic physical and dynamic meteorology.
- Basic synoptic meteorology.
- Basic climatology.
- Meteorological instruments and methods of observation.

It should be noted, however, that this is not intended to specify the structure of a programme of study. There are many ways of structuring a programme that will ensure all the learning outcomes are satisfied. For example:

- The learning outcomes associated with several topics could be divided up differently (e.g., some learning outcomes listed under basic physical and dynamic meteorology could be covered when dealing with basic synoptic meteorology and vice versa).
- The learning outcomes for one topic could be covered in several modules of the programme of study that go into more detail than is required (e.g., separate modules on thermodynamics and dynamics).
- The learning outcomes could be covered in increasing detail as the programme of study progresses (e.g., there could be an initial module on the introduction to meteorology with topics then being covered in more detail at a later stage).
- The learning outcomes could be covered as part of a programme of study that is aimed at preparing participants for a particular role (e.g., a course aimed primarily at training observers could cover all the required learning outcomes in the BIP-MT in addition to developing more practical skills).

The priority is for each institution to develop a programme of study that takes account of the prior knowledge of the participants, the best way to structure the programme to meet local requirements, and the purpose of the overall programme of study that may go beyond what is needed to satisfy the learning outcomes specified here.

3.4 Basic physical and dynamic meteorology

The overall aim of the learning outcomes dealing with basic physical and dynamic meteorology is to ensure an individual shall be able to:

- Explain the basic physical and dynamical processes that take place in the atmosphere.
- Explain the physical principles used in instruments to measure atmospheric parameters.

Learning outcomes – able to:

- *Atmospheric composition and structure.* Describe the composition of the atmosphere and explain its vertical structure.
- *Radiation.* Explain the diurnal, latitudinal and seasonal variations in the radiation reaching the Earth's surface, describe the differences between short- (solar) and long-wave (terrestrial)

radiation, describe the processes affecting short- and long-wave radiation (i.e., reflection, scattering and absorption of radiation), outline the heat budget of the Earth's atmosphere, explain the greenhouse effect, explain the role of ozone in affecting ultraviolet radiation, and describe the heat balance at the surface and how it varies with latitude.

- *Atmospheric pressure*. Explain why pressure varies with height, explain the effect of temperature and humidity on the variation of pressure with height, and explain why pressure is often reduced to mean sea level.
- *Atmospheric temperature.* Describe the heating and cooling effect of convection, advection, turbulence and evaporation/condensation, explain the effect of water vapour, cloud and wind on the surface air temperature, explain the diurnal variation in surface air temperature, and describe the main factors that affect the global distribution of surface air temperature.
- *Atmospheric humidity.* Explain why humidity is important, explain the concepts of vapour pressure, saturated vapour pressure, wet-bulb temperature, dew point and relative humidity, and describe the factors that affect the rate of evaporation.
- *Atmospheric stability.* Describe the causes of variations in atmospheric stability, explain the concepts of dry adiabatic lapse rate, saturated adiabatic lapse rate and environmental lapse rate, explain various types of stability (e.g., absolute, conditional, neutral), explain the role of temperature inversions, and describe how stability and instability develop.
- *Wind.* Explain why winds occur, describe the pressure gradient force and Coriolis force, and explain concepts of the geostrophic and gradient winds, describe the effect of friction on the wind, and explain the causes of common local winds caused by topography (e.g., sea/land breezes, foehn winds and katabatic/anabatic winds).
- *Clouds, precipitation and thunderstorms.* Explain why rising motion leads to the formation of clouds, describe the main mechanisms for the formation of clouds, describe the processes that produce precipitation, and describe the triggering processes for thunderstorms and their life cycle.
- *Dew, frost and fog.* Describe the factors affecting visibility, explain the formation of dew and frost, and explain the causes of fog with emphasis on radiation and advection fog.
- *Atmospheric optics and electricity.* Explain the formation of rainbows, haloes, blue skies and lightning.

3.5 Basic synoptic and mesoscale meteorology

The overall aim of the learning outcomes dealing with basic synoptic meteorology is to ensure an individual shall be able to:

- Describe the formation, evolution and characteristics of synoptic-scale and mesoscale tropical, mid-latitude and polar weather systems, and analyse weather observations.
- Describe the forecast process and the use made of the associated products and services.

Learning outcomes – able to:

- *Weather at a specific location*. Explain how the weather experienced at a specific location is a combination of effects acting on different time and space scales.

- *Bodies of airs*. Describe and explain the origin, characteristics, movement and modification of bodies of air.
- *Mid-latitude and polar weather systems*. Describe the characteristics of depressions, anticyclones, troughs and ridges and their associated weather, with emphasis on those affecting the region of responsibility, describe the characteristics of warm, cold and occluded fronts and the weather associated with their passage, and describe the relationship between jet streams and weather systems.
- *Main tropical disturbances*. Describe the main tropical disturbances and their associated weather, including the ITCZ, tropical depressions, monsoons and El Niño-Southern Oscillation (ENSO).
- *Mesoscale systems*. Describe the formation and characteristics of important mesoscale features affecting the region of responsibility.
- *Hazardous weather*. Describe the formation and characteristics of hazardous weather systems (e.g., thunderstorms, and tropical cyclones) affecting the region of responsibility, the extent to which they can be forecast, and their impact on society.
- *Surface pressure diagrams*. Identify the main synoptic features on surface pressure diagrams and the associated satellite and radar imagery, and describe the typical weather associated with those features.
- *Upper-air diagrams*. Describe different types of upper-air diagrams, including height charts on constant pressure surfaces, identify the main synoptic features on the diagram and the associated satellite and radar imagery, and describe the typical weather associated with those features.
- *Aerological diagrams*. Describe the physical ideas that form the basis of aerological diagrams and perform basic operations on the diagram.
- *Display and mapping systems*. Discuss the common systems used within Meteorological Services to (a) display and map data and (b) prepare products and services for users, along with the benefits and shortcomings of the systems.
- *Forecast process.* Describe the forecasting process, describe the principles behind numerical weather prediction (NWP), and interpret basic operational NWP output.
- *Key products and services*. Describe the key products and services, including warnings of hazardous weather conditions, based on current and forecast weather information that are provided to the public and other users.
- *Function of National Meteorological Services*. Describe the function of National Meteorological Services in monitoring and forecasting the weather and the role of other service providers.

3.6 Basic climatology

The overall aim of the learning outcomes dealing with basic climatology is to ensure an individual shall be able to:

- Describe the general circulation of the atmosphere and the processes leading to climate variability and change.
- Describe the use made of products and services based on climate information.

Learning outcomes – able to:

- *Features of the global circulation.* Explain the main features of the global circulation of the atmosphere and oceans and their temporal (diurnal, seasonal, annual) variability.
- *Regional and local climates.* Explain the factors that determine regional and local climates.
- *Classifying and describing climates.* Describe the techniques for classifying the climate, including the Köppen method.
- *Local climate.* Describe the climatology and seasonal changes of the region of responsibility and the climatic trend in that region.
- *Climate variability and climate change*. Describe the difference between climate variability and climate change, describe the basic concepts behind the greenhouse effect and the basic science involved in human-induced climate change, and describe the basis for climate predictions.
- *Seasonal forecasts*. Outline the process and scientific basis for making seasonal forecasts.
- *Climate data.* Describe how climate data is captured, collected and quality-controlled in the meteorological service.
- *Climate statistics*. Describe how climate data is analysed in terms of its distribution (e.g., frequency and cumulative frequency), central tendency and variation.
- *Key products and services.* Describe the key products and services based on climate information that are provided to the public and other users.

3.7 Meteorological instruments and methods of observation

The overall aim of the learning outcomes dealing with meteorological instruments and methods of observation is to ensure an individual shall be able to:

- Explain the physical principles used in instruments to measure atmospheric parameters.
- Make basic weather observations.

Learning outcomes – able to:

- *WMO Integrated Global Observing System*. Describe the main components of the WMO Global Observing System and WMO Information System (including the Global Telecommunications System) that are used for making and transmitting meteorological and other environmental observations on a global scale using surface-based and space-based systems.
- *Siting of instruments*. Describe the factors that need to be taken into account when siting surface instrumentation.
- *Surface instrumentation*. Explain the physical principles used in instruments to make surface measurements of temperature, moisture, pressure, precipitation, wind, cloud height, visibility, sunshine and radiation (including instruments used in automatic weather stations), describe how these instruments operate, and outline the kinds of errors that might occur.
- *Hydrometeors.* Describe the various hydrometeors and how they are observed.
- *Clouds.* Describe the main cloud types, their characteristics, usual height range, and associated weather phenomena.

- *Weather phenomena*. Describe the various weather phenomena considered when taking a visual surface observation, describe their characteristics and explain their formation.
- *Monitoring and observing the weather*. Monitor the weather, make surface observations using remote and directly-read instruments and visual assessments (including identifying cloud types, cloud amount and weather type), and explain the reasons for the visual assessments.
- *Standards, quality control, calibration and intercomparison*. Describe national and international measurement standards and best practice for the quality control of observations and calibration and intercomparison of instruments.
- *Upper-air observations*. Explain the physical principles and the limitations of instruments used to make upper-air measurements.
- *Remote-sensing systems*. Describe the means by which remote sensing from ground and space (including use of satellites, radars, wind profilers, and aircraft, marine and lightning-detection systems) provides information about the atmosphere.
- *Coding*. Outline how observations are coded and transmitted, and describe the differences between different types of messages (e.g., SYNOP, SHIP, CLIMAT and METAR).
- *Use of observations.* Describe the main uses of observations from the WMO Integrated Global Observing System and other sources of information.

Resolution 33 (CG-XVI)

WMO PROGRAMME FOR THE LEAST DEVELOPED COUNTRIES

THE CONGRESS,

Noting:

(1) That the Fourth United Nations Conference on the Least Developed Countries (Istanbul, Turkey, May 2011) adopted a Programme of Action for the Least Developed Countries (LDCs) for the Decade 2011–2020,

(2) That the United Nations system, including WMO, was requested to continue to play an important role in the implementation of the Programme of Action,

(3) That the National Meteorological and Hydrological Services (NMHSs) have a major role to play in the socio-economic development of the countries concerned, particularly through the implementation of the Programme of Action at the national and regional levels,

Considering:

(1) Resolution 21 (Cg-XIV) – WMO Programme for the Least Developed Countries,

(2) The implementation strategy of the Global Framework for Climate Services (GFCS) adopted by Sixteenth Congress,

(3) That the LDCs need support from the United Nations system and other development partners for the implementation of the Programme of Action for the Least Developed Countries for the decade 2011–2020,

Decides:

(1) That the WMO Programme for the Least Developed Countries shall be continued in the sixteenth financial period and shall support the implementation of the Programme of Action for the Least Developed Countries for the Decade 2011–2020;

(2) That the substance of the WMO Programme for the Least Developed Countries shall comply with the WMO Strategic Plan and Operating Plan (2012–2015) and contribute to assisting NMHSs of least developed countries to fulfil their mandates;

Urges Members to participate actively in, and contribute to the maximum extent possible to, the funding of the WMO Programme for the LDCs, including through the WMO Trust Fund for NMHSs of LDCs;

Requests the regional associations to play a coordinating role in the implementation of the Programme as appropriate;

Requests the Executive Council to monitor the progress made, and to provide appropriate advice in the context of its oversight of WMO capacity-building activities, on the mobilization of resources and implementation of the Programme;

Requests the Secretary-General to report to the Seventeenth Congress on the implementation of the Programme.

Resolution 34 (CG-XVI)

WMO REGIONAL PROGRAMME

THE CONGRESS,

Noting the achievements and challenges of the Regions reported in the Abridged Final Reports of the sessions of the six WMO regional associations held during the fifteenth financial period,

Considering:

(1) The need for collective and coordinated activities of the regional associations in the implementation of the WMO Strategic and Operating Plan throughout the sixteenth financial period (2012–2015),

(2) The role of the regional associations and the WMO Regional Offices in identifying regional requirements and mainstreaming the capacity-building activities,

(3) The need for maintaining and broadening the liaison and cooperation with regional partner organizations in developing and implementing weather-, climate- and water-related programmes and projects for the benefit of Members,

(4) The need for WMO to be strongly and efficiently represented at the regional and subregional levels among other international organizations as a world leader in weather, climate and water matters,

(5) The need for ongoing support and advice to Members, particularly developing and least developed countries, aimed at enhancing the role, operations and visibility of the National Meteorological and Hydrological Services (NMHSs) based on a comprehensive understanding of their contribution to regional and subregional cooperation scenarios and to national development agendas,

Decides:

(1) That the WMO Regional Programme shall be continued in the sixteenth financial period;

(2) That the major thrusts of the Regional Programme will be:

(a) To continue providing support to the six Regional Associations of the Organization;

(b) To plan and coordinate regional activities, aligning them with the WMO Strategic and Operating Plans and the WMO technical and scientific programmes to ensure a harmonized and synchronous implementation effort by Members;

(c) To ensure that in the planning, implementation, monitoring and evaluation of the regional and national strategic/operating plans, the scientific and technical programmes of the Organization and the particular needs, capabilities and priorities of the various Regions are recognized and considered;

(d) To foster a strengthening of the role and operation of NMHSs at the national and regional levels to enable them to fulfil their mandates and provide an adequate response to emerging challenges;

(e) As a cross-cutting programme to facilitate expert assistance to Members;

(f) To identify Members' needs for the provision of regional facilities and services through continuation and monitoring of existing Regional Centres and establishment of new Centres, as appropriate;

(g) To promote the establishment and maintenance of links and partnerships with relevant regional and subregional organizations, intergovernmental and economic groupings in the Regions, thus promoting WMO activities and identifying synergies to bring efficiency and effectiveness to the implementation efforts;

(h) To contribute to the resource mobilization, establishment and implementation of regional and subregional capacity development projects in partnership with Members, international organizations and financial institutions;

(i) To facilitate broad use of the expertise available at the national and regional levels through the transfer of knowledge and know-how from the developed to the developing parts of the Regions;

(j) To promote and establish pilot projects in the Regions aimed at building the capacity of developing countries as a collaborative effort between regional associations and technical commissions;

(3) That the Regional Programme shall contribute to all Expected Results of the WMO Strategic Plan and Operating Plan (2012–2015), with particular focus on Strategic Thrust 3: "Strengthening capacity-building", and Expected Result 6: "Enhanced capabilities of NMHSs, in particular in developing countries and least developed countries, to fulfil their mandates";

Urges Members:

(1) To contribute to the maximum extent possible to the Programme during the sixteenth financial period, including support to Regional Offices and WMO Offices in the Regions through secondments and other appropriate means;

(2) To continue their support to the subsidiary bodies of the regional associations based on the principle of volunteerism;

Requests the presidents of regional associations to maintain strong liaison and ensure interregional cooperation and consistency on regional priorities, programmes and projects that cross regional borders;

Requests the presidents of the regional associations and the presidents of the technical commissions to maintain strong liaison and undertake joint coordinated actions aimed at harmonized and synchronous implementation of various programmes and projects;

Requests the presidents of the technical commissions to provide advice relating to the needs of regional associations and consider the priorities stated by the regional associations in the development of the programmes and projects of the respective technical commissions;

Requests the Secretary-General:

(1) To continue to administer the Regional Programme during the sixteenth financial period and to support resources for its activities within the approved budget;

(2) To review, in consultation with the presidents of the regional associations concerned, the current set-up of the WMO Regional Offices and WMO Offices in the Regions and propose measures for improving their effectiveness and efficiency, including appropriate relocations, within available resources.

Resolution 35 (Cg-XVI)

PUBLICATIONS FOR THE SIXTEENTH FINANCIAL PERIOD

THE CONGRESS,

Noting:

(1) Resolution 26 (Cg-XV) – Publications Programme for the fifteenth financial period,

(2) Resolution 20 (EC-LXII) – Mandatory publications and publication distribution policy for the sixteenth financial period,

(3) Resolution 10 (EC-LXI) – WMO mandatory publications for the sixteenth financial period,

(4) Resolution 13 (EC-LVI) – Publications Programme,

Recognizing that the free and unrestricted dissemination of WMO publications to Members' operational, scientific, educational and other interested institutions promotes awareness and broader use of WMO standards, guides and other products,

Recognizing that some of the publications contained in the previous approved Lists of Mandatory Publications have not been produced within a given financial period, as intended,

Noting that a shift toward the increased use of the World Wide Web and electronic dissemination of WMO publications has resulted in the near total loss of income from the sales of publications,

Recognizing the benefits of more economical and environmentally friendly electronic means of production and dissemination,

Decides:

(1) That the management of the Publications Programme, notably the presentation and method of reproduction of the publications and the most economical use of the available publication funds, including the revenue from sales of publications, shall be the responsibility of the Secretary-General within the framework established by Congress and taking into account the guidance given by the Executive Council;

(2) That additional publications may be produced during the sixteenth financial period given the availability of the necessary funding;

Adopts the list of WMO publications proposed by the Executive Council, technical commissions and regional associations to be produced during the sixteenth financial period and identified in the regular budget proposal, as provided in the annex to this resolution;

Requests the Executive Council:

(1) To continue to review regularly the status of the Publications Programme, taking into account the funds and facilities available, and to review the ongoing needs resulting from the introduction of new technologies and the expanding availability of alternatives to printed material;

(2) To consider any proposals for improved services and enhanced cost-efficiency, and to provide guidance on the best way to ensure the flow of information to Members and others through the Publications Programme;

Requests the Secretary-General to provide the Executive Council with the appropriate mechanism and resources for the regular review of the Publications Programme, and to allocate funding within the available budget for the further development of electronic publishing.

Note: This resolution replaces Resolution 26 (Cg-XV), which is no longer in force as of 1 January 2012.

Annex to Resolution 35 (Cg-XVI)

**LIST OF SELECTED WMO PUBLICATIONS
(PROVIDED FOR IN THE REGULAR BUDGET PROPOSAL AND PROPOSED FOR PRODUCTION DURING THE SIXTEENTH FINANCIAL PERIOD)**

Publication	*Number*	*Languages*	*Responsibility*
1. Governance and technical publications:			
1.1 Governance publications			
Basic documents	WMO-No. 15	A, C, E, F, R, S	WMO Secretariat
Composition of WMO	WMO-No. 5	E, F	WMO Secretariat
Abridged reports with resolutions of Congress		A, C, E, F, R, S	WMO Secretariat
Abridged reports with resolutions of the Executive Council		A, C, E, F, R, S	WMO Secretariat
Abridged reports with resolutions and recommendations of the regional associations		Same as for session documentation	WMO Secretariat
Abridged reports with resolutions and recommendations of the technical commissions		A, C, E, F, R, S	WMO Secretariat
Resolutions of Congress and the Executive Council	WMO-No. 508	E	WMO Secretariat
WMO Strategic Plan		A, C, E, F, R, S	WMO Secretariat
WMO Operating Plan		A, C, E, F, R, S	WMO Secretariat
1.2 Technical publications			
Guide to Meteorological Instruments and Methods of Observations	WMO-No. 8	E	CIMO, OBS
Technical Regulations, Vol. I	WMO-No. 49	A, C, E, F, R, S	Presidents of technical commissions and WMO Secretariat
Technical Regulations, Vol. II	WMO-No. 49	A, C, E, F, R, S	CAeM, WDS
Technical Regulations, Vol. III	WMO-No. 49	A, C, E, F, R, S	CHy, CLW
Technical Regulations, Vol. IV	WMO-No. 49	A, C, E, F, R, S	CBS, WDS
Manual on Codes, Vols. I.1, I.2 and II	WMO-No. 306	E, F, R, S	CBS, OBS
Manual on the Global Telecommunication System, Vols. I and II	WMO-No. 386	E, F, R, S	CBS, OBS
Manual on the Global Data-processing and Forecasting System	WMO-No. 485	E, F, R, S	CBS, OBS

Publication	*Number*	*Languages*	*Responsibility*
Manual on the Global Observing System	WMO-No. 544	E, F, R, S	CBS, OBS
Manual on the WMO Integrated Global Observing System		E	CBS, OBS
Manual on the WMO Information System	WMO-No. 1060	A, C, E, F, R, S	CBS, OBS
Guide to Hydrological Practices	WMO-No. 168	F, R, S	CHy
Manual on Stream Gauging	WMO-No. 1044	F, R, S	CHy
Manual on Flood Forecasting and Warnings	WMO-No. 1072	E, F	CHy
Manual on Water Resources Assessment		E, F, R, S	CHy
2. General information publications:			
WMO Bulletin		E, F, R, S	WMO Secretariat
World Meteorological Day materials		E, F, R, S	WMO Secretariat
WMO Statement on the Status of the Global Climate		A, C, E, F, R, S	WMO Secretariat
WMO Greenhouse Gas Bulletin		A, C, E, F, R, S	WMO Secretariat

Resolution 36 (Cg-XVI)

WMO STRATEGIC PLAN (2012–2015)

THE CONGRESS,

Noting:

(1) That Fifteenth Congress, in Resolution 27 (Cg-XV), adopted the WMO Strategic Plan for the period 2008–2011,

(2) Resolution 28 (Cg-XV) – Preparation of the WMO Strategic Plan for 2012–2015,

(3) The decisions of the Executive Council concerning the development of the WMO Strategic Plan,

Noting further that the WMO strategic planning process for the period 2012 to 2015 is based on and comprises three interlinked key components, namely:

(1) The WMO Strategic Plan**,** which provides a high-level statement of the future direction and priorities of WMO,

(2) The WMO Operating Plan**,** which translates the Strategic Thrusts, Expected Results and Key Outcomes described in the Strategic Plan into time-bound specific programme activities and projects needed to address the global societal needs and achieve the Expected Results,

(3) The WMO Results-based Budget, which identifies resources for the implementation of the Strategic Plan, including the functioning of WMO constituent bodies, the Secretariat and programme activities,

Approves under the provision of Article 8 (a), (b) and (c) of the Convention of the World Meteorological Organization, the WMO Strategic Plan for the period 2012–2015;

Urges Members to take the WMO Strategic Plan into account in developing and carrying out their national and regional programmes in meteorology, hydrology and related disciplines, as well as in their participation in the programmes of the Organization;

Requests the Executive Council, the regional associations, the technical commissions and the Secretary-General to adhere to the strategic direction and priorities set forth in the Strategic Plan and to organize their programme structures and activities so as to pursue the Strategic Thrusts and to achieve the Expected Results;

Further requests the Executive Council to use the Strategic Plan, complemented by the WMO Operating Plan, as a benchmark to monitor progress and performance in the implementation of the Expected Results, programmes and activities of the Organization, and to submit a report to the Seventeenth Congress;

Requests the Secretary-General to arrange for the publication of the Plan, for its distribution to all Members and constituent bodies of WMO, to United Nations system and other international organizations, and other partners, as appropriate.

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Note: This resolution replaces Resolution 27 (Cg-XV) after 31 December 2011.

Resolution 37 (Cg-XVI)

MAXIMUM EXPENDITURE FOR THE SIXTEENTH FINANCIAL PERIOD (2012–2015)

THE CONGRESS:

Noting:

(1) Article 23 of the Convention of the World Meteorological Organization,

(2) Article 4 of the Financial Regulations of the Organization,

Authorizes the Executive Council during the sixteenth financial period from 1 January 2012 to 31 December 2015:

(1) To incur maximum expenditures of 276 000 000 Swiss francs, of which 261 000 000 Swiss francs shall be from the assessed contributions and shall serve as the starting point for the assessed contributions level for the seventeenth financial period, and the balance of

15 000 000 Swiss francs shall be from other regular resources (rental income, support cost income, interest and other income) as shown by the Expected Results in Annex 1 to this resolution;

(2) To approve biennial appropriations within these limits;

Further authorizes the Executive Council, during the sixteenth financial period, to monitor and incur expenditure from the budget funded from voluntary resources estimated at 175 000 000 Swiss francs, including priorities funded from voluntary resources of 142 000 000 Swiss francs as outlined in Annex 2 to this resolution, and programmes jointly funded from voluntary resources of 33 000 000 Swiss francs.

Annex 1 to Resolution 37 (Cg-XVI)

MAXIMUM EXPENDITURE 2012–2015 BY EXPECTED RESULTS (in Swiss francs)

Expected Result	Total
1. Enhanced capabilities of Members to deliver and improve access to high-quality weather, climate, water and related environmental predictions, information, warnings and services in response to users' needs and to enable their use in decision-making by all relevant societal sectors.	24 666 700
2. Enhanced capabilities of Members to reduce risks and potential impacts of hazards caused by weather, climate, water and related environmental elements.	10 807 200
3. Enhanced capabilities of Members to produce better weather, climate, water and related environmental information, predictions and warnings to support in particular disaster risk reduction, climate impact and adaptation strategies.	24 440 600
4. Enhanced capabilities of Members to access, develop, implement and use integrated and interoperable Earth- and space-based observation systems for weather, climate and hydrological observations, as well as related environmental and space weather observations, based on world standards set by WMO.	36 245 200
5. Enhanced capabilities of Members to contribute to and draw benefits from the global research capacity for weather, climate, water and the related environmental science and technology development.	23 142 700
6. Enhanced capabilities of National Meteorological and Hydrological Services (NMHSs), in particular in developing and least developed countries, to fulfil their mandates.	59 200 700
7. New and strengthened partnerships and cooperation activities to improve NMHSs' performance in delivering services and to increase the value of the contributions of WMO within the United Nations system, relevant international conventions and national strategic issues.	22 469 600
8. An effective and efficient Organization	75 027 300
Total maximum expenditure	276 000 000

Annex 2 to Resolution 37 (Cg-XVI)

PRIORITIES FUNDED FROM VOLUNTARY RESOURCES (in Swiss francs)

	Priorities	Resources
1.	Climate activities and Global Framework for Climate Services (GFCS)	47 600 000
2.	Aviation meteorological services	1 750 000
3.	Capacity-building for the developing and least developed countries	62 400 000
4.	Implementation of the WMO Integrated Global Observing System (WIGOS) and WMO Information System (WIS)	22 400 000
5.	Disaster risk reduction	7 850 000
Total		142 000 000

Resolution 38 (Cg-XVI)

PREPARATION OF THE STRATEGIC PLAN FOR 2016–2019

THE CONGRESS,

Noting Resolution 36 (Cg-XVI) – WMO Strategic Plan (2012–2015),

Considering:

(1) That the WMO Strategic Plan and the WMO Operating Plan provide useful guidance to Members and their National Meteorological and Hydrological Services in consolidating their own planning policies, programmes and activities,

(2) That there is a continuing need for a sufficiently long lead time in planning the main directions of the scientific and technical work of the Organization,

(3) That the WMO strategic planning process enables the Organization to reflect on goals and major expected results in the light of anticipated societal changes and scientific and technical progress,

(4) That the WMO strategic planning process has improved the overall effectiveness of WMO in addressing relevant issues and has thus enhanced the status of WMO within the United Nations system,

Reaffirming that the overall purpose of the strategic planning process in WMO is to set Strategic Thrusts that address the global societal needs to achieve Expected Results for the Organization and to provide sufficient guidance for the formulation of the four-year WMO Operating Plan and Results-based Budget,

Confirming the leading role of the Executive Council and important contributions of regional associations and technical commissions in developing and implementing the Strategic Plan,

Decides that the WMO Strategic Plan 2016–2019 should be prepared;

Requests the Executive Council:

(1) To organize a planning process, taking into account lessons learned from the previous planning phases;

(2) To adjust, if necessary, Strategic Thrusts, Expected Results and performance targets on the basis of evolving societal and economic needs, as well as on the results of evaluation of the performance in the implementation of the Strategic Plans for the periods 2008–2011 and 2012–2015;

(3) To effectively engage regional associations and technical commissions in the planning process and to consider stronger linkages and complementary roles of technical commissions and regional associations in the planning process, in particular the development of guidance relating to the integration of technical commission and regional association operational plans into the overarching WMO strategic planning process;

(4) To develop a better means of integrating and supporting the development of regional and technical components of the WMO-wide Operating Plan;

(5) To identify areas that need further improvements and address them in the order of priority with specific emphasis on establishing baselines, formulating Specific, Measurable, Achievable, Realistic and Time-bound (SMART) Key Performance Indicators, setting achievable targets, and synchronization with technical commission/regional association decision-making;

(6) To take into account the outcomes of the work on continuous improvement of WMO working processes and practices;

Requests the regional associations:

(1) To provide regional needs and priorities that should be taken into consideration in developing the WMO Strategic Plan 2016–2019;

(2) To coordinate, as necessary, national contributions to regional aspects of the Plan;

(3) To develop their own Operating Plans in support of the implementation of the next WMO Strategic Plan;

Requests the technical commissions:

(1) To lead the formulation of the scientific and technical aspects of WMO Programmes and activities falling within their respective responsibilities in preparing the WMO Operating Plan;

(2) To develop their own Operating Plans in support of the implementation of the next WMO Strategic Plan;

Requests the Secretary-General:

(1) To provide Secretariat support to the strategic planning process;

(2) To ensure that the WMO Strategic Plan, the WMO Operating Plan and the budget for the seventeenth financial period are fully coordinated;

(3) To submit the first outline with possible scenarios to the sixty-fourth session of the Executive Council (2012);

(4) To submit the draft WMO Strategic Plan 2016–2019 to the Seventeenth Congress for approval.

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Note: This resolution replaces Resolution 28 (Cg-XV), which is no longer in force.

Resolution 39 (Cg-XVI)

ASSESSMENT OF PROPORTIONAL CONTRIBUTIONS OF MEMBERS FOR THE SIXTEENTH FINANCIAL PERIOD

THE CONGRESS,

Noting:

(1) Article 24 of the Convention of the World Meteorological Organization,

(2) Resolution 40 (Cg-XV) – Assessment of proportional contributions of Members for the fifteenth financial period,

Decides:

(1) That the latest United Nations scale of assessments approved by the United Nations General Assembly should continue to be used as the basis for the calculation of the WMO scale of assessments, duly adjusted for differences in membership;

(2) That the scale of assessments of proportional contributions of Members for the years 2012 and 2013 shall be based on the United Nations scale of assessments adopted by the United Nations General Assembly at its sixty-fourth session, and adjusted for differences in membership as specified in Table 1 of the annex to this resolution;

(3) That the proportional contributions of countries that are not members but may become Members shall be assessed for the years 2012 and 2013 as specified in Table 2 of the annex to this resolution;

Authorizes the Executive Council:

(1) To adjust the scale of assessments for the year 2014 to 2015, using the United Nations scale of assessments to be adopted by the United Nations General Assembly in December 2012 and adjusted for differences in membership, provided that for the WMO scale, the minimum rate shall remain at 0.02 per cent, and that corrections shall be made to ensure that no Member's rate of assessment would increase to a level that would exceed 200 per cent of the WMO scale in 2012 to 2013;

(2) To make a provisional assessment in respect of non-Members in the event of any such non-Members becoming Members, the method of assessment being based on principles similar to those governing the assessments laid down in this resolution.

Note: This resolution replaces Resolution 40 (Cg-XV) after 31 December 2011.

Annex to Resolution 39 (Cg-XVI)

PROPOSED WMO SCALE OF ASSESSMENTS 2012 AND 2013

Table 1

Proposed WMO scale of assessments for 2012 and 2013

Member	WMO scale of assessments 2012–2013
Afghanistan	0.02
Albania	0.02
Algeria	0.13
Angola	0.02
Antigua and Barbuda	0.02
Argentina	0.28
Armenia	0.02
Australia	1.90
Austria	0.84
Azerbaijan	0.02
Bahamas	0.02
Bahrain	0.04
Bangladesh	0.02
Barbados	0.02
Belarus	0.04
Belgium	1.06
Belize	0.02
Benin	0.02
Bhutan	0.02
Bolivia (Plurinational State of)	0.02
Bosnia and Herzegovina	0.02
Botswana	0.02
Brazil	1.59
British Caribbean Territories	0.02
Brunei Darussalam	0.03
Bulgaria	0.04
Burkina Faso	0.02
Burundi	0.02
Cambodia	0.02
Cameroon	0.02

Member	WMO scale of assessments 2012–2013
Canada	3.16
Cape Verde	0.02
Central African Republic	0.02
Chad	0.02
Chile	0.23
China	3.14
Colombia	0.14
Comoros	0.02
Congo	0.02
Cook Islands	0.02
Costa Rica	0.03
Côte d'Ivoire	0.02
Croatia	0.10
Cuba	0.07
Curaçao and Sint Maarten	0.02
Cyprus	0.05
Czech Republic	0.34
Democratic People's Republic of Korea	0.02
Democratic Republic of the Congo	0.02
Denmark	0.73
Djibouti	0.02
Dominica	0.02
Dominican Republic	0.04
Ecuador	0.04
Egypt	0.09
El Salvador	0.02
Eritrea	0.02
Estonia	0.04
Ethiopia	0.02
Fiji	0.02
Finland	0.56
France	6.03
French Polynesia	0.02
Gabon	0.02
Gambia	0.02
Georgia	0.02
Germany	7.89
Ghana	0.02
Greece	0.68
Guatemala	0.03
Guinea	0.02
Guinea-Bissau	0.02
Guyana	0.02
Haiti	0.02

Member	WMO scale of assessments 2012–2013
Honduras	0.02
Hong Kong, China	0.02
Hungary	0.29
Iceland	0.04
India	0.53
Indonesia	0.23
Iran (Islamic Republic of)	0.23
Iraq	0.02
Ireland	0.49
Israel	0.38
Italy	4.92
Jamaica	0.02
Japan	12.34
Jordan	0.02
Kazakhstan	0.06
Kenya	0.02
Kiribati	0.02
Kuwait	0.26
Kyrgyzstan	0.02
Lao People’s Democratic Republic	0.02
Latvia	0.04
Lebanon	0.03
Lesotho	0.02
Liberia	0.02
Libyan Arab Jamahiriya	0.12
Lithuania	0.06
Luxembourg	0.09
Macao	0.02
Madagascar	0.02
Malawi	0.02
Malaysia	0.25
Maldives	0.02
Mali	0.02
Malta	0.02
Mauritania	0.02
Mauritius	0.02
Mexico	2.32
Micronesia (Federated States of)	0.02
Monaco	0.02
Mongolia	0.02
Montenegro	0.02
Morocco	0.06
Mozambique	0.02
Myanmar	0.02

Member	WMO scale of assessments 2012–2013
Namibia	0.02
Nepal	0.02
Netherlands	1.83
New Caledonia	0.02
New Zealand	0.27
Nicaragua	0.02
Niger	0.02
Nigeria	0.08
Niue	0.02
Norway	0.86
Oman	0.09
Pakistan	0.08
Panama	0.02
Papua New Guinea	0.02
Paraguay	0.02
Peru	0.09
Philippines	0.09
Poland	0.82
Portugal	0.50
Qatar	0.13
Republic of Korea	2.23
Republic of Moldova	0.02
Romania	0.14
Russian Federation	1.58
Rwanda	0.02
Saint Lucia	0.02
Samoa	0.02
Sao Tome and Principe	0.02
Saudi Arabia	0.82
Senegal	0.02
Serbia	0.04
Seychelles	0.02
Sierra Leone	0.02
Singapore	0.33
Slovakia	0.12
Slovenia	0.10
Solomon Islands	0.02
Somalia	0.02
South Africa	0.38
Spain	3.13
Sri Lanka	0.02
Sudan	0.02
Suriname	0.02
Swaziland	0.02

Member	WMO scale of assessments 2012–2013
Sweden	1.05
Switzerland	1.11
Syrian Arab Republic	0.03
Tajikistan	0.02
Thailand	0.21
The former Yugoslav Republic of Macedonia	0.02
Timor-Leste	0.02
Togo	0.02
Tonga	0.02
Trinidad and Tobago	0.04
Tunisia	0.03
Turkey	0.61
Turkmenistan	0.03
Uganda	0.02
Ukraine	0.08
United Arab Emirates	0.39
United Kingdom of Great Britain and Northern Ireland	6.50
United Republic of Tanzania	0.02
United States of America	21.66
Uruguay	0.03
Uzbekistan	0.02
Vanuatu	0.02
Venezuela (Bolivarian Republic of)	0.31
Viet Nam	0.03
Yemen	0.02
Zambia	0.02
Zimbabwe	0.02
Total	**100.00**

Table 2

Provisional assessments in respect of non-Members for the years 2012 and 2013 in the event of any such non-Members becoming Members

Country	Percentage assessment
Andorra	0.02
Equatorial Guinea	0.02
Grenada	0.02
Holy See	0.02
Liechtenstein	0.02
Marshall Islands	0.02
Nauru	0.02
Palau	0.02
Saint Kitts and Nevis	0.02
Saint Vincent and the Grenadines	0.02
San Marino	0.02
Tuvalu	0.02

Resolution 40 (Cg-XVI)

INCREASED TRANSPARENCY AND INVOLVEMENT OF MEMBERS IN GOVERNANCE ISSUES OF WMO BETWEEN CONGRESSES

THE CONGRESS,

Noting:

(1) Resolution 33 (Cg-XV) – Increased transparency and involvement of Members in governance issues between Congresses,

(2) The actions taken by the Executive Council in pursuance of Resolution 33 (Cg-XV),

Taking into account the report of the Secretary-General on the level of attendance of Members and the impact assessment, and that the arrangements made during the sixty-first and sixty-second sessions of the Executive Council permit the attendance of Members' representatives at the sessions of the Executive Council and its Working Groups of interest to Members and serve the purpose of transparency and involvement of Members in governance issues to the Members' satisfaction,

Decides that the arrangements for the attendance of Members' representatives at the sessions of the Executive Council and its relevant bodies should be as provided in the annex to this resolution;

Requests the Secretary-General to continue provisions for the Members' attendance at sessions of the Executive Council and its relevant bodies, and to report to the Seventeenth Congress on the impact of such attendance.

Annex to Resolution 40 (Cg-XVI)

PROVISIONS FOR PARTICIPATION OF MEMBERS' REPRESENTATIVES IN THE SESSIONS OF THE EXECUTIVE COUNCIL AND ITS RELEVANT BODIES

1. Access to all information and non-confidential documents of the Executive Council and its subsidiary bodies, including session agendas and tentative workplans, shall be provided through the Website.

2. Interested Members should inform the Secretariat of the meetings at which they wish to be represented before the opening of the meeting. The Secretariat shall nevertheless send notifications of Executive Council sessions to Permanent Representatives of Members, with a copy to Permanent Missions of Member States in Geneva.

3. Representatives of Member States and Territories should be formally designated as such by the Permanent Representative or Permanent Mission of the Member in Geneva, or by any other authority entitled to issue credentials within the context of WMO.

4. Participation of Members' representatives shall be at the cost of Members.

5. Representatives of Members should be registered for a meeting upon their arrival and should receive a session badge for security reasons, for access to the WMO building and meeting rooms, and for record-keeping purposes. The badge will indicate the Member State or Territory represented.

6. Dedicated rows shall be allocated in the meeting rooms with the nameplate "Representatives of Members", if possible. If a meeting room proves insufficient to accommodate Members' representatives, in addition to official participants, observers and members of the Secretariat, the Secretariat shall arrange for video broadcasting of the sessions of the Executive Council in another room, provided that the meeting is being held at the WMO headquarters in Geneva.

7. The representatives of Members shall not be entitled to take the floor.

8. Pre-session and in-session documents shall not be distributed to representatives of Members by the Secretariat. They may be downloaded from the Website and/or ftp server.

9. The names of Members' representatives will appear on the official list of participants of the sessions for purposes of the official record.

Resolution 41 (Cg-XVI)

SECRETARY-GENERAL'S CONTRACT

THE CONGRESS,

Noting Article 21 (a) of the Convention of the World Meteorological Organization,

Decides that the terms of the appointment of the Secretary-General should be as set forth in the contract in the annex to this resolution.

Annex to Resolution 41 (Cg-XVI)

SECRETARY-GENERAL'S CONTRACT

In application of Article 21, paragraph (a) of the Convention of the World Meteorological Organization, prescribing that the Secretary-General shall be appointed by the Congress on such terms as the Congress may approve; and

Having regard to the resolution adopted by the Sixteenth Congress of the World Meteorological Organization approving the terms of appointment included in the present agreement;

It is hereby agreed as follows:

Between the World Meteorological Organization, hereinafter called the Organization, represented by its President, on the one part, and Mr Michel J.P. Jarraud, appointed Secretary-General by the Sixteenth World Meteorological Congress during its meeting of 24 May 2011, on the other part,

1. The Secretary-General's term of appointment shall take effect from 1 January 2012.

2. The Secretary-General, at the time of taking up his/her appointment, shall subscribe to the following oath or declaration:

"I solemnly swear (undertake, affirm, promise) to exercise in loyalty, discretion and conscience the functions entrusted to me as an international civil servant of the World Meteorological Organization, to discharge these functions and regulate my conduct with the interests of the Organization only in view, not to seek or accept instructions in regard to the performance of my duties from any government or other authority external to the Organization, and at all times to observe the Standards of Conduct for the International Civil Service and the WMO Code of Ethics for Staff".

This oath or declaration shall be made orally by the Secretary-General in the presence of the President and either a Vice-President or another member of the Executive Council.

3. During the term of his/her appointment, the Secretary-General shall enjoy the privileges and immunities in keeping with his/her office which are granted him by appropriate agreements entered into by the Organization; he/she shall not engage in any activity that is incompatible with the proper discharge of his/her duties and Secretary-General of the Organization; he/she shall renounce any employment or remunerated activities other than those of Secretary-General of the Organization, except those activities authorized by the Executive Council; he/she shall not accept any honour, decoration, favour, gift or remuneration from any source external to the Organization without first obtaining the approval of the Executive Council.

4. The term of appointment of the Secretary-General shall end:

(a) By expiration of this agreement on 31 December 2015; or

(b) By this official's resignation submitted in writing to the President of the Organization, in which case the Secretary-General shall cease his/her functions two months after the date of acceptance of his/her resignation by the Executive Council; or

(c) By termination for serious failure to carry out his/her duties and obligations, and in particular those set out in paragraphs (2) and (3) of this agreement. In such case, the Secretary-General shall be heard as of right by the Executive Council; if the

Executive Council decides to terminate the appointment, the decision shall take effect two months after the date of pronouncement and on conditions to be determined by the Executive Council. After consultation with the Executive Council, the President of the Organization may suspend the Secretary-General from the exercise of his/her functions pending investigation by the Executive Council and until this Council has taken a decision.

5. The Secretary-General shall receive from the Organization:

(a) An annual salary of US$ 164 650 at the dependency rate or US$ 150 083 at the single rate net (after deduction for staff assessment), with the application of the appropriate post adjustment at a rate equivalent to that applied to executive heads of other comparable specialized agencies, salary and post adjustment to be paid in monthly instalments; and

(b) An annual representation allowance of CHF 29 000, to be paid in monthly instalments; and

(c) Other allowances including dependency benefits, education, installation and repatriation grants, payment of removal, if pertinent, and travel and subsistence allowances appropriate and under the conditions applicable to Under-Secretaries of the United Nations.

All the above-mentioned sums will be paid in the currency of the country where the Secretariat is located, unless the Executive Council and the Secretary-General agree to some other arrangement.

The salary and emoluments received from the Organization will be free of tax.

6. The Secretary-General shall be allowed thirty working days' leave each year. In order that the Secretary-General may take his/her annual leave every two years in his/her home country, the Organization shall pay the expenses in connection with the travel of the Secretary-General, his/her spouse and his/her dependent children, under the conditions applicable to Under-Secretaries of the United Nations.

7. The Secretary-General shall participate in any social security scheme established by the Organization, the benefits he/she would receive being not less favourable than those which would accrue in similar circumstances to an official of the next highest rank of the staff covered by the scheme.

8. Any divergence of views concerning the application or interpretation of the present agreement, which it shall not have been possible to settle by direct discussion between the parties, can be submitted to the judgement of the Administrative Tribunal of the International Labour Organization, the competence of which is recognized by the Organization, whose decisions will be final. For any appeals by the Secretary-General against the non-observation of the statutes of the United Nations Joint Staff Pension Fund, of which the Secretary-General shall be a participant in accordance with the regulations and rules of that Fund, the United Nations Internal Justice System whose jurisdiction has been accepted by the Organization for pension cases is recognized hereby as the competent arbitrator.

Done and signed in duplicate at _____ on the _____ 2011.

_____	_____
(David Grimes) President of the World Meteorological Organization	(Michel Jarraud) Secretary-General appointed by the Sixteenth World Meteorological Congress

Resolution 42 (Cg-XVI)

AMENDMENTS TO THE GENERAL REGULATIONS OF THE WORLD METEOROLOGICAL ORGANIZATION

THE CONGRESS,

Noting that the General Regulations of the Organization and the Rules of Procedure of the Executive Council make no distinction between the three ordinary sessions of the Executive Council preceding an ordinary session of Congress and its shorter ordinary session directly following Congress,

Considering that there will be efficiency gains in recognizing the special nature of such shorter ordinary sessions and limiting their role to the consideration of matters not dealt with by Congress or those requiring immediate Council action,

Decides to include the following paragraph in Regulation 156 of the General Regulations (2011 edition):

> "The agenda of an ordinary session of the Executive Council directly following an ordinary session of Congress shall contain only those matters requiring its immediate action."

Noting:

(1) That Regulation 112 of the General Regulations (2011 edition) requires the Secretariat to prepare summarized minutes of discussions at plenary meetings of constituent bodies,

(2) That following the decision made by the Executive Council at its fiftieth session and confirmed by the Thirteenth Congress that no minutes of plenary meetings at sessions of the Executive Council, regional associations and technical commissions should be prepared, except where there is a specific request, and the decision of Fifteenth Congress to suspend the operation of Regulation 112 of the General Regulations (2011 edition) for the duration of the session,

(3) That audio recordings of plenary meetings will continue to be made and will be retained for record purposes, and that the formal government statements will be summarized in the general summary of the work of the sessions,

Considering therefore that it is timely to amend Regulation 112 of the General Regulations (2011 edition) to bring it into line with the practice that has developed,

Decides to amend Regulation 112 of the General Regulations (2011 edition) as follows:

REGULATION 112

At sessions of a constituent body the substance of the discussion and the decisions arrived at for each agenda item shall be recorded in the general summary of the work of the session.

Summarized minutes of the discussion at plenary meetings of constituent bodies shall be prepared by the Secretariat only where there is a specific request from the plenary.

Audio recordings of plenary meetings shall be made and retained for record purposes.

Summarized minutes shall be distributed as soon as possible during the session or by correspondence to all delegations, which may submit their proposed corrections in writing to the Secretariat. Any disagreement on the proposed corrections shall be decided by the presiding officer after consultation with the person concerned.

Summarized minutes will be adopted by the plenary in session or by correspondence.

Noting the review of the General Regulations for modernization and consolidation with current terminology,

Noting also the importance of gender-neutral language in the Basic Documents of the Organization,

Noting further, however, the technical impact and the expense that would be incurred by amending the entire Basic Documents,

Considering the need to bring the definition of limits between the WMO Regions into alignment with current geographical and political borders,

Decides to amend the General Regulations as follows:

(1) To insert a footnote at the bottom of the first page of the document to read as follows:

** In the General Regulations, the use of one gender shall be considered as including a reference to the other unless the context otherwise requires;

(2) To replace ‘”long-term planning” with “strategic planning” in Regulations 136 (10), 156 (4), 174 (6) and 191 (6) of the General Regulations (2011 edition);

(3) In Annex II, to replace “USSR boundary” with “former USSR boundary”.

Resolution 43 (Cg-XVI)

TERMS OF REFERENCE OF THE TECHNICAL COMMISSIONS

THE CONGRESS,

Noting:

(1) Regulation 180 and Annex III of the General Regulations (2011 edition) of the Organization,

(2) The proposal for a change in the general terms of reference of the technical commissions proposed by the Meeting of Presidents of Technical Commissions and subsequently noted by the Executive Council at its sixty-second session,

(3) The proposal for a change in its terms of reference adopted by the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) at its third session and subsequently noted by the Executive Council at its sixty-second session,

(4) The proposal for a change in its terms of reference adopted by the Commission for Atmospheric Sciences at its fourteenth session and subsequently noted by the Executive Council at its sixty-second session,

(5) The proposal for a change in its terms of reference adopted by the Commission for Aeronautical Meteorology adopted at its fourteenth session and subsequently noted by the Executive Council at its sixty-second session,

(6) The proposal for a change in its terms of reference adopted by the Commission for Climatology at its fifteenth session and subsequently noted by the Executive Council at its sixty-second session,

(7) The proposal for a change in its terms of reference adopted by the Commission for Agricultural Meteorology at its fifteenth session in 2010,

(8) The proposal for a change in its terms of reference adopted by the Commission for Basic Systems at its 2010 extraordinary session,

(9) The proposal for a change in its terms of reference adopted by the Commission for Instruments and Methods of Observation at its fifteenth session in 2010,

Considering the importance of ensuring that WMO scientific and technical activities are in line with the needs of Members and with developments in the fields concerned,

Decides:

(1) To amend the general terms of reference applicable to all technical commissions as given in Annex 1 to this resolution;

(2) To adopt the revised terms of reference of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology, the Commission for Atmospheric Sciences, the Commission for Aeronautical Meteorology, the Commission for Climatology, the Commission for Agricultural Meteorology, the Commission for Instruments and Methods of Observation and the Commission for Basic Systems as given in Annex 2 to this resolution;

(3) To retain unchanged the terms of reference for the Commission for Hydrology;

Requests the Secretary-General to reflect these changes in Annex III to the General Regulations (2011 edition), to inform all concerned of this decision and to continue to support the work of the technical commissions as provided for in the General Regulations.

Annex 1 to Resolution 43 (Cg-XVI)

AMENDMENT TO THE GENERAL TERMS OF REFERENCE OF TECHNICAL COMMISSIONS

The general terms of reference of the technical commissions contained in Annex III to the General Regulations (2011 edition) are amended by adding a new paragraph after paragraph 6 as in the 2007 edition:

"Structure its work to address societal outcomes, in line with existing management processes by creating and maintaining an operating plan focusing on the areas identified within its specific terms of reference and addressing the WMO Strategic Plan;"

and by renumbering paragraph 7 as in the 2007 edition as paragraph 8.

Annex 2 to Resolution 43 (Cg-XVI)

TERMS OF REFERENCE OF THE TECHNICAL COMMISSIONS

TERMS OF REFERENCE OF THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY

The Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) shall:

(a) Coordinate, develop and recommend standards and procedures for the work of Members/Member States in the overall collection, exchange, access, understanding, application and delivery of marine meteorological and oceanographic data, information, forecasts and warnings upon which marine meteorological and oceanographic services and marine-related decision-making processes are based;

(b) Coordinate, develop and recommend standards and procedures for the work of Members/Member States in the overall collection, management, exchanges and archival of high-quality marine meteorological and oceanographic data, information and products, on which climate studies, predictions and services, as well as impact and adaptation strategies, are based;

(c) Promote and facilitate the international sharing of implementing experience, transfer of technology and research uptake, and support relevant education and training to meet the capacity development needs of national agencies and of other organizations that play a role in the provision of marine meteorological and oceanographic services.

In this regard, the Commission will give special attention to education and training, and technology transfer initiatives on marine meteorological and oceanographic data, products and services that respond to the needs of, and build capacity in, the developing countries with particular emphasis on the least developed countries and small island developing States. Additionally, the Commission will support cooperation among WMO, UNESCO/IOC and other United Nations agencies that are

members of UN-Oceans, the International Hydrographic Organization (IHO), the International Council for Science (ICSU) and other governmental and non-governmental organizations, the private sector as well as user organizations, on matters related to marine meteorology and oceanography.

Within its terms of responsibility as defined above, and consistent with the IOC Statutes, the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology shall have responsibilities common to all WMO Technical Commissions as defined in Regulation 180 of the General Regulations (2011 edition), and shall structure its work to address societal outcomes as envisaged by the planning documents of the parent organizations, by creating an operating plan focusing on the areas identified within its specific terms of reference and addressing appropriate (or applicable) strategic thrusts and expected results.

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TERMS OF REFERENCE OF THE COMMISSION FOR ATMOSPHERIC SCIENCES

The Commission for Atmospheric Sciences shall be responsible for promoting, coordinating and facilitating research and access to its results, technology transfer from research to operations, training and capacity-building activities in atmospheric sciences including weather and its forecasting, climate, water, atmospheric chemistry, and related environmental sciences.

The specific objectives of the Commission shall be:

(a) To identify the requirements of WMO Members, including those related to support of environmental and climate conventions, and to facilitate the transfer of knowledge, technologies and advice concerning atmospheric science issues;

(b) To support and facilitate research in atmospheric and related sciences to advance the understanding and prediction of atmospheric processes within the broader Earth system, with emphasis on the following:

  (i) Weather, climate, water and related environmental analysis and prediction for timescales ranging from minutes to seasons to multi-decadal, embracing new developments in environmental prediction;

  (ii) Refining the end-to-end prediction process so as to improve the forecasting of high impact events associated with serious consequences for populations and economies;

  (iii) Atmospheric composition and air pollution, their interaction with weather and climate, studies of transport, transformation, deposition and impacts of air pollutants and related monitoring;

  (iv) The physics and chemistry of clouds, greenhouse gases, ozone and aerosols;

  (v) Weather modification science assessment with emphasis on the underlying physical and chemical processes and the development of rigorous evaluation procedures;

  (vi) Processes in tropical and polar regions where the lack of understanding has large impacts on global predictive skill;

(c) To maintain and develop the Global Atmosphere Watch Programme using an integrated approach to observations and research, focusing on greenhouse gases, atmospheric

chemistry and air quality, contributing to scientific assessments in support of international environmental and climate conventions and policies;

(d) To maintain and develop the World Weather Research Programme, including the Observing System Research and Predictability Experiment (THORPEX), focusing on knowledge of high impact weather and partnerships in multidisciplinary research advancing the broader science of environmental prediction;

(e) In accordance with the WMO Strategic Plan, to coordinate the activities of the Commission with relevant WMO bodies and promote cooperation between WMO Members, international scientific organizations, environmental institutions and other scientific groups;

(f) To standardize functions, constants, terminology and bibliographic practices applicable to atmospheric sciences;

(g) To support and facilitate the effective transfer of advances made by atmospheric science research to reduce societal impact of weather, climate and pollution on societies, economies and ecosystems;

(h) To conduct scientific assessments in atmospheric science as required by Members or by the delivery of the science programmes of the Commission.

TERMS OF REFERENCE OF THE COMMISSION FOR AERONAUTICAL METEOROLOGY

The terms of reference of the Commission for Aeronautical Meteorology shall be:

(a) To assist Members in improving delivery of aeronautical meteorological observations and forecast services, and in applying quality standards in line with the requirements of aviation users;

(b) To coordinate development and implementation of aeronautical meteorological services in support of safe and efficient Air Traffic Management, in collaboration with the International Civil Aviation Organization (ICAO);

(c) To assist Members in developing and promoting aeronautical meteorological related climate services in collaboration with the other WMO constituent bodies;

(d) To enhance the capabilities of Members in the provision of aeronautical meteorological warning services to reduce the impacts of hazardous weather on aviation users;

(e) To provide the best available guidance, resource material and coordination for aeronautical meteorological education and training to Members in cooperation with the regional associations, ICAO regional groups and the Education and Training Office of the WMO Secretariat, particularly for developing and least developed countries;

(f) To develop and implement, in coordination with regional associations, pilot projects to demonstrate and share best practices for capacity building of Members in the provision of aeronautical meteorological services and to promote regional cooperation for technology transfer to developing and least developed countries;

(g) To develop guidance material for Members to enhance their management of aviation weather service provision in cooperation with regional associations;

(h) To review existing and emerging user requirements, in cooperation with regional associations, and to develop and update associated regulatory documentation and effective cost recovery mechanisms related to the provision of aeronautical meteorological services in collaboration with the International Civil Aviation Organization.

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TERMS OF REFERENCE OF THE COMMISSION FOR CLIMATOLOGY

The terms of reference of the Commission for Climatology shall be:

(a) To advise and guide WMO climate activities relevant to the implementation of the Global Framework for Climate Services;

(b) To assist Members in the gathering, management and sharing of climate data;

(c) To promote the analysis, monitoring, assessment and reporting of the climate system;

(d) To promote the development of climate products and services and, in conjunction with the Commission for Basic Systems, their delivery mechanisms;

(e) To promote the development of climate products, services and information to inform on adaptation and climate risk management, in collaboration with relevant institutions, and demonstrate the social and environmental benefits of such services;

(f) To assist Members, especially those from developing and least developed countries, to build their climate-related capacity to meet the needs of their stakeholders;

(g) To play an active role in WMO's interactions with other United Nations and international agencies on climate-related matters.

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TERMS OF REFERENCE OF THE COMMISSION FOR AGRICULTURAL METEOROLOGY

The terms of reference of the Commission for Agricultural Meteorology shall be:

(a) Support applications of meteorology to the management of agriculture, livestock, forestry, rangelands and fisheries sectors (herein after referred to as agricultural subsectors), taking into account developments in both the scientific and operational fields;

(b) Assist the Member countries in developing and establishing their agrometeorological services (and, where necessary, encourage and assist National Meteorological and Hydrological Services in realigning/restructuring their services to provide effective agrometeorological services) through transfer of knowledge, methodologies and techniques, and by providing advice, particularly on:

    (i) The most operational use of knowledge concerning weather and climate for sustainable agricultural management through conservation and better use of natural resources;

(ii) The use of weather and agrometeorological observations, forecasts and warnings for operational purposes;

(iii) The use of climate observations and predictions;

(iv) Adaptation to climate variability and change, in particular in developing countries;

(v) Combating unfavourable influences of weather and climate on agricultural subsectors, including weather-related pests and diseases;

(vi) The protection of agricultural produce in storage or in transit against damage or deterioration due to direct and indirect influences of weather and climate;

(vii) Effective means of communication and fostering coordination and collaboration activities between weather and climate service providers and users in subsectors;

(c) Improve coordination and collaboration mechanisms through which users of weather and climate information in agricultural subsectors can liaise actively with weather and climate service providers and vice versa;

(d) Formulate data and information requirements for agricultural purposes;

(e) Foster the development and use of effective communication methods and channels for acquiring and disseminating agrometeorological information, advice and warnings to agricultural subsectors and obtaining feedback;

(f) Promote a better understanding of the interactions and impacts of weather and climate in regards to drought and desertification.

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TERMS OF REFERENCE OF THE COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION

The Commission shall be responsible for matters relating to international standardization, compatibility and sustainability of instruments and methods of observation of meteorological, climatological, hydrological, marine, and related geophysical and environmental variables.

This responsibility underpins all observations within WIGOS, and will be carried out in close consultation with relevant WMO partner organizations that co-sponsor, own and/or operate some of the observing systems. This responsibility also extends to supporting the requirements of WMO cross-cutting activities such as the Global Framework for Climate Services, Disaster Risk Reduction and Capacity Building.

This shall include in particular:

(a) Respond to the requirements for standardized and compatible observations, including data content, quality, metadata and observational product generation;

(b) Provide advice, and recommendations, and promote studies concerning effective and sustainable use of instruments and methods of observation, including quality management procedures such as methods for testing, preventive maintenance, calibration and quality assurance;

(c) Conduct and/or coordinate global and regional instrument intercomparisons and performance testing of instruments and methods of observation;

(d) In collaboration with the other international organizations, such as BIPM and ISO, promote the development of measurement traceability to recognized international standards (SI), including reference instruments within a hierarchy of world, regional, national and lead centres for instrument calibration, development and testing;

(e) Promote compatibility, intercomparison, integration and inter-operability within and between, space-based and surface-based (in situ and remote-sensing) observations, including conducting testbed observing experiments;

(f) Encourage research and development of new approaches in the field of instruments and methods of observation of meteorological, climatological, hydrological, marine, and related geophysical and environmental variables;

(g) Promote the appropriate and economical production of instruments and methods of observation with particular attention to the needs of developing countries;

(h) Support training and capacity-building activities in the area of instruments and methods of observation;

(i) Liaise with the scientific research community and instrument manufacturers to evaluate and to introduce new observing systems into operations.

TERMS OF REFERENCE OF THE COMMISSION FOR BASIC SYSTEMS

The Commission shall be responsible for matters relating to:

(a) Cooperation with Members, other technical commissions, regional associations and relevant bodies in the development and operation of integrated systems for observing, data processing, forecasting, telecommunications, and data management. These activities shall be in response to requirements and in support of all WMO Programmes, particularly contributing to disaster risk reduction, and taking advantage of opportunities provided by technological developments;

(b) The assessment of opportunities for, and the provision of, a common infrastructure to meet the requirements defined by technical commissions and regional associations, as well as by organizations with whom WMO has relations, taking into account new applications of meteorology, hydrology, oceanography, and related environmental sciences;

(c) Continued development of the World Weather Watch (WWW) as a priority;

(d) Further development and implementation of the Public Weather Services Programme, with particular attention to end-to-end service delivery;

(e) Further development and implementation of the WMO Space Programme;

(f) Contribution to the development and implementation of the Global Framework for Climate Services;

(g) The processing, storage and retrieval of basic data for meteorological and related purposes including, in particular, the organization of the Global Data-processing and Forecasting System of the WWW;

(h) The development and application of systems and techniques to meet user requirements including those of operational weather analysis and forecasting and of services for environmental emergency authorities;

(i) Observational systems, facilities and networks (land, sea, air, and space) as decided by Members including, in particular, all technical aspects of the WMO Integrated Global Observing System, particularly the global observing systems;

(j) Telecommunication networks, radio-frequency allocation and facilities for operational, research and applications purposes including, in particular, the organization of the WMO Information System, including the Global Telecommunication System of the World Weather Watch;

(k) The development and application of operational procedures, schedules, and arrangements for the exchange of and access to weather, climate and water information (data and, products), including warnings, required by all WMO Programmes, in particular, through the WMO Information System;

(l) The development and application of data management principles and procedures including monitoring and evaluation of the common infrastructure, in particular, of the World Weather Watch.

Resolution 44 (Cg-XVI)

AMENDMENTS TO THE GENERAL REGULATIONS OF THE WORLD METEOROLOGICAL ORGANIZATION – DISTRIBUTION OF SEATS IN THE EXECUTIVE COUNCIL

THE CONGRESS,

Noting:

(1) Article 13 of the Convention of the World Meteorological Organization,

(2) Resolution 39 (Cg-XIV) – Amendments to Article 13 (c) of the Convention,

(3) The General Regulations of WMO,

Considering that the distribution of seats in the Executive Council should, as a priority, reflect the number of Members in each Region,

Also considering that the number of Members in each Region has changed little since the Fourteenth World Meteorological Congress and that, in the event of major changes, Congress could reconsider the total number of seats in the Executive Council,

Decides:

(1) To introduce a new regulation number 17, to Chapter I – General, under the heading "Members of the Executive Council", just before the heading "Sessions of constituent bodies", worded as follows:

"Article 13 of the Convention establishing the composition of the Executive Council is clarified by the present regulation on the distribution of the seats in the Executive Council as follows: Region I (Africa): 9; Region II (Asia): 6; Region III (South America): 4; Region IV (North America, Central America and the Caribbean): 5; Region V (South-West Pacific): 4; and Region VI (Europe): 9.";

(2) To replace in Regulation 15 the text "of Article 13 (c) (ii) of the Convention" with "of Article 13 (c) (ii) of the Convention, and Regulation 17";

(3) To modify Regulation 85 (b) as follows:

"(b) A second election consisting of separate elections conducted simultaneously shall be held to fill the remaining places on the Executive Council, on the basis of a list containing the names of candidates from particular Regions in order to satisfy the requirement in accordance with Article 13 (c) (ii) of the Convention, and Regulation 17, except those who have been elected under subparagraph (a). In this second election, separate voting slips shall be used for each Region involved. In addition to the provisions of Regulation 82, a voting slip shall be invalid if it contains a number of names greater, for any Region, than the maximum number of seats which remains possible for that Region, in accordance with Article 13 (c) (ii) of the Convention, and Regulation 17. A voting slip containing fewer names than the number of places to be filled shall be valid and shall not be regarded as an abstention provided it contains at least one name.";

(4) To replace in Regulations 87 (a), (b) and 88 the text "Article 13 (c) (ii) of the Convention" with "Article 13 (c) (ii) of the Convention, and Regulation 17";

(5) In Regulation 144, to replace the text "of that article" with "of that article and Regulation 17";

(6) To renumber the regulations after new Regulation 17 accordingly;

Requests the Secretary-General to reflect these changes in the General Regulations, to inform all the parties concerned of these amendments and to continue to support the work of Congress and the Executive Council as provided for in the General Regulations.

Resolution 45 (Cg-XVI)

TECHNICAL REGULATIONS OF THE WORLD METEOROLOGICAL ORGANIZATION

THE CONGRESS,

Noting:

(1) Articles 8 (d) and 14 (c) of the Convention of the World Meteorological Organization,

(2) Resolution 1 (Cg-XV) – Technical Regulations of the World Meteorological Organization,

(3) Resolution 2 (EC-LVIII) – Amendments to the *Manual on the Global Observing System* (WMO-No. 544), Volume I – Global Aspects,

(4) Resolution 10 (EC-LIX) – Report of the Extraordinary Session (2006) of the Commission for Basic Systems,

(5) Resolution 20 (EC-LIX) – Amendments to the *Manual on the Global Observing System* (WMO-No. 544), Volume II, Regional Aspects – The Antarctic,

(6) Resolution 7 (EC-LX) – Amendments to the WMO *Technical Regulations* (WMO-No. 49), Volume II – Meteorological Service for International Air Navigation,

(7) Resolution 3 (EC-LXI) – Report of the fourteenth session of the Commission for Basic Systems relevant to data-processing and forecasting systems, including emergency response activities,

(8) Resolution 4 (EC-LXI) – Establishment of Regional Climate Centres,

(9) Resolution 7 (EC-LXI) – Report of the fourteenth session of the Commission for Basic Systems relevant to the WMO Information System,

(10) Resolution 6 (EC-LXII) – Report of the fourteenth session of the Commission for Aeronautical Meteorology, as it pertains to competence standards for aeronautical meteorological personnel,

(11) Resolution 8 (EC-LXII) - Amendment to the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485),

(12) Resolution 10 (EC-LXII) – Third edition of the *Guide to Climatological Practices* (WMO- No. 100) and Amendment to the *Technical Regulations* (WMO-No. 49), Volumes I, II and III,

(13) Resolution 16 (EC-LXII) – Publication of Volume IV of the *Technical Regulations* (WMO-No. 49) – Quality Management,

(14) Resolution 17 (EC-LXII) – Amendment to the *Technical Regulations* (WMO-No. 49), Volume II – Meteorological Service for International Air Navigation,

Considering:

(1) That Fifteenth Congress emphasized the need for appropriate regulatory documentation for the WMO Information System (WIS) and instructed the Commission for Basic Systems (CBS) to develop such documentation,

(2) That the Executive Council, at its sixty-second session, emphasized the importance of appropriate regulatory and guidance documentation on the WIS and requested the Inter-commission Group on WIS (ICG-WIS) and CBS to prepare amendments to the relevant section of the Technical Regulations, and the *Manual on the WMO Information System*, (WMO-No. 1060) for the consideration of Sixteenth Congress,

(3) The need to keep the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485) up to date,

Affirms the authority of the Executive Council to approve amendments to the Technical Regulations or new regulations if they need to be implemented before the time of the next Congress;

Requests the Secretary-General:

(1) To arrange for the amendments, as approved by the Executive Council, to be included in the Technical Regulations and to ensure the editorial consistency of the relevant documents, including editorial amendments to the *Manual on the WMO Information System*;

(2) To ensure the revision of the regulatory documents in a systematic manner and ensure that the published versions of the regulatory documents can be used as reference documentation within a nationally implemented Quality Management System;

(3) To ensure that the amended versions of the Technical Regulations are translated in all official languages of WMO, with the minimum time lag.

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Note: This resolution replaces Resolution 1 (Cg-XV), which is no longer in force.

Resolution 46 (Cg-XVI)

REVIEW OF PREVIOUS CONGRESS RESOLUTIONS

THE CONGRESS,

Considering that it is important not to let accumulate a collection of resolutions from previous Congresses, some of which would have become redundant and others which have been replaced by new decisions,

Noting:

(1) Regulation 136 (17) of the General Regulations (2011 edition), concerning the review of previous Congress resolutions,

(2) Resolution 49 (Cg-XV) – Review of previous Congress resolutions,

Having examined its previous resolutions still in force,

Decides:

(1) To keep in force the following resolutions:

Second Congress (Cg-II)	18*
Third Congress (Cg-III)	3, 4
Fifth Congress (Cg-V)	6, 15*, 30*
Seventh Congress (Cg-VII)	32, 39
Eighth Congress (Cg-VIII)	33, 36*, 48
Ninth Congress (Cg-IX)	9*, 30
Tenth Congress (Cg-X)	31*

Eleventh Congress (Cg-XI)	8*, 19, 24, 30, 37
Twelfth Congress (Cg-XII)	21*, 35, 40*
Thirteenth Congress (Cg-XIII)	25, 26, 31
Fourteenth Congress (Cg-XIV)	5, 6, 24, 46*
Fifteenth Congress (Cg-XV)	4, 9, 15, 21, 22, 29*, 31, 38*, 39*, 41*, 42*, 45*;

(2) To keep in force but only until 31 December 2011:

Fifteenth Congress Resolutions (Cg-XV) 2, 13, 14, 26, 27, 35, 40, 43;

(3) Not to keep in force other resolutions adopted before its sixteenth session;

(4) To publish the text of resolutions kept in force pursuant to resolutions adopted by Sixteenth Congress.

Note: This resolution replaces Resolution 49 (Cg-XV), which is no longer in force.

The full texts of the resolutions of Congress and the Executive Council that are kept in force are published in *Resolutions of Congress and the Executive Council* (WMO-No. 508).

* Resolutions that refer to other resolution(s) which are no longer in force will be reproduced with footnotes as provided in the annex to this resolution.

Annex to Resolution 46 (Cg-XVI)

FOOTNOTES TO FOLLOWING RESOLUTIONS

1. Resolution 18 (Cg-II) – Definition of the Guides of the World Meteorological Organization

Resolution 17 (Cg-II) not in force

2. Resolution 15 (Cg-V) – Administration of technical assistance projects

Resolution 12 (Cg-IV) not in force

3. Resolution 30 (Cg-V) – Units for wind speed in meteorological messages for international exchanges

Resolutions 30, 31 (Cg-IV) and 12 (EC-XVIII) not in force

4. Resolution 36 (Cg-VIII) – Technical co-operation among developing countries in the field of meteorology and operational hydrology

Resolution 21 (EC-XXX) not in force

5. Resolution 9 (Cg-IX) – United Nations Conference on the Law of the Sea

Resolution 16 (Cg-VIII) not in force

6. Resolution 31 (Cg-X) – Incentive scheme for early payment of contributions

Delete footnote "**See Resolution 28 (Cg-X)"*

Add footnote *"As amended by Resolution 46 (Cg-XVI) adopted by Congress at its sixteenth session in June 2011."*

7. Resolution 8 (Cg-XI) – Establishment of a WMO Special Trust Fund for climate and atmospheric environment activities

Resolution 5 (EC-XLI) not in force

8. Resolution 21 (Cg-XII) – Global Runoff Data Centre (GRDC)

Resolution 11 (EC-XLV) not in force

9. Resolution 40 (Cg-XII) – WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities

Resolutions 23 (EC-XLII), 20, 21, 22 (EC-XLVI) and 2 (EC-XLIII) not in force

10. Resolution 46 (Cg-XIV) – Use of Portuguese

Add note *"Note: This resolution replaces Resolution 26 (Cg-XII) and Resolution 20 (Cg-XIII), which are no longer in force."*

11. Resolution 15 (Cg-XV) – Stratospheric ozone observations

Change note to *"Note: This resolution complements Resolution 14 (Cg-XV) – Atmospheric Research and Environment Programme, which is no longer in force as of 1 January 2012, and replaces Resolution 7 (EC-XXXIX) and Resolution 3 (EC-LVI), which are no longer in force."*

12. Resolution 29 (Cg-XV) – Evolution of National Meteorological and Hydrological Services and WMO

Resolution 21 (EC-LVII) not in force

13. Resolution 38 (Cg-XV) – Audit Committee

Resolutions 15 (EC-LVI), 11 (EC-LVII) and 10 (EC-LVIII) not in force

14. Resolution 39 (Cg-XV) – Financial Advisory Committee

Resolution 29 (Cg-X) not in force

15. Resolution 41 (Cg-XV) – Settlement of long-outstanding contributions

Resolution 12 (EC-LVIII) not in force

16. Resolution 42 (Cg-XV) – Working Capital Fund

Resolution 37 (Cg-XIV) not in force

17. Resolution 45 (Cg-XV) – Emblem and flag of the World Meteorological Organization

Resolutions 2 (EC-X), 20 (EC-LVII) not in force

Resolution 47 (Cg-XVI)

RESPONSE TO THE REPORT OF THE HIGH-LEVEL TASKFORCE ON THE GLOBAL FRAMEWORK FOR CLIMATE SERVICES

THE CONGRESS,

Noting:

(1) The decision of the World Climate Conference-3 to establish a Global Framework for Climate Services (GFCS),

(2) The *Report of the Intergovernmental Meeting for the High-level Taskforce for the Global Framework of Climate Services* (WMO-No. 1052), which was held in Geneva on 11 and 12 January 2010,

Welcoming the report of the High-level Taskforce on the Global Framework for Climate Services, *Climate Knowledge for Action: A Global Framework for Climate Services – Empowering the Most Vulnerable* (WMO-No. 1065),

Considering the findings and recommendations of the High-level Taskforce,

Decides:

(1) To endorse the broad thrust of the High-level Taskforce's Report;

(2) To accept the intent of Recommendation 1, with the understanding that the international community would make, consistent with its ability to do so, a significant investment in the implementation of the GFCS;

(3) To note with interest Recommendation 2, thereby encouraging the use of the eight principles provided by the Taskforce as a guide for decision-making in the implementation of the Framework;

(4) In response to Recommendation 3:

(a) To entrust the Executive Council with the responsibility of developing proposals, with the involvement of relevant stakeholders, including other United Nations bodies, for consideration by an Extraordinary World Meteorological Congress. These proposals are to address:

(i) The development of the draft implementation plan for the GFCS;

(ii) The establishment of the draft terms of reference and rules of procedure for the GFCS Intergovernmental Board and its substructures based on the draft implementation plan;

(b) To request the Secretary-General:

(i) To support the work of the Executive Council as it develops the draft implementation plan, which would include, inter alia, details of the ongoing Secretariat support arrangements;

(ii) To organize an Extraordinary World Meteorological Congress in 2012 with the participation of all relevant stakeholders, including other United Nations bodies, to review and adopt the draft implementation plan for the GFCS for subsequent

consideration by the GFCS Intergovernmental Board, and to adopt the terms of reference and rules of procedure of the Intergovernmental Board;

(5) To accept Recommendation 4, particularly supporting the rapid implementation of projects at the national and regional levels, possibly including, but not limited to the Report's "Fast-Track projects", which are aimed at increasing the capacity of developing countries to provide climate services and ensuring that such proposed capacity-developing projects are of high priority and meet clearly identified requirements;

(6) To proceed with Option A of Recommendation 5 as contained in Chapter 10 of the Taskforce Report, to implement the GFCS, amended to reflect the agreement that the Intergovernmental Board of the Framework will be accountable to the World Meteorological Congress and that the management committee structures, which may be accountable to the Intergovernmental Board, will be decided upon completion of the drafting of the implementation plan;

(7) To establish the GFCS Secretariat within WMO;

Strongly urges Members:

(1) To continue to make their expertise available during the development and implementation of the GFCS;

(2) To strengthen their own capacity to meet national climate services needs;

(3) To make maximum use of national, regional and global capabilities to collect and exchange data and products, to generate climate information and to provide climate services;

(4) To make voluntary contributions of the resources needed to continue the implementation of the GFCS;

Calls on other United Nations system entities, as well as all relevant regional and international organizations and entities, whether governmental or non-governmental, to give strong support to the implementation of the GFCS through participation in its working mechanisms and contribution of expertise and resources to its programmes, projects and activities;

Requests the Executive Council:

(1) To take necessary actions for the Global Framework for Climate Services to become an effective operational entity in 2012–2015 and beyond;

(2) To give high priority to ensuring effective overall coordination of the Framework;

(3) To review relevant resolutions and structures of WMO with a view to ensuring effective implementation of the GFCS;

Requests the Secretary-General:

(1) To convey the gratitude of Congress to the members of the High-level Taskforce for their outstanding work and for consulting broadly and producing a high-quality and well-balanced report in such a short time;

(2) To continue to draw fully on the advice and assistance of climate experts and users of climate services in the further development of the Framework.

Resolution 48 (Cg-XVI)

IMPLEMENTATION OF THE GLOBAL FRAMEWORK FOR CLIMATE SERVICES

THE CONGRESS,

Noting:

(1) The report of the High-level Taskforce on the Global Framework for Climate Services, *Climate Knowledge for Action: A Global Framework for Climate Services – Empowering the Most Vulnerable* (WMO-No. 1065),

(2) The urgent need to put in place improved climate services for all, but most particularly for climate-vulnerable developing countries, particularly African countries, least developed countries, land-locked developing countries and small island developing States, where climate services are also often weakest,

Considering:

(1) That internal working methods for the Global Framework for Climate Services (GFCS), particularly for communications and for debating and deciding on implementation priorities, including for the observations, information systems, research and capacity-building components, need to be established,

(2) That mechanisms are needed to strengthen the global cooperative system for collecting observations, for processing and exchanging data and products, and for using climate-related information,

(3) That projects that target the needs of developing countries, particularly those currently least able to provide climate services, must be designed and implemented,

(4) That strategies for external communications, resource mobilization and capacity-building programmes for the Framework need to be developed,

(5) That targets need to be set and procedures established for monitoring and evaluating the performance of the Framework,

Decides to support and facilitate the implementation of the GFCS as a priority of the Organization in the sixteenth financial period;

Requests Members:

(1) To assist in the development of the implementation plan for GFCS by further developing national and regional requirements for climate services so that capacity development projects can be designed and implemented;

(2) To facilitate coordination and collaboration among various institutions within their countries as required for the generation and use of climate services through appropriate legal and institutional arrangements;

(3) To provide adequate resources to the National Meteorological and Hydrological Services (NMHSs) for strengthening weather, climate and water data networks and recruiting experts with new technical skills required for generating and delivering climate services;

(4) To support research in climate science at national, regional and global levels to improve the understanding of climate systems and to promote the delivery of better climate services;

Urges NMHSs:

(1) To develop partnerships with relevant intermediary organizations and specialized sectoral institutions within the countries, including the establishment of National Climate Outlook Forums (NCOFs)/National Climate User Platforms;

(2) To collaborate with universities, climate research institutions, and regional and national training centres to continuously improve the technical skills for developing climate services and serving the needs of various users;

(3) To continue to improve the technical skills of the staff within their institutions through regular training;

Requests the Executive Council:

(1) To provide support for, and guidance to, the process of developing the detailed implementation plan and monitoring of its implementation through appropriate working mechanisms;

(2) To review Annex 1 – Data and products to be exchanged without charge and with no conditions on use, to Resolution 40 (Cg-XII) – WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities, with a view to ensuring that the climate data and products needed for the GFCS climate services are included therein;

(3) To review the role and operation of NMHSs, specifically addressing the needs of GFCS;

Invites the regional associations:

(1) To regularly review and prioritize the need for climate services within their Regions and encourage collaboration with regional user sectors;

(2) To encourage regional collaboration so as to enable the building of regional institutions such as Regional Climate Centres (RCCs) and collaborative mechanisms such as Regional Climate Outlook Forums (RCOFs) for sharing climate data and products, and developing climate information and services;

(3) To improve coordination of ongoing activities among Regions;

Invites the technical commissions:

(1) To regularly review the technical needs of the Framework as they relate to the activities and competencies of the respective commissions, guide establishment and improvement of procedures and processes on technical matters to support GFCS operations, and assist with the implementation of the Framework to the extent possible;

(2) To improve coordination of ongoing activities relevant to the Framework within and among technical commissions;

Requests the Secretary-General to put in place arrangements through which the WMO Secretariat can provide a high level of support to the regional associations, technical commissions, WMO Programmes and co-sponsored programmes as they make their important contributions to the Global Framework for Climate Services.

Resolution 49 (CG-XVI)

WMO STRATEGY FOR CAPACITY DEVELOPMENT

THE CONGRESS,

Noting:

(1) Article 2 (a), (b), (d), (f) of the Convention of the World Meteorological Organization, which relates to capacity development,

(2) Resolution 36 (Cg-XVI) – WMO Strategic Plan (2012–2015),

(3) Resolution 30 (Cg-XI) – Development of National Meteorological and Hydrological Services,

(4) Strategic Thrusts of the WMO Strategic Plan 2012–2015, which call for enhancing capabilities of Members and National Meteorological and Hydrological Services (NMHSs) and strengthening partnerships, cooperation and good governance,

(5) Paragraph 4.9.11 of the *Abridged Final Report with Resolutions of the Fifteenth Session of Regional Association VI* (WMO-No. 1046) requesting the Secretary-General to look at innovative ways to strengthen the capacity-building activities with a view to presenting a new concept of effective development assistance to the Sixteenth World Meteorological Congress in 2011,

Noting further:

(1) The definitions of capacity development in bilateral and multilateral development organizations such as the Organization for Economic Co-operation and Development/ Development Assistance Committee (OECD/DAC), which defines capacity development as "the process whereby people, organizations and society as a whole unleash, strengthen, create, adapt and maintain capacity over time",

(2) That capacity-building is an element of all WMO Programmes, most notably the Least Developed Countries, Technical Cooperation, Voluntary Cooperation, Education and Training, and Regional Programmes,

Recognizing that capacity development is a comprehensive approach to enhancing capacity and includes the consideration of stakeholder requirements, existing capabilities, and ongoing capacity development activities in the preparation of development projects, as well as the establishment of improved implementation and feedback mechanisms at regional, subregional and national levels,

Considering:

(1) That the ability of a National Meteorological and Hydrological Service to fulfil its mandates not only depends on the strength of its own service, and the support provided to it by its national government, but also on the observations and technical contributions of neighbouring National Meteorological and Hydrological Services, and therefore, capacity development for the less developed National Meteorological and Hydrological Services ultimately benefits all WMO Members,

(2) That capacity development is cross-cutting and that the success of this activity will affect all WMO Programmes,

(3) That capacity development activities need to be better coordinated to fulfil the purposes of the Organization,

Decides that a Capacity Development Strategy should be prepared, taking into account the elements of a WMO Capacity Development Strategy as set out in the annex to this resolution;

Requests the Executive Council:

(1) To take the lead in preparing a cross-cutting Capacity Development Strategy, including a plan to implement the Strategy, which takes into account the needs and guidance of Members and will provide further focus for WMO efforts in the coordination and cooperation of technical assistance among Members, regional associations, technical commissions, WMO Programmes and the WMO Secretariat;

(2) To establish a mechanism, which includes the active participation of the Members, leading to approval of the above-mentioned Capacity Development Strategy by the Executive Council at its sixty-fourth session;

(3) To submit a report to Seventeenth Congress on the application of the Capacity Development Strategy during the sixteenth financial period;

Requests Members, regional associations, technical commissions and WMO co-sponsored Programmes to support the creation of a Capacity Development Strategy;

Requests the Secretary-General:

(1) To provide the necessary support to the Executive Council to develop a Capacity Development Strategy;

(2) To further promote partnerships and coordination among WMO Departments and Programmes to effectively and efficiently implement capacity development activities of the WMO;

(3) To further cultivate relationships at the regional, subregional and national levels to ensure that capacity development projects and activities supported by WMO meet the specific user needs of each Member;

(4) To ensure coordinated and streamlined capacity development activities within WMO.

Annex to Resolution 49 (Cg-XVI)

ELEMENTS OF A WMO STRATEGY FOR CAPACITY DEVELOPMENT

Definition of Capacity Development

(1) Capacity is defined as the ability of individuals, organizations and society as a whole to perform, sustain itself, and self renew.

(2) Capacity development is defined as the process of strengthening the abilities or capacities of individuals, organizations and societies to solve problems and meet their objectives on a sustainable basis which:

(a) Is an ongoing continuous improvement process with feedback mechanisms rather than a short-term intervention;

(b) Aims to augment capacity in a manner conducive to sustained growth;

(c) Includes the activities, approaches, strategies, and methodologies which help organizations, groups and individuals improve their performance, and generate development benefits;

(d) Is an endogenous process driven by national mechanisms and facilitated by complementing external agencies;

(e) Should be evaluated based on growth as a whole and over time.

(3) In the WMO context, this definition puts emphasis on a **holistic approach to building competencies and capabilities of NMHSs.** Also it promotes the role of the NMHSs in all aspects of development rather than multiple parallel efforts to improve an NMHS's capacity in a non-cohesive manner.

(4) The definition also implies NMHSs should have strong linkages to national, sub-regional and regional planning and political processes to ensure sustainability as well as coordination and cooperation with related capacity development activities.

(5) Capacity development recognizes that two types of capacities, **technical capacities** and **management capacities** are needed to sustain capacity development. These two types of capacities are distinct, yet inter-related. While technical capacities are straightforward and have been well addressed during the long history of technical cooperation of WMO, management capacities are also required in the formulation of institutional arrangements and leadership to implement and review policies, strategies, programmes and projects. These include the capacity to:

(a) Engage with stakeholders to identify, and create consensus around capacity development issues, as well as related policies, regulations and laws;

(b) Articulate the mandate of the NMHS or to envision the desired course of the organization;

(c) Develop a strategy, translate it into an actionable plan and prepare a budget;

(d) Implement a programme or policy and to monitor its implementation and evaluate results.

(6) These core management capacities are fundamental to all organizations, institutions and societies needed to be effective and function well, without which technical capabilities cannot be maintained over time.

Capacity Development Process

(1) The capacity development process should be a continuous process that comprises of at least five steps rather than a "one-off" intervention. The basic five steps of the capacity development process are:

(a) Engage Stakeholders
The first step is to identify and engage stakeholders. To ensure an effective and sustainable capacity development process, political commitment and ownership is essential and therefore NMHSs need to embed their capacity development plans in National, Sub-regional and Regional Development Plans.

(b) Assess capacity assets and needs
The level of existing capacity and desired future capacity needs to be assessed to gather critical information and knowledge on capacity assets and needs. Such assessment helps to formulate capacity development responses and to prioritize capacity development investments.

(c) Formulate a capacity development response
UNDP uses the term capacity development response to refer to an integrated set of deliberate and sequenced actions that are embedded in the programme or project. Strategies proposed in capacity development response are usually including elements related to management capacities such as institutional arrangements, leadership, knowledge and performance.

(d) Implement a capacity development response
To successfully implement capacity development response, initiatives for change must be owned at the national or local level. Implementation of capacity development response is a part of the programme or project implementation and should be part of the national development plan. During implementation, efforts should also be made to best align the existing system and capacity to the response.

(e) Evaluate capacity development
Evaluation focuses on how outputs contribute to the achievement of overall goals. Evaluation should address whether capacity development response has helped to build, enhance and retain capacities of the NMHS. It should also include institutional arrangements, leadership, knowledge and performance, individuals, organization, and society levels. Reporting on the results achieved and deficiencies identified by Members is critical for the capacity development process. This evaluation will increase the effective involvement of Members in the implementation of the CDS.

(2) Although establishing baselines is a necessity, it should also be noted that some aspects of capacity development are difficult to measure quantitatively because aspects like behaviour change cannot be fully captured by any quantitative scales. In addition, effects of capacity development response may be seen only some years later thus it is not appropriate to assess only after a short period of time. Therefore, for evaluation to capture overall progress, both qualitative and quantitative analyses on information from subjective and objective sources need to be utilized.

Towards a Strategy for WMO Capacity Development

(1) A WMO Capacity Development Strategy should be used to infuse the definitions and processes described above across all WMO RAs, TCs, and Programmes. The creation of the Development and Regional Activities Department (DRA) within the WMO Secretariat has provided a focus for the coordination and cooperation of technical assistance among Members, the Secretariat, RAs, TCs and WMO Programmes. Development of a crosscutting strategy for capacity development will provide further focus for WMO's capacity building programmes (ETRP, LDCRP, TCOP, and ROs) as well as add measures to strengthen the long-term viability of capacity assistance offered by other WMO Programmes.

(2) The crosscutting nature of capacity development is evident as the AgM, HWR, PWS, AM and DRR Programmes all seek to build the capacity of WMO Members through human resource, technical and infrastructure development to support climate change adaptation in their countries. The WIS and WIGOS initiatives also have a significant component of capacity development that will primarily be overseen by the World Weather Watch Programme or its successor. While technical assistance in specific programmatic areas would continue, the CDS should provide an umbrella for the capacity development activities already identified under the five Strategic Thrusts for the sixteenth financial period; GFCS, DRR, WIS/WIGOS, qualifications and competencies for aeronautical meteorological personnel, and general capacity development of NMHSs and their personnel in developing countries, particularly those in transition, LDCs and SIDSs.

(3) Closer programme collaboration with ETR, greater involvement of Regional Training Centres (RTCs) in capacity building in weather-, climate- and water-related matters and joint capacity building activities among CCl, CHy, CAgM, CBS, CAeM, WMO co-sponsored Programmes and external partners should be integral to the CDS.

(4) It can be anticipated that in all of these programmes it will be necessary to balance the needs of long-term, large (multi-Member) high-impact projects with activities of a short duration, lower cost and medium potential impact with regard to number of beneficiaries, with approaches such as training-of-trainers, roving seminars and distance and blended learning to be principally pursued, resorting to regional or global face-to-face courses only when it is proven to be the most practical, or sole solution.

Considerations

A number of considerations on the role of the WMO and its organs are important to the formulation of the CDS:

(1) Capacity development is an endogenous process as stated earlier and it cannot be forced from outside. For successful capacity development implementation, therefore, WMO's role should be to facilitate the development of technical and management capacities as well as through assisting Members conduct the 5-step capacity development process.

(2) For institutional arrangements to be more effective, considerations should also be given to building on major international initiatives and commitments including Millennium Development Goals, the 4th UNLDC conference (UN-LDC IV) follow-up, GFCS and regional initiatives and to contribute to their implementation; forging new strategic partnerships with shared execution when practical.

(3) While facilitating stronger national political ownership, WMO can assist in the development of relevant policies and legal frameworks, and enhancing sustainability by linking regional, sub-regional and national planning processes. Development of management capacities should result in stronger advocacy at the national and international level to improve compliance to WMO standards, and maintain political support for development of NMHS. Enhancing the Country Profile Database may provide some of the tools needed to better determine Members needs and progress.

(4) Regional associations, technical commissions and Regional Offices all have key roles, which could be clarified and enhanced. For example, regional association focus on integration of the requirements of the Region should lead to the identification of specific actions and outcomes that build the capacity of the Region; TCs, with the help of WMO co-sponsored Programmes, provide advice from scientific and technical perspectives offering standards and guidance on how these activities could be carried out effectively, and ROs

working with the RA could focus more on coordination of projects, assisting regionally organized initiatives and advocacy activities using its regional presence to foster development. The CDS should also consider how to respond to requests by Members for a stronger WMO regional presence and more frequent missions to Members to assist in advocacy and resource mobilization and to complement the information in the database.

(5) Project oversight and management should be reinvigorated including improved pre- and post-evaluation of projects and partnerships for their relevance and potential to assist Members. Streamlined procurement and reporting mechanisms to improve delivery time of projects while ensuring accountability, stronger project tracking at senior levels, as well as increased information for donors/stakeholders is needed, especially in light of voluntary funding.

(6) To strategically mobilize resources under the CDS, it would be helpful to establish a compliance database and systematic monitoring of performance of NMHS to be used in better understanding and addressing existing gaps. Updated guidelines are also necessary when applied as a dynamic tool in affording a clear sense of direction and progress. Such information would lead to the establishment of reference points, a baseline situation and to the development of Metrics to show progress. It is noted that Country Profile Database could be useful to develop such tools.

(7) Also important would be the establishment of mechanisms to improve internal collaboration, coordination and synergy with WMO Secretariat Programmes to minimize duplication of effort and establishing a consistent approach across all development efforts of the WMO.

Resolution 50 (Cg-XVI)

IMPLEMENTATION OF THE WMO INTEGRATED GLOBAL OBSERVING SYSTEM

THE CONGRESS,

Noting:

(1) Article 2 of the Convention of the World Meteorological Organization,

(2) Resolution 30 (Cg-XV) – Towards enhanced integration between WMO observing systems,

(3) Resolution 14 (EC-LXII) – Implementation of the WMO Integrated Global Observing System,

(4) The WMO Strategic Plan (2012–2015),

Considering:

(1) The greater vulnerability of society to extreme weather events and climate change and the need for more extensive and advanced information for WMO Members so that they can continue to improve service quality and to extend further service delivery,

(2) The benefits that can be realized through a more coordinated, collaborative and cost-effective approach to the planning and operation of an integrated global observing system,

(3) With satisfaction the progress achieved in the planning for the implementation of the WMO Integrated Global Observing System (WIGOS) (2007–2011),

(4) The importance of WIGOS to the development and implementation of the Global Framework for Climate Services (GFCS) and the Global Cryosphere Watch (GCW),

Appreciating:

(1) The important contributions Members, international partner organizations and programmes make towards observing the Earth system,

(2) The relevant work undertaken by Members, the Executive Council, the regional associations, the technical commissions, the EC Working Group on the WMO Integrated Global Observing System and the WMO Information System and the Secretary-General on the development and implementation of the WIGOS initiative launched by Fifteenth Congress,

Recognizing:

(1) That WIGOS and the WMO Information System (WIS) are strategic priorities of the Organization to improve Members' capabilities to effectively provide in a timely fashion a wide range of high-quality data, products and services,

(2) That WIGOS will enable the evolution and integration of the observing system components of WMO and enhance collaboration with its partner organizations and programmes,

(3) That WIGOS will improve WMO Members' ability to meet expanding national mandates and achieve higher visibility of National Meteorological and Hydrological Services (NMHSs) with other environment-related agencies,

(4) That WIGOS will provide a framework for improved collaboration and coordination between NMHSs and relevant national and regional organizations,

(5) That WIGOS will enable WMO Members to better respond to natural hazards, improve environmental monitoring, and adapt to climate change and man-made environmental impacts, especially in developing and least developed countries,

(6) That WIGOS will lead to cost-effectiveness and enhanced observing capabilities of Members,

(7) That WIGOS is a necessary prerequisite to allow WMO Members to realize the Organization's Strategic Thrusts,

Decides to implement the WMO Integrated Global Observing System;

Decides further that implementation activities will be undertaken during the next financial period as one of the major efforts of the Organization with the goal that WIGOS should become operational from 2016 onwards;

Requests the Executive Council**:**

(1) To monitor, guide and support the implementation of WIGOS;

(2) To establish an Inter-Commission Coordination Group on WIGOS (ICG-WIGOS);

Requests the regional associations:

(1) To develop their regional WIGOS implementation plans;

(2) To coordinate WIGOS implementation activities with the WMO Information System in their operating plans and work programmes;

(3) To promote capacity-building and outreach activities to assist Members in the implementation of WIGOS;

Requests the technical commissions:

(1) To guide the technical aspects of WIGOS implementation;

(2) To incorporate WIGOS implementation activities in their operating plans and work programmes;

(3) To provide technical guidance and advice to Members and the regional associations on WIGOS;

(4) To develop guidance for the design and evolution of observing components of WIGOS;

(5) To develop standards to support WIGOS in collaboration with partner organizations and programmes;

(6) To update WMO regulatory material, including development of the Manual on the WMO Integrated Global Observing System;

(7) To provide the technical lead for WIGOS through the Commission for Basic Systems (CBS) and the Commission for Instruments and Methods of Observation (CIMO);

Urges Members:

(1) To develop their observing systems to become their national components of WIGOS;

(2) To coordinate their WIGOS and WIS implementation activities;

(3) To provide experts to participate in the WIGOS-related work of technical commissions;

(4) To provide resources to help support the implementation of WIGOS;

(5) To support regional and global WIGOS implementation activities;

(6) To keep the Secretary-General informed about their WIGOS implementation activities;

(7) To share relevant experience and cooperate with one another in implementing WIGOS, including assistance to Members with specific WIGOS implementation needs;

Requests the Secretary-General:

(1) To ensure management of, and within available resources, provide support to the WIGOS implementation;

(2) To establish a WIGOS Project Office;

(3) To support the review and update of WMO regulatory material, including the development of the Manual on the WMO Integrated Global Observing System;

(4) To coordinate and collaborate WIGOS activities with United Nations system organizations and other relevant international organizations and programmes;

Invites partner organizations to collaborate with WMO on the implementation of WIGOS.

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Note: This resolution replaces Resolution 30 (Cg-XV), which is no longer in force.

Resolution 51 (Cg-XVI)

DESIGNATION OF CENTRES OF THE WMO INFORMATION SYSTEM

THE CONGRESS,

Noting:

(1) The designation procedure for Global Information System Centres (GISCs) and Data Collection or Production Centres (DCPCs), as endorsed by Fifteenth Congress (*Abridged Final Report with Resolutions of the Fifteenth World Meteorological Congress* (WMO-No. 1026), general summary, paragraph 3.1.2.13),

(2) The amendments to the *Technical Regulations* (WMO-No. 49), Volume I, Section A.3, as proposed in Resolution 4 (Cg-XVI) – Report of the extraordinary session (2010) of the Commission for Basic Systems relevant to Technical Regulations concerning the Global Telecommunication System, data management and the WMO Information System**,**

(3) The recommendation for a *Manual on the WMO Information System (WIS)* (WMO-No. 1060) as proposed in Resolution 4 (Cg-XVI),

Considering Recommendation 4 (CBS-Ext.(10)) – Designation of Centres of the WMO Information System,

Decides:

(1) To designate as WIS Global Information System Centres those centres listed in Table 1 of the annex to this resolution;

(2) To designate as WIS Data Collection or Production Centres those centres listed in Table 2 of the annex to this resolution;

(3) To designate those centres listed in Table 3 in the annex to this resolution for the roles defined in Table 3;

(4) To conditionally designate those centres shown in Table 4 in the annex to this resolution, subject to demonstration of meeting the pre-operational compliance requirements of the Commission for Basic Systems (CBS) Management Group, and that any centre in Table 4 that has not demonstrated pre-operational compliance by the time of the sixty-fourth session of the Executive Council will have its conditional designation removed;

(5) To confirm that any centres that have not been designated by the time of the sixty-fourth session of the Executive Council and that wish to be recognized as a DCPC or GISC, must demonstrate that they meet the pre-operational compliance requirements and be endorsed by the CBS Management Group before the Executive Council decides whether or not to designate that centre in the requested role;

Requests the Secretary-General to take appropriate actions to update the list of centres in the *Manual on the WMO Information System* accordingly;

Requests Members listed in the annex to this resolution to make operational those WIS Centres identified and to ensure that the centres maintain compliance with required WIS functions.

Annex to Resolution 51 (Cg-XVI)

CENTRES RECOMMENDED BY THE COMMISSION FOR BASIC SYSTEMS FOR DESIGNATION AS WMO INFORMATION SYSTEM CENTRES

Table 1. Centres endorsed by the Commission for Basic Systems (CBS) at its extraordinary session (2010) to serve as WMO Information System (WIS) Global Information System Centres (GISCs) and recognized as satisfying the pre-operational compliance requirements

Centre	Proposed Role
Beijing, China	GISC
Offenbach, Germany	GISC
Tokyo, Japan	GISC

Table 2. Centres endorsed by the Commission for Basic Systems at its extraordinary session (2010) to serve as WIS Data Collection or Production Centres (DCPCs) and recognized as satisfying the pre-operational compliance requirements

Centre	Proposed Role
Beijing, China (RTH)	1 DCPC
Offenbach, Germany (RTH, RSMC, RCC, GPCC)	4 DCPCs
Tokyo, Japan (RTH, WDC-GHG, Satellite Centre, RSMCs, RCC, GPC)	8 DCPCs
ECMWF	1 DCPC
EUMETSAT	1 DCPC

Table 3. Centres endorsed by the CBS Management Group after the CBS extraordinary session (2010) and recognized as satisfying the pre-operational compliance requirements

Centre	Proposed Role
Toulouse, France (VAAC, RTH, RSMC, Regional NWP support, RCC, GPC/LRF)	GISC, 6 DCPCs
Exeter, United Kingdom (WAFC, VAAC, Specialized Ocean/Wave Centre, RTH, RSMCs, Marine Observations Centre, GPC/LRF)	GISC, 6 DCPCs
Oslo, Norway (ADC)	DCPC
Hong Kong, China (WWIS)	DCPC
Bremerhaven, Germany (WRMC)	DCPC
Hamburg, Germany (WDCC, GCC)	2 DCPCs
Oberpfaffenhofen, Germany (WDC-RSAT)	DCPC
Lindenberg, Germany (GRUAN-LC)	DCPC
Koblenz, Germany (GRDC)	DCPC

Table 4. Centres that have registered to be considered for the role of GISC and/or DCPC of the WIS, but for which the demonstration of pre-operational compliance requirements had not been completed at the time papers were submitted to Sixteenth Congress

Centre	Proposed Role
Asheville, United States (GOSIC)	DCPC
Beijing, China (NSMC, NCC, RSMCs)	DCPCs
Belgrade, Serbia (RCC)	DCPC
Boulder, United States (NCAR)	DCPC
Brasilia, Brazil	GISC
De Bilt, Netherlands (Satellite Centre, RCC)	DCPCs
Delhi, India	GISC, DCPCs
Jeddah, Saudi Arabia	GISC
Khabarovsk, Russian Federation	DCPC
La Reunion, France (RSMC)	DCPC
Casablanca, Morocco	GISC
Melbourne, Australia	GISC, DCPCs
Montreal, Canada	DCPC
Moscow, Russian Federation	GISC, DCPCs
Novosibirsk, Russian Federation	DCPC
Obninsk, Russian Federation	DCPCs
Oslo, Norway (NILU)	DCPC
Prague, Czech Republic	DCPC
Pretoria, South Africa	GISC
Rome, Italy	DCPCs
St Petersburg, Russian Federation	DCPCs
Seoul, Republic of Korea	GISC, DCPCs
Sodankylä, Finland	DCPC
Sofia, Bulgaria	DCPC
Norrköping, Sweden	DCPCs
Tehran, Islamic Republic of Iran	GISC
Washington, DC, United States	GISC, DCPCs
Zagreb, Croatia (Marine Meteorological Centre – Split)	DCPC

Resolution 52 (Cg-XVI)

DISASTER RISK REDUCTION PROGRAMME

THE CONGRESS,

Noting:

(1) The *Abridged Final Report with Resolutions of the Fifteenth World Meteorological Congress* (WMO-No. 1026), general summary, paragraphs 3.9.1 to 3.9.16, and Resolution 25 (Cg-XV) – Natural Disaster Prevention and Mitigation Programme,

(2) The *Abridged Final Report with Resolutions of the Fifty-ninth Session of the Executive Council* (WMO-No. 1027), general summary, paragraphs 3.4 to 3.6,

(3) The *Abridged Final Report with Resolutions of the Sixtieth Session of the Executive Council* (WMO-No. 1032), general summary, paragraphs 4.1.1 to 4.1.25, and Resolution 5 (EC-LX) – Executive Council Working Group on Disaster Risk Reduction and Service Delivery,

(4) The *Abridged Final Report with Resolutions of the Sixty-first Session of the Executive Council* (WMO-No. 1042), general summary, paragraphs 4.1.1 to 4.1.17,

(5) The *Abridged Final Report with Resolutions of the Sixty-second Session of the Executive Council* (WMO-No. 1059), general summary, paragraphs 4.1.1 to 4.1.28,

(6) The outcome documents of the World Conference on Disaster Reduction, held in Kobe, Hyogo, Japan, from 18 to 22 January 2005, including the Hyogo Declaration and the Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters,

(7) The WMO 2012–2015 Strategic and Operating Plans,

(8) The outcomes of Decision 1/CP.13 – Bali Action Plan and Decision 1/CP.16 – The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention, in addition to the Cancun Adaptation Framework, adopted by the Conference of Parties to the United Nations Framework Convention on Climate Change at its thirteenth session, 3–14 December 2007, Bali, Indonesia, and sixteenth session, 29 November–10 December 2010, Cancun, Mexico, respectively,

Noting further:

(1) That disasters pose a serious threat to safety, security and sustainable development,

(2) The significant loss of life and property associated with weather-, water- and climate-related hazards and increasing risks associated with climate variability and change,

(3) That the increasing volatility of water supply and food security associated with the increasing severity and frequency of slow-onset disasters, such as drought, owing to climate change is becoming a major concern,

Considering:

(1) That more and more countries are shifting their policies from post-disaster response to preparedness and prevention within the national development framework, thus increasing the need for meteorological, hydrological and climate services,

(2) The increasing funding opportunities for National Meteorological and Hydrological Services (NMHSs) as part of national development planning linked to disaster risk reduction and climate change adaptation,

Considering further:

(1) That the WMO Disaster Risk Reduction (DRR) Programme is cross-cutting and inextricably linked to other WMO Programmes, technical commissions, regional associations and the Secretariat,

(2) That disaster risk reduction is one of the five priority areas for consideration under voluntary resources of WMO and among the high-priority areas recommended by the High-level Taskforce on the Global Framework for Climate Services (GFCS),

(3) The importance of lessons learned from national/regional coordinated DRR projects in further development of the DRR Programme implementation framework and its expansion to other regions,

(4) The high value of sharing lessons learned, and opportunities for improved operational procedures among NMHSs, Regional Specialized Meteorological Centres (RSMCs) and other United Nations and international agencies,

(5) That responsibilities for providing warnings, advice and information are spread over many agencies, that arrangements vary from nation to nation and that there are great sensitivities involved,

Reaffirming that protection of lives, livelihoods and property from weather-, climate and water-related hazards is a key strategic priority of WMO,

Recognizing the International Strategy for Disaster Reduction (ISDR) system as the primary collaboration mechanism across the United Nations system and other international and regional agencies and networks in disaster risk reduction,

Decides to endorse:

(1) The DRR Programme, which is aimed at increasing, through appropriate means, the capacity of all Members to contribute to national and regional DRR activities;

(2) Giving strong support to national and regional DRR capacity development projects that contribute to:

   (a) Development, improvement and sustainability of early warning systems, in particular with regard to scientific and technical infrastructures, systems and capabilities for research, observing, detecting, forecasting and warnings of weather-, water- and climate-related hazards;

   (b) Development, improvement and sustainability of standardized hazard databases and metadata, systems, methods, tools and applications of modern technologies, such as geographical information systems for recording, analysing and providing

hazard information for risk assessment, sectoral planning, risk transfer and other informed decision-making;

(c) Development and delivery of warnings, specialized forecasts and other products and services that are timely, understandable to those at risk and driven by requirements of disaster risk reduction decision processes and operations engaging socio-economic sectors;

(d) Stimulate a culture of resilience and prevention through strengthening of capacities for better integration of meteorological, hydrological and climate products and services in disaster risk reduction across all socio-economic sectors such as land use planning and infrastructure design, and continued public education and outreach campaigns;

(e) Strengthening cooperation and partnerships of WMO and NMHSs in national, regional and international user forums and mechanisms and structures for the implementation of disaster risk reduction;

Requests the Executive Council:

(1) To provide guidance on the future development of the appropriate governance mechanisms for the DRR Programme with the aim of further enhancing coordination among WMO Programmes, technical commissions, regional associations, the Secretariat and relevant partners;

(2) To provide guidance on linking the DRR Programme implementation framework with the Global Framework for Climate Services (GFCS);

(3) To urgently review and further consider the operational arrangements between RSMCs and NMHSs for providing hazard warnings and disaster response, focusing particularly on those with an international dimension, in close cooperation with the technical commissions, regional associations, and the relevant United Nations and international agencies, and with consideration of national accountability for disaster management and the requirements for regional coordination and support;

(4) To consider the establishment of an Executive Council Working Group on Service Delivery that would address DRR as a priority issue;

Requests the presidents of technical commissions:

(1) To coordinate their respective intra- and inter-commission DRR-related projects and activities and provide advice on these to Members through the presidents of regional associations;

(2) To respond to the needs of Members, including as communicated by presidents of regional associations, by developing guidelines and training modules consistent with Quality Management System (QMS) principles, spanning technical and operational aspects of meteorological, hydrological and climate services to support the implementation and scaling up of national/regional DRR projects;

Requests the presidents of regional associations to support the development and buy-in of national/regional DRR projects and facilitate input on needs and priorities of the Members and Regions;

Requests the Secretary-General:

(1) To implement the DRR Programme through DRR national/regional projects;

(2) To develop linkages between DRR and all relevant programmes and activities, and in particular with GFCS;

(3) To assist further strengthening of international cooperation in disaster risk reduction in close collaboration with the United Nations International Strategy for Disaster Reduction (ISDR), other United Nations and international partners, and other relevant governmental and non-governmental organizations;

(4) To support the development of a standard methodology for the collection and reporting of information on weather-, climate- and water-related hazards and their impact, with consideration for QMS principles;

(5) To explore opportunities for further enhancement of regional and global Websites such as those of the WMO Severe Weather Information Centre or the Network of European Meteorological Services (EUMETNET) MeteoAlarm project in Europe, for access to official national information and warnings, and encourage the evaluation of these portals for, inter alia, their purpose and target audience, the strategy for linking to official sources of warnings, standardization of advisory and warning formats, in particular tropical cyclone information issued by RSMCs and national tropical cyclone warning centres, and alignment with the emerging protocols for “authoritative” warnings on a nation-by-nation basis;

(6) To facilitate further documentation of good practices and development of guidelines on Multi-Hazard Early Warning Systems (MHEWS), risk assessment, risk reduction and risk transfer to support the NMHSs in further strengthening their national linkages with other agencies and sectors in these areas;

(7) To develop a post-disaster strategy for resource mobilization for WMO, including both national and international funding;

Invites the UN-ISDR Secretariat and other United Nations, international and regional agencies to continue strengthening their partnerships with WMO and the development of effective inter-agency coordination mechanisms at all levels to support DRR capacity development projects;

Urges Members:

(1) To actively participate in the national development planning and coordination processes linked to DRR and climate change adaptation;

(2) To support the development of relevant DRR policies and legislation, with the aim of clarifying the roles of NMHSs in the national DRR policies, legal frameworks, institutional coordination and operational mechanisms;

(3) To realize funding opportunities for strengthening of NMHSs capacities through national DRR development and adaptation funding;

(4) To strengthen collaboration of NMHSs with disaster risk reduction stakeholders, including disaster risk management agencies and all relevant economic sectors;

(5) To consider assisting WMO with post-disaster capacity assessments and activities by providing experts and other support as relevant.

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Note: This resolution replaces Resolution 25 (Cg-XV), which is no longer in force.

Resolution 53 (Cg-XVI)

AERONAUTICAL METEOROLOGY PROGRAMME

THE CONGRESS,

Noting:

(1) Resolution 18 (Cg-XV) – Aeronautical Meteorology Programme,

(2) Resolution 6 (EC-LXII) – Report of the fourteenth session of the Commission for Aeronautical Meteorology,

(3) Resolution 18 (EC-LXII) – WMO definition of a meteorologist,

(4) The *Abridged Final Report with Resolutions and Recommendations of the Fourteenth Session of the Commission for Aeronautical Meteorology* (WMO-No. 1053),

(5) The *Abridged Final Report with Resolutions of the Sixty-first Session of the Executive Council* (WMO-No. 1042) and in particular its paragraph 4.2.47 concerning the timelines proposed by EC-LXI for compliance with competency (1 December 2013) and qualifications (1 December 2016) requirements,

(6) The recommendation made by the Executive Council at its sixty-second session (*Abridged Final Report with Resolutions of the Sixty-Second Session of the Executive Council* (WMO-No. 1059), general summary, paragraph 7.2.17) to the Secretary-General that the Aeronautical Meteorology Programme be treated as a future priority issue,

Considering:

(1) That aviation is a key economic sector in most countries and aeronautical meteorology is an important component in ensuring safe and efficient operation of this sector,

(2) That aviation meteorology is the main source of income through cost recovery for many National Meteorological Services, particularly in developing countries,

(3) That there is constant pressure within the aviation sector to increase efficiency in the provision of services, including those that would lead to improved safety levels,

(4) That as of 15 November 2012, National Meteorological and Hydrological Services are required by the seventeenth edition of Annex 3 to the Convention on International Civil Aviation, paragraph 2.2.3, to implement recognized quality management systems, with the recommendation that they be certified according to the International Organization for Standardization Standard 9001:2008,

(5) That national and transnational air traffic management authorities in several regions are implementing new airspace structures and consequently request the provision of aeronautical meteorological services to aviation in line with the new airspace structures,

(6) That national and transnational air traffic management authorities and groupings are requesting new and extended services for air traffic management in line with global performance-based air navigation,

(7) That improved harmonization of many WMO Aeronautical Meteorology Programme activities, including training, capacity-building, scientific development and infrastructure investments, would greatly assist in meeting the needs of global performance-based air navigation,

(8) That aeronautical meteorology has to play an important role in cross-cutting activities, including disaster prevention and mitigation and support for developing countries, in particular least developed countries and small island developing States, for whom aviation is a key development factor,

Decides to modify the aeronautical meteorological personnel (AMP) competence standards as defined in Resolution 18 (EC-LXII) as shown in the annex to this resolution;

Decides further that the WMO Aeronautical Meteorology Programme is a high-priority programme that should be suitably resourced, thus enabling it to provide help to all Members in need to address the requirements of aviation stakeholders;

Urges all Members:

(1) To ensure that funds provided for meteorological services to aviation are used to meet International Civil Aviation Organization requirements for these services;

(2) To collaborate actively, by making time and expertise of their staff available for the work of expert teams in the implementation of the Aeronautical Meteorology Programme, including quality management systems;

Requests the Executive Council, with the assistance of the Commission for Aeronautical Meteorology and other relevant technical commissions, to guide and support the implementation of the Aeronautical Meteorology Programme;

Requests the regional associations to support existing or create, where not yet in place, dedicated regional groups in developing implementation plans for aeronautical meteorology and facilitating Members' implementation in close collaboration with partner organizations and aviation stakeholders by providing the necessary resources;

Requests the Secretary-General:

(1) To collaborate in the operation or, where necessary, the establishment of these groups with the International Civil Aviation Organization, the Agency for Air Navigation Safety in Africa and Madagascar, the European Organisation for the Safety of Air Navigation (EUROCONTROL), the International Air Transport Association, the International Federation of Airline Pilots' Associations, the International Federation of Air Traffic Controllers' Associations, regional and national aviation meteorology regulators and service providers, as well as user representatives;

(2) To bring this resolution to the attention of all concerned.

Note: This resolution replaces Resolution 18 (Cg-XV), which is no longer in force.

Annex to Resolution 53 (Cg-XVI)

AERONAUTICAL METEOROLOGICAL PERSONNEL COMPETENCE STANDARDS

Aeronautical Meteorological Forecaster

An **Aeronautical Meteorological Forecaster**,

A. For the area and airspace of responsibility,

B. In consideration of the impact of meteorological phenomena and parameters on aviation operations, and

C. In compliance with aviation user requirements, international regulations, local procedures and priorities,

Should,[1] in taking into account conditions A to C, have successfully completed the BIP-M[2] and should[3] be able to:

1. Analyse and monitor continuously the weather situation;
2. Forecast aeronautical meteorological phenomena and parameters;
3. Warn of hazardous phenomena;
4. Ensure the quality of meteorological information and services; and
5. Communicate meteorological information to internal and external users.

Aeronautical Meteorological Observer

An **Aeronautical Meteorological Observer**,

A. For the area and airspace of responsibility,

B. In consideration of the impact of meteorological phenomena and parameters on aviation operations, and

C. In compliance with aviation user requirements, international regulations, local procedures and priorities,

Should,[3] in taking into account conditions A to C be able to:

1. Monitor continuously the weather situation;
2. Observe and record aeronautical meteorological phenomena and parameters;
3. Ensure the quality of the performance of systems and of meteorological information; and
4. Communicate meteorological information to internal and external users.

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[1] 'Should' to become 'shall' in a November 2016 amendment of WMO-No. 49, Volume I.
[2] As defined in the revised WMO-No. 49, Volume I.
[3] 'Should' to become 'shall' in a November 2013 amendment of WMO-No. 49, Volume I.

Resolution 54 (Cg-XVI)

WMO GENDER MAINSTREAMING

THE CONGRESS,

Noting:

(1) Resolution 34 (Cg-XV) – Gender mainstreaming,

(2) The *Abridged Final Report with Resolutions of the Sixty-second Session of the Executive Council* (WMO-No. 1059),

(3) That following the passing of recommendations and resolutions encouraging and supporting increased participation of women in the work of all WMO regional associations and technical commissions, some of the associations and the majority of the commissions had already appointed gender focal points,

Noting further:

(1) United Nations Millennium Development Goal (MDG) 3, which is to "promote gender equality and empower women",

(2) The WMO Policy on Gender Mainstreaming,

Considering:

(1) The need to apply gender mainstreaming in the design, implementation, monitoring and evaluation of policies and programmes by Members and the Secretariat,

(2) The need for trained, qualified and diligent professionals, regardless of gender, in the work of WMO,

(3) The importance of monitoring and evaluation, to objectively track progress,

Requests Members:

(1) To actively implement the WMO Policy on Gender Mainstreaming;

(2) To provide support for the implementation of the policy through secondment of experts to the Secretariat and voluntary contributions;

(3) To report on progress in the implementation of this policy to Congress;

Requests the presidents of regional associations and technical commissions:

(1) To actively implement the WMO Policy on Gender Mainstreaming;

(2) To compile appropriate statistics on the participation of men and women in the work of their regional associations and technical commissions;

(3) To report annually to the Executive Council on those statistics and progress in the implementation of the WMO Policy on Gender Mainstreaming;

Requests the Executive Council to oversee and advise on implementation of the activities of WMO on gender mainstreaming at all levels;

Requests the Secretary-General:

(1) To continue his/her efforts as regards this important issue and to report to the Executive Council on progress made on aspects of the implementation of this resolution during the sixteenth financial period;

(2) To report on progress in the implementation of the WMO Policy on Gender Mainstreaming to Congress.

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Note: This resolution replaces Resolution 34 (Cg-XV), which is no longer in force.

Resolution 55 (Cg-XVI)

ANTARCTIC OBSERVING NETWORK

THE CONGRESS,

Noting:

(1) Resolution 14 (EC-LIX) – Antarctic Basic Synoptic Network,

(2) Resolution 15 (EC-LIX) – Antarctic Basic Climatological Network,

(3) The WMO *Technical Regulations* (WMO-No. 49), Regulation (B.1) 3.1.1.2,

(4) The WMO Strategic Plan (2012–2015) as it relates to observations in the Antarctic,

(5) The *Manual on the Global Observing System* (WMO-No. 544), Volume I, Global Aspects, Part III, paragraphs 2.1.3 and 2.1.4; Volume II, Regional Aspects – The Antarctic,

Considering:

(1) That the establishment and maintenance of an Antarctic Observing Network (AntON) of surface and upper-air stations to meet the requirements of Members constitutes one of the most important obligations of Members under Article 2 of the Convention of the World Meteorological Organization,

(2) That the density of the current Antarctic Observing Network of surface and upper-air stations is much less than that desirable to properly characterize Antarctic weather and climate,

(3) That in order to provide a good representation of climate for Antarctica, there is no need to distinguish between a synoptic and climate network,

(4) That manned stations in Antarctica also contribute vital ozone and other observations to the Global Atmosphere Watch (GAW),

(5) The need for further integration of Antarctic observing systems,

(6) The needs of the research community as expressed by the Scientific Committee on Antarctic Research (SCAR),

Decides:

(1) That the name “Antarctic Observing Network (AntON)” is to be used for a description of the Antarctic network composed of surface and upper-air stations and including all Global Climate Observing System (GCOS) Surface Network (GSN) and Upper-Air Network (GUAN) and GAW stations;

(2) That the stations and the observational programmes listed in the annex to this resolution constitute the Antarctic Observing Network;

Urges Members:

(1) To spare no effort in their endeavours to secure full implementation of the network of stations and observational programmes set forth in the annex to this resolution, particularly those contributing to GCOS;

(2) To seek to maintain, and where possible restore, radiosonde stations in Antarctica;

(3) To consider the possibility of cooperating with other Members in sharing the costs of reopening and operating silent stations;

(4) To comply fully with the standard times of observation, the coding procedures and the data-collection standards, as laid down in the WMO *Technical Regulations* and the *Manual on the Global Observing System* (WMO-No. 544), the *Manual on Codes* (WMO-No. 306), the *Manual on the Global Telecommunication System* (WMO-No. 386), and the *Manual on the Global Data-processing and Forecasting System* (WMO-No. 485);

(5) To validate station positions and elevations using modern surveying techniques against those given in *Weather Reporting* (WMO-No. 9), Volume A, at the required resolution and to communicate the results of these measurements to the WMO Secretariat;

(6) To ensure that traceable calibration certificates are available for instrumentation, in line with International Organization for Standardization (ISO) quality management certification;

(7) To ensure that appropriate metadata are maintained and provided with all observational datasets (and accessible through the WMO Information System);

(8) To make available historical research and routine observational data to the appropriate Antarctic Data Collection and Production Centres (DCPCs) for archiving for climate purposes;

(9) To incorporate existing research and new installations into AntON;

(10) To ensure that feedback is given to stations when numerical weather prediction (NWP) detects problems with data or its transmission;

Requests the Secretary-General to bring any changes to the Antarctic Observing Network to the attention of the Members of WMO.

Annex to Resolution 55 (Cg-XVI)

WMO ANTARCTIC OBSERVING NETWORK

This list shows the stations currently comprising the Antarctic Observing Network (AntON). It shows whether the stations currently contribute surface synoptic (S), climate (C) or upper-air synoptic (U) observations to the Global Telecommunication System (GTS), whether they are Global Climate Observing System (GCOS) Surface Network (GSN), GCOS Upper-Air Network (GUAN) or Global Atmosphere Watch (GAW) stations. Key stations are those that are GCOS stations or are over 200 km distant from a GCOS station. Reports from stations whose numbers begin with AA are sent on the GTS in SYNOP MOBIL code form. All operational AntON stations are expected to produce CLIMAT messages from 1 February 2011 (that is, the January 2011 CLIMAT), provided that they have suitable data.

Note: In addition to AntON stations, a number of other stations in the Southern Ocean (within the responsibility of Regional Associations I, III and V) lie in the zone of interest of the Executive Council Panel of Experts on Polar Observations, Research and Services (EC-PORS) and are therefore listed below AntON for information.

Abbreviations: X = message or data expected; NO = not operational; A = annual download; Add = suggestion for addition to the Regional Basic Climatological Network (RBCN); Closed = the Global Atmosphere Watch Station Information System (GAWSIS) indicates that the station is closed or inactive; AWS = automatic weather station; BAS = British Antarctic Survey; USAP = United States Antarctic Program; UoW = University of Wisconsin; ANI = Adventure Network International.

Antarctic stations									
WMO No.	***Station***	***Operator***		***S***	***U***	***Key***	***GSN***	***GUAN***	***GAW***
88963	Esperanza	Argentina		X		X	X		
88968	Orcadas	Argentina		X		X	X		
89002	Neumayer	Germany		X	X	X	X	X	X
89003	Halvfarryggen EP11	Netherlands	AWS	X					
89004	SANAE	South Africa		X		X	X		
89009	Amundsen-Scott	United States		X	X	X	X	X	X
89013	Baldrick	United Kingdom (BAS)	AWS	X		X			
89014	Nordenskiold	Finland	AWS	X		X			
89016	Wasa EP5	Netherlands	AWS	X					
89018	Svea EP6	Netherlands	AWS	X					
89020	Brunt	United Kingdom (BAS)	AWS	X					
89022	Halley	United Kingdom (BAS)		X	X	X	X	X	X
89034	Belgrano II	Argentina		X		X			X
89049	AGO-2	United States (USAP)	AWS	X		X			
89050	Bellingshausen	Russian Federation		X		X	X		
89053	Jubany	Argentina		X		X			
89054	Dinamet	Uruguay		X					
89055	Marambio	Argentina		X	X	X	X	X	X
89056	Frei	Chile		X		X	X		X
89057	Arturo Prat	Chile	AWS	X					
89058	Great Wall	China		X					
89059	O'Higgins	Chile		X		X			
89061	Palmer	United States		X		X			X

Antarctic stations									
WMO No.	***Station***	***Operator***		***S***	***U***	***Key***	***GSN***	***GUAN***	***GAW***
89062	Rothera	United Kingdom (BAS)		X	X	X	X		X
89063	Vernadsky	Ukraine		X		X	X		X
89064	Juan Carlos I	Spain		NO					
89065	Fossil Bluff	United Kingdom (BAS)	AWS	X		X	X		
89066	San Martin	Argentina		X		X			X
89087	Thiel Mountains	United States (ANI)	AWS	X		X			
89108	Henry	United States (UoW)	AWS	X		X			
89132	Russkaya	Russian Federation	AWS	A		X			
89251	King Sejong	Republic of Korea		X					
89252	Comandante Ferraz	Brazil		X					
89253	Joinville Island	Brazil	AWS	X					
89257	Limbert	United Kingdom (BAS)	AWS	X		X			
89262	Larsen Ice Shelf	United Kingdom (BAS)	AWS	X		X	X		
89266	Butler Island	United Kingdom (BAS)	AWS	X		X	X		
89269	Bonaparte Point	United States (UoW)	AWS	X					
89272	Sky Blu	United Kingdom (BAS)	AWS	X		X	X		
89314	Theresa	United States (UoW)	AWS	X		X			
89324	Byrd Station	United States (UoW)	AWS	X		X	X		
89327	Mount Siple	United States (UoW)	AWS	X		X	X		
89329	Harry	United States (UoW)	AWS	X		X	X		
89332	Elizabeth	United States (UoW)	AWS	X		X			
89345	Siple Dome	United States (UoW)	AWS	X		X	X		
89376	Gill	United States (UoW)	AWS	X		X	X		
89377	Lettau	United States (UoW)	AWS	X		X	X		
89504	Troll	Norway	AWS	X		X			
89507	Kohnen EP9	Netherlands	AWS	X		X			
89512	Novolazarevskaya	Russian Federation		X	X	X	X	X	X
89514	Maitri	India		X					X
89528	AGO-3	United States (USAP)	AWS	X					
89532	Syowa	Japan		X	X	X	X	X	X
89542	Molodeznaja	Russian Federation	AWS	A		X			
89564	Mawson	Australia		X	X	X	X	X	Closed
89570	Davis (Whoop Whoop)	Australia	AWS	X					
89571	Davis	Australia		X	X	X	X	X	X

Antarctic stations									
WMO No.	***Station***	***Operator***		***S***	***U***	***Key***	***GSN***	***GUAN***	***GAW***
89573	Zhongshan	China		X		X	X		X
89574	Progress	Russian Federation		X		X	X		
89575	Druzhnaya 4	Russian Federation	AWS	A					
89577	Dome A	Australia	AWS	X		X	X		
89578	Eagle	Australia	AWS	X		X			
89586	Davis (Mount Brown)	Australia	AWS	X		X			
89592	Mirnyj	Russian Federation		X	X	X	X	X	Closed
89598	AGO-4	United States (USAP)	AWS	NO		X			
89606	Vostok	Russian Federation		X		X	X		Closed
89610	Casey (Cape Poinsett)	Australia	AWS	X		X			
89611	Casey	Australia		X	X	X	X	X	Closed
89614	Wilkins Runway West	Australia	AWS	X					
89615	Wilkins Runway East	Australia	AWS	X					
89625	Concordia	Italy		X	X	X	X		X
89628	AGO-1	United States (USAP)	AWS	X		X			
89642	Dumont d'Urville	France		X	X	X	X	X	X
89643	Port Martin	United States (UoW/France)	AWS	X					
89646	Sitry (Irene)	Italy	AWS	X		X			
89648	Mid Point (Giulia)	Italy	AWS	X		X			
89657	Leningradskaya	Russian Federation	AWS	A		X			
89659	Priestley Nevee (Modesta)	Italy	AWS	X		X			
89661	Cape Phillips (Silvia)	Italy	AWS	X		X			
89662	Mario Zuchelli Station	Italy		X	X	X	X		
89664	McMurdo	United States		X	X	X	X	X	X
89665	Scott Base	New Zealand				X			X
89666	Cape Ross (Arelis)	Italy	AWS	X		X			
89667	Pegasus North	United States (UoW)	AWS	X		X			
A20629	Plateau	Netherlands	AWS	X		X			
89734	Dome Fuji	United States (UoW/Japan)	AWS	X					
89744	Relay Station	United States (UoW/Japan)	AWS	X		X	X		
A20631	Pole of Relative Inaccessibility	Netherlands	AWS	X		X			
89767	Amery Ice Shelf (G3)	Australia	AWS	X		X			
89768	Minna Bluff	United States (UoW)	AWS	X					
89769	Linda	United States (UoW)	AWS	X					
89799	Nico	United States (UoW)	AWS	X		X			
89807	Casey (Snyder Rocks)	Australia	AWS	X					
89809	Casey Skiway South	Australia	AWS	X		X			

Antarctic stations									
WMO No.	***Station***	***Operator***		***S***	***U***	***Key***	***GSN***	***GUAN***	***GAW***
89811	Casey (Law Dome Summit)	Australia	AWS	X		X			X
89815	Casey (Haupt Nunatak)	Australia	AWS	X					
89828	Dome C II	United States (UoW)	AWS	X		X	X		
89832	D-10	United States (UoW/France)	AWS	X					
89834	D-47	United States (UoW/France)	AWS	X					
89836	D-85	United States (UoW/France)	AWS	NO		X			
89864	Manuela	United States (UoW)	AWS	X					
89865	Whitlock	United States (UoW)	AWS	NO		X	X		
89866	Marble Point	United States (UoW)	AWS	X		X	X		
89868	Schwerdtfeger	United States (UoW)	AWS	X					
89869	Marilyn	United States (UoW)	AWS	X		X	X		
89872	Ferrell	United States (UoW)	AWS	X		X	X		
89873	Elaine	United States (UoW)	AWS	X					
89879	Possession Island	United States (UoW)	AWS	X		X	X		
AAALE	Cape King (Alessandra)	Italy	AWS	X					
AABIR	Cape Bird	United States (UoW)	AWS	X					
AABRI	Brianna	United States (UoW)	AWS	X		X			
AACAR	Carolyn	United States (UoW)	AWS	X		X			
AADIS	Dismal Island	United States (UoW)	AWS	X					
AADEN	Cape Denison	United States (UoW/Australia)	AWS	X		X			
AAEMI	Emilia	United States (UoW)	AWS	X					
AAERC	Eric	United States (UoW)	AWS	X		X			
AAERI	Erin	United States (UoW)	AWS	X		X			
AAKIR	Kirkwood Island	United States (UoW)	AWS	X		X			
AAKOM	Kominko-Slade	United States (UoW)	AWS	X					
AALAU	Laurie II	United States (UoW)	AWS	X					
AALIT	Little Mac (Mega A)	United States (UoW)	AWS	X					
AALOL	Tourmaline Plateau (Lola)	Italy	AWS	X					

Antarctic stations									
WMO No.	***Station***	***Operator***		***S***	***U***	***Key***	***GSN***	***GUAN***	***GAW***
AAMAR	Mary	United States (UoW)	AWS	X					
AAMIZ	Mizuho	United States (UoW/Japan)	AWS	X		X			
AAPEG	Pegasus South	United States (UoW)	AWS	X					
AAPET	Peter I Oy	United States (UoW)	AWS	X		X			
AAPIG	Pine Island Glacier	United States	AWS	X		X			
AARIT	Enigma Lake (Rita)	Italy	AWS	X					
AASOF	Sophia-B	Italy	AWS	X					
AASWI	Swithinbank	United States (UoW)	AWS	X					
AAUNI	Union Glacier	United States (ANI)	AWS	X		X			
AAVIT	Vito	United States (UoW)	AWS	X		X			
AAWIL	Willie Field	United States (UoW)	AWS	X					
AAWIN	Windless Bight	United States (UoW)	AWS	X					
AAZOE	Zoe (Mega B)	United States (UoW)	AWS	X					
AAZOR	Priestley Glacier (Zoraida)	Italy	AWS	X					
	Shackleton	Russian Federation	AWS			X			
	PANDA-North	China/Australia	AWS			X			

Sub-Antarctic stations (in Region I, III or V)											
WMO No.	***Station***	***Operator***	***Type***	***S***	***RBSN***	***C***	***RBCN***	***GSN***	***U***	***GUAN***	***GAW***
61997	Isle Crozet	France		X	X	X	X	X			X
61998	Isle Kerguelen	France		X	X	X	X	X	X	X	X
68906	Gough Island	South Africa		X	X	X	X	X	X	X	
68992	Bouvetoya	Norway		NO	X	X	X	X			
68994	Marion Island	South Africa		X	X	X	X	X	X	X	Closed
88878	Pebble Island	United Kingdom	AWS	X							
88883	Weddell Island	United Kingdom	AWS	X			Add				
88889	Mount Pleasant Airport	United Kingdom		X	X	X	X	X	X	X	
88897	Sea Lion Island	United Kingdom	AWS	X							
88900	Bird Island	United Kingdom (BAS)	AWS	X		X	Add				X
88903	Grytviken	United Kingdom (BAS)	AWS	X	X	X	Add	X			X
88986	South Thule Island	South Africa	AWS	X			Add				

Sub-Antarctic stations (in Region I, III or V)											
WMO No.	***Station***	***Operator***	***Type***	***S***	***RBSN***	***C***	***RBCN***	***GSN***	***U***	***GUAN***	***GAW***
93929	Enderby Island	New Zealand	AWS	X	X						
93947	Campbell Island	New Zealand	AWS	X	X	X	X	X			
94997	Heard Island (The Spit)	Australia		X	X						
94998	Macquarie Island	Australia		X	X	X	X	X	X	X	X
95997	Heard Island (Atlas Cove)	Australia		X							

Resolution 56 (Cg-XVI)

AMENDMENTS TO THE *MANUAL ON THE GLOBAL OBSERVING SYSTEM* (WMO-No. 544), VOLUME II, REGIONAL ASPECTS – THE ANTARCTIC

THE CONGRESS,

Noting:

(1) Resolution 58 (Cg-XVI) – WMO Polar Activities,

(2) Resolution 20 (EC-LIX) – Amendments to the *Manual on the Global Observing System* (WMO-No. 544), Volume II, Regional Aspects – The Antarctic,

(3) The WMO Strategic Plan (2012–2015) as it relates to the World Weather Watch and to the Antarctic,

Decides to amend the *Manual on the Global Observing System,* Volume II, Regional Aspects – The Antarctic, as given in the annex to this resolution;

Requests the Secretary-General:

(1) To make the appropriate amendments as given in the annex to this resolution;

(2) To bring this resolution to the attention of Members.

Annex to Resolution 56 (Cg-XVI)

AMENDMENTS TO THE *MANUAL ON THE GLOBAL OBSERVING SYSTEM* (WMO-No. 544), VOLUME II, REGIONAL ASPECTS – THE ANTARCTIC

To replace the text of section 7 "THE ANTARCTIC" with the following:

7.1 Antarctic Observing Network of surface and upper-air observing stations in the Antarctic

7.1.1 Composition of the Antarctic Observing Network (AntON)

7.1.1.1 The Antarctic Observing Network is composed of surface and upper-air stations, adequate to meet the requirements of Members and constitutes one of the most important obligations of Members under Article 2 of the WMO Convention.

7.1.1.2 The AntON is reviewed by a dedicated subsidiary body of the Executive Council and adopted by the WMO Congress or the WMO Executive Council in a resolution. The list of stations constituting the AntON is given in the annex to a resolution approved by Congress or the Executive Council. Changes are announced in the "Operational Newsletter" issued by the WMO Secretariat (see paragraph 7.1.6 below).

7.1.1.3 Manned surface land stations included in the AntON shall conform to the specifications laid down for land stations in Volume I of this Manual.

7.1.2 Surface synoptic observations

All manned surface stations included in the AntON should make surface observations at the four main standard times of observation, i.e., 0000, 0600, 1200 and 1800 UTC. Whenever possible and desirable, observations should also be made at some or all of the four intermediate standard times of observation, i.e., 0300, 0900, 1500 and 2100 UTC. The carrying out of the observations at the main standard times of observations should be given first priority.

7.1.3 Upper-air synoptic observations

All upper-air stations included in the AntON should make radiosonde and/or radiowind observations at 0000 and 1200 UTC. Other considerations permitting, those stations that are unable to carry out the full upper-air observing programme should give priority to the observations that maintain the historic record. Stations that are separated by no more than about 600 km may wish to consider bilateral arrangements whereby each undertakes one of the ascents so as to complete between them the full observing programme required.

7.1.4 Climatological observations

7.1.4.1 As far as possible, all AntON surface stations shall report CLIMAT messages for better monitoring of climate.

7.1.4.2 CLIMAT reports from AntON stations shall be regarded as essential data in the sense of Resolution 40 (Cg-XII).

7.1.5 Operational Procedures

Members are urged to comply fully with the global coding procedures and data collection standards in accordance with procedures laid down in the WMO Technical Regulations and the Manuals on the GOS, on Codes, and on the GTS when operating the stations in the AntON.

7.1.6 Arrangements and procedures for updating and amending the AntON

Certain minor changes in the AntON of surface and upper-air stations which do not affect the data requirements for the Antarctic as a whole are inevitable. To provide a simple and rapid means of effecting changes by Members, the following procedure shall be followed:

(a) The WMO President may approve, at the request of the Member concerned, on the advice of the Chairman of a dedicated EC subsidiary body, and in consultation with the Secretary-General, minor changes to the AntON. Any proposed significant change in the composition of AntON would still require formal agreement of Members operating components of the AntON;

(b) The Secretary-General shall notify all Members of WMO through the Operational Newsletter or by circular letter of changes.

7.2 Weather reporting by traverse parties

Members operating stations in the Antarctic are encouraged to instruct all traverse parties to make surface observations wherever circumstances permit when they are more than 200 km away from their base. The observations, which should be carried out as close as possible to the standard times of observations, should be transmitted at least once a day.

7.3 Automatic weather stations in the Antarctic

Members are encouraged to use automatic weather stations as a part of the AntON, taking advantage of the data-collection capabilities of the near-polar-orbiting satellites and, in some cases, of the geostationary meteorological satellites.

7.4 Ships operating in Antarctic waters

7.4.1 Members should ensure that all research vessels, supply vessels and tourist ships operating in the Antarctic make regular surface synoptic observations at main and intermediate synoptic hours, and transmit these data in real-time. When these data cannot be transmitted in real-time they should be submitted in delayed mode or as historic data.

7.4.2 Members should also ensure that vessels, whenever practicable, also make upper-air observations, and that any observations made are transmitted in real-time.

7.5 Surface Drifting Buoys

Members are encouraged to enhance their deployment and maintenance of surface drifting buoys, which shall be equipped with at least atmospheric pressure and sea surface temperature sensors, transmitting data in real-time. Members are also encouraged to further develop buoy technology to enhance operations and real-time reporting both on and off the ice.

7.6 Aircraft reports

Members are encouraged to arrange for making, recording and distributing in real-time, observational reports from all flights to/from and within the Antarctic.

7.7 Additional and extended observations

Members are encouraged to arrange for making, recording and distributing in real-time, additional and extended observations from ships and stations in the Antarctic. A list of observations made for the GAW should be recorded in the GAW Station Information System (GAWSIS).

Resolution 57 (Cg-XVI)

GLOBAL INTEGRATED POLAR PREDICTION SYSTEM

THE CONGRESS,

Noting:

(1) Resolution 36 (Cg-XV) – International Polar Year 2007–2008,

(2) The agreement expressed by the Executive Council at its sixty-second session that it would be highly desirable for coordinated international efforts to secure and develop an International Polar Year (IPY) legacy process,

Considering:

(1) That the concerns about amplification of anthropogenic climate change at higher latitudes, combined with an increasing interest of many governments in polar regions, call for a better understanding of weather, climate, water and related environmental variability and change to improve our ability to make reliable, quantitative predictions out to seasons, decades and centuries ahead,

(2) The increased economic and transportation activities in polar regions, and the associated long-term requirement for sustained availability of integrated observational and predictive weather, climate and water information to support decision-making,

(3) That there remain key gaps in:

   (a) Scientific understanding of processes and interactions in polar regions, including stable boundary layers, polar clouds and precipitation, sea ice/ocean dynamics, hydrology, permafrost and ice sheet dynamics,

   (b) Sustaining in situ and satellite observations in polar regions, including reference observations,

   (c) Products and services for polar regions,

(4) The global benefits of a Polar Prediction System, enabling not only service delivery and observing strategies in polar regions, but also addressing key uncertainties in weather, climate, water and related environmental variability and change, thereby improving global

prediction and contributing to all WMO high priorities, in particular Disaster Risk Reduction, and to the Global Framework for Climate Services,

(5) That this cannot be accomplished by WMO alone, and will require collaborative research and development involving the World Weather Research Programme/THe Observing system Research and Predictability EXperiment (WWRP/THORPEX), the World Climate Research Programme (WCRP), other WMO Programmes, and external partners,

Acknowledging in particular the contributions of Members' national operational and research programmes to monitoring and real-time data provision, process studies, and current prediction systems for polar regions,

Decides:

(1) To embark on a decadal endeavour towards a Global Integrated Polar Prediction System (GIPPS), as an IPY Legacy to benefit the global community;

(2) That GIPPS should provide information to meet user needs for decision-making on timescales from hours to centuries;

Requests the Executive Council:

(1) To develop a scalable, detailed strategic plan for GIPPS, laying out a path that WMO will take to identify and address gaps in our scientific understanding of polar processes, improve data and service delivery, and promote or establish national research programmes;

(2) To implement this decision and establish the initial governance mechanism by providing broad oversight, guidance and monitoring of progress;

(3) To ensure that there is broad consultation with and participation by other international organizations and agencies that wish to contribute to the development of GIPPS;

(4) To submit a comprehensive report on the development of GIPPS to the Seventeenth Congress;

Requests the technical commissions and regional associations to support the work of the Executive Council through the coordinated international research, development and implementation of GIPPS and to advise on possible future governance structures;

Invites relevant national bodies and international organizations, academic research programmes, such as the International Council for Science (ICSU), the Scientific Committee on Antarctic Research (SCAR), the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO/IOC), the International Arctic Science Committee (IASC), the International Association of Cryospheric Sciences (IACS) and other relevant associations of the International Union of Geodesy and Geophysics (IUGG), and WMO co-sponsored and WMO-led Programmes such as WCRP and the Global Climate Observing System (GCOS), to join in the multi-year endeavour towards an operational GIPPS;

Requests Members:

(1) To support efforts to address the key gaps in scientific understanding of the Earth system and environmental processes and interactions in polar regions;

(2) To promote and/or establish national research programmes towards this endeavour;

(3) To provide adequate voluntary resources to support development of GIPPS;

Requests the Secretary-General:

(1) To strengthen coordination and collaborate closely with relevant international partner organizations and programmes in pursuing this endeavour;

(2) To take any further actions necessary to implement these decisions;

(3) To bring this resolution to the attention of all concerned.

Resolution 58 (Cg-XVI)

WMO POLAR ACTIVITIES

THE CONGRESS,

Noting:

(1) Resolution 7 (Cg-XV) – WMO Antarctic activities,

(2) Resolution 11 (EC-LXII) – Executive Council Panel of Experts on Polar Observations, Research and Services,

(3) The WMO Strategic Plan (2012–2015),

Considering:

(1) The increasing human presence and activities in polar regions,

(2) That the polar regions are extremely important in terms of their global impacts on weather and climate, and the functioning of the Earth system,

(3) That there is a continuing need for weather, climate, water and related environmental data from the polar regions, including enhancement and development of instruments and methods of observation suited to these areas, for the full implementation of the World Weather Watch, for the full realization of the value of research, monitoring and prediction of hydrology, climate change, atmospheric composition and the ozone layer over the polar regions,

(4) That arrangements ensuring the legacy of the IPY-enhanced observational networks are cross-cutting, and should be closely coordinated with the implementation of the WMO Integrated Global Observing System (WIGOS) and the WMO Information System (WIS), and should be designed to improve the capability of Members to provide a widening range of operational services and to better serve research programme requirements,

(5) That there is a continuing need to coordinate WMO activities with other international organizations active in polar regions,

(6) That there is an ongoing need to formalize responsibilities for the Antarctic as a region not covered by any of the WMO regional associations,

(7) The achievements of the Executive Council through its Panel of Experts on Polar Observations, Research and Services (EC-PORS) in ensuring the coordination of operational activities in the Antarctic and in engaging technical commissions, regional associations and international organizations and entities in the enhancement of observations, research and services in polar regions, in particular within the framework of IPY legacy initiatives,

Decides:

(1) That an integrated approach is needed to understand the global impact of changes in polar regions so that required services may be provided to users and so that governments can be advised on aspects of adaptation and mitigation;

(2) That operational and research observing networks in polar regions (including the Antarctic Observing network (AntON)) should be integrated within the framework of WIGOS and WIS and be enhanced to include cryosphere-related variables;

(3) That a concerted effort should be made to engage WMO Members, technical commissions and regional associations, as well as relevant research and international organizations and bodies, to improve predictive capability in polar regions on timescales from hours to centuries;

Invites Members, particularly those that have operational activities in polar regions:

(1) To ensure the continuity of their weather, climate, water and related environmental programmes in polar regions;

(2) To provide additional observations in polar regions by using automatic weather and hydrometric stations, atmospheric soundings, and other geophysical observatories on land; by recruiting additional voluntary observing ships; by equipping aircraft with appropriate means of recording and distributing observations; and by deploying automated observing platforms on and under the sea and ice, in order to meet the needs of numerical weather prediction (NWP), hydrological services, climate studies and research programmes;

(3) To enhance their satellite programmes by delivering appropriate satellite observing system infrastructure and products and services required for polar regions;

(4) To consider the possibility of cooperating with other Members in sharing the costs of reopening and operating previously functioning stations, in expanding existing stations or in deploying new observing and communication systems;

(5) To support WMO polar activities by providing both human and financial resources for its endeavours to enhance observations, research and services in polar regions;

Requests the Executive Council:

(1) To promote the coordination of weather, climate, water and related environmental activities in polar regions;

(2) To ensure close collaboration with other international organizations concerned such as the Antarctic Treaty Consultative Meeting (ATCM), the Scientific Committee on Antarctic Research (SCAR), the International Arctic Science Committee (IASC), the International Association of Cryospheric Sciences (IACS) and other relevant associations of the International Union of Geodesy and Geophysics (IUGG), the Arctic Council, the Council of Managers of National Antarctic Programmes (COMNAP), the Forum of Arctic Research Operators

(FARO), and the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO/IOC);

(3) To ensure that WMO polar activities support the WMO Strategic Plan (2012-2015) and beyond;

Requests the regional associations and technical commissions to support WMO polar activities;

Requests the Secretary-General to bring this resolution to the attention of all concerned.

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Note: This resolution replaces Resolution 7 (Cg-XV), which is no longer in force.

Resolution 59 (Cg-XVI)

INTERNATIONAL POLAR DECADE INITIATIVE

THE CONGRESS,

Noting:

(1) Resolution 36 (Cg-XV) – International Polar Year 2007–2008,

(2) Resolution 11 (EC-LXII) – Executive Council Panel of Experts on Polar Observations, Research and Services,

(3) The Report of the Workshop on an International Polar Decade Initiative, St Petersburg, Russian Federation, 14–15 April 2011, the first international stakeholder consultation, which was organized in accordance with the guidance of the sixty-second session of the Executive Council (June 2010),

(4) The Nuuk Declaration on the occasion of the Seventh Ministerial Meeting of the Arctic Council, 12 May 2011,

Considering:

(1) That the preliminary results of the International Polar Year (IPY) 2007–2008 confirmed the global significance of polar processes and the role of the polar regions as drivers of change in global weather and climate, extreme events, the global carbon cycle and sea-level rise,

(2) The urgent need to observe, understand and predict the extremely rapid and significant environmental changes occurring in high latitudes,

(3) That substantial research investments made by many countries in IPY have resulted in new scientific knowledge and infrastructure, including new technologies for observations and analysis and improved models for prediction of all Earth system components,

(4) The substantial societal benefit to be gained by capitalizing on these IPY investments by improving services, including better prediction and assessment capabilities, for example, in securing shipping routes; managing risks related to resource mapping, exploration and

development; protecting the fragile polar environment; and improving welfare of indigenous and other northern communities,

(5) That some governments are continuing to make added commitments, particularly in the Arctic, and that the Arctic Council countries have produced or are preparing strategies for economic development, environmental stewardship and support to indigenous communities to adapt to changes in the polar environment,

Recognizing:

(1) That the first international stakeholder consultation on the International Polar Decade (IPD) supported an IPD initiative and recommended that the IPD start after 2015 to align to a set of agreed decadal-scale polar initiatives,

(2) That WMO polar initiatives such as the Global Integrated Polar Prediction System and the Global Cryosphere Watch would provide, if implemented, a substantial contribution to an IPD, and would strongly benefit from contributions by partner organizations,

Approves participation by WMO in the International Polar Decade should this initiative be endorsed by the relevant international organizations as key stakeholders to build on the solid foundation that IPY has established;

Invites relevant international organizations and programmes, such as Arctic Council (AC), the Antarctic Treaty Consultative Meeting (ATCM), the International Council for Science (ICSU), the International Arctic Science Committee (IASC), the Scientific Committee on Antarctic Research (SCAR), the International Association of Cryospheric Sciences (IACS) and other relevant associations of the International Union of Geodesy and Geophysics (IUGG), the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO/IOC), the United Nations Environment Programme (UNEP), the Arctic Council Indigenous Peoples, the Council of Managers of National Antarctic Programmes (COMNAP), the Forum of Arctic Research Operators (FARO), the European Commission, the European Science Foundation, the European Environment Agency, the Arctic Monitoring and Assessment Programme (AMAP), the International Arctic Social Sciences Association (IASSA), the Association of Polar Early Career Scientists (APECS), and others to participate in the IPD consultative process and identify their role and commitments to the IPD;

Requests the Executive Council through its Panel of Experts on Polar Observations, Research and Services:

(1) To secure WMO representation in a steering group that would be established to lead the IPD consultative process and prepare a draft IPD Concept Document for submission to the Montreal 2012 IPY Conference “From Knowledge to Action” (22–27 April 2012);

(2) To consult with the relevant international organizations to define the framework, objectives, resource requirements, timing, and organizational structure of an IPD;

(3) To coordinate the role and participation of WMO in the relevant initiatives that would be conducted under the auspices of an IPD;

(4) To review and approve the IPD Concept Document at its sixty-fourth session with a view of determining modalities and the level of WMO participation in the initiative;

Requests the Secretary-General to bring this resolution to the attention of all concerned.

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Note: This resolution replaces Resolution 36 (Cg-XV), which is no longer in force.

Resolution 60 (Cg-XVI)

GLOBAL CRYOSPHERE WATCH

THE CONGRESS,

Noting:

(1) Resolution 59 (Cg-XVI) – International Polar Decade initiative,

(2) That Fifteenth Congress welcomed the proposal to create a Global Cryosphere Watch (GCW) as an important part of the International Polar Year (IPY) legacy,

(3) That the Executive Council, at its sixty-second session, agreed that it would be highly desirable for coordinated international efforts to secure and develop an IPY legacy process,

(4) The GCW Implementation Strategy developed under the auspices of the Executive Council,

Considering:

(1) That the cryosphere is global, existing in various forms spanning all latitudes and occurring in approximately one hundred countries, in addition to the Antarctic continent,

(2) That the cryosphere is an integrative element within the climate system and provides one of the most useful indicators of climate change, yet it is arguably the most under-sampled domain in the climate system,

(3) The role of the cryosphere-related feedbacks in the amplification of anthropogenic climate change in polar regions, including the “third pole”, and the significant impact of a changing cryosphere on weather, climate and water globally,

(4) That the cryosphere, its changes and its impacts have not only received increased scientific scrutiny in recent years, but are also now receiving continual attention on the part of decision-makers and coverage by the media, creating an unparalleled demand for authoritative information on the past, present and future state of the world’s snow and ice resources,

(5) That GCW is a significant component of the WMO Integrated Global Observing System (WIGOS) and the WMO Information System (WIS), particularly in promoting interoperable and reference observations, and near real-time data and information exchange,

(6) That GCW can succeed only by working with WMO Members and with other organizations that have cryospheric interests,

Acknowledging in particular the contributions of Members’ national operational and research programmes to monitor and provide data on the cryosphere,

Decides to embark on the development of the Global Cryosphere Watch as an IPY legacy with a view towards achieving an operational GCW;

Urges Members and **Invites** international partner organizations and programmes:

(1) To collaborate actively in, and give all possible support to, the development and implementation of this initiative;

(2) To support the Global Cryosphere Watch by providing both human and financial resources to implement GCW;

Requests the Executive Council:

(1) To establish a mechanism to steer and monitor the activity and to achieve the broadest possible collaboration and cooperation;

(2) To ensure the active participation and representation of the principal bodies concerned and also the participation, as appropriate, of technical experts and representatives of agencies undertaking observing and research initiatives relevant to the cryosphere;

(3) To submit a comprehensive report, including an updated GCW implementation plan, to the Seventeenth World Meteorological Congress;

Requests the regional associations and technical commissions to include this activity in their work programmes in order to fully accommodate the cross-programme nature of this cross-cutting initiative;

Requests the Secretary-General:

(1) To strengthen coordination and collaborate closely with relevant international partner organizations and programmes in pursuing this endeavour;

(2) To put in place an appropriate mechanism in the Secretariat to ensure optimal management of, and support to, the initiative.

ANNEXES

ANNEX I
Annex to paragraph 2.3.1 of the general summary

RECOMMENDATIONS OF THE THIRTIETH MEETING OF THE FINANCIAL ADVISORY COMMITTEE TO SIXTEENTH CONGRESS

Financial report of the Secretary-General for the fifteenth financial period (2008–2011)

Recommendation 1

That Congress take note of the financial report of the Secretary-General to Sixteenth Congress.

Consideration of the Secretary-General's budget proposal for the sixteenth financial period (2012–2015)

Recommendation 2

That Congress:

2.1 Approve the Secretary-General's proposed maximum expenditure and the ensuing assessed contributions for the sixteenth financial period.

2.2 Adjust the proposed budget taking into account the comments by the Financial Advisory Committee.

Scale of assessments for 2012 and 2013

Recommendation 3

That Congress:

3.1 Approve the text (paragraphs 9.1.3 to 9.1.7) for inclusion in the general summary of the present report.

3.2 Adopt Resolution 39 (Cg-XVI) – Assessment of proportional contributions of Members for the sixteenth financial period, submitted by the Secretary-General.

3.3 Approve that Peru has fulfilled the financial obligations to recover its voting rights for the sixteenth session of Congress as an exception to Resolution 41 (Cg-XV).

Revisions to the Financial Regulations

Recommendation 4

That Congress endorse the action taken by the Executive Council.

Report on the implementation of International Public Sector Accounting Standards (IPSAS)

Recommendation 5

That Congress take note of the Secretary-General's report.

ANNEX II
Annex to paragraphs 3.1.0.1, 3.2.23, 3.3.45, 3.4.1.5, 3.5.8.3, 3.6.13, 3.7.14, 4.1.1, 4.2.25, 4.3.1, 4.4.2, 4.5.1, 5.2.16, 5.4.1, 6.1.8, 6.2.6, 6.3.14, 6.4.1, 6.4.16, 11.5.1, 11.5.21 and 11.6.1 of the general summary

WMO PROGRAMME DESCRIPTIONS

WORLD WEATHER WATCH PROGRAMME

1. Purpose and scope of the World Weather Watch (WWW) Programme

1.1 The World Weather Watch (WWW) Programme facilitates the development, operation and enhancement of worldwide systems for observing and exchanging meteorological and related observations, and for the generation and dissemination of analyses and forecast products, as well as severe weather advisories and warnings, and related operational information. The activities carried out under this Programme collectively ensure that Members have access to the required information to enable them to provide data, prediction and information services and products to users. WWW is organized as an international cooperative programme, under which the infrastructure, systems and facilities needed for the provision of these services are owned, implemented and operated by the Member countries. This is based on the fundamental understanding that the weather systems and patterns do not recognize national boundaries and are always evolving on varying temporal and spatial scales, and that international cooperation is paramount, as no one country can be fully self-sufficient in the provision of all weather, water and climate related services.

1.2 The Programme's main functions are planning, organization and coordination of the facilities, procedures and arrangements at the global and regional levels, related to the design of observing and communications networks, the standardization of observing and measuring practices and techniques, the use of data management principles, the application of scientific and technical means for assuring, analysing and predicting weather systems, and the presentation of the information in a form and format that is understood by all, regardless of language. WWW is the key Programme of WMO in providing basic data, analyses, forecasts, and warnings to Members and other WMO and co-sponsored Programmes, such as the Global Climate Observing System and Global Ocean Observing System, and relevant international organizations.

1.3 WWW puts priority on capacity-building activities to avail of technological advances to enhance the WWW components, especially in developing countries, and on cost-effective, systematic monitoring and improvements to the operations of WWW that can be derived thereof. Thus, it allows Members to obtain maximum benefits from the WWW.

1.4 The WWW Programme effectively contributes to the implementation of all the WMO Expected Results of the WMO Strategic Plan. Many of the activities are strongly linked with all other WMO Programmes and it will provide direct support to the future WMO high priority areas, namely GFCS, DRR, WIGOS and WIS, Capacity-building and Aeronautical Meteorology.

2. Programme structure

2.1 The World Weather Watch Programme comprises the design, implementation, operation and further development of the following three interconnected, and increasingly integrated, core components:

(a) Global Observing System (GOS), consisting of facilities and arrangements for making meteorological observations (including climatological observations) and other related environmental observations at stations on land and at sea, and from aircraft, meteorological environmental satellites and other platforms;

(b) Global Telecommunication System (GTS), consisting of integrated networks of telecommunications facilities and services for the rapid, reliable collection and distribution of observational data and processed information;

(c) Global Data-processing and Forecasting System (GDPFS), consisting of World, Regional Specialized, and National Meteorological Centres that provide quality-assured, processed data, analyses, and forecast products on a wide range of temporal and spatial scales.

2.2 Coordination, integration and efficient operation of the three core components are achieved through support programmes as follows:

(a) The WWW Data Management (WWWDM) support programme monitors and manages the information flow within the World Weather Watch system to assure quality and timely availability of data and products and the use of standard representation formats;

(b) The WWW System Support Activity (WWWSSA) support programme provides specific technical guidance, training and implementation support, the WWW Operational Information Services, and supports cooperative initiatives.

2.3 In addition, the WWW Programme incorporates three programmes that complement and enhance the core components of the WWW, as well as provide significant input and support to other WMO and co-sponsored Programmes:

(a) The Instruments and Methods of Observation Programme (IMOP) improves the quality and long-term stability of observations and measurements of meteorological and related environmental variables through the standardization activities and coordination and promotion of the use of efficient methods and technology to meet the requirements of operational and research applications;

(b) The Emergency Response Activities (ERA) programme assists NMHSs to respond effectively to large-scale atmospheric pollution and environmental emergencies in close collaboration with other relevant international organizations;

(c) The WMO Antarctic Activities (WMOAA) programme coordinates the WWW basic systems implementation and operation in Antarctica to meet the requirements for meteorological services as well as for environmental monitoring and climate research.

2.4 The World Weather Watch component systems are primarily managed under the technical responsibility of the Commission for Basic Systems (CBS) with the exception of the IMOP that is managed under the technical responsibility of the Commission for Instruments and Methods of Observation (CIMO).

2.5 The WWW Programme works closely with other related programmes, in particular:

(a) The Tropical Cyclone Programme (TCP), which assists Members in establishing national and regionally coordinated systems to ensure that the loss of life and damage caused by tropical cyclones are reduced to a minimum, and to achieve sustainable development;

(b) The WMO Space Programme (WMO SP) which promotes wide availability and utilization of satellite data and products for weather, climate, water and related applications of WMO Members, and coordinates environmental satellite matters and activities throughout all WMO Programmes;

(c) The WMO Public Weather Services Programme (PWSP) whose principal aim is to strengthen the capabilities of WMO Members to meet the needs of society through provision and delivery of comprehensive weather and related environmental services, with particular emphasis on public safety and welfare, and to foster a better understanding by the public of the capabilities of their respective National Meteorological and Hydrological Services (NMHSs), and of how best to use the services that NMHSs deliver.

3. Global Observing System (GOS)

3.1 Purpose and scope

(a) The GOS provides, from the Earth and from outer space, observations of the state of the atmosphere and ocean surface for the preparation of weather analyses, forecasts, advisories and warnings, and for climate and environmental studies and activities carried out under programmes implemented by WMO and by other relevant international organizations. It is operated by National Meteorological Services (NMSs), national or international satellite agencies, and involves several consortia [1] dealing with specific observing systems or specific geographic regions;

(b) GOS systematically evolves, through the Rolling Review of Requirements process, into a composite cost-effective system with its subsystems providing interoperable data and information based on the agreed upon standard practices. GOS is services driven observing system in support of the NMSs mandates;

(c) GOS put special emphasis on meeting the requirements of monitoring the climate and the environment, in collaboration with partner organizations, to improve understanding of climate processes and to enable increasingly beneficial climate and environmental studies and services;

(d) Areas of emphasis in the implementation of GOS may differ in individual countries, but common standards, cost-effectiveness, data interoperability, long-term sustainability and innovative collaborative arrangements among Members are the key aspects of the future design and operation of the observing networks.

3.2 Main long-term objectives:

(a) Improve and optimize global systems for observing the state of the atmosphere and the ocean surface to meet the requirements, in the most effective and efficient manner, for the preparation of increasingly accurate weather analyses, forecasts and warnings, and for climate and environmental monitoring studies and activities carried out under programmes implemented by WMO and by other relevant international organizations;

(b) Provide for the necessary standardization of observing practices, including the planning of networks on a regional basis to meet the requirements of users with respect to quality, spatial and temporal resolution and long-term stability, particularly with a view to its further evolution as the key component of the WMO Integrated Global Observing System (WIGOS).

4. Global Telecommunication System (GTS)

4.1 Purpose and scope

4.1.1 The Global Telecommunication System (GTS) is an integrated system of managed data communication networks, point-to-point circuits and satellite-based data collection and broadcast systems, which interconnect meteorological centres through agreed procedures and services. It provides the telecommunication services for the collection, and exchange of observational data

[1] Examples are EUMETNET, AMDAR, ASAP, DBCP, EUMETSAT.

(particularly GOS data) and the distribution of processed information from the Global Data-processing and Forecasting System (GDPFS) and other related centres. The GTS is operated by National Meteorological Services, national or international satellite agencies or contracted commercial telecommunication service providers. The Internet complements the GTS where technical or economic conditions limit the scope of the GTS. Maintenance and enhancement of systems to exchange data, products and information thus facilitate access to information needed for the preparation of analyses, forecasts and warnings, research activities and other environment-related applications.

4.1.2 The main goal will be the further development of structure and operational principles of the GTS and other components of the WMO Information System (WIS). As a core network of WIS, the GTS will respond to growing data communication needs of all WMO Programmes and exploit new technical and economic opportunities. The priority activity will be focused on achieving cost-effectiveness, enhanced data transmission capacity and a greater variety and flexibility of services. The WIS will continue to evolve jointly supported by the GTS and WWWDM programmes, and including input from other relevant programmes.

Main long-term objectives:

(a) Improve and optimize the WIS and its operational procedures to provide effective and efficient telecommunication services for the collection and communication of observational data, processed information, advisories, warnings, and others, within established time limits;

(b) Maintain and further develop the GTS as the core network of the WMO Information System (WIS) that will provide the information systems and services for the exchange of and access to data, which will meet the requirements for such services of all WMO Programmes.

5. Global Data-processing and Forecasting System (GDPFS)

5.1 Purpose and scope

5.1.1 The WMO Global Data-processing and Forecasting System (GDPFS) represents the function of weather forecasting including the production of weather and climate analyses, forecasts, specialized forecast products, and alerts, advisories and warnings of severe weather for the protection of life and property. The GDPFS includes the network of operational meteorological centres that produce a wide range of numerical weather prediction (NWP) products, forecasts, and warnings, and is a part of a global early warning system for meteorological and environmental hazards. The outputs of the GDPFS are required by NMHSs and other Members' agencies to meet diverse requirements that range from immediate support to emergency response, to routine weather forecasts and warnings for the general public and for air traffic control, to environmental predictions such as sea-state or air quality, to products that create economic advantage for Members, tailored products and services to different economic sectors, and therefore represent the means for Members to deliver many meteorological services, especially those requiring predictions. The GDPFS aims at the provision of increasingly more relevant, reliable, and quality assured NWP products spanning forecast ranges from instantaneous to long-term, and from local to global scales, improved early warning services for the mitigation of meteorological disasters and effective advice for emergency response to environmental catastrophes.

5.1.2 The GDPFS contributes to several WMO high priorities: the GDPFS' network of Global Producing Centres and Lead Centres for Long-Range Forecasts and Regional Climate Centres is foundational in the development of a Global Framework for Climate Services. As well, the GDPFS contributes to Disaster Risk Reduction through the implementation of new scientific and technological means to improve severe weather forecasting, for example in the use of Ensemble Prediction Systems (EPS), and in particular contributes to building capacity through improved access to and use of advanced NWP/EPS products and post-processing methods in NMHSs of developing countries through the Severe Weather Forecasting Demonstration Project (SWFDP).

5.2 Main long-term objectives:

(a) Provide relevant, reliable, and quality assured NWP products spanning all forecast ranges, and from local to global scales, especially in support of improved early warning services;

(b) Develop capacity in weather and environmental predictions, especially in developing countries.

6. WWW Data Management (WWWDM)

6.1 Purpose and scope

The World Weather Watch Data Management (WWWDM) support programme will continue to develop and coordinate the support functions including data formats and codes, metadata standards, needed for an orderly and efficient overall management of meteorological data and products within the framework of WIS. It will also coordinate the monitoring of the operations of the WWW to improve the availability and quality of data and products.

6.2 Main long-term objectives:

(a) Implement modern standardized data handling and archiving models, procedures, practices, interfaces and formats required for efficient exchange, archive and retrieval of all information used in the World Weather Watch and other related WMO Programmes;

(b) Define and coordinate implementation of metadata standards for the WIS so that it meets the data exchange and access requirements of all WMO Programmes.

7. WWW System Support Activity, including the Operational Information Service (OIS)

7.1 Purpose and scope

7.1.1 The WWW System Support Activity (WWWSSA) support programme provides technical advice and support, especially to developing NMHSs, in order to assist in achieving the most effective and efficient implementation and sustainable operation of the World Weather Watch. The programme promotes the development of standard solutions to common operational problems and their implementation through coordinated projects.

7.1.2 The Operational Information Service (OIS) collects from and distributes to WMO Members detailed and up-to-date information, in a timely and efficient manner, on facilities, services and products made available through the operation of the World Weather Watch.

7.2 Main long-term objectives:

(a) Assist developing NMHSs, particularly through technical advice and training activities, in obtaining the necessary self-reliance for providing weather forecasting and warning services in their country and to allow them to fulfil agreed responsibilities within the WWW system and other related WMO or international programmes;

(b) Promote development and implementation of innovative arrangements for cooperation and funding within the WWW system to strengthen the long-term and cost-effective operation of the basic infrastructure;

(c) Provide the information services on the operation of the World Weather Watch and related systems and improve their utility for the users.

8. Instruments and Methods of Observation Programme (IMOP)

8.1 Purpose and scope

IMOP organizes the necessary studies, as well as instrument intercomparisons and calibration campaigns to ensure required accuracy and guarantee the long-term stability and interoperability of the observing systems used within WIGOS, with particular focus on the GOS. It promotes traceability of measurements done by Members to recognized international standards and supports Members' efforts to establish calibration laboratories, including collaboration with Regional Instrument Centres and relevant international organizations. This responsibility also extends to supporting the requirement of WMO cross-cutting activities such as the Global Framework for Climate Services, Disaster Risk Reduction and capacity-building. The programme develops and supports publication of technical guidance, observation practices, standards and performance characteristics, and implements related capacity-building activities. The programme effectively contributes to the implementation of all Expected Results, with the main emphasis on the implementation of Expected Result 4, in particular with respect to providing improved technical standards and guidance on instruments and methods of observations to ensure the improvement of observation quality.

8.2 Main long-term objectives:

(a) Improve the quality and long-term stability of observations and measurements of meteorological and related environmental variables through the coordination and promotion of the use of efficient methods and technology to meet the requirements of operational and research applications;

(b) Enhance the effective and economic use of observing technology/systems through training and technology transfer in developing countries.

9. Emergency Response Activities (ERA)

9.1 Purpose and scope

9.1.1 The Emergency Response Activities (ERA) programme, implemented in close conjunction with the Global Data-processing and Forecasting System (GDPFS), assists NMHSs and other relevant agencies of Members, as well as relevant international organizations, to respond effectively to environmental emergencies associated with airborne hazards, for example, caused by nuclear accidents or events, volcanic eruptions, chemical accidents, smoke from large fires, and other events, which require emergency atmospheric transport and dispersion modelling (ATM) support. This programme is carried out through the provision of specialized GDPFS products by designated Regional Specialized Meteorological Centres (RSMC); the development and implementation of efficient emergency procedures for the provision and exchange of specific data, information, and products related to the environmental emergency; regular exercises; and training for users.

9.1.2 Activities related to airborne radionuclide hazards fall under two categories. First, nuclear accidents or radiological incidents fall under two International Conventions, one on Early Notification, and the second on Assistance, to which WMO is a Party along with other international organizations concerned under the overall coordination of the IAEA. Secondly, WMO collaborates with the Comprehensive Nuclear-Test-Ban Treaty Organization and provides specialized operational modelling support to the Treaty's Verification regime.

9.2 Main long-term objectives:

(a) Provide effective meteorological support in the response to environmental emergencies related to airborne hazards;

(b) Collaborate with relevant international organizations in meteorological aspects of mitigating the impacts of environmental emergencies related to airborne hazards.

10. WMO Antarctic Activities (WMOAA)

10.1 Purpose and scope

10.1.1 The WMOAA programme coordinates operational meteorological activities in Antarctica carried out by nations and groups of nations and under the auspices of the WMO Executive Council. Within the framework of the Antarctic Treaty, it focuses on the interfaces between these activities and relevant WMO Programmes to ensure continuity of weather, climate, water and related environmental programmes in the Antarctic in meeting the requirements for meteorological services as well as for environmental monitoring and climate research. Important stakeholders in this engagement include the WMO technical commissions, regional associations, the IOC, Antarctic Treaty Consultative Meeting (ATCM), and key science groups such as the ICSU, SCAR, IASC and WCRP.

10.1.2 The WMOAA programme, as a component of the WWW Programme, effectively contributes to the implementation of all the WMO Expected Results of the WMO Strategic Plan. Many of the activities are strongly linked with all other WMO Programmes. It will provide direct support to all WMO high priority areas, namely GFCS, DRR, WIGOS and WIS, Capacity-building and Aeronautical Meteorology.

10.2 Main long-term objectives:

(a) Coordinate implementation and operation of the basic systems of the WWW to meet the requirements for meteorological services and research activities in the Antarctic, including climate and environment monitoring;

(b) Collaborate with other international organizations and programmes in Antarctica in order to ensure a coordinated and cost-effective scientific and technical programme.

GLOBAL ATMOSPHERE WATCH PROGRAMME

(Based on the *WMO Global Atmosphere Watch (GAW) Strategic Plan: 2008–2015* (WMO/TD-No. 1384[1]))

1. Mission and overall objective

The **rationale** for the Global Atmosphere Watch (GAW) Programme is to meet the need to better understand and control the increasing influence of human activity on the global atmosphere. Among the main challenges addressed in the Programme are:

- Stratospheric ozone depletion and the increase of ultraviolet (UV) radiation;
- Changes in weather and climate related to human influence on atmospheric composition, particularly, greenhouse gases, ozone and aerosols;
- Risk reduction of air pollution on human health and issues involving long-range transport and deposition of air pollution.

[1] Available at ftp://ftp.wmo.int/Documents/PublicWeb/arep/gaw/gaw172-26sept07.pdf.

Many of these have socio-economic consequences affecting weather, climate, human and ecosystem health, water supply and quality, and agricultural production.

The **mission** of GAW, taking into account the Integrated Global Atmospheric Chemistry Observations (IGACO) strategy, is to:

- Identify environmental risks to society and meet the requirements of environmental conventions;
- Strengthen capabilities of Members to predict climate, weather and air quality;
- Contribute to scientific assessments in support of environmental policy.

Through:

- Maintaining and applying global, long-term observations of the chemical composition and selected physical characteristics of the atmosphere;
- Emphasizing quality assurance and quality control;
- Delivering integrated products and services of relevance to users.

2. Purpose and scope

GAW contributes mainly to the implementation of the Expected Result 5 in the WMO Strategic Plan "Enhanced capabilities of Members to contribute to and draw benefits from the global research capacity for weather, climate, water and the related environmental science and technology development" under the Strategic Thrust of "Advancing scientific research and application, as well as development and implementation of technology" *(in the Strategic Plan 2012–2015)*.

GAW also fulfils a mandate from WMO Members by responding to the needs and clearly linking to the plans of national, regional, and international observing projects, programmes, systems and strategies, e.g.:

- As a core component of WIGOS and contributing to its implementation;
- By contributing to the European Programme Global Monitoring for Environment and Security (GMES);
- As a WMO contribution to the Global Earth Observation System of Systems (GEOSS);
- In supporting the Subsidiary Body for Scientific and Technological Advice (SBSTA) of the United Nations Framework Convention on Climate Change (UNFCCC), especially by contributing to the implementation plan for the Global Climate Observing System (GCOS);
- In observing the Vienna Convention on the Protection of the Stratospheric Ozone Layer and follow-up protocols;
- In supporting the Convention on Long-range Transboundary Air Pollution (CLRTAP);
- In providing a comprehensive set of observations of atmospheric composition in support of the Intergovernmental Panel on Climate Change (IPCC) process.

WORLD WEATHER RESEARCH PROGRAMME INCLUDING THORPEX

*(*Based on the *Strategic Plan for the Implementation of WMO's World Weather Research Programme (WWRP): 2009–2017 (WMO/TD-No. 1505[1]))*

1. Overall objective

WWRP is a comprehensive programme which contributes to improving public safety, the quality of life, economic prosperity and environmental quality by serving as an international mechanism for:

- Advancing the science of weather-related research with a particular focus on advancing our knowledge of high-impact weather, improving the prediction of these events and measuring the improvements in prediction;
- Advancing our understanding of how society is impacted by and reacts to high-impact weather and forecasts of these events in order to improve the utilization of and response to weather information;
- Contributing to the advancement of the science of broader environmental prediction through partnerships and collaborative multidisciplinary research;
- Promoting and facilitating the transfer of these research advances into the operational practice at NMHSs and among their end-users;
- Serving as the weather research underpinning for WMO efforts related to the WMO Natural Disaster Reduction and Mitigation Programme, operational weather prediction, use applications, and thereby contributing to relevant UN Millennium Goals.

2. Purpose and scope

The WWRP, including THORPEX, contributes primarily to Expected Result 5 of the WMO Strategic Plan, "5. Enhanced capabilities of Members to contribute to and draw benefits from the global research capacity for weather, climate, water, and the related environmental science and technology development".

The WWRP, including THORPEX, promotes the development and application of improved weather forecasting techniques, with emphasis on high-impact weather events. The programme projects emphasize a comprehensive approach involving all timescales associated with weather prediction, and ensure that the benefits of research advances are widely shared among Members.

3. WWRP governance

The policy and technical guidance for the WWRP is provided by the Commission for Atmospheric Sciences (CAS). The CAS interacts closely with the Commission for Basic Systems (CBS) and the WMO co-sponsored World Climate Research Programme (WCRP).

HYDROLOGY AND WATER RESOURCES PROGRAMME

1. Overall objective

The overall objective of HWRP is to apply hydrology in meeting the needs for sustainable water resources development through integration of hydrological, meteorological and climatological

[1] Available at http://www.wmo.int/pages/prog/arep/wwrp/new/documents/final_WWRP_SP_6_Oct.pdf.

information and forecasts for use in water resources management; prevention and mitigation of water-related disasters; and in climate change adaptation in the water sector at national, regional and international levels.

2. Purpose and scope

2.1 HWRP fulfils one of the major purposes of WMO, namely to promote application of hydrology and to further close cooperation between Meteorological and Hydrological Services (paragraph *(e)* of Article 2 of the Organization's Convention).

2.2 HWRP promotes improvements in the capabilities of Members, particularly in developing countries and those in transition, through technology transfer and capacity-building, so as to enable them to assess their water resources on a continuous basis, and respond, through risk management strategies, to the threats of floods and droughts; and thus to meet the requirements for water and its use and management for a range of purposes. The Programme aims at providing hydrologic information to various national development agencies, the civil society and the general public so that they can effectively use water resources for various development activities. At the same time the Programme endeavors to underscore the importance of hydrology and the role of National Hydrological Services (NHSs) in the development activities of various sectors through water resources management.

2.3 The Programme takes into consideration the existence of climate variability and change and its hydrological impacts. It promotes increased collaboration between NHSs and NMSs, particularly in the provision of timely and accurate hydrological forecasts, ranging from flash floods guidance to seasonal predictions as a contribution to the protection of life and property and overall climate risk management.

2.4 The Programme supports activities that contribute to the improved accuracy and usefulness of hydrological forecasts, resulting in the protection of life and property, and increased information and knowledge in support of sustainable socio-economic and environmental development and use of water. The activities of HWRP encompass the following broad areas:

(a) Measurement of basic hydrological elements from networks of hydrological, climatological and meteorological stations;

(b) Collection, processing, storage, retrieval and publication of hydrological data, including data on the quantity and quality of both surface water and groundwater;

(c) Implementation of a quality management framework in hydrologic activities;

(d) Provision of hydrologic data and related information for use in planning and operation of water resources projects and for monitoring the state of the freshwater resources;

(e) Installation and operation of hydrological forecasting systems;

(f) Development of flood management policies and strategies;

(g) Integration of meteorological and climatological information and forecasts into water resources management;

(h) Climate change adaptation in water resources management;

(i) Evaluation of hydrological research outcomes for their potential benefits for application by NMHSs.

2.5 The Programme effectively contributes to the implementation of all the Expected Results in the WMO Strategic Plan and particularly to ER 3 along with ER 2 and ER 4 (2012–2015). Many of the activities under HWRP are strongly linked with other Programmes, in particular the World Weather Watch Programme, the World Climate Programme, the Tropical Cyclone Programme, the Education and Training Programme, and contributes to the overall objectives of the Disaster Risk Reduction Programme, the Regional Programme and the Least Developed Countries Programme. The Programme will act as an interlocutor and conduit to provide climate services under GFCS for use in the water sector.

3. HWRP governance

The technical guidance for the HWRP is provided by the Commission for Hydrology (CHy). The Commission interacts closely with the Commission for Climatology and Commission for Agrometeorology on GFCS and the Commission for Basic Systems on WIGOS.

4. HWRP structure

The HWRP is implemented through three mutually supporting components:

(a) Basic Systems in Hydrology;

(b) Forecasting and Applications in Hydrology;

(c) Capacity-building in Hydrology and Water Resources Management.

5. Basic Systems in Hydrology (BSH)

Long-term objective

5.1 The long-term objective of the component is to provide guidance to, and support for, NHSs in hydrometry and its application for monitoring freshwater resources, with an emphasis on quality assurance.

Purpose and scope

5.2 BSH provides the basic building blocks and framework for the hydrometric support for hydrology and water resources management. It covers the collection, transmission and storage of data, implementation of Quality Management Framework within Hydrology, the further development of WHYCOS including its internal and external coordination, establishment of hydrologic information systems, assessment of water resources, applications of hydrologic information and socio-economic benefit analysis of hydrologic networks. The component will contribute to the implementation of ER 3, and support meeting the objectives of ER 4 through enhancing integration (WIGOS) and communication systems for delivering information (WIS); the BSH component, through WHYCOS activities, assists the LDCs by enhancing capacity of NMHSs, thus contributing to ER 6.

6. Forecasting and Applications in Hydrology (FAH)

Long-term objective

6.1 The long-term objective of the component is to apply hydrometric observations for hydrological forecasting, flood risk assessment and management, prevention and mitigation of water-related disasters, and to better understand the implications of climate variability and change for water management.

Purpose and scope

6.**2** The purpose of FAH is to support NHSs in the application of hydrological analysis through hydrologic modelling, development of flood forecasts, provision of flash flood guidance, studies on low season flows, storm surge coastal flooding, and design flood, in order to meet water resources management objectives. The component will undertake regular review of operational requirements for flood forecasts and warnings and keep up to date with new technological developments. The component organizes activities in support of integrated flood management and provides support to countries through a HelpDesk on flood management. Through its activities closely linked to flood prevention, mitigation and response, it contributes to the implementation of ER 2. The component will support climate change adaptation and environmental protection, and serve as the provider of climate information to the water sector users, and, as envisaged under GFCS, serve as an arm of the User Interface Programme and thus contribute to ER 3. The component works through increased collaboration between NMSs and NHSs, which is promoted and facilitated. The component will continue to closely link its activities with WCP, TCP and MMP.

7. Capacity-building in Hydrology and Water Resources Management (CBH)

Long-term objective

7.1 The long-term objective of the component is to assist the rational development, management and operation of NHSs, including the education and training of their staff, strengthening institutional coordination with NMSs and increasing general awareness of the importance of hydrological work.

Purpose and scope

7.2 The purpose of CBH is to provide guidance to NHSs on the institutional management within the hydrological and water resources development context and to build their capacities to serve their respective countries, through the implementation of the Hydrological Operational Multipurpose System (HOMS) for technology transfer and staff education and training. The component supports informing and educating the public, stakeholders and other government institutions about the socio-economic benefits of hydrologic services. The component also supports the technical cooperation activities in the developing and least developed countries and thus contributes to ER 6. This is a cross-cutting component that has strong linkages to other components within HWRP and will contribute to their implementation.

WORLD CLIMATE PROGRAMME

1. Overall scope of WCP

The World Climate Programme (WCP) primarily aims at enhancing climate services with adequate focus on user interaction, to facilitate evermore useful applications of climate information to derive optimal socio-economic benefits and thereby underpins the Global Framework for Climate Services (GFCS). The scope of WCP is to determine the physical basis of the climate system that would allow increasingly skilful climate predictions and projections, develop operational structures to provide climate services and to develop and maintain an essential global observing system fully capable of meeting the climate information needs.

2. Overall objectives of WCP

Given the growing awareness about the climate sensitivity of the society across a wide range of socio-economic sectors, and increased focus on the need for adaptation and risk management that

is implemented at local level and requires climate information and services available at global to regional, national and local scales, the objectives of the refocused WCP are:

(a) To improve the understanding of climate processes for determining the predictability of climate, including its variability and change, identifying the extent of human influence on climate and developing the capability for climate prediction and projection;

(b) To promote comprehensive observation of the global climate system and facilitate the effective collection and management of climate data and the monitoring, including the detection and assessment of climate variability and changes from global to local scales;

(c) To enhance and promote the availability of and access to user-targeted climate services, especially prediction, by providing an international framework and establishing the operational elements of production and delivery systems for climate services;

(d) To foster the effective application of climate knowledge and information for the better management of the risks of climate variability and change into planning, policy and practice and the provision of the required climate services;

(e) To promote capacity development, particularly in developing and least developed countries, to enable them to contribute to the operation of GFCS and at the same time benefit from it.

3. WCP structure

The new refocused WCP will consist of:

(i) World Climate Research Programme (WCRP);

(ii) Global Climate Observing System (GCOS);

(iii) World Climate Services Programme (WCSP).

3.1 WORLD CLIMATE RESEARCH PROGRAMME

3.1.1 Mission and objectives

The mission of WCRP is to facilitate analysis and prediction of Earth system variability and change for use in an increasing range of practical applications of direct relevance, benefit and value to society.

The overall objectives of the World Climate Research Programme are to determine:

– To what extent climate can be predicted;

– The extent of human influence on climate.

3.1.2 Scope of the Programme

The main foci of WCRP research are:

– Observing changes in the components of the Earth system (atmosphere, oceans, land and cryosphere) and at the interfaces among these components;

– Improving knowledge and understanding of global and regional climate variability and change, and of the mechanisms responsible for this change;

– Assessing and attributing significant trends in global and regional climates;

– Developing and improving numerical models and predictive techniques that are capable of simulating, predicting, and assessing the climate system for a wide range of space and timescales;

– Investigating the sensitivity of the climate system to natural and human-induced forcing and estimating the changes resulting from specific disturbing influences;

– Facilitating the translation of climate research results to useful information and knowledge for practical applications in sustainable development and climate services.

In addition to these primary tasks, the WCRP cooperates, as appropriate, with other cognate programmes in the field of Earth system science. In particular, the WCRP will continue to develop its cooperation with its partners in the Earth System Science Partnership, namely the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme (IHDP) and DIVERSITAS, in order to introduce the chemical, biological, ecological and socio-economic dimensions into models and field studies of the environment, thus promoting further advances in the knowledge of the total Earth system and the understanding of global change in support of sustainable development and global climate services.

3.2 GLOBAL CLIMATE OBSERVING SYSTEM

3.2.1 The scope of GCOS

The Global Climate Observing System (GCOS) is a WMO-led co-sponsored programme of WMO, the IOC of UNESCO, UNEP and ICSU. The GCOS is built on existing operational and scientific observing, data management and information distribution systems. It is based upon an improved World Weather Watch Global Observing System, the Global Ocean Observing System, the Global Terrestrial Observing System, the WMO global observing systems and the maintenance and enhancement of programmes monitoring other key components of the climate system, such as the distribution of important atmospheric constituents (including the Global Atmosphere Watch).

The vision of the GCOS programme is that all users have access to the climate observations, data records and information which they require to address pressing climate-related concerns. GCOS users include individuals, national and international organizations, institutions and agencies. The role of GCOS is to work with partners to ensure the sustained provision of reliable physical, chemical and biological observations and data records for the total climate system – across the atmospheric, oceanic and terrestrial domains, including hydrological and carbon cycles and the cryosphere.

3.2.2 Objectives of GCOS

The objectives of GCOS are to ensure that observations are provided that meet the needs for:

- Characterizing the state of the global climate system and its variability;
- Monitoring the forcing of the climate system, including both natural and anthropogenic contributions;
- Supporting the attribution of the causes of climate change;
- Supporting the prediction of global climate change;
- Enabling projection of global climate change information down to regional and local scales;
- Ensuring the availability of information important in impact assessment and adaptation, and for the assessment of risk and vulnerability, including the characterisation of extreme events.

3.2.3 GCOS Steering Committee

GCOS is directed by a Steering Committee constituted by the four sponsoring partners of the programme and provides guidance, coordination and oversight to the programme. The Steering Committee is supported in its work by its science panels that have been established to define the observational needs required in the domains of the atmosphere, ocean and land.

3.3 WORLD CLIMATE SERVICES PROGRAMME

3.3.1 Scope of WCSP

The scope of WCSP spans across four inter-related areas: (i) climate data and analysis; (ii) climate monitoring, watch and prediction; (iii) climate system operation and infrastructure; and (iv) climate adaptation and risk management; thereby serving as the Climate Services Information System and a part of the User Interface Platform components of the GFCS.

WCSP contributes to improve the availability and access to reliable data, advancement of the knowledge in the area of climate data management and climate analysis, definition of the technical and scientific standards, and development of activities to support them in countries. Climate data management will include data rescue, development and coordination of a global climate data management system compatible with the WMO Information System (WIS).

WCSP defines the associated products and their contents, develop prediction methodologies, including their requirements and standards. It will facilitate provision of regular global and regional consensus statements on the climate monitoring and prediction and tailoring and assessments of the reliability of climate products. The programme would establish and maintain research operations linkages to expedite the implementation of research advances in operational climate services and to ensure ongoing improvement to the operational practices and outcomes.

WCSP will put in place appropriate institutional mechanisms to generate, exchange and disseminate quality information at global, regional and national levels on an operational basis. In particular, it would facilitate the establishment of a network of global, regional and national entities, including Global Producing Centres of Long-Range Forecasts (GPCs), global data and monitoring centres, Regional Climate Centres (RCCs) and climate operations within NMHSs that would serve as key elements that develop and provide the climate information. WCSP will essentially coordinate, define, develop, strengthen and sustain this operational mechanism to produce and disseminate climate products and services and provide guidance on the requirements and best practices for establishing climate service programmes.

WCSP covers the near future to the long-term climate risks by promoting the use of reliable and available climate information, methods, tools and systems through interdisciplinary activities, initially focusing on the agriculture/food security, water resources and disaster risk reduction sectors. Over time, the methods, tools and systems will evolve to cover the requirements of other key social and economic sectors in collaboration with other UN agencies and other international entities.

3.3.2 Objectives of WCSP

(a) To facilitate the development and implementation of methods to enable rescue, preservation and management of climate data by Members, especially developing countries, and to promote international exchange of climate data and related products;

(b) To coordinate the development of global and regional climate databases including metadata, in both national and international repositories and facilitate their exchange;

(c) To develop methods and tools for analysing trends, anomalies, frequencies and extreme values;

(d) To develop climate indices for assessment and analysis of their occurrence and attribution;

(e) To coordinate development of a well-coordinated global system for monitoring, analysis, diagnosing and disseminating information on climate variability and change;

(f) To identify state-of-the-art climate prediction methodologies up to decadal timescales;

(g) To develop and support consensus-based climate updates and climate watches including both monitoring and prediction aspects;

(h) To facilitate close interactions between operational and research communities to identify their needs and requirements;

(i) To support development of methods and tools for operational climate predictions (seasonal, annual and decadal) and climate watch systems, assessment of their socio-economic value and incorporation of user feedback;

(j) To build an effective infrastructure for seasonal to inter-annual climate predictions by facilitating the development of a network of regional and national climate centres and facilitate global to regional to national flow of operational climate information;

(k) To facilitate definition, development and standardization of operational climate prediction products and promote standards and quality management;

(l) To support development and implementation of climate services at the national level;

(m) To support the interdisciplinary efforts to develop methods and tools for generating sector-specific climate information and products;

(n) To help Members in developing climate application services based on the climate information and knowledge;

(o) To raise awareness of climate as a risk and as a resource, and to better communicate climate information to specialists with limited climate background;

(p) To identify and share best practices for the application of climate information, in order to develop user-oriented climate information, products and services through carrying out a number of showcase projects.

3.3.3 Technical guidance for WCSP

The technical guidance for the WCSP is provided by the Commission for Climatology (CCl). It interacts closely with the Commission for Basic Systems, the Commission for Agricultural Meteorology and the Commission for Hydrology.

WORLD CLIMATE RESEARCH PROGRAMME

1. Mission and objectives

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The overall objectives of the World Climate Research Programme are to determine:

– To what extent climate can be predicted;

– The extent of human influence on climate.

2. Scope of the Programme

The main foci of WCRP research are:

– Observing changes in the components of the Earth system (atmosphere, oceans, land and cryosphere) and at the interfaces among these components;

– Improving knowledge and understanding of global and regional climate variability and change, and of the mechanisms responsible for this change;

– Assessing and attributing significant trends in global and regional climates;

– Developing and improving numerical models and predictive techniques that are capable of simulating, predicting, and assessing the climate system for a wide range of space and timescales;

– Investigating the sensitivity of the climate system to natural and human-induced forcing and estimating the changes resulting from specific disturbing influences;

– Facilitating the translation of climate research results to useful information and knowledge for practical applications in sustainable development and climate services.

In addition to these primary tasks, the WCRP cooperates, as appropriate, with other cognate programmes in the field of Earth system science. In particular, the WCRP will continue to develop its cooperation with its partners in the Earth System Science Partnership, namely the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme (IHDP) and DIVERSITAS, in order to introduce the chemical, biological, ecological and socio-economic dimensions into models and field studies of the environment, thus promoting further advances in the knowledge of the total Earth system and the understanding of global change in support of sustainable development and global climate services.

3. Current Programme

The research priorities of the WCRP are pursued through four major internationally coordinated core projects:

Climate and Cryosphere (CliC)

Mission:
To assess and quantify the impacts of climatic variability and change on components of the cryosphere and their consequences for the climate system, and to determine the stability of the global cryosphere.

Climate Variability and Predictability (CLIVAR)

Mission:
To observe, simulate, and predict the Earth's climate system with a focus on ocean-atmosphere interactions in order to better understand climate variability, predictability and change.

Global Energy and Water Cycle Experiment (GEWEX)

Mission:
To measure and predict global and regional energy and water variations, trends, and extremes (such as heat waves, floods, and droughts), through improved observations and modelling of land, atmosphere, and their interactions.

Stratospheric Processes And their Role in Climate (SPARC)
Mission:
To determine the role of stratospheric processes in the Earth's climate, with a particular emphasis on the interaction between chemistry and climate.

WCRP also collaborates with IGBP on the **Surface Ocean-Lower Atmosphere Study (SOLAS)**, the goal of which is to achieve quantitative understanding of the key biogeochemical-physical interactions and feedbacks between the ocean and atmosphere, and of how this coupled system affects and is affected by climate and environmental change.

The activities in support of WCRP Integrating themes are carried out by the following groups:

Working Group on Coupled Modelling (**WGCM**) coordinates WCRP modelling activities and organizing numerical experimentation for the global environmental assessments such as IPCC.

Working Group on Numerical Experimentation (**WGNE**) co-sponsored with the WMO Commission for Atmospheric Sciences (CAS) with a focus on improvement of accuracy and range of numerical weather predictions globally, and to foster the development of atmospheric circulation models for use in weather, climate, water and environmental prediction on all timescales.

WCRP Observation and Assimilation Panel (**WOAP**) coordinates research on climate observations supported by **GCOS** and other international observation programmes (e.g., GEOSS, CEOS, etc.) and promotes the development of climate system reanalysis and greater use of observations in conjunction with climate system models.

WCRP also co-sponsors, with the WMO Commission for Climatology (**CCl**) and the Joint Commission for Marine Meteorology, the **Expert Team on Climate Change Detection and Indices** (**ETCCDI**) that provides international coordination and organizes collaboration on climate change detection and indices and indicators of climate variability and change and related methodologies, from the surface and subsurface ocean to the stratosphere.

At its most recent session in February 2010, the JSC decided to form two coordinating groups, namely a **Modelling Council** and a **Data Council**. These Councils would report to the JSC and would include representatives from the Core Projects and relevant external organizations to enable activities to be coordinated across the entire WCRP. The JSC also decided to establish a Working Group on regional climate science and information that would facilitate transitioning climate research outcomes to climate services. Terms of Reference for these groups are currently being developed.

WCRP engages the international climate research community in a number of **cross-cutting initiatives** through the implementation of task forces, in coordination and active engagement by its Projects, and working groups in areas such as:

– Anthropogenic Climate Change (**ACC**), including Regional Climate Downscaling (**TFRCD**);

– Seasonal Climate Prediction;

– Decadal Variability, Predictability and Prediction;

– Sea-Level Variability and Change;

– Climate Extremes;

– Atmospheric Chemistry and Dynamics (AC&C);

– Monsoon and Climate.

4. Functions of the Programme

Recognizing that diagnostic, theoretical and experimental research activities relevant to the climate system are carried out by scientific research establishments within nations, the broad aim of the WCRP is to coordinate and enhance these national efforts, in order to constitute a comprehensive international research programme implemented through concerted actions of participating institutions. The principal functions of the WCRP are then:

– To initiate specific regional or global experiments for the study of particular phenomena or processes;

– To identify research priorities for recommendation to national scientific institutes and funding agencies;

– To propose and facilitate the implementation of relevant international research activities as required;

– To arrange for the rapid and effective dissemination of information on current results and new developments in climate research;

– To facilitate translation and interpretation of scientifically complex information into useful information and knowledge for practical applications in sustainable development and climate services;

– To support training and development of next generation of climate experts, especially in developing regions of the world.

WMO SPACE PROGRAMME

1. Overall objective and scope

The overall objective of the WMO Space Programme (WMO SP) is to promote wide availability and utilization of satellite data and products for weather, climate, water and related applications of WMO Members.

Its scope is to coordinate environmental satellite matters and activities throughout all WMO Programmes; to give guidance to these programmes on the potential of remote-sensing techniques in meteorology, hydrology and related disciplines and applications; and to ensure effective cooperation with and among international partners and organizations dealing with satellite systems.

2. Programme structure

The WMO SP has four main components:

(a) Integrated space-based observing system;

(b) Availability and use of satellite data and products;

(c) Information and training;

(d) Space Weather coordination.

3. Programme governance

The lead technical responsibility for the WMO SP is assigned to CBS. The WMO Consultative Meetings on High-level Policy on Satellite Matters (CM) maintain a broad policy overview of the Programme.

Space Weather activities are jointly overseen by CBS and CAeM.

4. Programme activities

4.1 Integrated Space-based Observing System

Long-term objective

The long-term objective is to develop an integrated space-based observing system involving operational and R&D environmental satellites and their associated ground segments. This observing system should support the WWW, as the space-based component of its GOS; and ultimately all the other WMO Programmes and WMO-supported programmes, as the space-based component of WMO Integrated Global Observing System (WIGOS).

Activities

The space components of the various observing systems are reviewed, and the gaps with respect to requirements are analysed, in order to optimize the effectiveness of each component while striving for cross-cutting integration in the context of WIGOS.

WMO SP leads the revision of the baseline for the space-based observing system to achieve full implementation of the “Vision for the GOS in 2025”. It promotes intercalibration of satellite instruments and harmonization of their specifications. It encourages operational and R&D space agencies to contribute to the GOS and pursue system harmonization with best practices.

The transition of mature research systems to operational status is encouraged when appropriate, with a view to improve operational capabilities in line with evolving requirements, while ensuring the long-term sustainability required for operational applications and climate monitoring.

4.2 Availability and use of satellite data and products

Long-term objective

In view of the exponential increase in satellite data which is anticipated from upcoming satellite systems, a major challenge for the WMO SP in the next decade is to make these improved data and derived products available while increasing the number and geographical spread of users.

The objective is to enhance timely accessibility of satellite data and products as required by users in all WMO Regions, in particular in developing countries, to promote data interoperability through WMO Information System (WIS) standards and practices, and to stimulate coordinated processing of observations to derived products with traceable quality.

Activities

The WMO SP serves as a catalyst for improving dissemination and exchange of satellite observation data and products, and for standardizing data and metadata management consistent with WIS practices.

The Integrated Global Data Dissemination Service (IGDDS) project focuses on: (i) establishing regional requirements for access to data and products; (ii) implementing sustainable regional Digital Video Broadcast by Satellite (DVB-S) dissemination systems offering cost efficient access to satellite data in every region; (iii) integrating all relevant data types in such broadcast services, including inter-regionally exchanged data; and (iv) supporting harmonization of future Direct Broadcast systems as well as complementary data access and distribution services via the Internet, recognizing different user needs.

Building on international science groups and projects, the WMO SP stimulates the coordinated processing of satellite data to products, and the traceable quality of these data and products. Particular attention is given to climate applications, e.g. through the Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) and to Disaster Risk Reduction.

Cooperation is encouraged to develop common basic tools for utilization of remote-sensing data, and on the assimilation of R&D and new operational data streams in NWP systems and climate models.

4.3 Information and Training

Long-term objective

The long-term objective is to raise awareness on satellite capabilities and promote satellite-related education to keep Members' operational and scientific staff up to date with the latest technological innovations, with a focus on developing countries.

Activities

The WMO SP implements the Five-year Strategy for the Virtual Laboratory for Training and Education in Satellite Meteorology and Environmental Applications (VLab), relying on the network of Centres of Excellence sponsored by satellite operators. Close links are maintained with relevant national and international education and training initiatives.

WMO SP ensures that appropriate websites and portals provide guidance on the availability and usability of satellite data, products and services. Information material is to be provided, and translated into the official WMO languages as resources allow. Participation of WMO Members from developing countries in satellite users' conferences is encouraged.

4.4 Space Weather coordination

Long-term objective

The long-term objective is to support international operational coordination for Space Weather, which has a severe impact on space assets and relies to a large extent on space-borne observations, and improve Space Weather warnings to major application areas including aviation.

Activities

Within available resources, through the Inter-Programme Coordination Team on Space Weather (ICTSW), the WMO SP supports coordination activities focusing on:

(a) Standardization and enhancement of Space Weather data exchange and delivery through the WIS;

(b) Harmonized definition of end-products and services, including e.g. quality assurance guidelines and emergency warning procedures, in interaction with aviation and other major application sectors;

(c) Integration of Space Weather observations, through review of space- and surface-based observation requirements, harmonization of sensor specifications, monitoring plans for Space Weather observation;

(d) Encouraging the dialogue between the research and operational Space Weather communities.

5. Coordination and partnership

WMO SP is conducted in partnership with space agencies of WMO Members and their coordination bodies: the Coordination Group for Meteorological Satellites (CGMS) and the Committee on Earth Observation Satellites (CEOS).

Participation in the WMO Consultative Meetings on High-level Policy on Satellite Matters (CM) provides space agencies with visibility on the WMO SP and related WMO strategy and expectations.

Through the WMO SP, WMO actively participates in CGMS, the main technical coordination body of space agencies for operational missions for weather or climate on such matters as orbit coordination, contingency planning, data dissemination formats, or data collection services. WMO and CGMS have jointly initiated and are supporting a number of projects (related, for example, to satellite calibration, data dissemination, product generation, or training).

The WMO SP represents WMO as an Associate of CEOS, and interacts with its relevant entities such as the Working Group on Calibration and Validation, and the CEOS Working Group on Climate. Some WMO SP activities, such as maintaining the Dossier on the Space-based GOS, are conducted in collaboration with CEOS.

WMO SP supports expert groups that play a key role in providing expert advice and feedback, and stimulating developments within the user community. These groups include the International Winds Working Group, the International TOVS Working Group, the International Precipitation Working Group, the International Radio-occultation Working Group, and the Space Frequency Coordination Group.

Through its participation in international bodies, WMO SP promotes an integrated, global, space-based observing system, encourages cooperation whilst discouraging unnecessary duplication.

PUBLIC WEATHER SERVICES PROGRAMME

1. Main long-term objectives

The main long-term objectives of the PWS Programme (PWSP) are to:

(a) Strengthen the capabilities of WMO Members to meet the needs of the community through the provision of comprehensive weather and related environmental services with particular emphasis on public safety and welfare;

(b) Foster a better understanding by the public of the capabilities of NMHSs and how best to use their services.

2. Purpose and scope

The purpose of the PWS Programme is to assist Members to provide and deliver reliable and effective weather and related services to the public and other user communities in support of safety of life, livelihood and property. To respond to the wide spectrum of requirements of the public, weather-sensitive user groups and national and governmental decision-makers, the following PWS Guiding Principles, which were developed at the inception of the Programme, define the scope of the PWS Programme and form a management framework for the development of a national public weather services programme.

(a) The **population's right** to weather services for safety, convenience and well-being;

(b) A single official **source** for severe weather warnings;

(c) **Focus** on meaningful phenomena that significantly affect the population's safety and well-being;

(d) Issuing warnings **in time** to allow protective action;

(e) Use of clear, concise, unambiguous and understandable **language**;

(f) **Dissemination methods** that ensure widespread, timely and accurate distribution;

(g) **Educating** the public in the providers' role and services, and how to use their products;

(h) Seeking **regular input** from public and other users on desirable improvements in services;

(i) Continuous **monitoring** of the products' accuracy, usefulness and timeliness to improve services;

(j) **Collaborative arrangements** with media and other organizations for most efficient and cost-effective delivery of services and for minimizing conflict.

Based on these Guiding Principles, the PWS Programme contributes to the WMO Strategic Plan by assisting Members to build capability to develop, improve and deliver user focused services, through regional and national Learning-Through-Doing (LTD) Projects, demonstration projects, training activities, publication of best practices and guidance, and engagement of experts in collaboration with the relevant WMO technical programmes, United Nations (UN) and international agencies, and regional bodies. The outcome is developing, strengthening and sustaining dialogue with users, understanding their needs and delivering products and services to meet those needs.

3. Governance

The technical guidance for the PWSP is provided by the Commission for Basic Systems (CBS). In addition, the Executive Council, through its Working Group on Disaster Risk Reduction and Service Delivery (EC WG DRR & SD), provides specific oversight and guidance in matters related to Service Delivery.

4. Programme structure

The PWSP activities are implemented through the following components aimed at improving overall service delivery capacities of Members:

(a) Services and products improvement;

(b) Dissemination and communication of products;

(c) Support to disaster prevention and mitigation;

(d) Socio-economic applications;

(e) Public education and outreach;

(f) Education and training.

AGRICULTURAL METEOROLOGY PROGRAMME

1. Overall objective

1.1 The overall objective of the Agricultural Meteorology Programme (AgMP) is to assist Members in the provision of meteorological and related services to the agricultural community to help develop sustainable and economically viable agricultural systems. It keeps WMO Members abreast of technological advances in the domain of agrometeorology and ensures that they find practical use in the work carried out by agrometeorological services.

1.2 The main long-term objectives of the AgMP are:

(i) To promote Members' indigenous capabilities to provide relevant agricultural meteorological services and technologies for sustainable, environment-friendly, and economically viable agricultural production;

(ii) To foster a better understanding by farmers and other end-users in the agricultural, forestry and related sectors of the value and use of meteorological (including climatological) information in planning and operational activities.

2. Purpose and scope

2.1 AgMP fulfils one of the main purposes of WMO, namely to further the application of meteorology to agriculture, water problems, and other human activities (paragraph (d) of Article 2 of the Organization's Convention). It also facilitates the application of meteorology to the protection of livelihoods and property, the health and well-being of citizens, economic growth and the protection of the environment.

2.2 The scope of the AgMP is broad since agriculture as defined by CAgM includes agriculture, forestry, livestock and fisheries. Therefore, the AgMP tries to facilitate of application of meteorology to all of these sectors. Also, AgMP and CAgM have a unique responsibility since they are the only United Nations based entities that represent the scientific discipline of agricultural meteorology.

2.3 The purpose of the AgMP is to support food and agricultural production and activities. The Programme assists Members in provision of meteorological and related services to the agricultural community to help develop sustainable and economically viable agricultural systems, improve production and quality, reduce losses and risks, decrease costs, increase efficiency in the use of water, labour and energy, conserve natural resources and decrease pollution by agricultural chemicals or other agents that contribute to the degradation of the environment. Although sometimes combined, climate information is used mainly for planning purposes, while recent weather data and weather forecasts are used mostly in current agricultural operations.

2.4 Specific efforts ensure that improvements in knowledge, methodologies and skill are made available to developing and Least Developed Countries (LDCs). It also addresses a number of important issues related to disaster risk reduction which includes drought within the framework of an integrated, multi-hazard approach to disaster risk reduction, including early warnings.

2.5 AgMP promotes the planning and use of agricultural technologies for sustainable food production through the provision of improved agricultural weather and climate data systems that are necessary to expedite generation of products, analyses and forecasts that facilitate agricultural cropping and management decisions, irrigation scheduling, commodity trading and markets, fire weather management and other preparedness for calamities, and ecosystem conservation and management. One goal is to enhance the quality of agrometeorological advisories and products and the bulletins that are routinely issued by Members by developing and disseminating improved tools and methods for their preparation through the World Agrometeorological Information Service (WAMIS-www.wamis.org).

2.6 AgMP provides capacity-building in agrometeorology at the national and regional levels. It promotes technological advances in the field of agrometeorology through conferences, workshop and symposia and the publication of the proceedings from these events.

2.7 AgMP contributes to the implementation of the WMO Strategic Plan, mainly to Expected Results 1, 2 and 6 (2012–2015). It also will contribute to the Global Framework on Climate Services by enhancing the contribution of climate information to land management, agriculture and food security including risk evaluation and information delivery, cooperation and partnerships, adaptation strategies for resilient agricultural systems, and climate change mitigation. This will be primarily done through the activities of the Commission for Agricultural Meteorology (CAgM) Open Programme Area Group 3 on Climate Change/Variability and Natural Disasters in Agriculture. The activities of the Commission will provide a major contribution to the development of the Climate User Interface Programme (CUIP) of GFCS.

3. AgMP governance

The technical guidance for the AgMP is provided by CAgM. The Commission interacts closely with the Commission for Climatology (CCl) and the Commission for Hydrology (CHy) through the CCl–CAgM–CHy Working Group on Climate, Food and Water and on issues related to drought and the user interactions with GFCS. CAgM interacts with the Joint WMO-IOC Commission for Oceanography and Marine Meteorology (JCOMM) on climate and fisheries issues. It also is involved in reaching out to the agricultural community with regards to the Sand and Dust Storm Warning and Advisory System (SDS-WAS) which is under the direction of the Commission for Atmospheric Sciences (CAS). CAgM also provides linkages between weather forecast products from NWP products and the applications for agricultural decision-makers with the Severe Weather Forecast Demonstration Project (SWFDP) which is a Commission for Basic Systems (CBS) activity.

TROPICAL CYCLONE PROGRAMME

1. Main long-term objectives

The main long-term objectives of the Tropical Cyclone Programme are:

(1) To strengthen the capabilities of WMO Members to provide reliable and timely forecasts of tropical cyclone tracks and intensities, and related forecasts of strong winds, heavy rainfall, and storm surges, covering all tropical cyclone-prone areas;

(2) To promote the establishment of national disaster risk management and reduction mechanism of the Members with regard to tropical cyclones with multi-hazard configuration.

2. Purpose and scope

The purpose of the Programme is to assist the Members to establish national and regionally coordinated institutional systems to ensure that the loss of life and damage caused by tropical cyclones are reduced to a minimum. This includes facilitating WMO's role in the implementation of follow-on activities to the International Strategy for Disaster Reduction and helping Members to obtain the humanitarian, social and economic benefits of effective tropical cyclone disaster mitigation and to achieve sustainable development. The Programme therefore makes its main contribution to the implementation of the WMO Strategic Plan by enhancing the forecasts of tropical cyclones and associated hazards and strengthening the NMHSs capacity to deliver the services in full compliance with the users' demand. To this end, the Programme places its emphasis on building capacity of the Members especially SIDSs and LDCs, developing assistance tools for forecasters, facilitating application of Research and Development outcomes, promoting

cooperative activities of regional TC bodies, enhancing coordination among the regional services, and taking a multi-hazard approach inclusive of flooding and storm surge. It also makes a closer link with relevant WMO Programmes and international agencies which are concerned with tropical cyclone disaster mitigation.

3. Governance

The technical guidance for the Programme is provided by WMO Regional Associations concerned, regional tropical cyclone bodies and the Commission for Basic Systems, with regard to RSMC with activity specialization in tropical cyclones. In addition, the Executive Council Working Group on DRR and Service Delivery also provides overall guidance in matters related to tropical cyclone disaster risk reduction and service delivery.

4. Programme structure

The activities of the Programme are implemented mainly through the two major components of the Programme:

(1) The general component which is focused on capacity-building and transfer of technology, information and expertise to the Members towards meeting the objectives of the Programme. It also encompasses the broader training requirements of the Members;

(2) The regional component which comprises the planning and implementation of the programmes of the regional TC bodies. Each of the five regional bodies has an operational plan or manual which aims to provide the best possible forecasting and warning services through regional agreements and cooperation. These plans are regularly updated to incorporate new facilities, advances and developments.

MARINE METEOROLOGY AND OCEANOGRAPHY PROGRAMME

1. Main long-term objectives

The long-term objectives of MMOP are:

(i) To enhance the provision of marine meteorological and oceanographic services by Members in support of the safety of life and property at sea and in coastal areas. Based on an integrated observing and data management system, the MMOP is to contribute to sustainable marine environment and coastal area management including risk management for ocean-based economic, commercial and industrial activities; and to coordinate and enhance the provision of the data, information, products and services required to support climate research and the detection and prediction of climate variability;

(ii) To manage the evolution of an effective and efficient programme through the selective incorporation of advances in meteorological and oceanographic science and technology; and to work to ensure that all countries have the capacity to benefit from and contribute to these advances, and to contribute to the implementation of the programme in general.

2. Purpose and scope

The MMOP seeks to coordinate, and develop and recommend standards and procedures, for a fully integrated marine observing, data management and services system that uses state-of-the-art technologies and capabilities. The Programme aims to maximize the benefits to Members in the projects, programmes and activities that it coordinates in their interest and that of the global marine

community in general. Thus the scope of MMOP is defined in responding to the evolving needs of all users of marine data and products, and includes an outreach programme to enhance the national capacity of all maritime countries –safety at sea has remained the priority, while other applications such as coastal area management, disaster risk reduction, and climate services has became increasingly important.

3. Governance

The overall technical guidance and governance for MMOP is provided by the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), jointly sponsored by WMO and the Intergovernmental Oceanographic Commission (IOC) of UNESCO.

4. Programme structure

The MMOP is implemented primarily through JCOMM, which is structured into three Programme Areas and a number of cross-cutting activities, aimed at improving overall marine and ocean service delivery capacities of Members:

1. Services and Forecasting Systems Programme Area, including maritime safety services, marine pollution emergency response, sea ice, waves and storm surges, ocean forecasting systems, and a range of marine climate services;

2. Observations Programme Area, involving an integrated global marine meteorological and oceanographic observing system;

3. Data Management Programme Area, coordinating and providing standards and best practices in the management of marine meteorological and oceanographic data, as a contribution to WIGOS/WIS;

4. Capacity Development and Outreach, to enhance the capacity of all Members to contribute to and benefit from the data and services delivered under MMOP;

5. Satellite Data Requirements, to determine the detailed requirements for satellite and other remote sensing ocean data in the delivery of marine and ocean services;

6. International coordination, within the UN system, with other intergovernmental and non-governmental organizations, with the marine user community, and with the private sector in general.

WMO QUALITY MANAGEMENT FRAMEWORK

1. Purpose and scope

WMO has encouraged Member NMHSs to implement an end-to-end Quality Management System (QMS) covering all activities from raw measurements and observations to services delivered to end users. To this end, the WMO Secretariat has developed a Quality Management Framework (QMF) and has tasked an Inter-Commission Task Team (ICTT) with the development and implementation of this Framework for National Meteorological Services (NMSs) to address:

(a) WMO technical standards;

(b) Quality management system(s) including quality control;

(c) Certification procedure(s).

The **WMO Quality Management Framework** is an appropriate holistic approach to the delivery of meteorological, climatological, hydrological, marine and related environmental data, products and services.

The **aim** of the WMO Quality Management Framework is to ensure the development, use and maintenance of the WMO technical documentation, supporting quality management systems for meteorological, climatological, hydrological, marine and related environmental data, products and services.

It consists of the following **key elements**:

(a) A WMO quality policy;

(b) Objectives aligned with the WMO Strategic Plan;

(c) Technical documentation and the procedures relevant to their development, review and adoption.

2. Structure and governance

The Inter-Commission Task Team on QMF (ICTT-QMF) reports to the Executive Council and is currently chaired by Mr Yap Kok Seng (Malaysia). Within the WMO Secretariat, the Chief of the Aeronautical Meteorology Division (C/AEM) is the officer in charge of QMS, whereas the Director of the Observing and Information Systems Department (D/OBS) is in charge of the relationship to ISO and matters of Technical Standards.

3. Cooperation with and implementation by technical commissions

All technical commissions have nominated experts as a minimum, or expert/working groups to interact with the ICTT-QMF. In particular, the following technical commissions are active in implementing QMS for data, products and services:

(a) CAeM has successfully completed a Pilot Project for the implementation of QMS in a developing country (United Republic of Tanzania) for services to aviation);

(b) JCOMM is actively taking steps to implement a QMS for MET-OCEAN data, products and services (Recommendation 8 (JCOMM-III) refers). It was noted that the Australian Bureau of Meteorology has commenced the development and implementation of a QMS for the delivery of Marine Weather and Ocean Services as a pilot project on behalf of JCOMM;

(c) CBS has decided that QMS must be an integral part of the WIGOS, and that it would form a core component of the service-oriented parts of the Commission such as PWS or GDPFS;

(d) CHy has chosen both standardization of measurements and observations and the status of regulatory documents as priority areas of their QMS initiatives;

(e) CIMO has taken a lead in developing new Technical Standards in cooperation with ISO. The instruments and methods of observation used form the essential basis for QMS on the data input for all WMO Programmes and activities;

(f) CCl has taken the decision to apply QMS to climate observations, data exchange, database and service delivery, publications, capacity-building and research;

(g) CAS has chosen its GAW Programme as a lead for QMS;

(h) CAgM has nominated a Rapporteur for QMS.

INFORMATION AND PUBLIC AFFAIRS PROGRAMME

1. Overall objective

The over-arching goal of the WMO Information and Public Affairs Programme is to win political and public support for the Organization and its Members to enable them to better serve society. In the pursuance of that goal, corporate communications mirror the evolving priorities and mandates set by Members for the Organization.

2. Message

Strategic core message:

WMO fosters user-friendly science to help provide services vital for the everyday lives of people

Derived messages:

- *WMO facilitates solutions to protect lives and livelihoods and to improve the quality of life for people everywhere, through better science in weather, climate and water domains.*
- *The activities of WMO and the NMHSs are vital investments in human, social and economic development, with big returns for society.*
- *The WMO is a responsive organization dedicated to serving the people, by working together with governments, business and civil society*.

3. Purpose and scope

The preamble of the WMO Convention as amended by Cg-XV reflects the growing social and economic role of WMO and NMHSs in managing issues connected with weather, climate and water. WMO is named as a principal actor in saving and protecting lives and property as well as helping to safeguard future generations. The vital importance of NMHSs is reaffirmed in providing services in support of the protection of life and property, the environment, and sustainable development, among other national needs.

The increase in extreme weather events (floods, droughts, storms and other hazards) caused by climate change has generated unprecedented curiosity of the public in the causes of such events and broadens possibilities of creating a better understanding of the weather and climate system. This context fosters people's interest in science-based services for the protection of lives and livelihoods.

The IPCC controversy and the hacking of climate data bear witness to the need for more dynamic communications to educate the media and help the public distinguish "good science" from "bad science." The WMO scientific community should coalesce in reacting to manipulations of science by enhancing climate literacy of the public through explanations in layman's language and playful tools.

Unlike campaigners, WMO's advocacy does not aim at preventing or promoting specific attitudes. Instead it highlights the value-added to the quality of people's lives by the work of WMO and NMHSs. It is intent based rather than campaign based.

4. Governance

The IPA Programme supports all WMO and NMHS activities by providing timely, relevant and science-based information in the appropriate format and style to decision-makers and the public at

large. It reports to the Executive Council, which provides guidance as part of its oversight of WMO strategy implementation.

5. Implementation activities 2012–2015

During the period, a project proposal, including the consolidation of the WMO web presence, will be developed and resources mobilized to build awareness on weather, climate and water issues and WMO and its Members contribution to the sustainable development of nations, with a special focus on:

(a) Illustrate how people in their everyday lives benefit from the work of National Meteorological and Hydrological Services (NMHSs) and cooperation among them;

(b) Build awareness of and support for the Global Framework for Climate Services among media, decision-makers and civil society;

(c) Demonstrate how early warning systems and risk reduction management protect people against weather and climate related disasters, with a focus on reaching the most vulnerable nations and communities;

(d) Attract investments in weather, climate and water observations, research and applications, using new communication tools to establish interactive relationships with clients in order to encourage effective and beneficial use of WMO services.

The main focus will be to ensure that WMO and the NMHSs take advantage of the raising awareness and interest in weather, climate and water issues to consolidate leadership at all levels and across disciplines, especially in connection with the development and implementation of the GFCS, by:

(a) Encouraging direct interaction with the public, in particular through climate information and services that inspire interest in specific areas of work;

(b) Building upon WMO science which brings added value to ordinary lives, which helps identify best choices in the face of a changing climate, thanks to WMO's singular strength of its 189 Members acting in a coherent and collaborative manner;

(c) Developing a communication product that provides concrete examples of the socio-economic returns of the work of NMHSs and encouraging the integration of meteorological, hydrological and climate information in planning and decision-making;

(d) Tying together the WMO (Secretariat, Members, Regional offices and the NMHSs), partners within the United Nations system, other international and regional entities, both intergovernmental and non-governmental, private sector and grassroots associations and civil society at large (including schools and other social groups) to promote the benefits of integrating climate information in planning and decision-making;

(e) Responding to the least developed country (LDC) special needs centred on communication capacity-building in NMHSs and the media.

In accordance with the Strategic and Operating Plan, activities of the Information and Public Affairs Programme include, inter alia, the following:

(a) Provision of strategic advice, initiatives and programmes to influence decision-makers, and improve public awareness on weather, water and climate-related issues;

(b) Building alliances with media and improving outreach through media campaigns, press conferences, and supporting print and audiovisual materials;

(c) Enhanced knowledge management and promotion of WMO issues through its Web site, including: consolidation of the existing overall WMO web presence; strengthening of the Media centre component; development of initiatives incorporating social media, youth and outreach to developing countries;

(d) Editorial development, production and promotion of the WMO Bulletin, MeteoWorld and brochures for the public, so that this information targets audiences appropriately, and supports strategic communications needs of WMO and Members;

(e) Fostering a communications culture within WMO and NMHSs, including through provision of training for media, web and social media initiatives;

(f) Celebration of the annual World Meteorological Day in a way that supports NMHSs and furthers strategic goals,

(g) Development, implementation and/or participation in promotional events and exhibitions. Creation of supporting materials such as calendars, displays, audio-visual presentations, etc.

VOLUNTARY COOPERATION PROGRAMME

1. Long-term objective

The main long-term objective of the WMO Voluntary Cooperation Programme (VCP) is to provide timely and effective technical assistance to Members by ensuring and furthering:

(a) Coordinated support to high-priority VCP projects by donors;

(b) Members' participation in the VCP Programme;

(c) Effective management and operation of the VCP Programme.

2. Purpose and scope

The main purpose of the WMO Voluntary Cooperation Programme (VCP) is to assist Member countries through cooperative efforts of Members to complement implementation activities for WMO scientific and technical Programmes under national programmes, bilateral or multilateral programmes, Trust Fund arrangements and the United Nations Development Programme (UNDP).

The VCP provides, inter alia, for support to be given to Member countries at their request either in the form of equipment and services, including training, contributed on a voluntary basis by Member countries or by direct financing, using financial contributions obtained on the same basis.

3. VCP governance

The technical guidance for the VCP is provided by the Executive Council and its subsidiary bodies. The EC collaborates closely with the presidents of regional associations and technical commissions as well as contributors to the VCP on technical cooperation activities.

EDUCATION AND TRAINING PROGRAMME

1. Overall objective

The overall objective of ETRP is to assist the National Meteorological and Hydrological Services (NMHS) of Member States develop staff with the competencies (knowledge, skills and behaviors) required to deliver the meteorological, hydrological and related services mandated by their Government and that help meet their international obligations.

2. Purpose and scope

To assist Members develop and utilize education and training resources in meteorology and hydrology, and to assist in coordinating the setting of international standards for this education and training.

Assist Members, particularly Least Developed Countries (LDCs) and Small Island Developing States (SIDSs), facing difficulties in providing national initial and ongoing meteorological and hydrological education and training of their staff through bi- and multi-lateral activities. The institutions in which the education and training activities are carried out include WMO Regional Training Centres (RTCs), national meteorological training institutions, the training units of Meteorological Services, universities and research centres.

The activities of the ETRP encompass the following broad approaches:

(a) Develop and review the standards required for education and training of Meteorologists, Meteorological Technicians, Hydrologists or Hydrological Technicians in line with changing international regulations, technical and educational and societal demands;

(b) Liaise with the WMO Technical Commissions in the development of the competencies (knowledge, skills and behaviors) required for the specialist areas overseen by each of the Commissions;

(c) Assist NMHSs develop adequately trained staff to provide meteorological, climatological and hydrological related information and services;

(d) Promote capacity development by assisting NMHSs become self-sufficient in meeting their education and training needs and developing their human resources;

(e) Promote and strengthen the development and exchange of education and training knowledge, resources and expertise between Members, making particular use of relevant technologies and techniques such as e-learning;

(f) Promote high-quality continuing education in meteorology, climatology, hydrology and related disciplines to update the knowledge and skill of NMHS staff in line with scientific, technological and educational advances and innovations;

(g) Assist in the education of the public, governments and other interested parties regarding the societal socio-economic benefits of meteorological, hydrological, oceanographic and related services.

These approaches will ensure that the high priority activities of aviation services, WIS and WIGOS, GFCS and Disaster Risk Reduction are supported by the development and execution of appropriate education and training programmes.

3. ETRP governance

Oversight for the ETRP is provided by the WMO Executive Council.

4. ETRP structure

ETRP consists of four interdependent components:

(a) Human resources development;

(b) Training activities;

(c) Education and training fellowships;

(d) Support to training events under other WMO Programmes.

4.1 Human resources development

Purpose and scope: To provide a framework for assessing the present and future needs of Members for educated and trained personnel. This framework provides an objective basis for planning and setting priorities, as well as assisting and providing advice to Members. The activities under this component will contribute to the implementation of Expected Result 6 through an enhancement of the management capabilities of personnel in Member States, particularly those from NMHSs.

Long-term objective: Human resource development in NMHSs is supported through a coordinated, priority driven, approach.

4.2 Training activities

Purpose and scope: To contribute to the education and training process with respect to training centres, in particular RTCs, through provision of training materials, instructors and management of training events, and by acting as the interface between Meteorological and Hydrological Services and the international meteorological and hydrological education and training community. The activities under this component will contribute to the implementation of Expected Result 6 by an enhancement of the capabilities of education and training personnel in Member States, particularly those from NMHSs.

Long-term objectives:

(a) More effective use of training materials and technologies, including distance learning techniques is made by Members;

(b) RTC training activities meet more Member demands;

(c) More effective, and wider, utilization by user sectors of meteorological and hydrological information and services.

4.3 Education and training fellowships

Purpose and scope: To assist Members educate and train meteorological and hydrological personnel through funding and organization of specially tailored individual and group study training programmes, including management and familiarization visits/study tours for senior personnel. This component focuses on the provision of long-term and short-term fellowships to NMHS personnel. The activities under this component will contribute to the implementation of Expected Result 6 by an enhancement of the number of qualified personnel in Member States, particularly those from NMHSs. Education and training is mainly provided in subject areas and technologies for which the facilities and teaching expertise are not available at home. Emphasis continues to be placed on using, as a first priority, the training facilities within the regions concerned, in particular those of the RTCs.

Long-term objective: Human resources in NMHSs are strengthened through the implementation of short- and long-term fellowships.

4.4 Support to training events under other WMO Programmes

Purpose and scope: To monitor, coordinate and assist the planning of training events implemented by Members or the Secretariat under other WMO Programmes which include specific training responsibilities. The scope of the component therefore extends to collaboration and interaction with the other major Programmes of the Organization. The activities under this component will contribute to the implementation of Expected Results 1 to 6 by an enhancement of the capabilities of personnel in Member States in specialized areas, particularly those from NMHSs.

Long-term objective: Education and training activities are coordinated across all WMO Programmes.

WMO PROGRAMME FOR THE LEAST DEVELOPED COUNTRIES

1. Overall objective

The overall objective of the Programme is to enhance the capacities of the NMHSs of the LDCs including those which are SIDS, so that they can contribute efficiently and in a timely manner to the socio-economic development efforts of the countries concerned through the production, delivery and effective use of relevant weather, water and climate information and services in order to eradicate poverty, achieve internationally agreed development goals and enable graduation from the least developed country category.

2. Purpose and scope

In support to the Istanbul Programme of Action for the LDCs for the decade 2011–2020, adopted by the Fourth United Nations Conference on the LDCs, the WMO Programme for the LDCs will contribute to the following strategic and specific areas:

(a) Building viable national productive capacity in all sectors, particularly infrastructure, energy, transport and other weather and climate sensitive sectors;

(b) Promote agriculture, food security and rural development strategies that strengthen support for smallholder farmers and contribute to poverty eradication;

(c) Invest in basic services for health, education, water and sanitation;

(d) Strengthen the resilience of LDCs by reducing their vulnerability to economic, natural and environmental shocks and disasters, as well as climate change and, enhancing their ability to meet these challenges, particularly climate change adaptation and mitigation;

(e) Promote science and technology for peaceful and development purposes including strengthening national and regional institutions, as appropriate and in line with LDCs' national development priorities;

(f) Strengthen the global partnership and public-private partnerships for inclusive economic growth and sustainable development of LDCs.

The resources mobilized within the framework of this Programme, including those available from the Trust Fund for the NMHSs of Least Developed Countries (established by Cg-XIV), will be used to support the NMHSs of the LDCs to enhance their capabilities to participate and contribute actively to priority areas such as agriculture, food security and rural development, disaster risk reduction, health, water resources management and climate change adaptation and mitigation. Specific projects will be developed for individual LDCs and on a subregional basis for countries in Africa, Asia and the Pacific.

3. Governance

Overall guidance for the LDC Programme is provided by the Executive Council as part of its oversight of capacity-building activities.

4. Implementation activities 2012–2015

During the period, project proposals will be developed and resources mobilized to assist the LDCs to:

(a) Raise the profile of NMHSs with the national development outcome and increase government and stakeholders support to the NMHSs, through advocacy and institutional capacity-building, among others;

(b) Improve the infrastructure and operational facilities of NMHSs in LDCs;

(c) Enhance regional cooperation in the countries concerned, especially in areas such as training and the production, delivery and effective use of weather and essential climate services;

(d) Share good practices and experiences.

The main focus will be to ensure that NMHSs are able to address adequately such issues as the relevant priority areas for action in the Istanbul Programme of Action for the LDCs, particularly productive capacity sectors, agriculture, food security and rural development, disaster risk reduction, water resources management and climate change and environmental sustainability.

In accordance with the Strategic and Operating Plan, activities of the Programme include, inter alia, the following:

(a) Assistance to all the LDCs in the preparation and implementation of development plans of their NMHSs based on the priority needs of countries;

(b) Development of technical cooperation projects and programmes on infrastructure development and socio-economic benefit valuation, climate change issues, including fast track projects;

(c) Provision of support in the area of human resources development through special training of selected staff;

(d) Development of capacity-building activities, including planning, management and resource mobilization;

(e) Resource mobilization and technical assistance for the development of NMHSs activities.

REGIONAL PROGRAMME

1. Background

The WMO First Congress (1951) established six WMO Regions with related Regional Associations (RAs). The Regional Programme (RP) aimed at facilitating a regional approach to the implementation of WMO Programmes and activities, was first introduced by Seventh Congress (1975). As a cross-cutting programme, the RP contributes to all Expected Results of the WMO Strategic Plan, with its main focus on ER 6 of the WMO Strategic Plan 2012–2015.

2. Overall objective

The overall objective of the RP is to ensure the efficient and effective functioning of the six RAs of the Organization in coordinating meteorological, hydrological, climatological and related activities of their Members. The RP provides a framework for regional cooperation in the implementation of the WMO strategies, policies and programmes taking into account regional requirements, capacities and priorities.

3. Purpose and scope

3.1 The RP provides support to the six RAs. The regional associations play a key role in planning and coordinating the regional activities, aligning them with the WMO Strategic Plan and the other WMO technical and scientific programmes, ensuring a harmonized and synchronous implementation effort by Members. RAs should play an important role in monitoring and evaluation of the implementation activities of their Members, establishing suitable baselines and measuring performance.

3.2 The RP ensures that in the planning, implementation and evaluation of the scientific and technical programmes of the Organization, the particular needs and capabilities of Regions are recognized and considered, taking into account the best interests of the Organization as a whole. The activities under the RP provide significant assistance in addressing regional aspects and

integrating them within the entire scope of the work of WMO, particularly in strengthening the role and operation of NMHSs at the national and regional levels to enable them to fulfil their mandates and provide adequate response to emerging challenges.

3.3 The RP is a cross-cutting programme involving all Members, RAs and TCs. It provides a two-way interface between the Members and the WMO Secretariat to allow for streamlined expert assistance to Members, particularly developing and Least Developed Countries, and for feedback on best practices and lessons learned. The RP identifies the need for and fosters the establishment of Regional Centres to serve Members in different fields, such as, numerical weather prediction, climate, instruments, education and training. The regional basic observing networks (RBSN/RBCN) are also coordinated through the RP mechanisms in coordination with CBS and the WMO Secretariat, taking into account the Global Framework for Climate Services (GFCS).

3.4 Through the RP, WMO establishes and maintains links and partnerships with relevant regional and subregional organizations, inter-governmental and economic groupings in the Regions. In this way it promotes WMO activities, contributes to the implementation of the WMO strategic objectives, and provides tools needed to effectively address regional, subregional and national issues of importance to society.

3.5 The RP accounts for the wide range in development levels of the countries in the various WMO Regions resulting in large differences in the capacities of the respective NMHSs. In this regard, RP, as part of the WMO capacity development effort, focuses on the assistance given at regional level that is needed to bridge gaps in the capabilities of all Members, especially LDCs, SIDS and countries in transition to produce, utilize and benefit from hydrometeorological information, products and services, as called for by WMO strategies, standards and recommended practices.

4. Governance

The overall guidance and direction of the RP is provided by the regional associations and, during the intersessional periods, the oversight of the regional activities is carried out by the presidents of the regional associations, assisted by their respective management groups. The regular meetings of the presidents of RAs allow for the inter-regional coordination of the Programme.

5. Programme structure

5.1 The RP consists of two interdependent functional areas, as follows:

(a) Regional associations activities:

- Institutional support to RAs;
- Regional events;

(b) Regional cooperation and partnership:

- Coordination of capacity development activities in the Regions;
- Cooperation with regional partners.

5.2 The RP supports the organization and conduct of the RA sessions which decide on ways of coordinated implementation of the WMO Programmes and strategies in the respective Regions and develop regional operating/action plans to address priority tasks through coordinated implementation efforts of its Members. The RAs have emphasized the need for capacity

development of its Members, including activities taken by individual or groups of Members on behalf of the Region, coordinated through the RP. In order to pursue the tasks during their intersessional periods, RAs develop appropriate work structures for its subsidiary bodies such as working groups, task teams, networks and forums, engaging the available expertise of its Members based on the principle of volunteerism. The RP supports the activities of RA's subsidiary bodies and plays an important role in ensuring consistency between the WMO Strategic Plan, technical programmes and respective regional activities. The RP provides technical and logistics support to the related RA activities in order to ensure achievement of planned key outcomes.

5.3 In each WMO Region there are a number of international organizations, inter-governmental agreements, regional economic groupings, development agencies, and NGOs, whose objectives and activities are related to those of WMO. The RP works towards establishment of close cooperation and partnership with those organizations in order to find synergies, possibilities for financing projects and provision of technical assistance to Members in the Region. The RP accounts for the representation of WMO in different inter-agency and inter-governmental meetings at regional and subregional level, thus, contributing to a better visibility of WMO and the NMHSs and emphasizing their role an in the development agenda.

5.4 WMO Regional Offices support the RP and other Programmes as appropriate. The Regional Offices include a number of offices located in Sub-Regions for closer coordination of regional activities with Members and development partners. The RP contributes to capacity development efforts, through the Regional Offices and WMO Offices in the Regions, by maintaining close relations with all Members, by acting as point-of-contact between Members and the WMO Secretariat. One of the main tasks of these Offices is to advocate the role of the NMHSs and the need for support from the governments to sustain and enhance their operations. A major task in the advocacy effort is to demonstrate the socio-economic benefits of the weather, climate and water services and promote the need to invest in necessary infrastructure, as well as in related research and development. The RP puts emphasis on strengthening the national and regional institutional frameworks, legislation and regulations, in order to ensure sustainability of NMHSs and their continuous improvement.

DISASTER RISK REDUCTION PROGRAMME

1. Long-term objective

The main long-term objective of the WMO DRR Programme is to contribute to the strengthening of institutional capacities with respect to the provision of meteorological, hydrological and climate services and cooperation in supporting disaster risk management for the protection of lives and property and contributing to sustainable development of Members.

2. Purpose and scope

The purpose of the WMO DRR Programme is to assist Members to provide and deliver services that are directed towards the protection of lives, livelihoods and property, in a cost-effective, systematic and sustainable manner.

The scope of the Programme is defined through its five strategic goals underpinned by the Hyogo Framework for Action 2005–2015 and approved by Cg-XV:

(a) Development, improvement and sustainability of early warning systems in particular related to scientific and technical infrastructures, systems and capabilities for research, observing, detecting, forecasting and warnings of weather-, water- and climate-related hazards;

(b) Development, improvement and sustainability of standardized hazard databases and metadata, systems, methods, tools and applications of modern technologies such as geographical information systems for recording, analysing and providing hazard information for risk assessment, sectoral planning, risk transfer and other informed decision-making;

(c) Development and delivery of warnings, specialized forecasts and other products and services that are timely, understandable to those at risk and driven by requirements of disaster risk reduction decision processes and operations engaging socio-economic sectors;

(d) Stimulate a culture of resilience and prevention through strengthening of capacities for better integration of meteorological, hydrological and climate' products and services in disaster risk reduction across all socio economic sectors, such as land use planning and infrastructure design and continued public education and outreach campaigns;

(e) Strengthening cooperation and partnerships of WMO and NMHSs in national, regional and international user forums, mechanisms and structures for implementation of disaster risk reduction.

3. Governance

The guidance and oversight to the DRR Programme is provided by the Executive Council Working Group on Service Delivery (EC WG SD). The implementation of the Programme engaged a number of inter-commission task teams, with experts drawn from CBS, CHy, CCl, JCOMM and CAgM.

4. Programme structure

The DRR Programme is cross-cutting and is implemented through coordination among WMO Members, regional associations, WMO Technical Programmes and Commissions, WMO global operational components (GDPFS, WIS, WIGOS), other UN international and regional humanitarian and development partners and the regional inter-governmental disaster risk management agencies linked to the UN-ISDR System. Specifically, the implementation of the DRR Programme is built upon strong cooperation across a number of programmes such as WWW, HWR, WCP, TCP, PWS, MMOP, and AgM. The Programme is implemented through regional and national projects based on a project management framework and set of criteria approved by the WMO EC-LXII.

Implementation of resource mobilization in support of the crosscutting DRR Programme is coordinated through the WMO resource mobilization office, with consideration for:

(a) The development of DRR Programme implementation priorities based upon the WMO’s Strategic and Operating Plans;

(b) Identification of strategic donors, understanding of their priorities and interests in investing in DRR projects in different regions and their engagement in the projects from early stages of assessments and project identification;

(c) Realization of post-disaster funding opportunities such as the UN Flash Appeal led by UN-OCHA and the Post Disaster Needs Assessment (PDNA) and reconstruction planning, led by UNDP–World Bank–European Union.

AERONAUTICAL METEOROLOGY PROGRAMME

1. Main long-term objective

The Aeronautical Meteorology Programme has the objective of furthering the application of meteorology to aviation by providing aviation stakeholders with operational meteorological information required for a safe, regular and efficient air navigation considering also the mutual impact of aviation, the global environment and, in particular, climate change.

2. Purpose and scope

The AeMP promotes improvements in the capabilities of Members, particularly in developing countries and those in transition, through technology transfer and capacity-building, so as to enable them to serve international and national civil air navigation and to meet the requirements for such services as defined by the relevant bodies of ICAO, national meteorological authorities and civil aviation authorities. The education and training component of the programme, in close cooperation with the relevant programmes of WMO and the ICAO, continually reviews the changing competency requirements of personnel in aeronautical meteorology, and maintains a competency assessment toolkit to enable Members to monitor, verify and document the competency of their personnel. The governance and partnership element of the programme provides guidance material, exchange of best practice models, documentation and training to Members encountering difficulties in providing services to the required standards. These activities include guidance on verification and evaluation of products, individual assistance in difficult cases, and fostering of regional cooperative agreements through relevant Task Teams of regional associations. Close liaison is maintained with ICAO, regulators and Air Navigation Service Providers to translate scientific progress into operational benefits. Areas of work will include new net-centric information systems, up-linking ground- and space-based observations as well as nowcast products to aircraft and ATM units, and issues of Volcanic Ash and Space weather. Estimating impacts of climate change on aviation operations with services helping to adapt to such changes are another area of future priorities.

3. Governance

The constituent body providing technical guidance to the programme is the Commission for Aeronautical Meteorology which meets every four years, and holds conjoint meetings with the relevant ICAO body typically every 12 years.

4. Programme structure

The programme is implemented by expert teams or experts in the following areas:

1. Education and Training;
2. Development of an Aeronautical Forecaster Competency Assessment Toolkit;
3. User Needs for Meteorological Services in the Terminal Area;
4. Governance and Partnership;
5. Coordination of Implementation Activities;
6. Space Weather;
7. Operational Meteorological Data Exchange;
8. Aviation and the Environment.

ANNEX III
Annex to paragraph 3.6.13 of the general summary

FINANCIAL ARRANGEMENTS FOR THE JOINT CLIMATE RESEARCH FUND

1. A special account, to be known as the Joint Climate Research Fund (JCRF), will be established by the Secretary-General of WMO, in accordance with Articles 9.7 and 9.8 of the WMO Financial Regulations. Contributions to the Fund will normally be made in equal amounts by WMO, IOC and ICSU (through national contributions). Each organization may unilaterally subscribe an additional amount to the Fund.

2. The administration of the Fund shall be the responsibility of the Secretary-General of WMO, according to the procedures described below.

3. Unless otherwise specified below, the WMO Financial Regulations shall apply, including the arrangements for external audit.

4. Biennial contributions assessed on the parties shall be paid in equal instalments to the JCRF.

5. Budget estimates for activities of the JSC and its supporting staff in the following biennium shall be prepared by the Joint Scientific Committee, and submitted for approval to the executive bodies of WMO, IOC and ICSU by their respective Executive Heads. Should there be any divergence between the level of biennial appropriations approved by the respective executive bodies, then the lowest approved level shall prevail. However, if one of these bodies is prepared to fund at a greater level without matching funds from the other organizations, the total level of appropriations may exceed that jointly agreed upon.

6. Disbursements from the Fund shall be made only upon the financial authority of the Secretary-General of WMO, in conformity with the recommendations of the JSC, with the provisions of this Agreement and with any relevant decision which may be taken by the executive bodies of the sponsoring organizations.

7. The Fund shall be maintained on a continuous basis and amounts standing to the credit of the Fund at the end of any biennium shall remain in the Fund, for re-appropriation to the corresponding parts of the JCRF budget. The WMO will produce a statement of the account of revenue and expenditure of the Joint Climate Research Fund for each biennial financial period and will submit this statement to ICSU and IOC no later than the first day of April in the following year.

Supplementary estimates

8. Supplementary estimates, prepared in the same form as that of the applicable portions of the estimates for the biennium, may be submitted by the Secretary-General of WMO. Subject to the concurrence of the Secretary of IOC and the Secretary-General of ICSU, these estimates shall be submitted to the respective executive bodies of WMO, IOC and ICSU for approval.

9. Additional contributions or grants to the JCRF from sources other than WMO, IOC or ICSU may be accepted by the Secretary-General of WMO provided that the purposes of such contributions or grants are to support activities consistent with the aims and interests of the sponsoring organizations. The specific activities funded from such additional grants will be considered as increases of the total level of expenditure approved for the JCRF.

Liquidation of the assets of the Joint Climate Research Fund

10. Should either the activities of the Joint Scientific Committee or the commitment of one of the parties concerned, i.e. WMO, IOC, or ICSU, be brought to an end, then the remaining balance of the JCRF, after the settlement of all financial commitments by the Secretary-General of WMO,

will be shared between WMO, IOC and ICSU or their liquidating authorities, in proportion to their respective contributions to the Fund.

Administration of the JCRF

11. The Secretary-General of WMO shall be responsible for the provision of services to the Joint Scientific Committee and its supporting staff within the cash resources available in the JCRF, and in accordance with the procedures approved by the executive bodies of WMO, IOC and ICSU. The Secretary-General of WMO will consult the Executive Heads of IOC and ICSU on any important questions that may arise.

Travel arrangements

12. Travel and subsistence expenses authorized for payment from the Fund shall be in conformity with WMO rules and regulations. All travel costs charged to the Fund shall be in accord with the programme established by the JSC. Travel authorizations shall be issued by the Secretary-General of WMO.

Logistic support

13. Indirect support costs and administrative services provided within the WMO Secretariat will normally be provided by WMO, from the resources approved for this purpose in the regular WMO budget.

Other provisions

14. These Financial Arrangements may be modified at any time by mutual agreement between WMO, IOC and ICSU, provided that no modification would result in conflict with applicable WMO Financial Regulations.

15. In case of doubt as to the interpretation or application of any of the present provisions, the Secretary-General of WMO is authorized to rule thereon, subject to prior consultation with the Secretary of IOC and the Secretary-General of ICSU.

ANNEX IV
Annex to paragraph 3.7.11 of the general summary

GLOBAL PREPAREDNESS FOR SPACE WEATHER HAZARDS

The participants in the Cg-XVI Side Event on Space Weather acknowledged:

- The increasing risks of Space Weather events to all WMO Members due to the increasing reliance on advanced technologies;
- The diversity of sectors impacted by Space Weather, including: navigation, communication, electric power, pipelines, satellites, and aviation, as well as the impacts on core meteorological observations;
- The actions being taken today by industries and governments to prepare for, and respond to, Space Weather storms and related indirect hazards;
- The progress already achieved in establishing ground-based and space-based observing networks;

- The progress already achieved in establishing a framework of Space Weather prediction and service centres;

- The need for coordinated near-term and far-term actions in order to plan and implement capabilities that will meet regional and global Space Weather requirements, as identified in the WMO Rolling Review of Requirements (RRR) in a sustained, comprehensive, robust, efficient and integrated fashion;

- The capacity of WMO Members to contribute to a globally coordinated system of observations and services, relying on their national R&D and operational assets, as well as on international partnerships;

- The benefits that can accrue to all WMO Members from increased WMO coordination of Space Weather activities;

- The need to raise awareness, advocate the benefits, and provide training so that WMO Members can take advantage of coordinated Space Weather activities.

The participants in the Cg-XVI Side Event on Space Weather therefore recommended:

- To develop and implement near-term and far-term action plans that will enable Members to determine needs and requirements, and to benefit from existing services;

- That WMO Members will contribute, where possible, to enhance regional and global capabilities, including observation collection and information delivery;

- That Cg-XVI request the development of action plans, including training and education, and the implementation of a coordinated strategy for Space Weather.

ANNEX V
Annex to paragraph 4.1.4 of the general summary

THE WMO STRATEGY FOR SERVICE DELIVERY

PURPOSE OF THIS DOCUMENT

The purpose of this document is to provide a World Meteorological Organization (WMO) Strategy for Service Delivery that will assist National Meteorological and Hydrological Services (NMHSs) in the provision of weather-, climate- and water-related services to the public and decision-makers. The Strategy incorporates assessment of user needs and the application of performance metrics.

While there is no prescriptive way to provide services, the Strategy serves as a foundation to improve service delivery by sharing best practices, supporting mutually agreed upon guidelines, and by increasing user engagement throughout the delivery process, recognizing the many differences in cultures, structures, operational practices, resource and development levels across NMHSs.

This Strategy, which is at once broad yet flexible, seeks to do two things: (1) serve as a tool for evaluating current service delivery practices; and, (2) serve as high-level guidance for developing more detailed methods and tools for better integrating users into the service delivery process. It is adaptable to the unique needs of providers in both developed and developing countries, regardless of who the users are and whether providers deliver public or commercial products and services.

The role of the WMO Secretariat in the implementation of this Strategy is to serve as facilitator and coordinator.

INTRODUCTION

The bottom line for most government organizations is their mission. To achieve the mission, organizations need resources, but resources are often in short supply and must be shared among competing organizations. This competition for scarce resources requires NMHSs to demonstrate their value by realizing cost efficiencies while delivering high-quality, useful products and services.

Policy-makers and the public continually assess the effectiveness of NMHSs based on their ability to meet the service delivery standards of the nations they serve. By incorporating the role of users and customers in day-to-day operations, those customers and users are more likely to receive services that meet their needs.

The ability of NMHSs to meet national service needs is put to its most critical test when an extreme hydrometeorological event occurs. Even the best forecast, issued on time, is no defense if, for various reasons, it did not generate the desired response from those at risk. In other words, the forecast had little impact. Most of the utility of weather-, climate-, and water-related information occurs in communicating the information to users and the response of those users based on information received. Ultimately, the utility of weather-, climate-, and water-related information is the degree to which it has a beneficial impact on societal and economic outcomes. If the currently available information is underutilized, value can be increased by improving the forecast, improving communication, and by improving the decision-making process. Effective service delivery, then, is about providing products and services that bring utility to users and customers.

Much has been done for service delivery by the WMO through various international and regional institutions, programmes and structures, such as World Meteorological Centres (WMCs) and Regional Specialized Meteorological Centres (RSMCs), to prepare and provide products to serve as a basis for NMHSs to use in the provision of services. Similarly, at the national level, many NMHSs have focused significant efforts on improving service delivery by building relationships with various user communities to better understand and respond to their needs.

The present Strategy seeks to build upon and institutionalize such practices to strengthen service delivery across the entire WMO by describing key strategy elements and activities related to a service-oriented culture. The Strategy focuses on understanding the users' value chain to gain knowledge about users, the decisions they must make, and how weather-, climate-, and water-related information is applied to minimize risk and realize benefits not only to a specific user group but also to society as a whole. With this knowledge, service providers are able to develop, produce and deliver services that are useful, relevant and responsive. NMHSs are able to measure the value of their information to society and continually evaluate and improve upon services. Adopting a more collaborative approach provides everyone in the service delivery process – providers, users, and partners – with a clear understanding of service needs.

LINK TO THE WMO QUALITY MANAGEMENT SYSTEM (QMS) FRAMEWORK

WMO encourages NMHSs to implement Quality Management Systems (QMS) and has defined a Quality Management Framework (QMF) to provide advice on development and use of QMS relevant to meteorological and hydrological organizations. The ultimate goal of a QMS is to encourage and to support the continual improvement of product and service quality, focusing on quality control, quality assurance and quality improvement.

Quality management assesses not only the final product or service but the series of steps or operations that occur for the final product or service to be produced and delivered in a manner that satisfies the customer. The insight gained through quality management allows NMHSs to find, fix, and prevent failure that might lead to a faulty product or service. In the context of weather services, for example, the processes that make up a weather forecast and service delivery are:

- Data collection and analysis;
- Modelling for prediction;
- Model interpretation and forecast production;
- Dissemination of products and services received by users;
- Understanding and use of forecasts.

To improve the quality of weather products and services, NMHSs must assess and analyse each step and sub-steps of the forecast process to determine where root problems may exist and how better to correct them. For example, QMS processes may find that a high-quality product is of marginal use because it is not received by the user in time for decision-making.

Improvements in service delivery, then, are a natural consequence of using QMS. The WMO Strategy for Service Delivery may be viewed as a supplement to the WMO QMF. Even if NMHSs have no internal or external requirement to apply QMS, this strategy stands alone as a useful tool to improve overall effectiveness of products and services and customer/user satisfaction.

AN EXAMPLE OF BASIC APPROACH TO QMS

The Malaysian Meteorological Service (MMS) has implemented a process-based QMS at the Kuala Lumpur International Airport (KLIA) Forecast Centre as a means of institutionalizing effective service delivery. MMS implemented a QMS to improve the provision of consistent products and services that meet customer requirements; to improve customer satisfaction through continuous process improvement; and to establish quality metrics to measure, review, and control the forecasting processes.

The top management of the MMS is responsible for the QMS processes and is constantly upgrading its effectiveness through:

- Identifying customer needs and ensuring customer/client satisfaction through questionnaires, feedback, and reviews;
- Regular communication with Regional Forecast Offices to ensure and fulfil customer satisfaction achieved through various avenues like meetings, staff discussions, training, etc.;
- Determining the quality policy and objectives;
- Conducting management reviews;
- Identifying and ensuring availability of resources like skilled personnel, infrastructure, finances, training and internal audit teams.

WHAT IS SERVICE DELIVERY?

Defining service delivery first requires a common definition of service, which this Strategy defines as a product or activity that meets the needs of a user or can be applied by a user. To be effective, services should possess these attributes:

- **Available and timely:** at time and space scales that the user needs;
- **Dependable and reliable:** delivered on time to the required user specification;
- **Usable:** presented in user specific formats so that the client can fully understand;
- **Useful:** to respond appropriately to user needs;

- **Credible:** for the user to confidently apply to decision-making;
- **Authentic:** entitled to be accepted by stakeholders in the given decision contexts;
- **Responsive and flexible:** to the evolving user needs;
- **Sustainable:** affordable and consistent over time;
- **Expandable:** to be **applicable** to different kinds of services.

Service delivery, then, is a continuous, cyclic process for developing and delivering user-focused services. It is further defined in four stages:

- **Stage 1: User Engagement** identifying users and understanding their needs, as well as understanding the role of weather, climate, and water-related information in different sectors;

- **Stage 2: Service Design and Development –** process between users, providers, suppliers, and partners of creating, designing, and developing services, ensuring user needs are met;

- **Stage 3: Delivery –** producing, disseminating, and **communicating** data, products and information (i.e., services) that are fit for purpose and relevant to user needs;

- **Stage 4: Evaluation and Improvement –** process to collect user **feedback** and performance metrics to continuously evaluate and improve upon products and services.

Specifically related to weather-, climate-and water-related services the following four principles embody effective service delivery:

- User engagement and feedback are essential in designing and delivering effective services;
- Sharing best practices leads to effective and efficient service design and implementation;
- Partnership with other international and regional organizations also engaged in delivering services is essential in maximizing the use of weather, climate and water information for decision-making;
- The concepts and best practices of service delivery are applied to all WMO activities and accepted by the entire WMO.

AN EXAMPLE OF COLLABORATION AMONG DIFFERENT AGENCIES

The National Oceanic and Atmospheric Administration (NOAA) and the National Science Foundation in the United States developed the Communicating Hurricane Information Program (CHI) to focus on advancing the understanding by decision-makers (e.g., emergency managers, elected officials) and the general public of hurricane outlooks, forecasts, watches, and warnings. The program illustrates how national agencies can partner to support integrated weather-society work that advances fundamental understanding and addresses agencies' needs in fulfilling their missions.

MOVING TOWARD A SERVICE-ORIENTED CULTURE

This Strategy defines six elements and associated high-level activities necessary for moving towards a more service-oriented culture. The elements should assist providers in identifying current areas of success, which may be shared as best practices across the WMO, and areas where improvements are needed. The elements and suggested activities described below serve as a framework to guide the development of implementation plans that provide more detailed processes, methodologies, and tools.

WORKING WITH USERS IN DESIGNING AND DEVELOPING PRODUCTS – THE LEARN THROUGH DOING (LTD) PROJECT OF CHILE

Since 2008, the Meteorological Service of Chile (DMC) has been working with the Public Weather Services Programme (PWSP) of WMO to implement the Learning Through Doing (LTD) project with the objective of enhancing Service Delivery to the fisheries, agriculture and transport sectors. The Project is based upon engaging users from these sectors with a view to determining their needs and requirements, and to design and produce improved products to meet those needs. It also focuses on enhancing the dissemination and communication channels to ensure that the users access products easily. Multidisciplinary teams have been formed between DMC and the user sectors to steer the implementation of the project.

For example, regarding the transport sector, services target the Los Libertadores Border Complex which serves daily flow of traffic between Argentina, Brazil, Paraguay, Uruguay and Chile. Users for meteorological products and services include the public transport services, tourists, freight transportation companies, and passengers. The needs of each of these users are different, which requires different products and services to meet their specific needs.

The new line of products designed, consists of daily weather forecasts and weather warnings. The full report including all the sectors is available at: http://www.wmo.int/pages/prog/amp/pwsp/Activities_and_Reports_en.html.

As of 2010 the project had developed 22 new meteorological products and services; improved professional and technical skills in designing and implementing products and services improvements; and enhanced dialogue and cooperation between users with the DMC, resulting in increased uptake of meteorological products and services.

Strategy Element 1. Evaluate User Needs and Decisions

At the core of effective service delivery is the user of weather-, climate- and water-related information. Users take many forms – from the general public to government ministries, military, and private industry. Many NMHSs serve customers and users in government, including disaster management, agriculture, transportation, health, and tourism. NMHSs may also engage with intermediaries, such as the media, who represent a user group or who further develop products and services for end-users. The role of the provider is to identify those users, including intermediaries, understand what they need, and how NMHSs can meet those needs, either individually or in partnership with other providers and partners. The evaluation of user needs is not a onetime requirement but a continuous and collaborative part of the service delivery process.

Key Activities for Accomplishing

Depending on the user group, the provider should develop regular opportunities to engage with users to discuss needs, and performance. These are opportunities for the provider to better understand the user's business, including: their mission and goals; the types of decisions made on a regular basis; how risk is managed; and how the provider's services may contribute.

Typical questions to ask of any user or customer are:

- What is your mission?
- How do you do it?
- What are your goals and how can we contribute?
- How do you use our services?
- How can we make it work better?
- What types of decisions do you have to make?
- What would help you make better decisions?
- How do you measure success?

Providers should facilitate communication and use of weather-, climate-, and water-related information, and in some cases, provide training on specific products and services. User engagement is also a good opportunity to discuss, promote, and facilitate interdisciplinary research and development efforts for user-specific products and services.

How to engage users will vary by user group and by country. Interactions may be formal or informal, in-person or virtual, and may occur through user forums, focus groups, workshops, meetings, conferences, surveys, correspondence, or face-to-face with individual users. Frequency will vary, but must be ongoing and most likely more than once a year. Engagement should include not only the users, but also partners, such as private sector organizations and the media, and other government organizations as necessary.

AERONAUTICAL METEOROLOGICAL SERVICES

Customer focus is the first and foremost of the quality management principles to be adopted by aeronautical meteorological service providers. Customer requirements are documented through relevant ICAO and national regulatory bodies, and the quality of services as perceived by the customers is monitored. The means to achieve this include verification and evaluation processes, the conduct of regular customer satisfaction surveys, liaison group meetings with representatives of the customers (e.g., pilots, dispatchers, air traffic personnel, civil aviation regulators, etc.) and visits to the operation facilities of airlines and to meteorological offices. User suggestions and feedback are formally recorded and followed up. A formal response is given to the user before a suggestion or feedback is considered closed. Specific to aviation, the liaison group meetings also provide a forum for considering and documenting agreements on local arrangements in the provision of the aeronautical meteorological services as stipulated in ICAO Annex 3 / WMO Technical Regulations [C.3.1]. This user engagement process also goes a long way in satisfying the audit requirements of the Quality Management System and aviation safety oversight.

Services for airports could be considered an area for improvement. These are not covered by ICAO regulations except for TAFs and basic warnings, and have to be agreed between airport operators and service providers. This can lead to difficult situations when airports experiencing serious disruptions by weather elements are either not relying on met information at all in their operations, or receive them from independent service providers which are not coordinated with the services for airlines and air traffic management.

NMHSs should leverage existing WMO guidance and tool kits (see Appendix B), as well as new guidance and best practices coordinated by the WMO Secretariat to build a core set of service delivery criteria. NMHSs should develop methods and tools to document and validate user needs and expectations and to communicate them within the organization and to other partners as necessary. User needs should then be converted into requirements to be met by existing or new products and services.

User requirements should be evaluated to ensure that they fall within the mission of NMHSs and that NMHSs have the capability to meet those requirements. Evaluating user needs for such purposes is what this Strategy calls *fit for purpose*. NMHSs should not evaluate user needs in isolation, but do so collaboratively with users, providers, and partners. *Fit for purpose* demonstrates an agreement, either implicitly or explicitly, among all involved and acknowledges some or all of the following:

- Current and evolving user needs;
- Provider capabilities, including strengths and limitations;
- What services will be provided and how they will be provided;
- How services will be used;
- Expectations of acceptable outcomes and provider performance;
- Acceptable cost or level of effort;
- Risks inherent in applying information to decision-making.

TEMPLATE FOR BASIC COMPONENTS OF A SERVICE LEVEL AGREEMENT

ARTICLE I. PARTIES
Describe the parties involved in the SLA

ARTICLE II. SCOPE
Section 2.01 Scope
Describe the purpose and extent of the SLA
Section 2.02 Assumptions
Define any assumptions that underlie the defined scope
Section 2.03 Goals and Objectives
Describe what the parties are expecting to accomplish with the SLA

ARTICLE III. ROLES AND RESPONSIBILITIES
For all parties involved in the SLA, describes the role of each party and the responsibilities for supporting the SLA and delivering the products and services defined within

ARTICLE IV. EFFECTIVE DATE AND TERM
The date the agreement is effective its duration

ARTICLE V. DELIVERY AND PERFORMANCE
Describe in detail what each party is responsible for delivering and the key performance indicators to ensure compliance

ARTICLE VI. REPORTING, REVIEWING AND AUDITING
Describe oversight and reporting on the agreement; when the agreement should be reviewed, and reporting points of contact

ARTICLE VII. COST / FUNDING AND PAYMENT
Document costs associated with the SLA, who is responsible for paying, or funding, and when payment should occur. Cost may be broken down by specific line-items, such as labour, supplies, equipment, travel, training, etc.

ARTICLE VIII. CHANGES AND MODIFICATIONS
Describe the process by which changes or modifications will be made to the SLA and who is responsible for making changes

ARTICLE IX. TERMINATION
Describe terms for termination of the SLA and the process for terminating

NMHSs have limited resources and capacity, and therefore cannot be expected to provide everything to everyone. A clear *fit for purpose* understood by all parties sets clear expectations and minimizes risk for NMHSs while achieving the best possible solution for users. If appropriate, NMHSs may want to explicitly outline the agreement reached with the user in a service level agreement. Agreements with other suppliers or partners may be documented in operating level agreements. Such agreements should be prepared in such a way as to reflect the current scientific uncertainties associated with forecasting weather, climate and hydrological events.

Effective user engagement throughout the entire service delivery process builds knowledge of user needs. It also builds an understanding of the impact of weather-, climate-, and water-related information on protecting life and property, sustaining the environment, and promoting economic development and prosperity. This knowledge leads to more effective products and services that are better aligned with external demands with a clear *fit for purpose*.

Strategy Element 2. Link Service Development and Delivery to User Needs

Building knowledge of users is of marginal utility if such knowledge is not integrated into the design, development and delivery of services. NMHSs with service-oriented cultures produce products and

services with the user at the centre of the development process. This means that NMHSs need processes and tools for translating requirements into tangible products and services and then validating that user needs and expectations are met.

WORKING WITH THE CUSTOMER TO OPTIMIZE FLOOD WARNINGS

Flood forecasting methodology, developed by Schröter et al.[1] (2008) was applied to two small river basins in Austria and Spain. The methodology was based on an assessment of the effectiveness and efficiency of Early Warning Systems (EWS) for flash floods. It focused on the development of optimal alerts through the analysis of trade-offs between the benefits of an increased lead time and the simultaneous decrease of warning reliability associated with the longer lead time. Determining the ability to reduce flood damage was based on a survey of users. The approach considered that the increase in lead time provided valuable opportunity for preparedness and prevention; whereas, the decease of warning reliability would cause economic loss in the case of false alarms. The assessment concluded that increasing lead time for flash flood events does not produce the maximum societal benefits due to the decreasing reliability (i.e., increasing false alarm rate). In fact, to maximize damage avoidance and minimize production loss due to false alarms, the optimal lead time is not the longest lead time. In the Besòs basin in Spain, for example, the optimal warning lead time was two hours. In practice, this is the time where a "watch" becomes a warning.

1 Schröter, K., M. Otrowski, C. Velasco, H.P. Nachtnebel, B. Kahl, M. Beyene, C. Rubin M. Gocht, 2008: Effectiveness and Efficiency of Early Warning Systems for Flash-Floods (EWASE). First CRUE ERA-Net Common Call – Effectiveness and Efficiency of Non-structural Flood Risk Management Measures, 132pp. Available from www.crue-eranet.net.

Linking service development and delivery to user needs necessitates an operating model that delivers forecasts and information when and how the user specifies and provides users with the necessary support. Users will have different requirements so the key is to develop an operating model that is flexible and adaptable to wide-ranging and evolving user demands.

This includes workforce, systems, technical and physical infrastructures.

One approach is to create a model in the form of a real or virtual co-location of meteorologists and users of weather-, climate- and water-related information who work together to deliver products and services. This approach integrates hydrometeorological information with user-specific data to determine impacts on the public and industry, such as: energy grid management; construction; flood control and urban inundation; hospitals and health practitioners, emergency preparedness and response; transportation; and so forth. Meteorologists may have temporary (short-term) or permanent assignment that enables them to work side-by-side with road management and maintenance specialists, public health experts, emergency responders, and others. The benefit to users is an operational network that evolves to meet specific user needs, forecasts systems targeted to user decisions and an integrated system that aligns weather-, climate- and water-related information with societal and economic impacts and user-specific information.

PUBLIC WEATHER SERVICE PLATFORM – METEOROLOGICAL SERVICE DELIVERY IN THE MEGA CITY OF SHANGHAI

The Shanghai Meteorological Bureau (SMB) of the Chinese Meteorological Administration (CMA) established an Integrated Public Weather Services (PWS) operations platform in 2009 to strengthen the integration between SMB, other agencies and specialized users. The goals of the Platform are: to transform PWS delivery into routine work by specialized duty officers; and to provide highly targeted and tailored services to a variety of institutional, governmental, specialized users and the public.

Under the direction of the Chief Service Officer (CSO), the Platform develops products for decision-making for 26 sectors which include government departments, emergency response agencies, the public, and weather sensitive users. The daily forecasts and warnings dissemination mechanisms for the PWS Platform include SMS (Short Message Service), television, radio, newspapers, magazine, the Web; Basic Grid Unit management system, electronic screens, telephone and fax.

Key Activities for Accomplishing

NMHSs should develop and improve upon processes and tools to document and communicate user requirements to all parties involved, including the research community, developers, partners, budget and finance officials, and others. Users should be brought in at various stages of the design and development process to evaluate and test products and services to ensure that they meet requirements and allow for optimal decision-making.

Processes should be monitored and evaluated. (See Strategy Element 3 for more details on evaluation and monitoring).

To implement this strategy element, consideration should be given by the WMO to leverage existing guidance and best practices to develop a minimum set of standards and benchmarks for the design, development and delivery of products and services that integrate users throughout the process. Using the standards and benchmarks as a basis for evaluation, NMHSs should conduct a current assessment of their service design, development and delivery practices to identify gaps between current practices and the WMO standards. NMHSs should use structured problem solving and process improvement methods (see Appendix B) to develop and implement plans to close service design, development, and delivery gaps. WMO Members are strongly encouraged to share results and experiences obtained through these activities.

Strategy Element 3. Evaluate and Monitor Service Performance and Outcomes

Service delivery does not stop once the product or service has been delivered. User outreach and engagement must continue to ensure that services are received and acted upon and full benefit is achieved by the user. NMHSs should have a core set of metrics to measure the end-to-end-to-end service delivery process and its outputs. Each metric should only measure a specific aspect of the process but collectively, the metrics should enable an organization to demonstrate its strengths and identify its areas for improvement in terms of effectiveness, efficiency, impact, satisfaction, and value to its stakeholders, customers, users, partners, and employees. Specifically, metrics should possess the following attributes:

- **Specific** – Metrics are specific and targeted to the area being measured. For example, a good metric for customer satisfaction would be direct feedback from customers on how they feel about a service or product. A poorer metric would be the number of customer complaints because it is not specific nor a direct correlation to customer satisfaction and, as such, can be misleading;
- **Measurable** – Ability to collect data that is accurate and complete;
- **Actionable** – Metrics are easy to **understand**, interpret, and act upon;
- **Relevant** – Measure only those things that are important **and** relevant to an organization's goals and objectives. A common mistake is to measure everything, which is time consuming and produces meaningless results;
- **Timely** – Metric data can be collected when it is needed;
- **Agreed Upon** – Externally-based metrics should be agreed upon by the NMHSs and **customers**, users, or partners. As discussed under strategy element one, agreeing upon acceptable levels of performance is part of the evaluation of user needs, or fit for purpose;
- **Owned** – Metrics should have clearly identified owners. Ideally these owners should be **individuals** with the ability, influence and resources to take action to ensure targets are met;
- **Consistent** – Any two given metrics should not promote conflicting behaviours.

The following are examples of the types of metrics important for evaluating and monitoring service performance:

Forecast Accuracy

A service-oriented culture demands use of accuracy measure from the perspective of the user, which differs from some of the accuracy measures widely applied within the Numerical Weather Prediction (NWP) community. A service-oriented organization should use forecast parameters which have direct impact on users' activities and operations. Accuracy of warnings and of temperature predictions are good examples of 'service-oriented' accuracy metrics. Specific examples currently in use include:

- Rolling average of percentage of forecast maximum and minimum temperatures for today and tomorrow lying within 2 degrees Celsius of actual values;
- Measure of Storm-based Tornado False Alarm Rate.

Customer Satisfaction

User engagement is at the heart of a service delivery culture, and measurement of customer, or user, satisfaction is both necessary and hugely useful in assessing performance and areas for future development.

User surveys are already in widespread and regular use within the WMO. Surveys may have several levels of formality, scope and standardization, ranging from frequent customer liaison visits or user workshops, to bulk information gathering exercises using standardized surveys via e-mail, the web or by telephone. Both formal and informal methods for gathering user feedback are appropriate and useful. Surveys may be undertaken at routine intervals, or following a significant weather event. Satisfaction is often situational (environmental or economic) or influenced by public or media perceptions. These external factors can be minimized by using large and representative samples, longer periods of investigation or multiple events. Small-scale and highly-specific customer survey results are best used alongside larger survey results from which statistically valid conclusions can be more easily drawn. Further, customer satisfaction results can prove important when viewed alongside accuracy metrics, highlighting differences between customer perception and technical performance. Specific examples currently in use include:

- Telephone customer satisfaction surveys conducted immediately after a severe weather event has occurred or has been forecast;
- Yearly measure of customer satisfaction as measured on an external benchmarking scheme by an external assessor of public-sector organizations;
- Annual mail surveys to external users on quality of web services.

Customer Service

Customer service metrics are related to customer satisfaction, but tend to deal with monitoring the effectiveness of the processes designed to allow continuous feedback from users and customers, rather than the content of the feedback itself. They can also be used to measure various aspects of the contract between NMHSs and their customers.

Customer service metrics of these types tend to be well-defined and can be simple to formulate, at least initially, though there should be regular checks for relevance and the targets may need to be finely tuned to ensure they are realistic. Specific examples currently in use include:

- Respond to correspondence from all quarters within a maximum of 5 working days, and answer with courtesy all telephone calls within a maximum of 2 minutes;
- 95% or more of annual average of complaints answered within 28 days;
- 85% or more of annual average of all calls to be answered within 20 seconds.

Compliance, Timeliness & Resilience

Metrics of this kind are designed to measure the details of service quality away from conventional measures such as accuracy. These metrics may measure user requirements, mandates, or

internal requirements for producing and disseminating data and information. Specific examples currently in use include:

- 100% of Australian Tsunami Bulletins issued from the Joint Australian Tsunami Warning Centre (JATWC) are available to emergency services and the public within 40 minutes of a significant event in the Pacific or Indian Ocean;
- Monthly measurement of percentage of METAR and TAF bulletins issued on time.

Reach

As this Strategy identifies, effective services must be available, timely, and useful. Measuring the reach of services demonstrates how well NMHSs deliver products and services that users are aware of and can access. In the case of public weather services, there has traditionally been a reliance on the "push" of information to the wider public via the media – usually television and radio. It is necessary to measure the effectiveness, or reach, of this communication route, and the growing importance of other media, such as the Web, to reach the public. Specific examples currently in use include:

- Percentage of telephone survey responders who affirmatively responded to seeing or hearing a warning for a specific severe weather event;
- Number of referrals to the website from external sites;
- Maintain full functionality of public website over 99.5% of the time (three month rolling average).

WORKING WITH THE USERS – KENYA METEOROLOGICAL DEPARTMENT (KMD)

The Kenya Meteorological Department (KMD), through its Public Weather Services (PWS) Division serves the general public and a cross section of specialized users which includes the media, the disaster community, agriculture, energy and health sectors. In order to serve these users effectively, it has taken steps to understand their specific needs and to organize its service delivery operations to respond optimally to such needs. It has accomplished this through carrying out user surveys and increasing interaction with them in training workshops and through the meetings of multidisciplinary teams which have been created for the service delivery improvement.

Over the years, the scope of user groups has expanded and the demand for new products increased. A good example is a recent request by the Kenya National Examination Council (KNEC) for monthly weather forecasts and weekly updates to help them with the logistics of transporting examination papers to remote places using roads that could quickly be rendered impassable by heavy rains. New methods of weather dissemination options such as the RAdio InterNET (RANET) community radio stations have evolved too, serving areas that are highly prone to extreme weather such as flooding and drought. The community radios have been very effective in issuing warnings and forecasts in local languages.

KMD has also focused on public education and outreach through activities such as radio and television discussion programmes and organizing school visits to KMD facilities, in order to prepare the public to respond adequately to warnings.

Impact

Measuring forecast accuracy, timeliness, and reach do not tell the complete story of service delivery effectiveness. Measuring the impact of a product or service demonstrates the value or benefit received, often measured in terms of societal or economic impact. Measuring impact tells NMHSs whether or not their products and services are useful and relevant. Measuring impact may require a significant cultural shift within an organization because it typically uses more subjective methods based in social science. Effective impact metrics should be based on the input and collaboration from users and partners, including those in the social science community, such as economists and sociologists, who have expertise in measuring social and economic impacts and human behaviour. Specific examples currently in use include:

- Decrease in weather-related aviation delays;
- Cost avoidance from unnecessary evacuations.

Internal Processes

Good service delivery is reliant on insight into the organization's internal processes. Effective and efficient internal processes have direct impact on the quality of service delivery, the value of products and services, and the cost effectiveness of an organization's day-to-day operations. Measurement of an organization's internal processes should be driven largely by the QMS used, and the key processes defined therein. Specific examples currently in use include:

- Internal and external audits to review ISO9001 capabilities;
- Periodic review of research activities by an external committee from the research community.

Milestones

Milestones are also an internal metric often associated with project and programme management. Milestones measure the delivery of a product, service or system, or the completion of a phase, or step, in the delivery of a product, service, or system. They should refer to specific, in-year activities, with new milestones defined and agreed for the new review period. Examples include:

- Provide location forecasts, observations and mountain weather hazards in local languages by end of the fiscal year;
- Begin deployment of next generation radar capability in quarter XX of fiscal year YY.

Key Activities for Accomplishing

Once measures are collectively identified and a methodology defined for how data will be collected, NMHSs should collect baseline performance data. Baseline data informs both providers and users of current ability and capacity and serves as input when determining reasonable but stretch targets for future performance. Performance measurement data should be collected and reviewed at regular intervals by everyone in the value chain. NMHSs should use this data to reward and promote success, as well as to modify the service delivery process if performance is not meeting targets.

Care must be given in the design of any performance monitoring system to minimize the number of metrics to the extent possible, and to select metrics that provide the best measurement of service-related outcome. This is often not a simple process and the benefits of such measuring are best realized if the metrics are stable over a reasonably long period. Before implementing a system of performance metrics Members are encouraged to review the experiences of those Members who already have in place such monitoring.

Strategy Element 4. Sustain Improved Service Delivery

Service delivery should continuously evolve, along with user demands and changing external drivers, such as new technologies or science advancements, changing users, and evolving user capacity. For example, if the aviation sector improves its ability to avoid weather systems, thus becoming more weather resilient, the original services to the aviation sector must evolve. Likewise, if a sector becomes more weather sensitive, such as the energy sector, then the services should also reflect that evolution. Evolution of services may also mean that a specific product or service should be retired because it is no longer required by the user, or can be provided more efficiently and effectively by another provider.

Key Activities for Accomplishing

The role of NMHSs is to ensure users are able to reap full benefit of services by promoting, facilitating and coordinating improvements in interdisciplinary research, observing networks, modelling, and technology. NMHSs should keep users informed of new opportunities and advancements – first to validate that user needs continue to be met, but also to increase user knowledge. This can be achieved through various education, outreach and communication activities and should be part of ongoing user engagement described in element one. NMHSs also have a role in institutionalizing service delivery processes internally and among partners to achieve

and maintain service excellence. The application of QMS is an effective tool for institutionalizing processes.

NEW TECHNOLOGIES IN THE SERVICE OF USERS

The Hong Kong Observatory (HKO) has evolved its service delivery by implementing mobile platform and social networking services in 2010. HKO developed an iPhone application named MyObservatory to take advantage of the iPhone's communication capability and its geo-positioning function. In addition to providing weather forecasts and warnings, MyObservatory automatically provides the latest location-specific weather conditions, such as temperature, wind, and weather photos from the weather stations closest to the user. MyObservatory proved hugely popular and was on the top of free download lists for months. HKO also began experimenting with social networking services in 2010 by launching a Twitter service, http://twitter.com/hkobservatory, to issue weather warnings and disseminate information. The number of HKO's Twitter "followers" grew from a few hundred to thousands in a couple of months and continues to increase. By evolving their service delivery methods to meet changing user demands and expectations, HKO found new, cost-effective ways to reach a greater number of people.

Strategy Element 5. Develop Skills Needed to Sustain Service Delivery

To achieve the elements above and succeed in user-focused service delivery, NMHSs must identify and develop the required capacity. The WMO Secretariat should also identify and develop the ability to facilitate and support service delivery. Capacity includes developing the necessary skills, processes, and technologies that enable, support, and sustain a service-oriented culture. Much of this Strategy has already described needed processes and tools that will enable service delivery. Crosscutting across the entire Strategy and critical to its success is the development and enhancement of workforce skills.

Key Strategies for Accomplishing

Efforts should be made to identify the necessary skills relevant to an organization's operating model and objectives and then conduct a gap analysis to discover what skills are lacking within the organization and how those gaps can be bridged through a combination of training, employee development, and recruiting. The WMO Secretariat, in collaboration with the relevant technical commissions, is in the process of identifying requirements for specific competencies within NMHSs and the associated education and training needs for service delivery tasks. NMHSs must ensure their workforce has the necessary mix of technical skills to meet societal demands and user needs. Additionally, NMHSs need skills that enable effective service delivery. Such skills include, but are not limited to: communication; customer service; management, problem solving; and performance management.

DEVELOPING SKILLS TO SUSTAIN SERVICE DELIVERY

The China Meteorological Administration (CMA) has made every effort to cultivate a culture of service delivery by reforming an operational-based system into a service oriented one. It has paid much attention to team-building, interdisciplinary research, outreach, application of new technology, and utilization of social resources in service delivery. It takes special measures to encourage employees to communication more effectively with users. CMA was authorized by the central government to host a number of training courses on disaster prevention and mitigation each year with the nationwide participation by nationwide city mayors. It also regularly trains the voluntary weather information deliverers at grass-root level. A specific example is township leader training programme which was initiated as a pilot project in 2010.

Strategy Element 6. Share Best Practices and Knowledge

A second cross-cutting strategy that will enable a service-oriented culture is sharing and applying best practices and knowledge across the WMO – a strategy already highlighted earlier in this document. The WMO Secretariat should enable sharing of practices, approaches and tools. What

works in one country may not meet the user needs in another country, but service delivery is a collaborative process where providers, partners, suppliers, and users can all learn from one another.

IMPLEMENTATION APPROACH

Implementing this Strategy requires more detailed action plans for developing the processes, methodologies, and tools to enable each of the strategy elements of the four phases of service delivery.

The maturity and formality of service delivery among NMHSs varies significantly. Further, NMHSs operate differently due to a combination of internal and environmental factors. For example:

- Some NMHSs are completely government owned and offer services only to other areas of government and the public. Some are fully privatized and offer commercial services. Many lie somewhere between these extremes;
- Some NMHSs act as data suppliers to private forecast providers, while some undertake fully commercial operations in direct competition with these private organizations. Some play both of these roles;
- Some NMHSs use their own NWP models and forecasting and production systems. Others use those supplied by external organizations;
- Most NMHSs only provide services to their own country, whilst other NMHSs may offer to provide services to others.

The bottom line is that a one-size-fits-all implementation approach will not be effective. Members need flexibility for developing their own unique approaches. How to implement this Strategy within NMHSs will depend on service priorities as well as current service delivery capacity. One approach would be to develop implementation plans that focus on creating, growing, or sustaining a service delivery culture based on the maturity and formality of NMHSs' current capacity. The idea of creating a service delivery culture may at first seem overwhelming to some NMHSs and so they may wish to start incrementally by focusing on a particular service area that is an organizational or governmental priority. NMHSs may want to engage with the WMO Secretariat to identify and implement service delivery pilot projects that can easily demonstrate value and be replicated across other service areas, or even by other NMHSs. Additionally, WMO Members should seek opportunities to transfer knowledge through advanced capacity-building approaches, such as engaging in regional partnerships and documenting best practices. All implementation approaches and plans should factor in QMS practices and processes.

APPROACH TO SERVICE DELIVERY IMPLEMENTATION IN THE TAJIK HYDROMETEOROLOGICAL SERVICE

As part of the modernization of the Tajik Hydrometeorological Service, specific investments are being made to enhance service delivery. Tajik Hydromet recognizes the importance of service delivery as an element of modern meteorological service. The nascent sectors have new and emerging needs for meteorological services and in many cases, it is important for the NMS staff to have sufficient training in the user sector to be able to communicate effectively with those clients, resulting in a more collaborative approach to service delivery. The approach taken is to invest in training for both the TajikHydromet staff and the technical personnel from the weather-sensitive sectors in line with the four stages of the service delivery system.

In Tajikistan, the particularly important users are energy sector, agriculture and disaster reduction. For example, under this approach staff of the Emergency Management Committee (EMERCOM) local divisions will receive meteorological training to raise awareness of weather hazards and facilitate better utilization of hydrometeorological information in EMERCOM operational activities. The training will enhance EMERCOM capacity to disseminate hydrometeorological information about severe weather conditions to the regional and local branches of the Committee, and zone the country based on the probability of occurrence of hazardous hydrometeorological events.

Appendix A. Service Delivery Definitions

Collaborating Organization/Partner – An organization or entity (e.g., a university, a specialized non-government centre, a relevant government agency) of a WMO Member that provides complementary/ additional weather, climate or water information to NMHSs or directly to users, under terms and conditions that have been mutually agreed.

Coordinator – An organization or entity that facilitates or coordinates the delivery of products and services. For this Strategy the WMO Secretariat serves in this role. Working closely with Members, the Secretariat sets standards for weather-, climate- and water-related products and supporting services. This includes observations, data quality and telecommunications. The data underpinning meteorological and related products require international coordination and validation to guarantee that they meet the needs of the product generating centres. The communication systems that move data and products globally are coordinated through the Secretariat. The assessment, and objective verification of products that are generated by one country and used by others may also be coordinated by the Secretariat and the results shared and used in the process of improving the quality of products for all.

Fit for Purpose – results from collaboration and dialogue among users, providers, **suppliers**, and partners and demonstrates a clear agreement, either implicitly or explicitly, among all involved. A clear fit for purpose acknowledges:

- Current and evolving user needs;
- Provider capabilities, including strengths and limitations;
- What services will be provided and how they will be provided;
- How services will be used;
- Expectations of provider performance;
- Risks inherent in applying information to decision-making.

NMHSs (always used in the plural) – National Meteorological Services (NMSs) and National Hydrological Services (NHSs); NMS – A National Meteorological or Hydrometeorological Service; NHS – A National Hydrological Service.

Operating Level Agreement – An agreement among providers, suppliers, and **partners** detailing how a service or group of services would be delivered.

Product – A product is basic **information** such as observations, datasets, or information that is created by an analysis or forecast process.

Providers – Individuals or entities that produce or acquire weather, climate or water information or products that are then supplied in support of users' needs in this regard. Providers may include NMHSs, partners, other meteorologically relevant agencies and the private sector. This Strategy focuses only on WMO NMHSs.

Service – A product delivered or activity that is carried out (advice, interpretation, etc.) that meets the needs of a user or that can be applied by a user.

Service Delivery – A continuous process for **developing** and delivering user-focused services, defined by user engagement, service design and development, service delivery, and evaluation and improvement.

Service Level Agreement – A contract between a service provider and a user or customer, it details the nature, quality, and scope of the service to be provided. Also called a service level contract.

Users – Individuals, organizations, or intermediaries with responsibilities for decisions and policies

in sectors that are sensitive to weather, climate and water and for whom products and services are provided. If the user has paid directly for the service, he/she is generally called a customer. This Strategy defines users at national levels, with the exception of international users in the aviation and shipping sectors.

Appendix B. Further Reading

(1) WMO/TD-No. 1256, *Guidelines on Quality Management Procedures and Practices for Public Weather Services* (http://www.wmo.int/pages/prog/amp/pwsp/publicationsguidelines_en.htm).

(2) WMO/TD-No. 1023, *Guidelines on Performance Assessment of Public Weather Services* (http://www.wmo.int/pages/prog/amp/pwsp/publicationsguidelines_en.htm).

(3) WMO/TD-No. 1103, *Supplementary Guidelines on Performance* Assessment *of Public Weather Services* (http://www.wmo.int/pages/prog/amp/pwsp/publicationsguidelines_en.htm).

(4) For more information on QMS, see: http://www.wmo.int/pages/prog/amp/QMF-Web/home.html.

(5) For more information on survey designs and examples, see: http://www.wmo.int/pages/prog/amp/pwsp/surveys.htm.

ANNEX VI
Annex to paragraph 5.5.2 of the general summary

EARTH SYSTEM RESEARCH FOR GLOBAL SUSTAINABILITY: A NEW 10-YEAR RESEARCH INITIATIVE

Concept Paper developed by ICSU
28 February 2011

The current pace and magnitude of human-induced global change is unprecedented and is manifest in increasingly dangerous threats to societies and human well-being. At the same time, these same pressures create new opportunities for innovation and green economic development. Decision-makers and citizens have an urgent need for knowledge and solutions that will enable effective responses to these threats and opportunities and that will provide the basis for achieving sustainable development goals. The sheer scale of threats and needs mean that depending on opportunistic and ad hoc measures alone will not suffice.

Against this background, a series of international initiatives aimed at visioning future global environmental change research priorities was launched in 2009. In February of that year ICSU started a consultative Visioning Process (http://www.icsu-visioning.org/), in cooperation with the International Social Science Council (ISSC), aimed at developing options for a single, holistic international strategy for integrated, policy relevant Earth System research.

Based on widespread consultation with the scientific community, funders and other stakeholders, and following in-depth discussions at two international meetings – held in September 2009 and June 2010 – the Visioning Task Team produced a document outlining five Grand Challenges in Earth System Science for Global Sustainability (1). This document also emphasized the need for a single, new overarching structure, which would bring together researchers, funders, service

providers and users, and allow for more integration of existing Global Environmental Change (GEC) programmes plus ESSP and other activities.

In June 2009, some of the world's main funders of environmental change research established a new, high-level body called the Belmont Forum. Its aim is to align international resources to accelerate delivery of the science-derived knowledge and capabilities that society needs to address environmental change (2, 3). ICSU and ISSC have both joined the Forum's membership.

Members have agreed on the following 'Belmont Challenge' for future action and support: To deliver knowledge needed for action to avoid and adapt to detrimental environmental change and extreme hazardous events (2, 3). A White Paper (3) has been developed by the Forum to elaborate the Challenge and research priorities in further detail and to propose the next steps.

In October 2010, the funders from the Belmont Forum, ICSU and ISSC met in Cape Town, South Africa, to discuss the visions and implementation options that have emerged from both the Belmont and Visioning processes. All agreed that there are significant opportunities for convergence between these two processes: both in terms of substantive priorities, and next steps towards their implementation. It was also recognized that there was a need to engage representatives of operational service organizations (e.g. WMO) – who are crucial in the delivery of services on the basis of new scientific knowledge.

Therefore, just as the scientific community established the GEC research programmes 30 years ago in a landmark effort to further our understanding of the Earth System, ICSU, ISSC and the Belmont Forum are now building an Alliance to propose an initiative that is no less groundbreaking: an innovative 10-year Initiative on Earth System Research for Global Sustainability, structured as a cutting-edge network, and which is highly integrative, flexible and responsive.

The goals of the Initiative are to:

- Deliver at global and regional scales the knowledge that societies need to effectively respond to global change while meeting economic and social goals;

- Coordinate and focus international scientific research to address the Grand Challenges arising from the ICSU Visioning and Belmont Forum processes;

- Engage a new generation of researchers in the social, economic, natural, health, and engineering sciences in global sustainability research.

Many of the building blocks would come from the existing GEC components; but they will need to be organized in fundamentally new ways to address new research priorities. The Initiative will inspire and enlist the best researchers, be they anthropologists or geophysicists, northern or southern, young or veteran. And it will mobilize diverse teams quickly and strategically to tackle emerging challenges and deliver solutions at the local, regional and global scale.

Why a New Initiative?

Building upon the foundation provided by the GEC research initiatives and by national, international and intergovernmental investments in global change research, the scientific community must now deliver the knowledge that will enable countries to meet needs for sustainable development, poverty alleviation and environmental protection in the face of global change. While deepening our understanding of the Earth System and of human impacts, we must build the capacity to deliver solutions to pressing sustainability challenges at regional scales. We must attract the brightest young scientists, particularly in developing countries, and significantly expand the involvement of social scientists and economists in the Grand Challenge research agenda. We must increasingly adopt research approaches that actively involve stakeholders and decision-makers across governments, business and civil society in the process of defining and carrying out research. And we must effectively deliver end-to-end environmental services.

In June 2010, when ICSU convened a two-day meeting with the GEC leadership of the GEC initiatives and sponsors, funders and other key parties, there were different views shared concerning the future of global sustainability research. However, one sentiment united the room: ***business as usual is not an option***. The existing global change research arrangements are unable to adequately meet current needs. They do not address the full range of global sustainability research challenges defined in the Grand Challenge paper, particularly with regard to research on policy, institutional and behavioral responses to global change. In addition, they do not adequately address the needs for regional and decadal prediction of global change; or include a sufficient focus on transdisciplinary research. And, they do not adequately engage younger scientists or take full advantage of the potential of networked organizational arrangements.

Initiative Characteristics

The Initiative will have the following core characteristics:

Focus on global sustainability research. The Initiative will mobilize the scientific community to address pressing research questions on Earth System sustainability, and to provide knowledge for societies to effectively respond to global and regional changes. This requires improved integration of scientific disciplines and organizational structures.

Partnership between funders, scientists, users, services. This partnership is crucial to co-design and co-deliver adequately resourced research which will make a difference.

Strong regional nodes. Strong regional research nodes can more effectively identify and respond to needs and priorities of decision-makers at regional and national scales. At the same time, regional research and analysis is increasingly needed to understand Earth System functions, human impacts, and potential responses. A strong regional research presence should also facilitate the involvement of young scientists and help build research capacity.

Cutting-edge network structure. The progress that has been made on global change research over the last three decades was due in no small part to the effective use of coordinated research networks. In these “first generation” networks, relatively small coordinating secretariats, guided by scientific committees, served to identify research priorities and facilitate the involvement of scientists and the support of national and regional funders for that work. This Initiative will require “second generation” research networks. Some of the features of such new networks are:

- Cutting edge knowledge management system;
- Capability to identify network-wide research priorities, to ensure that those priorities are addressed, and the solutions delivered in a timely fashion;
- Nimbleness and flexibility to adapt as the challenges evolve;
- Innovation which will allow the network to ensure a constant flow of new ideas and talent;
- Mobilization of the network to support needs of regional nodes while also working with regional nodes to address global questions;
- Distributed network management and coordination arrangements.

Active engagement with decision-makers. Mechanisms already exist through which the global change scientific community can interact with decision-makers at the global scale. These include the Intergovernmental Panel on Climate Change and the new Intergovernmental Platform on Biodiversity and Ecosystem Services. Through these mechanisms, policy-makers are able to identify their highest priority needs and the scientific community is able to assess the state of knowledge bearing on those needs. These mechanisms also help to reveal policy relevant gaps in

research and knowledge and consequently they have helped the global change research and funding community set priorities.

In addition, there is a growing need to develop new mechanisms to engage the business community, so that priorities can be similarly informed by its needs in supporting sustainable economic development.

A critical need now exists for similar arrangements to better facilitate science-policy interactions at regional scales. Information provided at regional scales can better support the key regional and national decisions that will ultimately determine how effective societies are in responding to global change. The Initiative will thus utilize existing mechanisms for science-policy interactions or create new mechanisms to engage with decision-makers where such mechanisms do not exist.

Actively engage the full range of disciplines. Social sciences have long been a component of Earth System research, but addressing the Grand Challenges for global sustainability research requires stronger engagement of the social sciences, economics, health sciences, engineering and humanities, along with the natural sciences so that an integrated response and solutions can be developed. The goal of expanding the involvement of the social sciences in global change research has been difficult to achieve. The strongly regional and networked structure of this Initiative, combined with the focus on research aimed at understanding how to achieve sustainability in the context of global change, will provide a transformative opportunity for more active engagement of the social sciences, economics and health sciences in particular. In designing the Initiative, active steps that could be taken to expand the involvement of these disciplines over time will be identified.

Actively engage young scientists. The GEC research programmes have been successful over the past three decades also because of the caliber of young scientists that became engaged in the programmes when they were established. Based on our experience of involving young scientists in developing the Grand Challenges for Global Sustainability Research, we believe that the set of new research priorities, which more directly address the sustainable development agenda, provides a similar opportunity to engage the brightest young scientific talent. To succeed, the Initiative must focus on exciting research questions, must be open to “bottom up” innovation in research directions, and must actively incorporate younger scientists together with more senior scientists in governance and decision-making.

Creating the Initiative

Building the overarching structure

At the June 2010 meeting of sponsors, funders, GEC programme chairs and key partners, the majority of participants shared a belief that even a reform of the existing Earth System Science Partnership (ESSP) would not be able to effectively guide the Initiative. There needs to be a new, overarching structure with the authority and resources that the ESSP has never had. These elements are crucial to provide the next generation of integrated research.

At the October 2010 Belmont Forum meeting, it was agreed to align the key elements of the Belmont Challenge and the visioning process, and to establish a single new top-level body. This body was given the name of “Transition Team (TT)” during the third visioning meeting on 10–11 February 2011. The TT tasks will be to oversee the creation of the Initiative, and to take the lead on the Initiative’s vision, strategy, fund-raising, and relationships with partners and stakeholders. Members of the TT should be appointed for 18 months. During these 18 months, the TT should explore governance options and funding options, obtain the necessary ‘high level’ commitments from governments, and propose the final governing structure and composition. At the end of the 18-month design period, it would be replaced by the new structure to govern and implement the Initiative.

The TT will have high-level representation from stakeholder groups including researchers, funders, service agencies, and users. The membership will include:

1. *Scientists*
    - Internationally renowned scientists, including at least one early career scientist. The set of scientists will have to have a fair balance with regard to region, gender and scientific background/discipline, and should have knowledge of the broad global change research landscape.
2. *Current core programme sponsors*
    - ICSU and ISSC.
3. *Research donor*
    - Representative of the Belmont Forum.
4. *Users of global sustainability information and knowledge*
    - Individuals with experience at operational services and users of global change research.

Note that members representing ICSU, ISSC, and Belmont Forum will serve in ex-officio capacity. The other members will be formally appointed by ICSU and the ISSC on the basis of prior consultation and agreement with the Belmont Forum. A total of around 12 members will be appointed. In addition to the TT, working group(s) will be created to deal with specific tasks.

Collectively, the set of individuals selected for the TT will provide leadership and guidance, and bring a set of relationships that should be mobilized in support of the Initiative. Although nominated after consultation with numerous organizations, they are expected to serve as individuals and not as representatives of any interest group. More specifically, the set of individuals should meet the following criteria:

- World-renowned scientific leaders;
- Among the non-scientists, individuals with a strong affinity with science and with the potential use of science in decision-making;
- Individuals with a strong commitment and engagement to both environmental and social concerns;
- Individuals capable of interacting and engaging across existing GEC initiatives;
- Individuals with direct experience and knowledge of political decision-making around environmental issues at the highest levels;
- Individuals who can help open doors for possible core funding and research funding;
- Individuals with expertise in building and governing complex network-based institutions;
- Individuals with experience in building scientific capacities at individual, organizational and systemic levels;
- Appropriate gender and regional balance.

Integrating existing structures

Although socio-environmental research addressing the Grand Challenges is already happening, some of this under the aegis of the existing GEC programmes, this does not amount to a coordinated global effort. There is strong and growing recognition that more effective integration is

necessary. Over time, the Initiative will catalyze more effective integration of the various structures and activities including those of the existing GEC programmes in this area.

Designing and Creating the Initiative

Once the TT is in place, it will replace the visioning task team to oversee the development and early implementation of the Initiative. This will require an intensive design phase that must draw on the expertise of scientists who will be involved in the research, but equally importantly must draw on the existing knowledge and expertise regarding network design and knowledge management. We foresee the following steps:

1. Agree on a strategy to create the initiative. An overall strategy needs to be developed and agreed upon by ICSU, ISSC, and the Belmont Forum (each of which will consult their respective constituencies). This includes a network design for the new initiative. Organizational design experts may be engaged in the process.

2. Explore the greater integration of GEC programmes. The TT will progressively replace the current ESSP. Supported by the outcomes of the SWOT analysis, the TT will carry out discussion with the GEC programmes regarding their integration into the new structure.

3. Assemble information on obvious regional 'nodes' for the network. Dialogs will be carried out with various institutions/organizations in order to identify a set of candidate regional nodes that could contribute to the network.

4. Explore alternative options for the governance, funding, and priority setting for the network. The TT has a lifetime of 18 months, after which it will be replaced with a more permanent governance structure.

5. Explore options for knowledge management systems.

6. Co-design a detailed research and implementation plan for the first three years of the Initiative. Based on the Grand Challenges document, develop a much more concrete and specific action plan. As a first step in this effort, a small number of priority areas/directions must be established.

7. Identify mechanisms for funding and models for delivery. Processes and mechanisms that would allow the scientific community to move forward and deliver effective research need to be identified. Options for funding could include bilateral, multilateral, or coordinated actions. These activities will involve the scientific community, including those who are currently engaged in the GEC programmes and others who are willing and able to contribute to the needs of the action plan.

8. Develop a formal relationship among the relevant network nodes that will be promoting and/or carrying out the research and a funding plan for those nodes and for the Initiative management.

9. Reach out to potential partners and users. As an example, the UN High Level Panel on Global Sustainability would be one of such groups.

Launching the Initiative

After the launch of the Initiative at the March 2012 "Planet under Pressure" conference, the Rio+20 Earth Summit in June 2012 will provide a unique window of opportunity to present the Initiative and its goals and long-term benefits for societies, to a wide and influential audience of policy- and decision-makers from across the world.

References:

(1) ICSU (2010). Earth System Science for Global Sustainability: The Grand Challenges. International Council for Science, Paris.

(2) ICSU (2010). Regional Environmental Change: Human Action and Adaptation – What does it take to meet the Belmont Challenge. International Council for Science, Paris.

(3) Belmont Forum (2010). The Belmont Challenge: A Global, Environmental Research Mission for Sustainability.

ANNEX VII
Annex to paragraph 7.1.1 of the general summary

PROVISIONAL PROGRAMME OF SESSIONS OF CONSTITUENT BODIES

SESSIONS	PROPOSED DATES[1]	VENUE[2]
JCOMM-IV	23–31 May 2012	Yeosu, Republic of Korea
CBS-XV	September 2012	Geneva or Indonesia
CHy-XIV	November 2012	Geneva
XV-RA II	December 2012	Geneva or Qatar or Islamic Republic of Iran
XVI-RA IV	March 2013	Geneva or Curaçao and Sint Maarten
CAS-XVI	July 2013	Geneva or Egypt, Brazil, Turkey
XVI-RA VI	September 2013	Geneva or Serbia
CAgM-XVI	February 2014	Geneva or Turkey
XVI-RA V	April 2014	Geneva or Papua New Guinea
CAeM-XV	June 2014	Geneva or Canada (Montreal) (Conjoint with ICAO)
CCl-XVI	July 2014	Geneva or Germany
XVI-RA III	September/October 2014	Geneva or Paraguay
CIMO-XVI	October or November 2014	Geneva or Russian Federation (St Petersburg)
XVI-RA I	December 2014	Geneva or Kenya, Guinea, Zimbabwe

1. No invitation to host a session shall be considered unless it is received from the inviting government at least 300 days before the scheduled date of opening of the session (as stipulated in Annex I to Regulation 18 of the General Regulations (2011 edition)).
2. Necessary assurances should be obtained not later than 270 days before the scheduled opening date, failing which the meeting should be held in Geneva.

ANNEX VIII
Annex to paragraph 8.1.2 of the general summary

CONTRIBUTIONS TO THE EXPECTED RESULTS

Expected Results	WMO Programmes	Responsible Bodies	Responsible Departments
1. Enhanced capabilities of Members to deliver and improve access to high-quality weather, climate, water and related environmental predictions, information, warnings, and services in response to users' needs, and to enable their use in decision-making by relevant societal sectors.	AeMP*, AgMP*, ERA*, MMOP*, PWSP*, WWW/GDPFS*, GFCS*	CAeM, CAgM, CBS, JCOMM, EC, RAs	WDS*, CLW*
2. Enhanced capabilities of Members to reduce risks and potential impacts of hazards caused by weather, climate, water and related environmental elements.	DRR*, TCP*, WWW/GDPFS*, HWRP*, AgMP	CBS, EC/WG DRR, CHy, CAgM, EC	WDS*, CLW*
3. Enhanced capabilities of Members to produce better weather, climate, water and related environmental information, predictions and warnings to support in particular disaster risk reduction, and climate impact and adaptation strategies.	WCP/WCDMP, WWW/GDPFS, AgMP, WCP*, HWRP*	CBS, CAgM, CCl, CHy	OBS, WDS, CLW*
4. Enhanced capabilities of Members to access, develop, implement and use integrated and interoperable Earth- and space-based observation systems for weather, climate and hydrological observations, as well as related environmental and space weather observations, based on world standards set by WMO.	SAT, WCP*, WWW/GOS, WWW/IMO*, WWW/WIGOS*, WWW/WIS*, GCOS	JCOMM, CBS, CIMO, CCl, EC	OBS*, GCOS*
5. Enhanced capabilities of Members to contribute to and draw benefits from the global research capacity for weather, climate, water and the related environmental science and technology development.	WCRP*, WWRP*, GAW*	CAS	WCRP*, RES*
6. Enhanced capabilities of NMHSs, in particular in developing and least developed countries, to fulfil their mandates.	RP*, LDCP, TCOP*, AgMP, AeMP, ETRP*, HWRP*, WCP*, WCP/WCDMP*, WWW/GDPFS*	CAgM, CCl, CAeM, EC Panel on ET, CHy, CBS, EC Panel on Gender, RAs	DRA*, CLW*, WDS*, OBS*
7. New and strengthened partnerships and cooperation activities to improve NMHSs' performance in delivering services and to increase the value of the contributions of WMO within the United Nations system, relevant international conventions and national strategic issues.	AeMP, AgMP, WCP*, HWRP, OC*, RP, IPA*	CAeM, CAgM, CHy, CCl, EC	WDS, CLW, EM*, IPCC*, DRA, CER
8. An effective and efficient Organization.	PMO*, OC, LCP*		EM*, LCP*, IOO, REM

* Programmes and Departments that are significantly contributing to the Expected Results.

Note: A list of acronyms may be found at http://www.wmo.int/pages/themes/acronyms/index_en.html.

ANNEX IX
Annex to paragraph 9.1.8 of the general summary

FINANCIAL REGULATIONS OF THE WORLD METEOROLOGICAL ORGANIZATION

ARTICLE 1

Applicability

1.1 These Regulations shall govern the financial administration of the World Meteorological Organization (hereinafter called the Organization). They may be amended only by Congress. In the event of any conflict between any provisions of these Regulations and any provisions of the Convention, the Convention shall prevail.

ARTICLE 2

The financial period

2.1 The financial period shall be four years beginning on 1 January of the calendar year immediately following a session of Congress and ending on 31 December of the fourth year.

2.2 Nevertheless, in the event that a session of Congress is completed before the beginning of the last full year of a financial period, a new financial period shall begin on 1 January following that session of Congress.

ARTICLE 3

Maximum expenditures for the financial period

3.1 Estimates of maximum expenditures which may be incurred by the Organization in the financial period shall be prepared by the Secretary-General.

3.2 The estimates shall cover the income and expenditures for the financial period to which they relate and shall be presented in Swiss francs.

3.3 The estimates shall be presented in a results-based budget format and shall be accompanied by such informational annexes and explanatory statements as may be requested by, or on behalf of, Congress, and such further annexes or statements as the Secretary-General may deem necessary and useful.

3.4 The estimates shall be submitted to the Executive Council at least five weeks prior to the meeting at which they will be considered. The Executive Council shall examine them and prepare a report on them to Congress.

3.5 The estimates prepared by the Secretary-General shall be transmitted to all Members at least six months prior to the opening of Congress. The report of the Executive Council on the estimates shall be transmitted with the estimates or as soon as possible thereafter, but not later than three months before the beginning of the session of Congress.

3.6 The maximum expenditures for the following financial period shall be voted by Congress after consideration of the estimates and of any supplementary estimates prepared by the Secretary-General and of the reports of the Executive Council on them.

3.7 Supplementary estimates for the financial period may be submitted to the Executive Council by the Secretary-General during the interval between the submission of the estimates to the Executive Council and the opening of Congress.

3.8 The Secretary-General shall prepare each supplementary estimate in a form consistent with the applicable portion of the estimates for the financial period.

3.9 When time permits, the Executive Council shall examine the supplementary estimates and prepare a report thereon to Congress; otherwise they shall be left for consideration by Congress.

ARTICLE 4

Authorization of appropriations for the financial period

4.1 The maximum expenditures voted by Congress shall constitute an authority to the Executive Council to approve appropriations for each of the two bienniums comprising the financial period. The total appropriations shall not exceed the amount voted by Congress.

4.2 Transfers between appropriation parts may be authorized by the Executive Council, subject to the total amount of such transfers not exceeding 3 (three) per cent of the total maximum expenditure authorized for the financial period.

ARTICLE 5

The biennium

5.1 The first biennium will begin with the commencement of the financial period, followed by the second biennium beginning on 1 January of the third year of the financial period.

ARTICLE 6

The biennial budget

6.1 The biennial budget estimates shall be prepared by the Secretary-General.

6.2 The estimates shall cover income and expenditure for the biennium to which they relate and shall be presented in Swiss francs.

6.3 The biennial budget estimates shall be presented in a results-based budget format and shall be accompanied by such informational annexes and explanatory statements as may be requested by, or on behalf of, the Executive Council, and such further annexes or statements as the Secretary-General may deem necessary and useful.

6.4 The Secretary-General shall submit to the regular meeting of the Executive Council estimates for the following biennium. The estimates shall be transmitted to all members of the Executive Council at least five weeks prior to the opening of the regular session of the Executive Council.

6.5 The budget for the following biennium shall be approved by the Executive Council.

6.6 Supplementary estimates may be submitted by the Secretary-General whenever necessary.

6.7 The Secretary-General shall prepare these supplementary estimates in the same form as that of the applicable portions of the estimates for the biennium and shall submit the estimates to the Executive Council for approval.

ARTICLE 7

Appropriations

7.1 The appropriations approved by the Executive Council shall constitute an authorization to the Secretary-General to enter into commitments and make payments for the purposes for which the appropriations were approved and up to the amounts so approved.

7.2 Appropriations shall be available to enter into commitments during the biennium to which they relate.

7.3 Appropriations shall remain available for twelve months following the end of the financial year to which they relate to the extent that they are required to discharge commitments in respect of goods delivered and services rendered in the financial year and to discharge any other outstanding legal commitments of the financial year. At the end of the first biennium the remaining balance shall be re-appropriated subject to the approval of the Executive Council to the corresponding parts of the budget of the second biennium for the implementation of the programme approved by Congress. At the end of the second biennium the balance of the appropriations shall be surrendered.

7.4 At the end of the period provided in Regulation 7.3, the then remaining balance of any appropriations retained shall be surrendered.

7.5 Notwithstanding the provisions of Regulations 7.3 and 7.4 in the case of outstanding legal obligations in respect of fellowships, the portion of the appropriation required shall remain available until the fellowships are completed or otherwise terminated. At the time of the termination of the fellowship, any remaining balance shall be retained in the General Fund for the sole purpose of financing further long-term and short-term fellowships.

7.6 Amounts surrendered in accordance with Regulations 7.3 and 7.4 shall be retained for the purposes approved by Congress for the financial period subject to the provisions of Regulation 9.1.

7.7 A transfer between appropriation sections of the results-based budget format may be made by the Secretary-General subject to confirmation by the Executive Council.

ARTICLE 8

Provision of funds

Assessments

8.1 Appropriations shall be financed by contributions from Members of the Organization according to the scale of assessments determined by Congress, such contributions to be adjusted in accordance with the provisions of Regulation 8.2. Pending the receipt of such contributions the appropriations may be financed from the Working Capital Fund.

8.2 For each of the two years of a biennium the contributions of Member States shall be assessed on the basis of one half of the appropriations approved by the Executive Council for the biennium, except that adjustments shall be made to the assessment in respect of:

(a) Supplementary appropriations for which contributions have not previously been assessed on Member States;

(b) Half of the estimated miscellaneous income for the biennium for which credits have not previously been taken into account and any adjustments in estimated income previously taken into account.

8.3 After the Executive Council has approved the biennial budget and determined the amount needed for the Working Capital Fund, the Secretary-General shall:

(a) Transmit the relevant documents to the Members of the Organization;

(b) Inform the Members of their commitments in respect of annual contributions and advances to the Working Capital Fund;

(c) Request them to remit their contributions and advances.

8.4 Contributions and advances shall be considered as due and payable in full within 30 days of the receipt of the communication of the Secretary-General referred to in Regulation 8.3 above, or as of the first day of the year to which they relate, whichever is the later. As of 1 January of the following year, the unpaid balance of such contributions and advances shall be considered to be one year in arrears.

8.5 Annual contributions and advances to the Working Capital Fund of the Organization shall be assessed and paid in Swiss francs.

8.6 Notwithstanding the provisions of Regulation 8.5 and to facilitate payments by Members, the Secretary-General may accept, to the extent he may find it practicable, payments of contributions in freely convertible currencies other than the Swiss franc. The exchange rate applicable to these payments in establishing their equivalent in the currency of the State in which the Organization has its headquarters shall be the official United Nations rate of exchange in force on the date of credit to the WMO bank account.

8.7 Payments made by a Member of the Organization shall be credited first to the Working Capital Fund, then applied in chronological order to the reduction of the contributions which are due in accordance with the scale of assessments.

8.8 Notwithstanding the provisions of Regulation 8.7, amounts received in respect of the current year's contribution will be credited to that year providing that the full yearly instalment due under the terms of special arrangements as established by Congress concerning the repayment of long-outstanding contributions has been paid to the Organization. These special arrangements may be concluded with any Member being in arrears for more than four years on the date of entry into force of such arrangements.

8.9 The Secretary-General shall submit to the regular sessions of the Executive Council a report on the collection of contributions and advances to the Working Capital Fund.

Contributions from new Members

8.10 New Members of the Organization shall be required to make a contribution for the unexpired portion of the biennium in which they become Members and to provide their proportion of the total advances to the Working Capital Fund at rates to be determined provisionally by the Executive Council, subject to subsequent approval by Congress.

Contributions from Members withdrawing from the Organization

8.11 A Member withdrawing from the Organization shall make its contribution for the period from the beginning of the biennium in which it withdraws up to and including the date of its withdrawal and shall be entitled only to the amount standing to its credit in the Working Capital Fund, less any sum due from that Member of the Organization.

ARTICLE 9

Funds

9.1 There shall be established a General Fund for the purpose of accounting for expenditures authorized under Regulations 7.1, 7.2 and 7.3. The General Fund will be credited with contributions paid by Member States under Regulations 8.1, 8.10, 8.11 and miscellaneous income as defined under Regulation 10.1. Cash surpluses on the General Fund except that part of such surplus which represents income from interest received on funds other than the Working Capital Fund shall be credited on the basis of the scale of assessments to the Members of the Organization as follows:

(a) For Members who have paid in full their previous contributions, by deduction from the next assessment;

(b) For Members who have paid in full their contribution in respect of all previous financial periods, but who have not paid in full their contributions in respect of the period that relates to the surplus to be distributed, by reduction of their arrears, and thereafter by deduction from the next assessment;

(c) For Members who are in arrears for more than the financial period concerning the one which relates to the surplus to be distributed, their share of the surplus will be retained by the World Meteorological Organization in a special account and will be paid when the provisions of Regulation 9.1 (a) or (b) are met.

9.2 Income from interest on funds other than the Working Capital Fund that forms part of the cash surplus for any financial period shall be disposed of in accordance with decisions of Congress, and in the manner determined by Congress due consideration being given to the date of receipt of assessed contributions of Members of the Organization.

Working Capital Fund

9.3 There shall be established a Working Capital Fund to an amount fixed by Congress and for purposes to be determined from time to time by the Executive Council. The moneys of the Working Capital Fund shall be advanced by the Members of the Organization, or at the discretion of Congress provided from interest to the extent that it is earned on the investment of the cash resources of the Fund. Interest retained in the Fund shall be credited to Members' advance accounts in accordance with current balances. Advances by Members shall be calculated by the Executive Council in accordance with the scale of assessments for the apportionment of the expenses of the Organization, and shall be carried to the credit of those Members that have made such advances.

9.4 Advances made from the Working Capital Fund to finance appropriations during a biennium shall be reimbursed to the Fund as soon as and to the extent that income is available for that purpose.

9.5 Except when such advances are recoverable from some other source, advances made from the Working Capital Fund for unforeseen and extraordinary expenses or other authorized purposes shall be reimbursed through the submission of supplementary estimates.

9.6 Income derived from investments of the Working Capital Fund, not retained in the Fund to meet an increase in the level of the capital of the Fund, shall be credited to miscellaneous income.

9.7 Trust funds, reserve and special accounts may be established by the Secretary-General and shall be reported to the Executive Council.

9.8 The purpose and limits of each trust fund, reserve and special account shall be clearly defined by the Executive Council. Unless otherwise provided by Congress, such funds and accounts shall be administered in accordance with the present Financial Regulations.

9.9 Income derived from investments of trust funds, reserve and special accounts shall be credited as provided in the provisions applicable to such funds or accounts or at the request of the donors at any time. In other circumstances, Regulation 10.1 shall apply.

ARTICLE 10

Other income

10.1 All other income, except:

(a) Contributions to the budget;

(b) Direct refunds of expenditures made during the financial year;

(c) Advances or deposits to funds and accounts;

(d) Interest earned on the Working Capital Fund to the extent that it is required to augment the level of the Working Capital Fund;

shall be classed as miscellaneous income, for credit to the General Fund, unless otherwise specified in accordance with Regulation 9.9.

Voluntary contributions, gifts or donations

10.2 Voluntary contributions, whether or not in cash, may be accepted by the Secretary-General, provided that the purposes for which the contributions are made are consistent with the policies, aims and activities of the Organization and provided that the acceptance of such contributions that directly or indirectly involve additional financial liability for the Organization shall require the consent of Congress or, in case of urgency, of the Executive Council.

10.3 Moneys accepted for purposes specified by the donor shall be treated as trust funds or special accounts under Regulations 9.7 and 9.8.

10.4 Moneys accepted in respect of which no purpose is specified shall be treated as miscellaneous income and shall be reported as “gifts” in the annual accounts.

ARTICLE 11

Custody of funds

11.1 The Secretary-General shall designate the bank or banks in which the funds of the Organization shall be kept.

ARTICLE 12

Investment of funds

12.1 The Secretary-General may make short-term investments of moneys not needed for immediate requirements and shall inform the Executive Council periodically of the investments thus made.

12.2 The Secretary-General may make long-term investments of moneys standing to the credit of trust funds, reserve and special accounts, except as may be otherwise provided by the appropriate authority in respect of each such fund or account and having regard to the particular requirements as to the liquidity of funds in each case.

ARTICLE 13

Internal control

13.1 The Secretary-General shall:

(a) Establish detailed financial procedures in order to ensure effective financial administration and the exercise of economy;

(b) Cause all payments to be made on the basis of supporting vouchers and other documents that ensure that the services or goods have been received, and that payments have not previously been made;

(c) Designate the officers who may receive moneys, incur obligations and make payments on behalf of the Organization.

13.2 (a) In addition to payments authorized under clause (b) below, and notwithstanding Regulation 13.1 (b) above, the Secretary-General may, when he deems it in the interest of the Organization to do so, authorize progress payments;

(b) Except where normal commercial practice in the interest of the Organization so requires, no contract or purchase order shall be made on behalf of the Organization which requires a payment in advance of the delivery of goods or performance of contractual services.

13.3 No obligations shall be incurred until allotments or other appropriate authorizations have been made in writing under the authority of the Secretary-General.

Ex gratia payments

13.4 The Secretary-General may with the approval of the President make such ex gratia payments as he deems to be necessary in the interest of the Organization, provided that a statement of such payments shall be submitted to the Executive Council with the financial statements as detailed in Regulation 14.1.

Writing-off of losses or deficiencies

13.5 The Secretary-General may, after full investigation, authorize the writing-off of losses of cash, stores and other assets, except unpaid contributions, provided that a statement of all such amounts written off shall be submitted to the External Auditor with the financial statements.

Contracts and purchases

13.6 Tenders for equipment, supplies and other requirements shall be invited by advertisement, except where the Secretary-General deems that, in the interests of the Organization, a departure from the rule is desirable.

Internal oversight

13.7 Under the broader scheme of internal oversight, the Secretary-General shall establish an office to provide for an independent verification of financial, administrative and operational activities of WMO, including programme evaluation, monitoring mechanisms and consulting services. The office shall be called the Internal Oversight Office and shall ensure:

(a) The regularity of the receipt, custody and disposal of all funds and other financial resources of the Organization;

(b) The conformity of expenditure with the appropriations or other financial provisions voted by Congress or approved by the Executive Council, or with the purpose and rules related to trust funds and special accounts;

(c) The compliance of all financial and other management activities with the established legislation;

(d) The timeliness, completeness and accuracy of financial and other administrative data;

(e) The effective, efficient and economical use of all resources of the Organization.

13.8 The Internal Oversight Office shall also be responsible for investigating all allegations or presumptions of fraud, waste, mismanagement or misconduct and for conducting inspections of services and organizational units.

13.9 The Secretary-General shall appoint a technically qualified head of Internal Oversight Office after consulting with, and obtaining the approval of, the President of WMO acting on behalf of the Executive Council. Notwithstanding Articles 9, 10 and 11 of the Staff Regulations dealing with separation from service, disciplinary measures and appeals, respectively, the Secretary-General shall likewise consult the President of WMO acting on behalf of the Executive Council and obtain his approval before separation of the head of the Office. These actions by the President in accordance with General Regulation 146 shall be reported to the following regular session of the Executive Council.

13.10 The Internal Oversight Office shall function in accordance with the following provisions:

(a) The head of the Office shall report directly to the Secretary-General;

(b) The Office shall have full, free and prompt access to all records, property, personnel, operations and functions within the Organization that, in its opinion, are relevant to the subject matter under review;

(c) It shall be available to receive directly from individual staff members complaints or information concerning the possible existence of fraud, waste, mismanagement or misconduct. No reprisals shall be taken against staff members providing such information unless this was wilfully provided with the knowledge that it was false or with intent to misinform;

(d) It shall report the results of its work and make recommendations to the Secretary-General with a copy to responsible managers for action and the External Auditor. At the request of the head of the Office, any such report shall be submitted to the Executive Council together with the Secretary-General's comments thereon;

(e) The Office shall submit a summary report annually to the Secretary-General with a copy to the External Auditor on its activities, including the orientation and scope of such activities. This report shall be submitted to the Executive Council by the Secretary-General together with any comments he wishes to make;

(f) It shall monitor the implementation of recommendations duly noted by the Executive Council.

ARTICLE 14

Financial statements

14.1 The Secretary-General shall submit to the Executive Council, for its approval, annual financial statements showing for the year to which they relate:

(a) A statement of financial position;

(b) A statement of financial performance;

(c) A statement of changes in net assets/equity;

(d) A statement of cash flow;

(e) A comparison of actual amounts and the approved budget;

(f) Notes, comprising a summary of significant accounting policies and other explanatory notes.

In addition, he shall maintain, for management purposes, such accounting records as are necessary.

14.2 The Secretary-General shall submit for the second year of the biennium, in addition to the financial statements for the year as indicated in Regulation 14.1, a statement showing for the biennium to which they relate the status of appropriations, including:

(a) The original budget appropriations;

(b) The appropriations as modified by any transfers;

(c) Credits, if any, other than the appropriations approved by the Executive Council;

(d) The amounts charged against those appropriations and/or other credits.

14.3 The financial statements of the Organization shall be presented in Swiss francs and shall be prepared in accordance with International Public Sector Accounting Standards. Accounting records may, however, be kept in such currency or currencies as the Secretary-General may deem necessary.

14.4 Appropriate separate accounts shall be maintained for all trust funds, reserve and special accounts.

14.5 The financial statements shall be submitted by the Secretary-General to the External Auditor not later than 31 March following the end of the financial year to which they relate.

14.6 The Secretary-General shall submit, in addition to the financial statements of the first year of the financial period a statement of the total expenditures made in respect of the previous financial period.

ARTICLE 15

External audit

Appointment

15.1 An External Auditor, who shall be the Auditor-General (or officer holding the equivalent title) of a Member State, shall be appointed in the manner and for the period decided by the Executive Council.

Tenure of office

15.2 If the External Auditor ceases to hold that office in his or her own country, his or her tenure of office as External Auditor shall thereupon be terminated and he or she shall be succeeded as External Auditor by his or her successor as Auditor-General. The External Auditor may not otherwise be removed during his or her tenure of office except by the Executive Council.

Scope of audit

15.3 The audit shall be conducted in conformity with generally accepted common auditing standards, and, subject to any special directions of the Executive Council, in accordance with the additional terms of reference set out in the annex to these Regulations.

15.4 The External Auditor may make observations with respect to the efficiency of the financial procedures, the accounting system, the internal financial controls and, in general, the administration and management of the Organization.

15.5 The External Auditor shall be completely independent and solely responsible for the conduct of the audit.

15.6 The Executive Council may request the External Auditor to perform certain specific examinations and issue separate reports on the results.

Facilities

15.7 The Secretary-General shall provide the External Auditor with the facilities he or she may require in the performance of the audit.

15.8 For the purpose of making a local or special examination or of effecting economies of audit cost, the External Auditor may engage the services of any national Auditor-General (or equivalent title) or commercial public auditors of known repute or any other person or firm who, in the opinion of the External Auditor, is technically qualified.

Reporting

15.9 The External Auditor shall issue reports on the audit of the financial statements and relevant schedules, which shall include such information as he or she deems necessary in regard to matters referred to in Regulation 15.4 and in the additional terms of reference.

15.10 The External Auditor's reports shall be transmitted, together with the relevant audited financial statements, to the Executive Council, which shall examine them in accordance with any directions given by Congress.

15.11 The financial statements, together with the External Auditor's certificates, shall be transmitted to the Members of the Organization by the Secretary-General.

ARTICLE 16

Decisions involving expenditures

16.1 No regional association, technical commission or other competent body shall take a decision involving either an administrative change in a programme approved by Congress or the Executive Council, or the possible requirement of expenditure, unless it has received and taken account of a report from the Secretary-General on the administrative and financial implications of the proposal. Where, in the opinion of the Secretary-General, the proposed expenditure cannot be made from the existing appropriations, it shall not be incurred until the Executive Council has made the necessary appropriations, unless the Secretary-General certifies that provision can be made under the conditions of the resolution of the Executive Council relating to unforeseen expenditure.

ARTICLE 17

General provisions

17.1 In case of urgency and with the approval of the President of the Organization, the Secretary-General shall refer to Members, for decision by correspondence, financial matters that are beyond the competence of the Executive Council.

17.2 The applications of any of the present Regulations may be suspended for a period that shall not extend beyond the next session of Congress if the Executive Council has decided that the matter under consideration is of such a character that a decision should be taken before the next Congress. In such circumstances, the proposal of the Executive Council for such a suspension shall be communicated by the Secretary-General to all Members for consultation and subsequently for a postal ballot according to the procedures for voting by correspondence in the General Regulations.

17.3 In the application of Regulation 17.1 the proposal shall be adopted, and in the application of Regulation 17.2 the suspension of regulations shall be put into force, if two thirds of the votes cast for and against that have reached the Secretariat within 90 days of the date of dispatch of the request to vote to Members are in the affirmative. The decisions shall be communicated to all Members.

17.4 In case of doubt as to the interpretation or application of any of these Financial Regulations, the Secretary-General is authorized to rule thereon, subject to confirmation by the President in important cases.

17.5 The present Financial Regulations do not apply to the field projects of the technical cooperation activities of the Organization financed by the United Nations Development Programme; the Secretary-General is authorized to administer those activities under Financial Regulations and Rules established by the governing body and the Administrator of the United Nations Development Programme.

ANNEX

ADDITIONAL TERMS OF REFERENCE GOVERNING EXTERNAL AUDIT

(1) The External Auditor shall perform such audit of the financial statements of the Organization, including all trust funds and special accounts, as he or she deems necessary in order to satisfy himself or herself:

(a) That the financial statements are in accord with the books and records of the Organization;

(b) That the financial transactions reflected in the statements have been in accordance with the rules and regulations, the budgetary provisions and other applicable directives;

(c) That the securities and moneys on deposit and on hand have been verified by certificate received direct from the Organization's depositaries or by actual count;

(d) That the internal controls are adequate in the light of the extent of reliance placed thereupon;

(e) That procedures satisfactory to the External Auditor have been applied to the recording of all assets, liabilities, surpluses and deficits.

(2) The External Auditor shall be the sole judge as to the acceptance in whole or in part of certifications and representations by the Secretary-General and may proceed to such detailed examination and verification as he or she chooses of all financial records, including those relating to supplies and equipment.

(3) The External Auditor and his or her staff have free access at all convenient times to all books, records and other documentation that are, in the opinion of the External Auditor, necessary for the performance of the audit. Information that is classified as privileged and which the Secretary-General (or his designated senior official) agrees is required by the External Auditor for the purposes of the audit and information classified as confidential shall be made available on application. The External Auditor and his or her staff shall respect the privileged and confidential nature of any information so classified that has been made available and shall not make use of it except in direct connection with the performance of the audit. The External Auditor may draw the attention of the Executive Council to any denial of information classified as privileged that in his or her opinion was required for the purpose of the audit.

(4) The External Auditor shall have no power to disallow items in the financial statements but shall draw to the attention of the Secretary-General for appropriate action any transaction concerning which he or she entertains doubt as to legality or propriety. Audit objections to these, or any other transactions, arising during the examination of the financial statements shall be communicated immediately to the Secretary-General.

(5) The External Auditor shall express and sign an opinion on the financial statements of the Organization. The opinion shall include the following basic elements:

(a) The identification of the financial statements audited;

(b) A reference to the responsibility of the Secretary-General and the responsibility of the External Auditor;

(c) A reference to the audit standards followed;

(d) A description of the work performed;

(e) An expression of opinion on the financial statements as to whether:

(i) The financial statements present fairly the financial position as at the end of the period and the results of the operations for the period;

(ii) The financial statements were prepared in accordance with the stated accounting policies;

(iii) The accounting policies were applied on a basis consistent with that of the preceding financial period;

(f) An expression of opinion on the compliance of transactions with the Financial Regulations and legislative authority;

(g) The date of the opinion;

(h) The External Auditor's name and position;

(i) Should it be necessary, a reference to the report of the External Auditor on the financial statements.

(6) The report of the External Auditor to the Executive Council on financial operations of the period should mention:

(a) The type and scope of his or her examination;

(b) Matters affecting the completeness or accuracy of the financial statements, including, where appropriate:

(i) Information necessary to the correct interpretation of the financial statements;

(ii) Any amounts which ought to have been received but which have not been brought to account;

(iii) Any amounts for which a legal or contingent obligation exists and which have not been recorded or reflected in the financial statements;

(iv) Expenditures not properly substantiated;

(v) Whether proper books of accounts have been kept. Where in the presentation of statements there are deviations of a material nature from the generally accepted accounting principles applied on a consistent basis, these should be disclosed;

(c) Other matters that should be brought to the notice of the Executive Council, such as:

(i) Cases of fraud or presumptive fraud;

(ii) Wasteful or improper expenditure of the Organization's money or other assets (notwithstanding that the accounting for the transaction may be correct);

(iii) Expenditure likely to commit the Organization to further outlay on a large scale;

(iv) Any defect in the general system or detailed regulations governing the control of receipts and disbursements or of supplies and equipment;

(v) Expenditure not in accordance with the intention of Congress and/or the Executive Council after making allowance for duly authorized transfers within the budget;

(vi) Expenditure in excess of appropriations as amended by duly authorized transfers within the budget;

(vii) Expenditure not in conformity with the authority that governs it;

(d) The accuracy or otherwise of the supplies and equipment records as determined by stock-taking and examination of the records;

(e) If appropriate, transactions accounted for in a previous year concerning which further information has been obtained or transactions in a later year concerning which it seems desirable that the Executive Council should have early knowledge.

(7) The External Auditor may make such observations with respect to his or her findings resulting from the audit and such comments on the Secretary-General's financial report as he or she deems appropriate to the Executive Council or to the Secretary-General.

(8) Whenever the scope of audit of the External Auditor is restricted, or whenever he or she is unable to obtain sufficient evidence, the External Auditor shall refer to the matter in his or her report, making clear in the report the reasons for his or her comments and the- effect on the financial position and the financial transactions as recorded.

(9) In no case shall the External Auditor include criticism in his or her report without first affording the Secretary-General an adequate opportunity of explanation on the matter under observation.

(10) The External Auditor is not required to mention any matter referred to in the foregoing that, in his or her opinion, is insignificant in all respects.

ANNEX X
Annex to paragraph 9.2.4 of the general summary

REPORT OF THE STAFF ASSOCIATION

Staff members have indicated concern over the impacts of reductions of staff in the Conferences and Common Services functions in recent years. Reduction in staff in these areas has led to changes in procedures associated with meetings, procurement, etc. There have also been changes in procedures related to travel, finance and budget activities. With respect to the evolution of WMO Secretariat processes, staff members recommended that they be regularly included in the development of new procedures before they are implemented, that practical instructions and technical support be easily accessible and that related training be made mandatory. Funding for activities such as development of manuals, and conducting training is, however, often subject to the availability of funds.

Training in management and supervisory skills, such as working with the media, communicating technical information to non-technical audiences, using new software tools (e.g., conferencing,

publishing, database software) would be highly beneficial in the workplace. Such training is partly available through the United Nations (UN) system, but these courses are rarely used by staff. Language training in the six official languages of WMO is also available to most staff members through the UN system. Language courses are more frequently used by staff, although due to time/work constraints, not all staff members who would benefit from this training are able to take full advantage of this opportunity. The JCC agreed on the relevance and importance of training, but noted that approval and funding were at the discretion of managers in individual departments, as currently there is no central budget allocated to cover such costs, except for language training. Training other than in languages therefore is not systematically offered or approached through an organized plan for staff development.

In response to the 2008 Staff Opinion Survey, a recommendation had been made to review the Performance Appraisal Report (PAR) Scheme. Subsequently, a Management-Staff Task Team was established, which delivered a number of recommendations. Following consideration by the WMO Executive Management and JCC, it was agreed to expand the PAR process to include: discussion between supervisors and their staff on additional competencies of teamwork; communication; and planning and organizing skills. At the 2010 GA, it was noted that to date, this modification of the PAR Scheme process was the main concrete outcome directly based on the 2008 Survey.

The critical role of supervisors in the overall management of the human resources of the Secretariat, and in matters related to the health and well-being and effectiveness of staff was recognized by JCC. The staff noted the benefits of an information and briefing package to be provided to new supervisors, to provide an easy-to-use set of references, requirements, suggestions, forms and tools, but no agreement was reached to undertake this due to lack of resources. Based on the recommendation of JCC and subsequent endorsement by the Secretary-General, it was decided to include in the text of future vacancy notices, that supervisory experience, preferably in an international setting, would be an advantage. The staff recommended that all supervisors should be provided with the readily available UN training (which is mandatory for supervisors in the UN core system), shortly after undertaking their posts.

In addition to the introductory materials provided by the Human Resources Division (HRD) to new recruits, considerable practical and operational support is also required to enable new staff members to fully and quickly integrate into the WMO systems and activities. The JCC recommendation that retired staff members with knowledge of the work could be hired for up to one week to provide such introductory briefings and guidance (subject to the availability of funds), was endorsed by the Secretary-General.

The planned introduction of the new Google Apps System was noted by staff. The establishment of a new Management-Staff Working Group to look into, and facilitate, its potentially positive influence on simplification and efficiency of many of the Secretariat work processes was appreciated.

With respect to health and well-being, the staff noted that there were indicators (including through information provided by the Social Welfare Officer, cases reported to the SC, and an analysis of leave taken by staff from 2004–2008 by the Internal Oversight Office (IOO)), of some degree of work-related stress. At JCC, Management did not agree with the pursuit and joint analysis of factual information in this regard from the UN Medical Service, as requested by the staff.

The staff noted with appreciation the recent Management initiative to launch a recycling programme in the WMO Secretariat, and recommended the re-invigoration of the joint ‘Green Committee’ to undertake other environmentally friendly initiatives in line with guidance from EC-LX. Staff also appreciated the completion of a number of initiatives undertaken at their instigation, including the renovations to the cafeteria, and the re-establishment of the Medical Emergency First Aid Response Team.

ANNEX XI
Annex to paragraph 11.7.1 of the general summary

WORLD METEOROLOGICAL ORGANIZATION STATEMENT ON THE ROLE AND OPERATION OF NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES FOR DIRECTORS

Introduction

This statement by the World Meteorological Organization (WMO) presents information on the role and operation of National Meteorological and Hydrological Services (NMHSs) worldwide. The four sections of the document present the functions of National Meteorological and Hydrological Services; their contribution to social and economic development; the services they provide; the basic systems to support service delivery; legislative and institutional matters, including governance, partnership and cooperation; and future development opportunities, among other issues.

It is recognized that weather, climate, water and related environmental conditions have a significant influence on the socio-economic development of countries around the world. The increase in the world's population and the extension of human settlements and life-supporting activities into areas vulnerable to the impacts of weather-, climate- and water-related disasters make it necessary to improve the capacities of NMHSs, especially in developing and least developed countries, to provide better services to reduce disaster risks, and to support national development and life-supporting activities. The increase in the frequency and intensity of natural hazards due to climate variability and change poses critical challenges for many countries.

The NMHSs, as recognized in the World Meteorological Organization Convention[1], are a fundamental part of national infrastructure and play an important role in supporting vital functions of governments. Inadequate infrastructure and limited human resources in some NMHSs, however, especially in developing and least developed countries, are among the factors that limit their capacity to take advantage of advances in science and technology to improve their services.

The observations and data gathered by NMHSs form the foundation for the monitoring and prediction of weather, climate, water and related environmental conditions, as well as the issuance of warnings and alerts. There is marked disparity in the observation networks, however, with developing and least developed countries having sparse networks that do not adequately represent the weather and climate conditions affecting these countries. The sparse observation networks ultimately affect the quality and range of services that NMHSs can provide.

The NMHSs also use telecommunications networks, which are vital for the exchange of data and products that enable them fulfil their national mandates. The telecommunications networks used by some NMHSs are inadequate and obsolete, which hampers the efficient flow of observations and products, including multi-hazard early warnings.

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[1] The WMO Convention, adopted on 11 October 1947 and revised in 2007, reaffirmed "the vital importance of the mission of the National Meteorological, Hydrometeorological and Hydrological Services in observing and understanding weather and climate and in providing meteorological, hydrological and related services in support of relevant national needs which should include the following areas:
(a) Protection of life and property;
(b) Safeguarding the environment;
(c) Contributing to sustainable development;
(d) Promoting long-term observation and collection of meteorological, hydrological and climatological data, including related environmental data;
(e) Promotion of endogenous capacity-building;
(f) Meeting international commitments;
(g) Contributing to international cooperation."

The efficient provision and delivery of services can significantly reduce the impacts of hydrometeorological hazards that cause large losses of life and property worldwide.

The media offer an important means of delivering forecasts and warnings to the public, hence developing constructive relationships and partnerships with the media is important to enhance service delivery to the public.

This statement is developed, in accordance with the decision of the Fifteenth World Meteorological Congress (May 2007), to assist the Directors of NMHSs in addressing the evolving scientific, technological and societal challenges within the purview of their respective mandates, and in their collaboration with government agencies and user sectors. This statement informs decisions by Directors of NMHSs and decision-makers on further development of their respective NMHSs.

PART 1: MISSION

Functions of National Meteorological and Hydrological Services

1. The National Meteorological and Hydrological Services own and operate most of the infrastructure that is needed for providing the weather, climate, water and related environmental services for the protection of life and property, economic planning and development, and the sustainable exploitation and management of natural resources. Most of the NMHSs:

(a) Develop and distribute forecasts, warnings and alerts to help protect life and property and to support efforts to reduce the impacts of weather, climate, water and related environmental natural hazards;

(b) Provide essential data, information and products necessary for designing/planning, developing and managing infrastructure, settlements and other essential sectors, such as agriculture, water resources, energy and transport, for improving the well-being of societies;

(c) Maintain a continuous, reliable and comprehensive historical record of their national weather, climate, water and related environmental data;

(d) Provide relevant advice on weather, climate, water and related environmental issues for decision-making;

(e) Advance science and technology related to weather, climate and water, in addition to developing and improving their own operations and services through research and development;

(f) Participate in the development, implementation and operation of national multi-hazard early warning systems, including those involving seismology, volcanic ash monitoring, transboundary pollution and ocean-related phenomena such as tsunamis;

(g) Fulfil relevant international commitments, including those under the Convention of the World Meteorological Organization, and further national interests through participation in the appropriate international programmes and activities;

(h) Establish and operate observing station networks that gather observations of the earth–atmosphere–ocean system in real time to support the provision of weather, climate, water and related environmental services and research activities, including the assessment and projection of climate change;

(i) Establish and operate telecommunications networks for the rapid exchange of observations, data and services;

(j) Acquire and operate data-processing and forecasting systems to provide real-time weather, climate, water and related environmental services, including warnings and alerts to the

public and sectors such as agriculture, water resources, energy, health, shipping, aviation, national defence and environment;

(k) Acquire and operate a product dissemination system for the efficient and effective delivery of information and services to users to enable planning, preparedness and decision-making for socio-economic development.

Contribution to economic and social development activities in their countries

2. Weather, climate, water and related environmental services are useful inputs for socio-economic planning and development. The influence of weather, climate, water and related environmental conditions continues to shape the cultures, traditions and development paths of societies worldwide. The challenges of climate variability and change will require efficient provision and application of weather, climate, water and related environmental services to enable societies to reduce the associated risks. Improved understanding of weather, climate and hydrological processes, together with their prediction, enables the NMHSs to provide better services to their countries. Some NMHSs, however, have not been able to take advantage of the advances in science and technology due to inadequate infrastructure and limited human resource capacities.

3. The potential benefits from enhancing the quality and use of meteorological, climate, and hydrological information and products in decision-making are enormous, but realizing these benefits will require improvements in infrastructure, human resources development, and engagement between the providers and users to enhance the process for decision-making and realization of social and economic benefits.

Contribution to international efforts on sustainable development

4. Weather systems and changing climate conditions do not stop at national boundaries. In order to forecast weather and ascertain future climate conditions, the NMHSs require meteorological, hydrological and environmental data and products not only from within their own territory, but also from outside its borders. The requirement for sharing information in a common format has been recognized since the establishment of the first National Meteorological Services (NMSs) in the 1850s and it was the driving force behind the formation of the International Meteorological Organization (IMO) in 1873 to coordinate data sharing and the development of user- and sector-specific products and services. The World Meteorological Organization, an intergovernmental specialized agency within the United Nations system, replaced the IMO in 1950.

5. The NMHSs make important contributions to international systems established by the Members of WMO to coordinate the collection of observations based on common standards of accuracy and reliability, to process these observations and data into weather forecasts and advisories, and to exchange information and products among all NMHSs in real time. The success of the operation of this established international system is dependent on the contributions of individual countries.

6. The World Meteorological Organization carries out its work through ten major scientific and technical programmes. These are designed to assist all Members to provide, and benefit from, a wide range of meteorological and hydrological services and to address present and emerging problems. The programmes are based on the concept and experience that mutual benefits are gained from cooperative use of the pool of knowledge that has been and is still being created through the worldwide sharing of meteorological, hydrological and related information among Members. The programmes of WMO make possible the provision of meteorological and related services through NMHSs in all countries at costs far below those that would be incurred if each Member acted alone.

7. The observational data gathered and kept by NMHSs provide useful information to advise national governments on international and regional environmental agreements and working arrangements related to weather, climate, water and the environment.

PART 2: SERVICE DELIVERY

Services provided by National Meteorological and Hydrological Services

8. The NMHSs provide weather, water, climate and related environmental services to a wide range of sectors, including agriculture, water, energy, tourism, transport and health, to help them reduce the risks of, and derive economic benefits from, the associated conditions. The provision of user-targeted products, together with their application, requires close collaboration between NMHSs and users to enable the integration of user needs into the development of services and facilitate feedback for their improvement. The rapid delivery of warnings and alerts requires close collaboration with the media and telecommunications service providers.

9. The NMHSs provide meteorological and related services to the agricultural community to help improve production, reduce losses and risks, and reduce costs and increase efficiency in the use of water and energy, among other things.

10. With regard to the civil aviation sector, NMHSs provide data, products and services that contribute to the safety of aviation and the economical operation of the sector both nationally and internationally. The measurements and forecasts of conditions en route and at, or on the approach to, terminal aerodromes are useful for minimizing aircraft operating costs. By increasing the operating efficiency of flights, NMHSs also contribute to a reduction in the negative impacts of aircraft emissions on global climate change and stratospheric ozone.

11. The NMHSs provide early warnings and alerts of extreme events that contribute to reducing the impact of these events when coupled with effective emergency response systems. NMHSs rely on the communications infrastructure to issue timely warnings. In most countries the NMHSs are part of multisectoral systems for disaster risk reduction and response. Some of them participate in the development, implementation and operation of multi-hazard early warning systems, including those involving seismology and ocean-related phenomena such as tsunamis. The integration of weather, climate, water and related environmental information into national planning and development policies is an essential element in reducing the risks associated with severe weather and extreme climate events.

12. The NMHSs provide forecasts and warnings of floods, water levels and discharge within river basins, watersheds and coastal areas. These products are critical for protecting life and property, for safeguarding the environment, and for efficient management of water resources as a contribution to sustainable development. In some countries National Meteorological Services and National Hydrological Services are represented by separate institutions, making it essential to engage in close collaboration for the efficient delivery of services.

13. The NMHSs provide marine meteorological forecasts and warnings of coastal and open ocean conditions that are vitally important for marine transport and operations, for the safety of life and property in coastal areas, and for operations of ports and harbours.

14. The NMHSs provide data, products and services, such as daily forecasts of temperature, humidity and air quality, as well as long-range predictions and severe weather warnings, that help in monitoring disease outbreaks, which is important for planning and providing public health services.

Basic systems to support the delivery of services

- ***Observing and monitoring the atmosphere and related environment***

15. Observations of the atmosphere and the related environment form the foundation for the production of weather, climate, water and related environmental services. These observations are also essential for conducting research to improve services, for assessing changes in the climate system, and for developing and operating systems in weather- and climate-dependent sectors

such as agriculture, water, transport and energy, among others, to support efforts of communities to reduce disaster risks and adapt to climate variability and change.

16. Observation is one of the pillars of the Global Framework for Climate Services (GFCS), established by the Heads of State and Government, Ministers and Heads of Delegations at the World Climate Conference-3 in 2009, "to strengthen the production, availability, delivery and application of science-based climate prediction and services." The pillar on observation forms the foundation for achieving the expectations arising from the other pillars of the GFCS, namely Climate Research, Modelling and Prediction; a Climate Services Information System; and a Climate User Interface Programme.

17. The NMHSs establish and operate observation networks that form the WMO Global Observing System (GOS), a component of the WMO Integrated Global Observing System (WIGOS). The Global Observing System is comprised of operationally reliable surface- and space-based subsystems. These systems are owned and operated by the WMO Member countries, which undertake to meet certain standards and responsibilities in the agreed global system, for the benefit of all nations.

18. The Global Observing System forms the foundation for the development and implementation of WIGOS. The WMO Integrated Global Observing System is a coordinated, standardized system of systems for gathering meteorological and other environmental observations on a global scale in support of all WMO Programmes. Its purpose is to significantly improve the availability of observational data and products for all Members.

- ***Exchange of observations, data and products – nationally and internationally***

19. The NMHSs establish and operate telecommunications networks that together form the WMO Global Telecommunication System (GTS), which facilitates the rapid exchange of observations, data and products to enable NMHSs worldwide to meet their national and international obligations. This system also plays a key role in the dissemination of tsunami early warnings around the world.

20. The Global Telecommunication System forms the foundation for the development and implementation of the WMO Information System (WIS). The Members of WMO are cooperating in the design and implementation of WIS to improve current data communications and the dissemination of weather, climate and water data and information. By using a broader array of communication and data technologies, including the Internet, WIS will reduce the operating costs and enhance the reliability of data communications and provide easier, more user-friendly ways to share data and products internationally. In addition to its automated dissemination of observed data and products, WIS will provide data discovery, access and retrieval services for all weather, climate, water and related data and products produced by WMO centres and Members.

21. The WMO policy on the exchange of meteorological data and hydrological data is determined to a large degree by Resolution 40 (Cg-XII) and Resolution 25 (Cg-XIII), respectively. These resolutions commit "to broadening and enhancing the free and unrestricted international exchange" of meteorological, hydrological, and related data and products as a fundamental WMO principle.

- ***Data processing and forecasting***

22. The observations and data gathered by NMHSs are processed to generate products that can support decision-making in addressing events such as tropical cyclones and hurricanes, heatwaves, disease outbreaks, flash floods and drought, among others. The quality of the products is dependent on the adequacy of processing facilities and human resources. All NMHSs contribute to these products through the sharing of observations, which are the basis for generating the forecasts and warnings.

23. The World Meteorological Organization has designated some NMHSs as Regional Specialized Meteorological Centres (RSMCs), which provide forecast products to all other NMHSs. These centres may have a geographical, tropical cyclone, or environmental emergency response specialization, among other things. In addition, WMO has designated Global Producing Centres (GPCs) and Regional Climate Centres (RCCs), which focus on longer-range predictions. The climate predictions and information provided by GPCs and RCCs are useful tools for planning and developing activities in climate-sensitive sectors such as agriculture, water resources, energy and health.

24. The NMHSs can then utilize RSMC products to develop forecasts and warnings of severe weather and climate extreme events for their respective countries to support socio-economic development activities.

PART 3: THE ELEMENTS FOR SUCCESSFUL OPERATION OF THE NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES

Legislative and institutional matters

- ***National legal instruments to define the mission and mandate of NMHSs***

25. The legal instrument establishing an NMHS is an important element in its successful operation. The Thirteenth World Meteorological Congress reaffirmed the importance of having national legal instruments that define the mission and mandate of NMHSs to ensure clarity in the definition of their responsibilities and recognition of their contribution to society to facilitate the allocation of adequate resources. The advantages of such a legal instrument are:

(a) Duties and areas of responsibility of the NMHS are defined for the benefit of both the NMHS and the governments;

(b) The NMHS is clearly designated as the “official” weather, climate and flood warning service and as the “national authority” in warning situations, to avoid public confusion;

(c) Legal protection is provided for the field equipment and officers in the performance of their duties;

(d) Direct access to essential international communications is assured;

(e) Coordination of various weather, climate, water and related environmental activities in the country is provided;

(f) A basis for determining the level of funding needed to fulfil the agreed role is clarified, including provisions for retaining revenues earned by the NMHS to improve its operations.

26. Over half of the NMHSs operated by Members of WMO have formal legal instruments (such as a law, act or decree) covering their responsibilities, the establishment and operation of their facilities, and government regulation and legal responsibility. Other issues included in the legal instruments are the roles of the NMHSs in the prevention/mitigation of natural disasters, international cooperation, and supplementary provisions and funding.

- **Impacts of international agreements**

27. Observations and data gathered, processed and archived by NMHSs provide useful information for addressing international conventions and agreements, especially those related to climate, water and environment. Most governments are parties to some international conventions, agreements or declarations, such as the United Nations Millennium Declaration, including the

Millennium Development Goals, the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Convention to Combat Desertification (UNCCD), and the Vienna Convention for the Protection of the Ozone Layer, among others. Working with other national agencies, the NMHSs are often involved in developing and supporting government positions at international meetings related to weather, climate, water and related environmental issues. The recent increase in the number of agreements addressing climate, water and related environmental issues, together with the significant influence of climate on sustainable development, will lead to more involvement of NMHSs in related activities. This will require improvements in the gathering, processing and archiving of meteorological and hydrological observations and data.

Governance

28. The governance structure of an NMHS has a strong influence on its operation and efficient delivery of services. The organizational structures of NMHSs, aimed at facilitating efficient provision of services to their countries, vary considerably from country to country. They are influenced by: (1) a government's approach to or models for the delivery of public services; (2) the size and character of the country, its population distribution, and the services provided; (3) the availability of trained staff and appropriate technology; (4) the availability of and means for obtaining resources; (5) the nature of the user communities and the degree of outreach. These structures are also dependent on the model of the NMHS, which may include government agencies, semi-autonomous government agencies, government-owned organizations, and private companies. In countries where private and government-owned agencies exist, every effort needs to be made to assign clear responsibilities to minimize conflicts.

29. With the increasingly broad challenges facing countries and the international community, the NMHSs may need to adopt flexible organizational models and management strategies that allow for strengthened interactions with relevant national agencies, as well as international and regional institutions.

Partnerships and cooperation

30. The delivery of weather, climate, water, and related environmental services is founded on cooperation among NMHSs worldwide, and the NMHSs are mutually dependent on the gathering and sharing of observations, data and products to provide services. The World Meteorological Organization coordinates the policy and programmes for the global exchange of observations and data.

31. Many NMHSs have noted the advantages of closer regional and subregional cooperation to aid their operations, especially where they have been able to enhance joint capability through the sharing of resources, reducing duplication or promoting capacity-building through technology exchange. Regional initiatives such as Regional Climate Outlook Forums that bring together the providers and users of weather, climate, water and related environmental services within a region continue to play an important role in efforts to improve service quality and service delivery. The WMO Regional Training Centres (RTCs), Regional Instrument Centres (RICs) and Regional Climate Centres ensure that NMHSs can access cost-effective regional education, training and services. The WMO Regional Associations and Regional Offices play an important role in promoting capacity-building among developed and developing countries.

32. Given the magnitude of the scientific challenges of providing accurate and reliable weather, climate and water services and the difficulties of obtaining adequate resources, many NMHSs benefit from close cooperation with regional and international institutions. In particular, academic and research institutions offer the opportunity for developing user-specific services to meet the ever-evolving needs of the users. The partnership with the Association of Hydro-Meteorological Equipment Industry (HMEI) continues to provide a good linkage between the developers and producers of hydrometeorological equipment and the users. The NMHSs also have the opportunity to contribute to the activities of other United Nations agencies that can be of benefit to their countries, such as those involved in economic development and environmental protection.

33. Since the media offer an important means of delivering forecasts and warnings to the public, developing constructive relationships with global, regional, national and local electronic and print media is important for enhancing service delivery to the public.

PART 4: FUTURE DEVELOPMENT OF AND OPPORTUNITIES FOR NMHSs

Exploiting greater scientific understanding

34. The services provided by NMHSs are dependent on the sustained investments of WMO Member countries in research and development (R&D) and capacity-building. Further improvement of current services will require: (1) effective conversion of R&D results into fully operational products and services; (2) R&D that is responsive to the specific needs of NMHSs and their constituencies; (3) effective means to develop linkages with decision-makers and users, especially through the effective use of their public weather services to communicate scientific research that has been translated into tools, products and services that are useful for decision-making. The language used should be easy to understand and serve as a clear basis for taking action.

35. The balanced (seamless) prediction initiative developed by the weather/climate modelling community to provide an integrated framework for advancing prediction from weather to climate timescales provides the potential for improving services and should be a priority for NMHSs.

Exploiting technological advances

36. With the development of WIGOS and WIS, the NMHSs will have the benefit of access to more and better data, including data to support the delivery of services. The WMO Information System will also provide NMHSs with more effective ways to disseminate information and products to users.

37. The challenge for many NMHSs will be to develop the data-processing and prediction systems that will effectively utilize these high-volume, complex data streams.

38. New modelling approaches, such as ensemble prediction and “seamless” prediction systems, benefit from improved supercomputing capabilities.

39. New and developing technologies and techniques, such as Internet delivery of data and products and networking, offer NMHSs the opportunity to expand the availability and use of their products and services, and thus broaden their influence as well.

Education and training

40. Education and training activities are focused on subjects such as meteorology (including marine meteorology and tropical meteorology), weather forecasting, agricultural applications, aeronautical meteorology, climate and climate prediction, disaster prevention, environment, hydrology, instruments (including satellite and in situ remote-sensing) and observations, oceanography, telecommunications, and many others.

41. Education and training are important not just for technical matters, but also for applications to address the ability of users to integrate weather, climate, water and related environmental services into decision-making. Training is also required to improve the capacities for conducting targeted research to improve services; planning and institutional management; communication and public relations; and other administrative and support functions. Priority needs to be given to enhancing skills through education and training to improve the provision, delivery and application of services from NMHSs.

ANNEX XII
Annex to paragraph 11.8.2 of the general summary

WMO POLICY ON GENDER MAINSTREAMING

1. General

1.1 Purpose

The purpose of this WMO Policy is to promote, encourage and facilitate gender equality across WMO and to establish a mechanism by which progress can be measured.[1]

1.2 Definitions

1.2.1 For the purposes of this Policy, WMO has adopted the definitions relating to gender mainstreaming adopted by the Economic and Social Council (ECOSOC), and for gender and gender equality those developed by the United Nations Office of the Special Adviser on Gender Issues and Advancement of Women.

1.2.2 *Mainstreaming a gender perspective* was defined by the ECOSOC agreed conclusions 1997/2 of 18 July 1997 as "the process of assessing the implications for women and men of any planned action, including legislation, policies or programmes, in all areas and at all levels. It is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres so that women and men benefit equally and inequality is not perpetuated. The ultimate goal is to achieve gender equality".

Gender refers to the social attributes and opportunities associated with being male and female and the relationships between women and men and girls and boys, as well as the relations between women and those between men. These attributes, opportunities and relationships are socially constructed and are learned through socialization processes. They are context/time-specific and changeable. Gender determines what is expected, allowed and valued in a woman or a man in a given context. In most societies there are differences and inequalities between women and men in responsibilities assigned, activities under-taken, access to and control over resources, as well as decision-making opportunities (ref.: United Nations Office of the Special Adviser on Gender Issues and Advancement of Women).	**Gender equality** refers to the equal rights, responsibilities and opportunities of women and men and girls and boys. Equality does not mean that women and men will become the same but that women's and men's rights, responsibilities and opportunities will not depend on whether they are born male or female. Gender equality implies that the interests, needs and priorities of both women and men are taken into consideration, recognizing the diversity of different groups of women and men. Gender equality is not a women's issue, but should concern and fully engage men as well as women. Equality between women and men is seen both as a human rights issue and as a precondition for, and indicator of, sustainable people-centred development (ref.: United Nations Office of the Special Adviser on Gender Issues and Advancement of Women).

[1] Throughout this document, all references to WMO encompass the Secretariat and its programmes, National Meteorological and Hydrological Services (NMHS), technical commissions and regional associations.

1.3 The WMO Vision on Gender Equality

1.3.1 The WMO vision is to provide world leadership in expertise and international cooperation in weather, climate, hydrology and water resources, and related environmental issues, and thereby to contribute to the safety and well-being of people throughout the world and to the economic benefit of all nations.

1.3.2 The gender perspective of this vision is to realize fully the professional and human potential of both women and men through equal employment opportunities (see paragraph 3.3.2(a) below) and to provide improved environmental services that are responsive and sensitive to women's and men's needs and will make a difference to their lives.

2. Rationale for the WMO Policy on Gender Mainstreaming

2.1 Gender mainstreaming is a globally accepted strategy in the United Nations (UN) for promoting gender equality. The UN has taken specific actions to eliminate gender discrimination. Such actions include, among others: the 1995 Beijing Declaration and Platform for Action, ECOSOC agreed conclusions 1997/2; the United Nations General Assembly resolution 52/100; and more recently the Millennium Development Goal (MDG) No. 3: "Promote gender equality and empower women".

2.2 As a specialized agency of the UN System, WMO is committed to this strategy and has to date conducted two global surveys on gender issues and convened two conferences on women in meteorology and hydrology, in 1997 and 2003, respectively. These produced a number of recommendations and areas for action. These recommendations, together with Resolution 33 (Cg-XIV, Geneva, May 2003) of WMO, were taken into account in drafting this Policy at the Expert Meeting on Gender Mainstreaming, which was held in Geneva, Switzerland, March 2007, with participants from different Regions and representatives of the WMO technical commissions.

3. The WMO Approach to Gender Mainstreaming

3.1 Goal

The overall goal is to achieve gender equality. The provision of enhanced and gender-sensitive environmental services will contribute to an improved response to humanitarian needs related to weather, climate and water.

3.2 Strategy

In order to achieve this goal, WMO will adopt a three-pronged approach. First, gender mainstreaming is intended to ensure that the diverse needs and experiences of women and men will be factored into employment, policymaking and the provision of services. Second, gender-specific interventions will be undertaken, where appropriate, based on the results of previous WMO gender analyses. Third, a mechanism will be set up to oversee gender mainstreaming activities at all levels.

3.3 Objectives

3.3.1 WMO's three Top-Level Objectives (TLOs) are as follows:

(a) To produce more accurate, timely and reliable forecasts and warnings concerning weather, climate, water and related environmental parameters;

(b) To improve the delivery of weather, climate, water and related environmental information and services to the public, governments and other users;

(c) To provide scientific and technical expertise and advice in support of policy and decision-making and implementation of the agreed international development goals and multilateral agreements.

3.3.2 In relation to the above objectives, the WMO Policy on Gender Mainstreaming focuses on **providing balanced and equal opportunities in employment and delivery of environmental services and will provide a foundation for gender-sensitive actions as follows**:

(a) Employment:

(i) Use of balanced recruitment, selection and retention practices;

(ii) Provision of equitable working conditions (leave, hours of work, pay, facilities, retirement and other benefits);

(iii) Equal opportunities for training at local, regional and international levels;

(iv) Provision of fair opportunities for promotion;

(v) Equitable distribution of work responsibilities at all levels;

(vi) Balanced work/life arrangements for differing personal/family situations;

(vii) Equal opportunities for the participation of women and men in WMO activities and programmes;

(viii) Inclusion of women and men in decision-making on employment issues;

(b) Provision of environmental services:

(i) Access to, and interpretation and use of, information and services;

(ii) Effective participation in public education and awareness activities;

(iii) Gender balance in user participation in WMO activities;

(iv) Effective consideration of diverse user needs.

3.4 Framework for Action

This Framework provides guidance and direction for WMO and its Members. The four main elements of this Framework are:

(a) Governance:

(i) Visible support, accountability and transparency from top-level management in ensuring gender equality;

(ii) Provision of adequate resources for gender mainstreaming activities in regular budget planning;

(iii) Inclusion of gender equality in all communications and consultations with stakeholders;

(iv) Promotion of more clear communications between countries on gender equality issues;

(v) Development of gender-sensitive human resource policies;

(vi) Appointment of gender focal points at all WMO levels to address gender-specific issues;

(vii) Establishment of a mechanism to direct gender mainstreaming activities;

(b) Employment:

(i) Implementation of gender-sensitive actions in the areas of recruitment, selection and promotion and balancing work with life;

(ii) Implementation of gender-sensitive policies in terms of working conditions and the allocation of benefits;

(iii) Provision of equal opportunities for in-career education and training for the professional development of all staff;

(iv) Development and implementation of outreach programmes to promote meteorology and hydrology and related sciences as attractive careers for women and men;

(c) Enhanced service delivery:

(i) Consideration of the specific needs of women and men when providing timely and effective services;

(ii) Active involvement of women and men in designing services for users;

(iii) Attention to gender equality when selecting participants for user forums;

(d) Effective monitoring and evaluation:

(i) Collection and analysis of data on gender issues;

(ii) Annual evaluation of and feedback on progress in gender mainstreaming by NMHSs;

(iii) Assessments of the impact of the implementation of the WMO Gender Mainstreaming Policy;

(iv) Sharing (communication) of best practices on gender mainstreaming between NMHSs and international organizations;

(v) Accountability and continuous improvements in the elements of the framework.

3.5 Implementation

3.5.1 The success of this Policy depends on the commitment of WMO and its Members. This Policy will be implemented by the national and international collective and coordinated activities of WMO's major Programmes, regional associations, technical commissions and Members, including NMHSs.

3.5.2 Owing to the political, cultural and socio-economic differences between Members, it is essential that NMHSs develop action plans that are appropriate for addressing their local needs. The above Framework is intended to assist in carrying out this Policy.

3.6 Roles and responsibilities

The responsibility to ensure the effective implementation of this Policy is shared as follows:

(a) The Permanent Representatives of Member countries with WMO and the Secretary-General have the ultimate responsibility for the implementation of this Policy at their respective levels;

(b) All individual staff members, policymakers, service providers and gender focal points should carry out their activities in the spirit of the gender mainstreaming approach as described in this Policy.

3.7 Monitoring

3.7.1 The implementation of this Policy will be reviewed on an annual basis by an appropriate mechanism.

3.7.2 Progress will be reported to the Secretary-General, who will relay the information to Member countries and report to the Executive Council and Congress.

ANNEX XIII
Annex to paragraph 11.9.5 of the general summary

CONCEPT PAPER
GLOBAL INTEGRATED POLAR PREDICTION SYSTEM

EC-PORS Research Task Team:
Peter Lemke (leader), Johan Stander, Steve Pendlebury, Neil Adams (consultant)
Version 3, January 2011

GIPPS in context

The World Meteorological Organization's (WMO) Executive Council Panel of Experts on Polar Observations, Research and Services (EC-PORS), at its Second Session in Hobart in October 2010, agreed to the concept of a major decadal initiative to develop a Polar Prediction System. The Panel entitled this new initiative the **Global Integrated Polar Prediction System** (GIPPS). The word 'Global' reflects that it would be an international effort and that the poles, including the *third* pole[1], affect systems (weather, climate, hydrological, biological, chemical, etc.) globally; 'Integrated' reflects the interconnections between all these systems, and also because the System itself will be based on the principles of research, observations and services that are integrated and aligned[2]. For polar areas, GIPPS is seen as becoming a foundation of delivering the WMO's substantial contribution to "*the protection of life and property against natural disasters, to safeguarding the environment and to enhancing the economic and social well-being of all sectors of society in areas such as food security, water resources and transport*[3]."

The basic aims of GIPPS

In championing a *'Polar Prediction System*' EC-PORS is mindful that it should be primarily service-driven (i.e. is operational in focus) and provides 'predictions' from daily to inter-decadal time-frames (and possibly beyond). In other words, GIPPS needs to:

- Meet 'user requirements';
- Accurately predict the future state of the atmosphere, ocean, and hydrosphere/cryosphere for high northern and southern latitudes, particularly where prediction systems that are tuned for lower latitudes are less robust;
- Be supported by appropriate observational systems and enabling scientific research and development.

Three timescales are envisaged for GIPPS to cover:

- Short-term prediction underpinned by deterministic fully coupled models (hours-days) and, perhaps by ensemble approaches for the days to weeks periods;
- Medium-term (months to decades) prediction, most likely relying on ensemble approaches;
- Long-term projections (in the IPCC sense) of ice sheet mass balance, sea level and climate variability and change for the next few centuries, perhaps based on the scenario approach.

There is evidence that polar processes are not well modelled in current global systems and getting the polar atmospheric physics right will not only improve polar forecasting but should improve global forecasting as well.

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1 Himalaya and Tibetan Plateau region
2 See Section 6.4 at http://www.wmo.int/pages/prog/www/WIGOS_6_EC_PORS/Final_Report2010.pdf
3 http://www.wmo.int/pages/about/index_en.html

Values of a Polar Prediction System

A Polar Prediction System will deliver benefits to a very wide range of users and communities. Not only will it enhance the scientific understanding of polar meteorology, but also will fundamentally underpin improved services for those engaged in polar activities. An effective polar prediction system will also directly contribute to the global modelling effort and provide benefits to communities at all latitudes. Benefits that will flow from a polar prediction system include:

- Improved services to key users, including those involved in transportation, logistics and planning, biological and energy resource management, water resources, tourism, marine and aviation activities and Disaster Risk Reduction (DRR);
- Improved understanding of key physical process that drive the polar weather and climate system and to diagnose the benefits of particular observational technologies and approaches;
- Providing input to global models to ensure that polar processes and teleconnections are effectively captured.

In addition to typical synoptic variables, a Polar Prediction System should focus on specialized variables, such as sea ice, permafrost, polar clouds, ice sheet mass balance, and snow cover.

Stakeholders

Partners in specifying GIPPS – the end-users:

Primacy in this task is that GIPPS should be "service-driven". In other words, the Polar Prediction System needs to provide outputs which provide end-users with intelligence about their environment that will enable them to maximize the best outcomes from their activities. To this end the EC-PORS Services Task Team will develop a White Paper that comprehensively describes the global community's polar services requirements and articulates the value to be delivered by a GIPPS – the White Paper itself will be made available for consideration at the next session of EC-PORS in the boreal autumn of 2011.

As a foray into understanding end-user requirement the EC-PORS Research Task Team undertook an initial 'gap analysis' which asked simple questions concerning perceived service/observational/modelling deficiencies in current polar prediction systems. The respondents to this pilot survey were mostly operational or research-based professionals in the areas of meteorology; the cryosphere; the hydrosphere; and numerical modelling. And so it is not surprising that many of the gaps identified were of a technical nature. For example, the need for more comprehensive sea-ice modelling across both polar areas, and the need for better observations and modelling of boundary-layer fluxes. And so it will be the task of the EC-PORS Services Task Team to articulate the requirements of the 'real' end-users, that is, the 'expeditioners' (e.g.: geologists; glaciologists; biologists) who work 'in the field' in both polar areas; the citizens and utility providers of, in particular, the northern polar area; polar shipping and aviation, including tourism, fisheries and other commercial ventures. It is likely that there will be synergies between end-user requirements and service providers – for example, the aforementioned sea-ice modelling will lead to more efficient and safer routing of ship traffic in polar waters.

Partners in developing GIPPS

It is clear from above that the *'Polar Prediction System*' will need to be an end-to-end, fully supported, *operational* prediction system, if it is to serve polar citizens in a completely reliable way – reliable not only in the underpinning science, but also in the robustness of supporting processing (computer modelling resources) and communication infrastructure. Therefore, it is equally clear that the skills, requirements and ideas of researchers and modellers (atmospheric; cryospheric; hydrospheric; chemistry; oceanographic; soil, etc.) will need to be at the forefront of the *'Polar Prediction System*' development, as do the institutions, agencies and national hydrological, meteorological and oceanographic services that are the foundation of year-round, day-by-day

operational service delivery. The proposed development of cross-regional Polar Regional Climate Centres (RCCs) and Polar Climate Outlook Forums (PCOFs) would be very useful for addressing services in the Polar Regions.

Supporting and steering the substantial depth of energy already in play in the polar prediction area will be a key focus for EC-PORS who can tap the work of *Research and Observational Groups* such as: the Antarctic Mesoscale Prediction System (AMPS) developers; the Antarctic Meteorological Observations, Modelling and Forecasting Workshop (AMOMFW) forums; the Scientific Committee for Antarctic Research (SCAR) Operational Meteorology Group; various Working Groups of the International Arctic Science Committee (IASC); the International Commission on Polar Meteorology (ICPM); WMO's World Weather Research Programme (WWRP) and The (WMO) Observing System Research and Predictability EXperiment (THORPEX), and the World Climate Research Programme (WCRP); the British Antarctic Survey (BAS); and the Byrd Polar Institute etc. All are key players specifying the observational and research requirements for a '*Polar Prediction System*'. Moreover *Operational Numerical Weather systems* such as: the European Centre for Medium-Range Weather Forecasts (ECMWF); the US National Centers for Environmental Prediction (NCEP); and various national NWP centres all will have key implementation roles, not to mention key roles in informing the overall process as to what can be pragmatically/realistically implemented on a sustainable operational basis.

GIPPS: a 10-year milestone

The International Polar Year (IPY) 2007–081 continued the success of outcomes underpinned by concentrated efforts into polar research facilitated by IPYs in 1882-3, 1932-3, and 1957-8. There are sure to be more IPYs and no doubt polar prediction will *incrementally* improve as the operational global prediction systems become more fully coupled and earth-system integrated. The word, *incrementally*, is deliberately emphasized here since globally focused modellers tend to focus on globally-measured improvements (e.g. skill scores), not on individual regional outcomes. Therefore, EC-PORS sees a fully operational, end-to-end, polar-tuned but Global(ly) Integrated, Polar Prediction System, which meets the contemporary needs of the citizens of Polar Regions and beyond, as a decadal endeavour towards an operational GIPPS.

ANNEX XIV
Annex to paragraph 11.9.17 of the general summary

GLOBAL CRYOSPHERE WATCH IMPLEMENTATION STRATEGY

1.0 BACKGROUND:

The cryosphere collectively describes elements of the Earth System containing water in its frozen state. It includes solid precipitation, snow cover, sea ice, lake and river ice, glaciers, ice caps, ice sheets, permafrost, and seasonally frozen ground. The cryosphere is global, existing not just in the Arctic, Antarctic and mountain regions, but at all latitudes and in approximately 100 countries. Frozen water and its variability and change in the atmosphere, on land, and on the ocean surface has direct feedbacks within the climate system, affecting energy, moisture, gas and particle fluxes, clouds, precipitation, hydrological conditions, and atmospheric and oceanic circulation. The cryosphere provides some of the most useful indicators of climate change, yet is one the most under-sampled domains of the Earth System. Improved cryospheric monitoring is essential to fully assess, predict, and adapt to climate variability and change.

1 http://www.ipy.org/

All of these issues require a coordinated international and cross-disciplinary mechanism, thus the proposal for the establishment of an operational Global Cryosphere Watch (GCW).

2.0 GCW Meets User Needs

GCW will provide data, information and products that will help Members and the wider user community reduce the loss of life and property from natural and human-induced disasters, improve management of energy and water resources, contribute to a better understanding of environmental factors affecting human health and well-being, understand, assess, predict, mitigate and adapt to climate variability and change, improve weather forecasts and hazard warnings, aid in management and protection of terrestrial, coastal and marine ecosystems, and support sustainable agriculture.

GCW will provide information for informed decision-making and policy development related to climate, water and weather, for use in real time, for climate change adaptation and mitigation, and for risk management. Over time, this information will become more service-oriented. During GCW consultation, Members emphasized the national and global impact of the cryosphere, particularly:

- Sea level rise threatens vital infrastructure, settlements and facilities of small island states and low-lying coastal zones;
- Changes in sea-ice affect access to the polar oceans and surrounding seas, in turn affecting economic development, accessibility to resources, navigation, tourism, marine safety and security. Declining summer sea-ice may also impact ocean circulation and weather patterns in the mid-latitudes;
- Permafrost thawing impacts infrastructure and is a potential major source of methane, a greenhouse gas;
- Changes in the cryosphere have major impacts on water supply, food production, availability of potable water, freshwater ecosystems, hydropower production, and the risk of floods and droughts;
- Natural hazards such as icebergs, avalanches and glacier outburst floods create risks for transportation, tourism and economic development;
- Cryospheric data and information are required for improved numerical weather prediction and climate monitoring and prediction in polar and alpine regions as well as globally;
- Changes in large-scale dynamics such as the Arctic Oscillation (AO) Index have major and currently not well predicted impacts on climate in North America, Europe and Asia.

3.0 Mission and Objectives

GCW will be an international mechanism for supporting all key cryospheric in-situ and remote sensing observations, from research and operations, and for implementing the recommendations of the Integrated Global Observing Strategy Partnership (IGOS-P) – Cryosphere Theme (hereinafter “CryOS”).

To meet the needs of WMO Members and partners in delivering services to users, the media, public, decision and policy makers, GCW will provide authoritative, clear, and useable data, information, and analyses on the past, current and future state of the cryosphere. In its fully developed form, GCW will include observation, monitoring, assessment, product development, prediction, and research. It will provide the framework for reliable, comprehensive, sustained observing of the cryosphere through a coordinated and integrated approach on national to global scales and deliver quality-assured global and regional products and services. GCW will organize analyses and assessments of the cryosphere to support science, decision-making and environmental policy. To meet these objectives, GCW will encompass:

- *Requirements:* Meet evolving cryospheric observing requirements of WMO Members, partners, and the scientific community, by making CryOS a living document and contributing to the WMO Rolling Review of Requirements (RRR) process;
- *Integration*: Provide a framework to assess the state of the cryosphere and its interactions within the Earth System, emphasizing integrated products using surface- and space-based observations, while including a mechanism for early detection of, and support for, endangered long-term monitoring series, aimed at optimizing knowledge of environmental conditions and exploiting this information for predictive weather, climate and water products and services, thus contributing to the proposed WMO Global Integrated Polar Prediction System (GIPPS) and Polar Regional Climate Centres;
- *Standardization*: Enhance the quality of observational data by improving observing standards and practices for the measurement of cryospheric variables, by addressing differences and inconsistencies in current practices used by Members, partner organizations and the scientific community;
- *Access*: Improve exchange of, access to, and utilization of observations and products from WMO observing systems and those of its partners;
- *Coordination*: Foster research and development activities and coherent planning for future observing systems and global observing network optimization, especially within the WMO Integrated Global Observing System (WIGOS), by working with all WMO Programmes, technical commissions (TCs), regional associations (RAs), partner organizations and the scientific community.

GCW will be an essential component of WIGOS and will coordinate cryospheric activities with the Global Climate Observing System (GCOS), which includes the climate-related components of the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS), enhancing GCOS support to the UNFCCC. GCW will strengthen the WMO contribution to the Global Framework for Climate Services (GFCS). Through WIGOS and the WMO Information System (WIS), GCW will also provide a fundamental contribution to the Global Earth Observation System of Systems (GEOSS).

4.0 GCW and the WMO Strategic Plan

The cryosphere, by its nature, is intrinsically interdisciplinary. GCW, in the context of the WMO Strategic Plan 2012–2015, is a crosscutting activity contributing to all five priority areas and to achieving the expected results of all Strategic Thrusts. It cuts across all the WMO technical departments (Observing and Information Systems, Research, Climate and Water, Weather and Disaster Risk Reduction Services), joint sponsored activities (e.g. WCRP, GCOS) and WMO TCs. GCW will:

- Enhance capabilities to produce better climate predictions and assessments, hydrological forecasts and assessments, weather forecasts and warnings;
- Provide the mechanism to integrate the atmospheric, terrestrial (including hydrology) and marine cryosphere Essential Climate Variables (ECVs) within GCOS;
- Coordinate cryospheric observations of WMO and other agencies and organizations;
- Be part of the WIGOS and WIS.

5.0 GCW Implementation

5.1 Phases

GCW Definition Phase (2007–2011)

Following a review of the feasibility study for developing and implementing GCW within WMO, EC-LXI endorsed the next steps for developing GCW with the guidance of its EC Panel of Experts

on Polar Observations, Research and Services (EC-PORS). Extensive consultation contributed to developing the rationale, concept, principles and characteristics of GCW as well as the engagement of WMO Programmes and TCs, key partners from other agencies, institutes and organizations, and the scientific community who could contribute to the development and implementation of GCW. Pilot and demonstration projects are being identified to test GCW implementation. The Secretariat has provided support for initial GCW development through the EC-PORS Trust Fund.

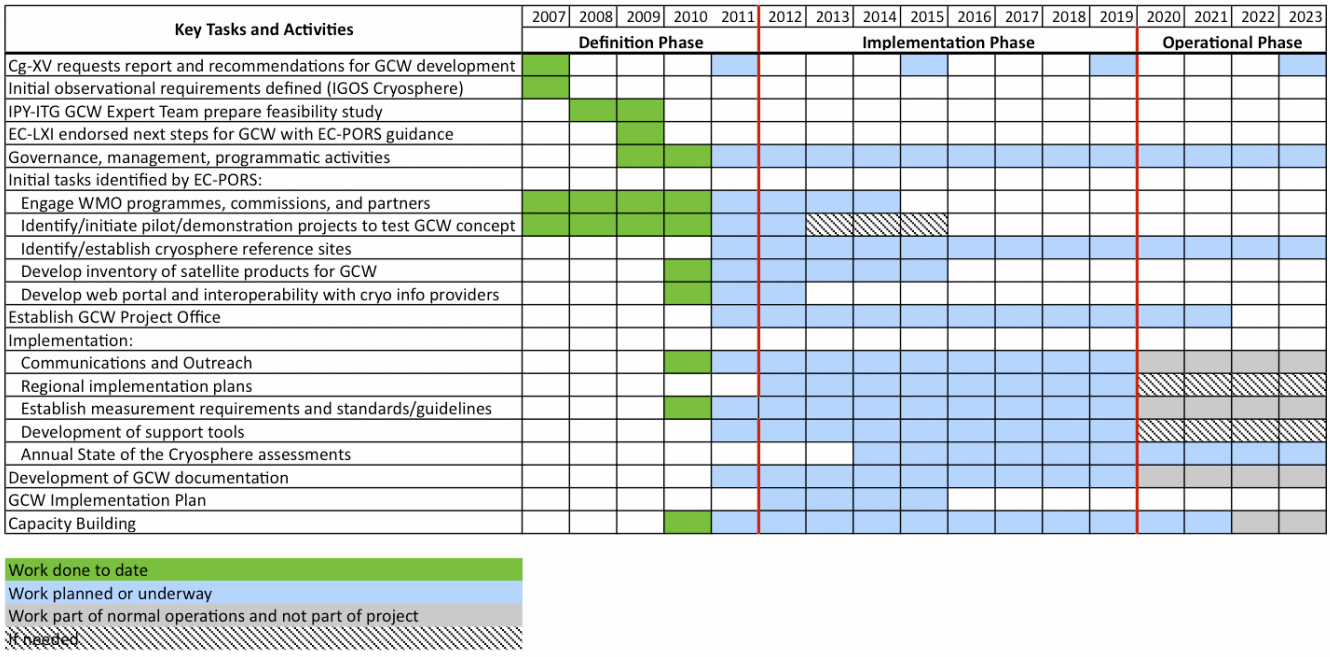
GCW Implementation phase (2012–2019)

The Implementation phase, to be undertaken between 2012 and 2019, will be coordinated by WMO and its partners. It will focus on developing and implementing GCW through tasks and activities that will form the GCW Implementation Plan. Initial timelines and deliverables are given in Figure 1.

GCW Operational Phase (2020 onward)

Once the framework is established, GCW enters its Operational Phase. It will continue to evolve to improve service delivery and support decision-making in response to the needs of users and technological opportunities.

Figure 1: GCW Milestones and Deliverables



5.2 Tasks

Based on the feasibility study and continuing consultation with WMO Members and potential partners by the EC-PORS GCW Task Team, initial key tasks were identified for implementation:

1. Implement recommendations of CryOS;
2. Initiate pilot and demonstration projects;
3. Establish cryosphere reference sites;
4. Develop an inventory of satellite products for GCW;
5. Develop a web portal and interoperability for cryosphere users and providers;
6. Capacity-building;
7. Communication and outreach;
8. Monitor scientific progress.

GCW Expert and Technical Teams will be established to lead these activities with experts from WMO and its partners. A summary of the initial tasks follows.

Implementation of CryOS recommendations

CryOS provides a framework for developing and implementing GCW. Developed through widespread consultation and review within the global cryosphere community, it details observational capabilities and requirements, and gives recommendations for filling gaps. It proposes measures to develop and coordinate cryospheric components of the WIGOS, GCOS/GOOS/GTOS and other systems, so that cryospheric products will meet most user requirements within approximately 10–15 years. It describes arrangements to ensure that existing cryospheric data and products are openly accessible to users in a timely and interoperable manner. It highlights the need for the identification and coordination of resources to continuously improve observations as requirements and technology evolve, and reiterates the need for commitment by observing system operators to sustain and augment cryospheric observations and products. GCW will build on these recommendations to ensure a comprehensive, coordinated and sustainable system of observations and information to allow for a full understanding of the cryosphere and its changes.

Pilot and Demonstration Projects

Pilot projects will be implemented to demonstrate: (a) the types of data and information that GCW could provide for cryosphere components globally, regionally and nationally; (b) how GCW could build on existing efforts by the cryospheric community; (c) the time and resources required to create a fully functional integrated cryosphere information system; (d) how to document standards and best practices for observing and product development; and (e) challenges/gaps/needs that GCW could address. Demonstration projects would focus on regional or national contributions to standardization, integration and interoperability.

Projects will involve contributions of WMO Members, Programmes and TCs, and contributing partners. Potential projects which can contribute to demonstrating GCW's operation include CIMO's intercomparison of measurement of solid precipitation, snowfall and snow depth; Norway's CryoClim initiative to develop new operational services for long-term systematic climate monitoring of the cryosphere; ESA's "Global Monitoring of Essential Climate Variables" programme (Climate Change Initiative) for the cryosphere; the World Glacier Monitoring Service (WGMS), University of Zurich, Switzerland, which is operated under the auspices of the International Council for Science World Data System (ICSU/WDS), International Association of Cryospheric Sciences of the International Union of Geodesy and Geophysics (IUGG/IACS), UNEP, UNESCO and WMO; Nordic Centre of Excellence (NCoE): SVALI – Stability and Variations of Arctic Land Ice; USGS Benchmark Glacier Programme and the IPY Data and Information Service (IPYDIS) global partnership of data centres, archives, and networks creating interoperability between cryosphere data centres in Norway, United States, Canada and the United Kingdom. GCW will build on existing programmes and projects, but other pilot and demonstration projects need to be established in different regions, including alpine areas, central Asia (notably the "Third Pole"), the tropics, and Antarctica.

Reference Sites

GCW will initiate a comprehensive cryosphere observing network called "CryoNet", a network of reference sites or "supersites" in cold climate regions, on land or sea, operating a sustained, standardized programme for observing and monitoring as many cryospheric variables as possible. CryoNet will provide reference sites for validation of satellite and model outputs. Initially, it will build on existing cryosphere observing programmes or add standardized cryospheric observations to existing facilities to create supersite environmental observatories. As encouraged by GCOS, GCW will facilitate the establishment of high-latitude supersites with co-located measurements of key variables, especially permafrost and snow cover, thus enhancing GCOS/GTOS Networks for Permafrost (GTN-P), Glaciers (-G) and Hydrology (-H) and including the measurements of solid

precipitation. GAW stations and WCRP/Coordinated Energy and Water Cycle Observations Project (CEOP) reference sites in cold climates are potential candidates.

Members, through their cryosphere focal points, are being asked to recommend suitable sites. China has established supersites in the "Third Pole" region where the High Asian cryosphere (HAC) serves as the Asian "water tower" for over a billion people. They would like to merge into the proposed GCW network and help lead the development of standardized cryosphere observing programmes. Another proposed contribution is the Sodankylä-Pallas supersite in the boreal forest of northern Finland. Its infrastructure is designed for integrated monitoring of soil-snow-vegetation-atmosphere interaction and provides reference measurements for satellite sensors on a continuous basis.

Reference sites will lead in the effort to establish best practices, guidelines and standards for cryospheric measurement. This will include consideration of data homogeneity, interoperability, and compatibility of observations from all GCW constituent observing and monitoring systems and derived cryospheric products.

Inventory of Satellite Data Products

This task involves developing an inventory of candidate satellite products for GCW which are mature and generally accepted by the scientific community. It includes an intercomparison of products to assess quality and to ensure an authoritative basis. The Polar Space Task Group of EC-PORS, with its direct connection to Space Agencies, will work with GCW to identify new satellite products to support GCW pilot projects and services.

Currently, the WCRP/SCAR/IASC Climate and Cryosphere Project (CliC) is sponsoring a workshop on the evaluation of satellite-derived sea ice extent and concentration products. This task was identified as a pilot project in the GCW feasibility study. The results of the intercomparison will provide valuable information to GCW on the many available products and on the process for determining "authoritative" information. The WCRP Observation and Assimilation Panel (WOAP) is organizing a workshop on essential climate variables (ECVs), where an inventory of satellite and in situ ECV products will be compiled with information on product maturity, accuracy, users, applications, and adherence to the GCOS guidelines for ECV datasets. For example, the United States National Oceanic and Atmospheric Administration (NOAA) is supporting work on satellite-derived climate data records (CDRs) for snow and ice, and the European Space Agency (ESA) Climate Change initiative will provide ECVs that meet GCOS requirements, and will support efforts to validate and improve current methods for extracting cryospheric geophysical parameters from satellite data.

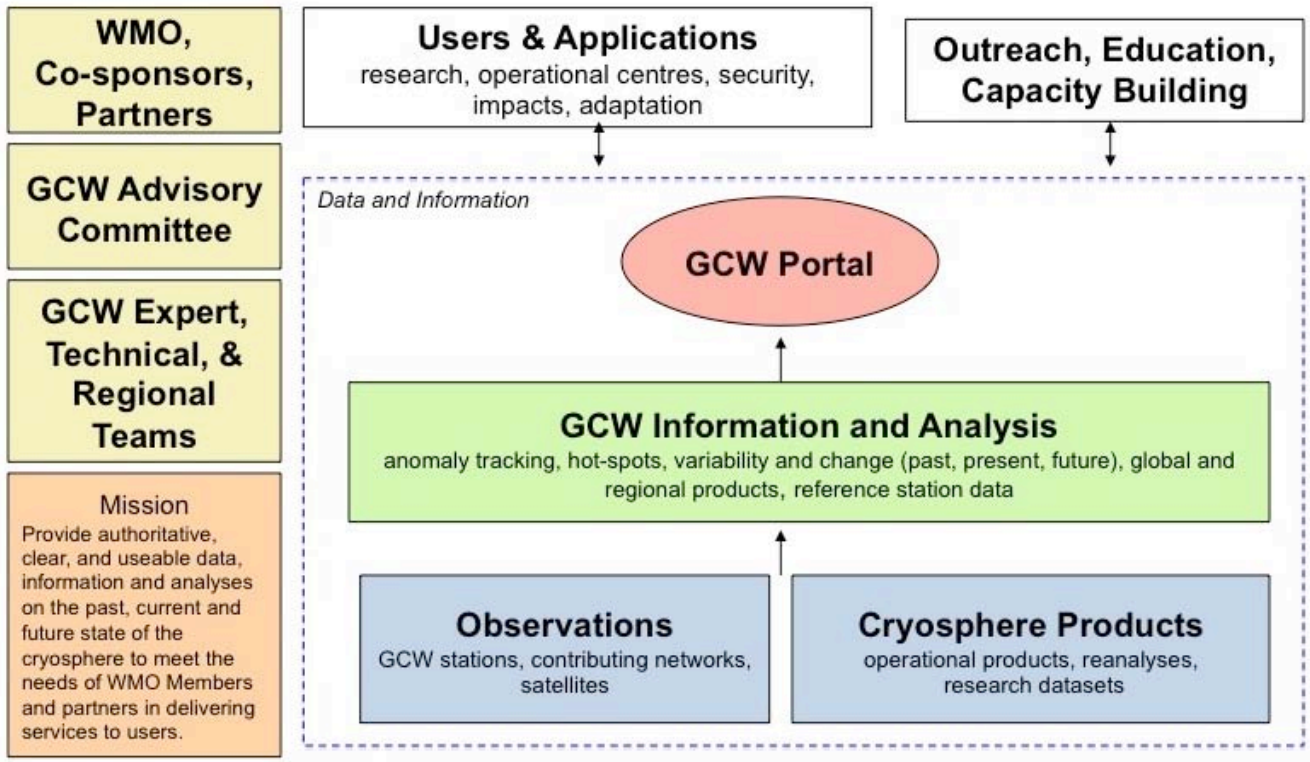
GCW Web Portal

The GCW web portal will make GCW data and information available to WMO Members, their partners, and users while providing the ability to exchange data and information among a distributed network of providers of data and products. The portal, as a part of WIS, will allow for rapid exchange of data, metadata, information, and analyses. The concept for the flow of information to the portal is given in Figure 2.

The portal and associated data and information will be capable of including all elements of the cryosphere at national, regional and global scales. It will provide access to data and information on past, present and future cryospheric conditions, and be able to draw on operational and research-based observation and monitoring and modelling. GCW will ensure access to real time, near-real time and historical cryospheric data and products through WIS. GCW will respect partnership, ownership and data-sharing policies of partners. It will allow new types of information to be widely distributed, such as real-time cryospheric "hot news" (e.g. extremes, physical or socio-economic impacts, new research results).

A prototype GCW web portal for GCW is being developed by the Norwegian Meteorological Institute (METNO), building on their web-based tool for searching data. IPY data centres/portals, such as METNO, Canadian Cryosphere Information Network (CCIN), British Antarctic Survey (BAS), and US National Snow and Ice Data Centre (NSIDC) are already interoperable. This approach will facilitate seamless access with NMHSs and external data centres holding relevant cryospheric data and information at the national or global scale.

Figure 2: Conceptual Framework for GCW Operation



Capacity-building

GCW must develop an effective capacity-building strategy. A coordinated capacity-building effort should respond to the needs at national and regional levels, as identified by Members, which would assist all countries in improving and sustaining observation and exchange of cryospheric data and information. For developing and the least developed countries there is a need to ensure access to, and effective utilization of, observations, data and products, related technologies and new knowledge. For example, information on potential sea level rise, loss of mountain, including tropical, glaciers, and improved understanding of the impact of cryospheric changes in the Antarctic on extreme weather and climate in tropical and sub-tropical regions has been identified by Members as a need to which GCW can contribute.

Capacity-building will be coordinated with existing WMO efforts and will take advantage of mechanisms established by WIGOS and other WMO Programmes, RAs, TCs, and GCW partners.

Communications and Outreach

GCW will have numerous, diverse stakeholders both within WMO and with its partners. GCW will establish an effective communication, outreach and education strategy in collaboration with WMO Members, Programmes, RAs and TCs. It will take advantage of outreach programmes developed and effectively deployed through IPY and with organizations such as Association of Polar Early Career Scientists (APECS) and the Global Learning and Observations to Benefit the Environment program (GLOBE) program. The GCW portal will provide relevant information on communication, outreach and capacity-building, aimed at complementing, not duplicating, others' efforts.

6.0 Collaborations, Partnerships, Sponsorship

WMO Members have responded strongly and positively to GCW and, so far, over 30 Members from all WMO Regions have nominated GCW focal points. These focal points will be involved in the development of GCW and will help integrate the global initiative with their national plans. In addition to Members with specific national or regional activities in the Polar Regions, interest was expressed by Members (e.g. Maldives, Thailand, Ethiopia, Tajikistan) who are concerned about changes in the cryosphere and the potential impact on their country.

GCW will engage WMO co-sponsored programmes, TCs, RAs, and other organizations that have cryospheric responsibilities. GCW partnerships are being identified, including government agencies and institutions that measure, monitor, or archive cryosphere data and information from in-situ and satellite research and operational networks and model sources. International bodies, such as International Permafrost Association (IPA), World Glacier Monitoring Service (WGMS), Global Precipitation Climatology Centre (GPCC), and national institutions, such as the US National Snow and Ice Data Center (NSIDC) have already indicated their willingness to support GCW.

WMO's co-sponsored programmes are essential partners. WCRP/CliC coordinated the development of the GCW feasibility study and co-led with SCAR the development of CryOS. The WMO-IOC-UNEP-ICSU Steering Committee for GCOS endorsed the creation of GCW as a mechanism for integrating cryospheric observations.

Potential co-sponsorship is being investigated. The IOC of UNESCO, which has been engaged in the GCW process from the beginning, has already indicated its interest in being a co-sponsor. Memorandum of understanding or agreements would be established between all sponsors.

EC-PORS and its GCW Task Team will lead the discussion with partners.

7.0 GCW Management and Governance

7.1 *Conceptual Framework for GCW*

GCW's organizational, programmatic, procedural governance will be based on WMO structures and interfaced with those of partner organizations. Cryospheric data, information, products and knowledge will be provided not only from National Meteorological and Hydrological Services (NMHSs), but also from national and international partner organizations, agencies and the scientific community. Collaboration and cooperation through co-sponsorship and partnership is essential. GCW will include an effective interface with the user community. Capacity-building and training will be included in all aspects of the GCW framework. Expert, technical and regional task teams would be responsible for developing, implementing and managing the GCW tasks. A GCW Advisory Committee will initially steer activities, tasks, and the establishment of teams within the available resources. An initial framework, or conceptual model, for GCW is given in Figure 2. It illustrates the "why, what, and how" of GCW operation.

7.2 *Deliverables and Milestones*

Upon approval and within available resources, GCW will address tasks associated with the key deliverables and milestones. Figure 1 shows the key milestones and timelines. The aim is to begin now to implement tasks, recognizing the complexity of engaging NMHSs and their national partner agencies, national and international institutes and the scientific community.

7.3 Resources

The successful launch of GCW depends directly on the availability of resources. Support of the definition phase has been through funding by Members to the GCW and EC-PORS Trust Funds (namely, part-time temporary staff and consultative meetings), supplemented by in-kind contribution from Members for technical expertise. However, additional resources will need to be

provided through the WMO Secretariat for both staff and non-staff costs for the implementation and coordination that goes beyond the programmatic activities of the Secretariat to date. One full staff position would be needed in the WMO Secretariat for GCW implementation activities and should be funded jointly by the WMO regular budget and other sources, including:

- GCW and EC-PORS Trust Funds to supplement the WMO regular budget;
- In-kind contributions, e.g. Task Office/activity funded by a Member(s);
- Staff secondments;
- Project Compendium that includes a request for GCW funding from voluntary contributions (seeking contributions totalling CHF2.4M for implementation of EC-PORS activities over four years, including GCW to support the advisory committee and expert teams in implementing GCW and provide some Secretariat support for GCW development, coordination and implementation).

7.4 *Governance within WMO*

GCW requires cooperation, collaboration and coordination within WMO and with external partners, for which working arrangements between WMO and partners would be established. WMO provides a legitimate, valued and unique entry point on cryospheric issues related to weather, climate, water and other environmental matters in 189 countries.

A GCW Secretariat (Project Office) will be established in the WMO Secretariat to support all GCW activities, including coordination with partners, monitoring of implementation, reporting and follow-up actions. It will also provide support to national focal points and activities.

GCW is a truly cross-cutting activity. However, at the beginning of the Implementation Phase observational aspects (e.g. reference sites, observing practices, data compatibility, interoperability, etc.) may prevail. This would likely shift later in the Implementation Phase, as services become more prominent. At the beginning, the links would be strongest with WIGOS and WIS, several of the TCs, and co-sponsored programmes. Hence, the Executive Council, through its EC-PORS, would be best positioned to oversee GCW's initial development and implementation, recognizing that the structure of the Secretariat will have to adapt, as and when appropriate, to ensure optimal management of, and support to, the initiative.

APPENDIX

LIST OF PARTICIPANTS

1. Officers of the session

President	Mr Alexander I. BEDRITSKIY
First Vice-President	Mr Ali Mohammad NOORIAN
Second Vice-President	Mr Tyrone SUTHERLAND
Third Vice-President	Mr Antonio Divino MOURA

2. Representatives of WMO Members

Afghanistan

Mr Mohammad Ishaq NOORI	Alternate
Ms Khatima Yalda NATIQ	Delegate

Albania

H.E. Mr Sedji QERIMAJ	Principal Delegate
Mrs Inid MILO	Delegate
Mrs Dorina XHIXHO	Delegate

Algeria

H.E. Mr Idriss JAZAIRY	Principal Delegate
H.E. Mr Boualem CHEBIHI	Alternate
H.E. Mr Tou AMAR	Delegate
Mr Fayçal BELKACEMI	Delegate
Mr Hocine BEY	Delegate
Mr Djamel BOUCHERF	Delegate
Mrs Zineb CHEMLAL	Delegate
Mr Malek HAMANE	Delegate
Mr Cherif NEGRI	Delegate
Mr Ferhat OUNNAR	Delegate
Mr Brahim SEGHEIRI	Delegate
Mr Abdelhafid TERCHI	Delegate
Mr Badaoui ZEDDHIGA	Delegate

Angola

Mr Benjamim DOMINGOS	Principal Delegate
Mr Angélica COSTA	Alternate
Mr Francisco Osvaldo NETO	Delegate
Mr Lutumba TIMA	Delegate

Antigua and Barbuda

Mr David FARRELL	Principal Delegate

Argentina

Mr Héctor Horacio CIAPPESONI	Principal Delegate
Ms Mariela FOGANTE	Delegate
Mr Juan Manuel HÖRLER	Delegate
Mr Alejandro LUPPINO	Delegate
Ms Mónica MARINO	Delegate

Armenia

Mr Levon VARDANYAN	Principal Delegate

Australia

Mr Gregory AYERS	Principal Delegate
Mr Alan VALLANCE	Alternate
Ms Sue BARRELL	Delegate
Ms Miranda BROWN	Delegate
Mr Jon GILL	Delegate
Mr Peter HIGGINS	Delegate
Ms Sue O'ROURKE	Delegate
Mr David WALLAND	Delegate

Austria

Mr Michael STAUDINGER	Principal Delegate
Mr Georg ZEHETNER	Alternate
Mr Ernest RUDEL	Delegate

Azerbaijan

Mr Ismayil ALAKBAROV	
Mr Sahib KHALILOV	Principal Delegate

Bahamas

Mr Arthur ROLLE	Principal Delegate

Bahrain

Mr Abdul MAJEED H. ISA	Principal Delegate
Mr Adel Tarrar MOHAMMED	Delegate

Bangladesh

Ms Arjumand HABIB	Principal Delegate

Barbados

Mr Hampden LOVELL	Alternate
Ms Natalie BURKE	Delegate

Belarus

Mr Mikhail KHVOSTOV	Principal Delegate
Mr Andrei POPOV	Alternate
Mr Vitaly KNIAZEV	Delegate
Mr Oleg MAKSIUTA	Delegate

Belgium

Dr Daniel GELLENS	Principal Delegate
Dr Gaston DEMARÉE	Delegate
Mr Pieter LEENKNEGT	Delegate
Dr Christian TRICOT	Delegate

Belize

Mr Fred SAMBULA	Principal Delegate

Benin

Mr Martin KASSIN	Principal Delegate

Bhutan

Mr Tenzin CHODA	Alternate

Bolivia (Plurinational State of)

Mr Laurent GABERELL	Delegate
Mr Ricardo LOPEZ	Delegate

Bosnia and Herzegovina

H.E. Ms Emina KECO-ISAKOVIC	Principal Delegate
Mr Darko BOROJEVIC	Delegate
Mr Zoran BOZOVIC	Delegate
Mr Igor KOVACIC	Delegate
Mr Muhamed MUMINOVIC	Delegate
H.E. Mr Enes SARAC	Delegate
Ms Ines SUZNJEVIC	Delegate

Botswana

Mr Phetolo PHAGE	Principal Delegate
Ms Boitshepo Maphoi KOMANYANE	Delegate

Brazil

H.E. Ms Maria Nazareth FARANI AZEVEDO	Principal Delegate
Mr Antonio Divino MOURA	Alternate
Mr Antonio CARDOSO NETO	Delegate
Mr Rui Antonio JUCÁ PINHEIRO	Delegate
Mr Eduardo Sávio PASSOS RODRIGUES MARTINS	Delegate
Mr José Arimatea SOUSA BRITO	Delegate

British Caribbean Territories

Mr Tyrone SUTHERLAND	Principal Delegate
Mr Glendell DE SOUZA	Alternate
Mr Fred SAMBULA	Alternate
Mr David FARRELL	Delegate

Brunei Darussalam

Mr Muhamad Husaini AJI	Principal Delegate
Mr Haji Yunus HAJI MD. TAHIR	Delegate

Bulgaria

Mr Georgi KORTCHEV	Principal Delegate
Ms Tatyana ANGELOVA	Delegate
Mr Valentin KAZANDJIEV	Delegate
Ms Tatiana SPASSOVA	Delegate

Burkina Faso

Mr Ali Jacques GARANE	Principal Delegate
Mrs Mireille SOUGOURI - KABORE	Delegate

Burundi

Mr Leonard MINANI	Principal Delegate

Cambodia

H.E. Mr Suon SUN	Principal Delegate
Mr Theng BIENG	Delegate
Mrs Solida CHHOEUNG	Delegate

Cameroon

Mr Pierre HELE	Principal Delegate
H.E. Mr Anatole Fabien Marie NKOU	Alternate
Mr Paul BATIBONAK	Delegate

Canada

Mr David GRIMES	Principal Delegate
Mr Bruce ANGLE	Alternate
Mr Jim ABRAHAM	Delegate
Ms Christine BEST	Delegate
Mr Gilbert BRUNET	Delegate
Mr Brian DAY	Delegate
Ms Kathleen FISCHER	Delegate
Ms Johanne FOREST	Delegate
Mr Allan HOWARD	Delegate
Mr Michel JEAN	Delegate
Mr Guennadi KROUPNIK	Delegate
Mr Charles LIN	Delegate
Mr Brian O'DONNELL	Delegate
Mr Thomas PIEKUTOWSKI	Delegate

Chad

H.E. Mr Ahmat Mahamat KARAMBAL	Principal Delegate
Mr Moussa TCHITCHAOU	Alternate
Mr Awada ANGUI	Delegate
Mr Malache DOLMIA N.	Delegate
Mr Mahamat Lamine Younous KOSSO	Delegate
H.E. Mr Bamanga Abbas MALLOUM	Delegate

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Mrs Myrna ARANEDA	Principal Delegate
Mr Fernando GUZMAN	Delegate
Mr Pedro OYARCE	Delegate
Mr Luciano PARODI	Delegate

China

Mr Guoguang ZHENG	Principal Delegate
Mr Xiaonong SHEN	Alternate
Mr Baogui BI	Delegate
Mr Zhi CHEN	Delegate
Mr Jianfang FEI	Delegate
Mr Gang LI	Delegate
Ms Mingmei LI	Delegate
Ms Hua LIU	Delegate
Mr Zhiyu LIU	Delegate
Mr Yunfeng LUO	Delegate
Mr Bangzhong WANG	Delegate
Mr Xiaoyun WANG	Delegate
Mr Jianliang XU	Delegate
Mr Jixin YU	Delegate

Colombia

Ms Maria Teresa MARTINEZ	Alternate
Mr Gedeon JARAMILLO REY	Delegate

Congo

Mr Camille LOUMOUAMOU	Principal Delegate
Mr Michel AMBENDE	Delegate
Mr Alphonse KANGA	Delegate
Mr Martin MASSOUKINA KOUNTIMA	Delegate
Mr Célestion TCHIBINDA	Delegate

Costa Rica

Mr Juan Carlos FALLAS SOJO	Principal Delegate
Ms Roxana TINOCO-BRENES	Delegate
Mr Mario A. VEGA-HERNÁNDEZ	Delegate

Côte d'Ivoire

Mr Goroza GUEHI	Principal Delegate
Mr Joel Lancine BAMBA	Delegate

Croatia

Mr Ivan ČAČIĆ	Principal Delegate
H.E. Ms Vesna VUKOVIC	Alternate
Ms Branka IVANCAN PICEK	Delegate
Mr Kreso PANDZIC	Delegate
Ms Zlata PENIC IVANKO	Delegate
Mr Dusan TRNINIC	Delegate
Mr Vlasta TUTIS	Delegate

Cuba

H.E. Mr Rodolfo REYES RODRIGUEZ	Principal Delegate
Mrs Janet ROMAN ARREDONDO	Alternate
Mr Juan Antonio QUINTANILLA ROMAN	Delegate

Curaçao and St Maarten

Mr Albert A.E. MARTIS	Principal Delegate

Cyprus

Mr Silas MICHAELIDES	Principal Delegate
Ms Myrianthi SPATHI	Delegate
Ms Christina TSENTA	Delegate

Czech Republic

Mr Vaclav DVORAK	Principal Delegate
Mr Radim TOLASZ	Alternate
Mr Jan DANHELKA	Delegate
Mr Karel PESATA	Delegate
Ms Iveta SPALTOVA	Delegate
Mr Karel VANCURA	Delegate

Democratic People's Republic of Korea

H.E. Mr Se Se PYONG	Principal Delegate
Mr Kim Tong HWAN	Delegate

Denmark

Mr Peter AAKJAER	Principal Delegate
Mr Flemming JENLE	Alternate
Ms Kerri SWAIL-BORN	Alternate

Djibouti

Mrs Oubah MOUSSA AHMED	Delegate

Ecuador

Mr Carlos NARANJO	Principal Delegate
Mr Luis ESPINOSA SALAS	Delegate

Egypt

Mr Mohamed Mahmoud EISSA	Principal Delegate
Ms Ola ABOU STEIT	Delegate
Mr Hassan Mohamed HASSAN	Delegate
Mr Ahmed Hussein IBRAHIM	Delegate
Mr Alaa-Eldin Ahmed IBRAHIM	Delegate
Mr Mokhtar Omar IBRAHIM	Delegate
Mr Kamal Fahmy MOHAMED	Delegate

El Salvador

H.E. Ms Carmen Elena CASTILLO-GALLANDAT	Principal Delegate

Estonia

Mr Jaan SAAR	Principal Delegate
Mr Aarne MANNIK	Delegate

Ethiopia

Mr kidane ASEFA	Principal Delegate
Mr Girma Kassaye AYEHU	Delegate
H.E. Mr Kebede GERBA	Delegate

Fiji

Mr Alipate WAQAICELUA	Principal Delegate

Finland

Mr Petteri TAALAS	Principal Delegate
Ms Marja-Liisa TUOMOLA	Alternate
Mr Juhani DAMSKI	Delegate
H.E. Mr Hannu HIMANEN	Delegate
Ms Maria HURTOLA	Delegate
Mr Martti HUSU	Delegate
Mr Keijo LEMINEN	Delegate
Mr Jaakko NUOTTOKARI	Delegate
Mr Tony PASO	Delegate
Mr Pekka PLATHAN	Delegate
Mr Markku PUUPPONEN	Delegate
Ms Marja-Liisa TUOMOLA	Delegate
Mr Yrjö VIISANEN	Delegate

France

Mr François JACQ	Principal Delegate
Mr Matteo DELL'ACQUA	Alternate
Mr Marc GILLET	Alternate
Mr François LALAURETTE	Alternate
H.E. Mr Jean-Baptiste MATTEI	Alternate
Mr Stephane BENCHIMOL	Delegate
Mr Patrick BENICHOU	Delegate
Mr Michel POUSSE	Delegate
Mr Jacques ROUMILHAC	Delegate
Ms Caroline WITTWER	Delegate

French Polynesia

Ms Mariannick LECORCHER	Principal Delegate
Mr Laurent PERRON	Alternate

Gabon

Mr Landry MBOUMBA	Alternate

Gambia

Mr Lamin Kaba BAJO	Principal Delegate
Mr Bernard Edward GOMEZ	Alternate
Mr Amadou SAINE	Alternate
Mr Charles Mustapha CAMARA	Delegate

Georgia

Mr Shalva JAVAKHADZE	Principal Delegate
Mr Ramaz CHITANAVA	Alternate

Germany

Mr Gerhard ADRIAN	Principal Delegate
Mr Detlev FRÖMMING	Alternate
Mr Konrad SCHARINGER	Alternate
Mr Andreas BECKER	Delegate
Mr Johannes CULLMANN	Delegate
Mr Jochen DIBBERN	Delegate
Mr Dirk ENGELBART	Delegate
Mr Tobias FUCHS	Delegate
Mr Peter LEMKE	Delegate
Mr Björn ORIWOHL	Delegate
Mr Joachim SAALMÜLLER	Delegate
Mr Axel THOMALLA	Delegate

Ghana

Mr Hakeem BALOGUN	Principal Delegate

Greece

Mr Loukas ASIMAKIS	Principal Delegate
Mr Theagenis CHARANTONIS	Alternate
Ms Konstantina MITA	Delegate
Mr Michail MYRSILIDIS	Delegate
Mr Andreas PAPASTAMOU	Delegate

Guatemala

H.E. Mr Carlos Ramiro MARTINEZ	Principal Delegate
Ms Michelle BRAN ALVARADO	Alternate
Ms Angela CHAVEZ	Delegate

Guinea

Mr Mamadou Lamine BAH	Principal Delegate
Mr Oousmane DIAKITE	Delegate

Guyana

Mr Garvin CUMMINGS	Principal Delegate

Haiti

Mr Pierre Mary Guy ST AMOUR	Principal Delegate
Mr Jude BAPTISTE	Delegate

Honduras

Mr Mauricio PEREZ ZEPEDA	Delegate

Hong Kong, China

Mr Chi-ming SHUN	Principal Delegate
Mr Lap-Shun LEE	Alternate

Hungary

Mr Zoltán DUNKEL	Principal Delegate
Ms Ildikó DOBI	Alternate
Mr Márk HORVÁTH	Alternate
Mr Balazs RATKAI	Delegate

Iceland

Mr Arni SNORRASON	Principal Delegate
Mr Halldor PETURSSON	Delegate
Mr Vertulidi Thor STEFANNSON	Delegate

India

Mr Ajit TYAGI	Alternate
Ms Swati BASU	Delegate
Mr Rahul BHANDARI	Delegate
Mr Manoj Kumar BHATNAGAR	Delegate
Ms Kheya BHATTACHARYA	Delegate
Mr Mohan Kumar G.	Delegate
Ms Medha KHOLE	Delegate
Mr Bishwajit MUKHOPADHYAY	Delegate
Mr Harendu PRAKASH	Delegate
Mr Laxman Singh RATHORE	Delegate
Mr Vishwa Nath SHARDA	Delegate
Mr Anil SHARMA	Delegate

Indonesia

Ms Sri Woro HARIJONO	Principal Delegate
Mr Edvin ALDRIAN	Alternate
Ms Arum ATMANAGARI	Delegate
Mr Arie S. MOERWANTO	Delegate
Ms Nurhayati NURHAYATI	Delegate
Mr Mulyono R PRABOWO	Delegate
Ms Endang PUDJIASTUTI	Delegate
Mr Widada SULISTYA	Delegate
Mr Muhsin SYIHAB	Delegate

Iran (Islamic Republic of)

Mr Ali Mohammad NOORIAN	Principal Delegate
Mr Bahram SANAEI	Alternate
Mr Ramin DEISON	Delegate
Mrs Mina JABBARI	Delegate
Mr Javad Bodagh JAMALI	Delegate
Mr Mohammas Taghi Zamanian KOOPAEI	Delegate
Mrs Farzaneh MOSHAYEDI	Delegate
Mr Parviz POURKIANI	Delegate
Mr Alireza TOOTOONCHIAN	Delegate
Mr Motjaba Zoljoodi ZARANDI	Delegate
Ms Sepideh Sahar Mohammad Mirzaei ZARANDI	Delegate

Iraq

Mr Dawood Shakir MAHMOOD	Principal Delegate
Mr Tahir Hassan HANTOSH	Alternate
Mrs Shilan AL-HAIDERI	Delegate
Mr Abdulhakeem Ali HASSOON	Delegate

Ireland

Mr Liam CAMPBELL	Principal Delegate
Mr Joseph BOURKE	Alternate
Mr Gerald FLEMING	Delegate
Mr James O'SHEA	Delegate

Israel

Ms Henia BERKOVICH	Principal Delegate
Mr Ron ADAM	Alternate
H.E. Mr Aharon LESHNO YAAR	Alternate

Italy

Mr Costante DE SIMONE	Principal Delegate
Mr Marco LAPADURA	Alternate
Mr Leone MICHAUD	Alternate
H.E. Ms Laura MIRACHIAN	Alternate
Mr Ezio BUSSOLETTI	Delegate
Mr Massimo CAPALDO	Delegate
Mr Paolo PAGANO	Delegate
Mr Ludovico PANZIERI	Delegate
Mr Sergio PASQUINI	Delegate

Jamaica

Mr Esmond REID	Alternate
Ms Tyesha TURNER	Delegate

Japan

Mr Mitsuhiko HATORI	Principal Delegate
Mr Noritake NISHIDE	Alternate
Mr Motohiro SAKATA	Alternate
Mr Naoyuki HASEGAWA	Delegate
Mr Yoshiaki KANNO	Delegate
Ms Teruko MANABE	Delegate
Mr Akihide SEGAMI	Delegate
Mr Akihiko SHIMPO	Delegate
Mr Yoshihiko TAHARA	Delegate
Mr Seiichi TAJIMA	Delegate
Mr Eiji TOYODA	Delegate

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Mr Abdel Halim ABU HAZIM	Principal Delegate
Mr Fhaid AL TIAMEH	Delegate
Ms Majd HATTAR	Delegate

Kazakhstan

Ms Zhibek KARAGULOVA	Principal Delegate
Ms Ainur ABENOVA	Alternate
Mr Muratbek MADIMAR	Delegate
Ms Bayan SAZANOVA	Delegate
Mr Talgat ZEINULLIN	Delegate

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Mr Joseph MUKABANA	Principal Delegate
Mr James KONGOTI	Alternate
H.E. Mr John MICHUKI	Alternate
H.E. Mr Anthony ANDANJE	Delegate
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Mr Nicholas MAINGI	Delegate
H.E. Mr Tom Mboya OKEYO	Delegate

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Mr Mohammad Karam ALI	Principal Delegate
Mr Hamed ABDULRAHMAN	Delegate
Mr Osama ALMETHEN	Delegate
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Mr Naser ALMOTOTEH	Delegate
Mr Khalid F. ALSHAYJI	Delegate
Mr Malek ALWAZZAN	Delegate

Latvia

Mr Andris LEITASS	Principal Delegate

Lebanon

Mr Bachir SALEH AZZAM	Principal Delegate

Lesotho

H.E. Mr Monyane MOLELEKI	Principal Delegate
Mr Bruno Tseliso SEKOLI	Principal Delegate
Mr Bataung LELEKA	Alternate
Mr Lefeu RAMONE	Delegate

Lithuania

Ms Vida AUGULIENE	Principal Delegate
Mr Robertas NAUDZIUNAS	Delegate

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Mr Jean Yannick DAMY	Principal Delegate
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Mr John (jean) SANTURBANO	Alternate
Mr Léon WIETOR	Alternate
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Macao, China

Mr Fong SOI KUN	Principal Delegate
Mr António VISEU	Alternate
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Madagascar

Mr Jean Pierre RAKOTANIRINA	Alternate
Ms Soafara RANDRIAMIARISOA	Delegate

Malawi

Mr Gray MUNTHALI	Principal Delegate

Malaysia

Mr Kok Seng YAP	Principal Delegate
Mrs Che Gayah ISMAIL	Alternate
Mr Ismail MOHAMAD BKRI	Alternate

Mali

Mr Mama KONATE	Principal Delegate
Mr Moussa KOUYATE	Alternate

Malta

Mrs Antoinette CUTAJAR	Alternate

Mauritania

Mr Mohamed Laghdaf Ould Mohamed BÉCHIR	Principal Delegate

Mauritius

Mr Balraj DUNPUTH	Principal Delegate

Mexico

H.E. Mr Juan Jose GOMEZ CAMACHO	Principal Delegate
Ms Victoria ROMERO	Alternate
Mr Adrian VAZQUEZ GALVEZ	Alternate
Ms Perla FLORES LIERA	Delegate
Mr René LOBATO	Delegate
Mr Franciso VILLALPANDO IBARRA	Delegate

Moldova

H.E. Ms Tatiana LAPICUS	Principal Delegate
Mr Alexei IATCO	Alternate

Monaco

H.E. Mr Robert FILLON	Principal Delegate
Ms Martine GARCIA	Alternate
Mr Gilles REALINI	Alternate

Mongolia

Mr Luvsantseren ORGIL	Principal Delegate
Mr Sevjid ENKHTUVSHIN	Alternate
Ms Sarantuya GANJUUR	Delegate
Mr Saruul ZORIGT	Delegate

Montenegro

Mr Luka MITROVIC	Principal Delegate
Mr Darko NOVAKOVIC	Delegate
Ms Ivana PAVICEVIC	Delegate

Morocco

Mr Abdalah MOKSSIT	Principal
H.E. Mr Omar HILALE	Alternate
Mr Omar CHAFKI	Delegate
Mr Mustapha EL BOUAZZAOUI	Delegate
H.E. Mr Abderrazzak LAASSEL	Delegate
Mr Abdallah NASSIF	Delegate
Mr Abdelaziz OULDBBA	Delegate

Mozambique

Mr Moísés Vicente BENESSENE	Principal Delegate
Mr Jaime MATSINHE	Delegate
H.E. Mr Eusébio SAÍDE	Delegate
Mr Miguel Raul TUNGADZA	Delegate

Myanmar

Mr Htin LYNN	Alternate
Ms Su Lay NYO	Alternate

Namibia

Mr Honorable ERKKI NGHIMTINA	Principal Delegate
Mr Franz UIRAB	Alternate
Mr Emmanuel. N. Z. KAMBUEZA	Delegate
Mr Simon MARUTA	Delegate
Ms Jennifer M. MOETIE	Delegate
Mr Absalom NGHIFITIKEKO	Delegate
Mr Joas SHIMUYENGU	Delegate

Nepal

Mr Keshav Prasad SHARMA	Principal Delegate
Mr Bhrigu DHUNGANA	Delegate

Netherlands

Mr Frits J.J. BROUWER	Principal Delegate
Mr A.T. Frank GROOTERS	Alternate
Mr Theo VAN STIJN	Alternate
Mr Marhijn VISSER	Alternate

New Caledonia

Ms Laure SAYSSET	Principal Delegate
Mr Sebastien CHATELUS	Alternate

New Zealand

Mr Neil GORDON	Principal Delegate
Mr Penehuro LEFALE	Alternate
Mr Norman HENRY	Delegate

Niger

Mr Abdoulkarim TRAORE	Principal Delegate

Nigeria

Mr Anthony C. ANUFOROM	Principal Delegate
Mr Ifeanyi NNODU	Alternate
Mr Garba ADAMU	Delegate
Mr Ernest AFIESIMAMA	Delegate
Mr Joe ANEKE	Delegate
Mr Syndoph ENDONI	Delegate
Ms Anne ENE-ITA	Delegate
Mr Olufemi ODUMOSU	Delegate
Mr John SHAMONDA	Delegate
Ms Juliana UKEJE	Delegate

Norway

Mr Anton ELIASSEN	Principal Delegate
H.E. Ms Bente ANGELL-HANSEN	Alternate
Mr Eivind A. MARTINSEN	Alternate
Ms Marit Viktoria PETTERSEN	Alternate
Mr Jens SUNDE	Alternate
Ms Annette ABELSEN	Delegate
Mr Morten JOHNSRUD	Delegate
Mr Heiko KLEIN	Delegate
Ms Heidi LIPPESTAD	Delegate
Ms Maren MAAL	Delegate
Mr Roar SKÅLIN	Delegate

Oman

Mr Abdul Rahim Salim AL-HARAMI	Alternate
Mr Ahmed Mohammed bin Salem AL-FATASI	Delegate
Mr Musallem Said AL-MASHANI	Delegate
Mr Juma AL-MASKARI	Delegate
Mr Mohamed AL-RAWAHI	Delegate

Pakistan

Mr Qamar-Uz-Zaman CHAUDHRY	Principal Delegate
Mr Bilal AHMAD	Delegate
Mr Mubarak HUSAIN	Delegate

Panama

Mrs Berta OLMEDO	Principal Delegate
Mr Jorge CORRALES	Delegate
Mr Grisselle RODRIGUEZ	Delegate

Papua New Guinea

Mr Samuel MAIHA	Principal Delegate
Mr Tau R. GABI	Delegate

Paraguay

Mr Julián BAEZ	Principal Delegate
H.E. Ms Nimia DA SILVA	Delegate
Mr Roberto RECALDE	Delegate

Peru

Mr Wilar GAMARRA MOLINA	Principal Delegate
Mr Eynard ZEVALLOS AGUILAR	Delegate

Philippines

Mr Dennis LEPATAN	Alternate
Mr Nathaniel SERVANDO	Alternate
Mr Rodolfo DE GUZMAN	Delegate
Ms Leizel FERNANDEZ	Delegate
Ms Flaviana HILARIO	Delegate
H.E. Ms Maria Teresa LEPATAN	Delegate
Mr Elizabeth TE	Delegate

Poland

Mr Mieczyslaw S. OSTOJSKI	Principal Delegate
Mr Janusz FILIPIAK	Alternate
H.E. Mr Remigiusz A. HENCZEL	Alternate
Mr Lukasz LEGUTKO	Alternate
Mr Maciej BRODOWICZ	Delegate
Mrs Agnieszka HARDEJ-JANUSZEK	Delegate
Mrs Ewa Elzbieta PIASECKA	Delegate
Ms Edyta WOZNIAK-DUDZINSKA	Delegate

Portugal

Mr Adérito SERRÃO	Principal Delegate
Mr Carlos TAVARES	Alternate
Mr Ricardo PRACANA	Delegate
Mr Manuel RAMALHEIRA	Delegate

Qatar

Mr Ahmed ALI	Alternate
Mr Abdulla AL-MANNAI	Delegate

Republic of Korea

Mr Seok-Joon CHO	Principal Delegate
Mr Ha-Man CHO	Alternate
Mrs Won-Tae KWON	Alternate
Mr Myoung-Hwan AHN	Delegate
Mr Seonghoon CHEONG	Delegate
Mr Yong-Seong KANG	Delegate
Mr Seong-Heon KIM	Delegate
Mr Se-Won KIM	Delegate
Mr Chang-Heum LEE	Delegate
Mr Jae-Cheol NAM	Delegate
Mr Won-Tae YUN	Delegate

Romania

Mr Ion SANDU	Principal Delegate
Mr Grigore MAKKAI	Alternate
Mr Petre STANCIU	Alernate
Ms Alexandra SPANU	Delegate

Russian Federation

Mr Alexander FROLOV	Principal Delegate
Mr Alexander I. BEDRITSKIY	Alternate
Mr Valery DYADYUCHENKO	Alternate
Mr Sergey ARTEMENKOV	Delegate
Mr Vasily ASMUS	Delegate
Mr Alexander GUSEV	Delegate
Mr Vladimir KATTSOV	Delegate
Mr Mikhail KRASNOPEROV	Delegate
Mr Alexander NURULLAEV	Delegate
Ms Marina PETROVA	Delegate
Mr Yury TSATUROV	Delegate
Mr Roman VILFAND	Delegate
Mr Valery VUGLINSKYI	Delegate

Rwanda

Mr John Semafara NTAGANDA	Principal Delegate
Mr Alphonse KAYITAYIRE	Delegate
Mr Patrick SAFARI	Delegate

Saint Lucia

H.E. Mr Elddrige STEPHENS	Principal Delegate

Samoa

Mr Mulipola Ausetalia TITIMAEA	Principal Delegate

Saudi Arabia

H.S.H. Turki Bin Nasser Bin ABDULAZIZ	Principal Delegate
Mr Saad Mohamad S. MOHALFI	Principal Delegate
Mr Ali HAMAD AL-BATHI	Alternate
Mr Ahmed ALOTAIBI	Delegate
Mr Mohammed BABIDHAN	Delegate
Mr Ali BAHITHAM	Delegate
Mr Jamal BANTAN	Delegate

Senegal

Mr Mactar NDIAYE	Principal Delegate
Mr Abdoulaye BATHILY	Delegate
Mr Momar GUEYE	Delegate
Mr Charles Sombel SAAR	Delegate
Mr Papa Yatte WADE	Delegate

Serbia

Mr Milan DACIC	Alternate
Mr Jovan DESPOTOVIC	Delegate
Mrs Danica SPASOVA	Delegate
H.E. Mr Ugljesa ZVEKIC	Delegate
Mr Bratislav CEPERKOVIC	Observer
Ms Vesna FILIPOVIC-NIKOLIC	Observer

Singapore

Ms Chin Ling WONG	Principal Delegate
Ms Lay Eng LIM	Delegate

Slovakia

Mr Vladimir PASTIRCAK	Alternate
Mr Fedor ROSOCHA	Alternate
Mr Anton FRIC	Delegate
Mr Pavol NEJEDLIK	Delegate
Ms Jana POROVA	Delegate

Slovenia

Mr Klemen BERGANT	Principal Delegate
Mr Joze KNEZ	Delegate
Mr Silvo ZLEBIR	Delegate

Solomon Islands

Mr Lloyd TAHANI	Principal Delegate

South Africa

Ms Linda MAKULENI	Principal Delegate
Mr Mark MAJODINA	Alternate
Mr Luvuyo Lonsdale NDIMENI	Alternate
Mr Nish DEVANUNTHAN	Delegate
Mr Lawrence Themba DUBE	Delegate
Mr Lindani GCWENSA	Delegate
Ms Modjadji MAKOELA	Delegate
Ms Zoleka MANONA	Delegate
Mr Mnikeli NDABAMBI	Delegate
Mr Eugene Rene POOLMAN	Delegate
Mrs N.L POTELWA	Delegate

Spain

Mr Ricardo GARCIA-HERRERA	Principal Delegate
H.E. Mr Francisco DE BORJA MONTESINO	Alternate
Mr Jose Antonio FERNANDEZ-MONISTROL	Alternate
Mr Ricardo RIOSALIDO ALONSO	Alternate
Ms Rosario DIAZ-PABON	Delegate
Mr Francisco ESPEJO	Delegate
Mr Jose Antonio GARCIA-MOYA	Delegate
Ms Maria Jose GOMEZ	Delegate
Mr Luis Fernando LOPEZ-COTIN	Delegate
Mr Jose Maria MARCOS	Delegate
Mr Manuel PALOMARES	Delegate
Ms Gemma SANCHEZ	Delegate
Ms Teresa SILES	Delegate
Mr Jorge TAMAYO	Delegate
Mr Enric TERRADELLAS	Delegate

Sri Lanka

Mr Gunavi SAMARASINGHE	Principal Delegate
H.E. Mr U.L.M JAUHAR	Delegate

Sudan

Mr Mezamel Abdel Rahman ABDEL GADIR	Principal Delegate
Mr Sharaf El-Din HASSAN IDRISS	Delegate
Mr Ali Mohammed Ahmed OSMAN	Delegate
H.E. Ms Fadwa SHOWAY DING	Delegate

Swaziland

Mr Emmanuel DLAMINI	Principal Delegate

Sweden

Ms Lena HÄLL ERIKSSON	Principal Delegate
Mr Ilmar KARRO	Alternate
Mr Tord KVICK	Alternate
Ms Cristina EDLUND	Delegate

Switzerland

Mr Christian PLUESS	Principal Delegate
Mr Dominique BÉROD	Delegate
Ms Veronika ELGART	Delegate
Mr Gerhard MUELLER	Delegate
Mr Andreas OBRECHT	Delegate
Mr Boris RICHARD	Delegate
Mr Alex RUBLI	Delegate
Mr Christoph SCHMUTZ	Delegate
Ms Gabriela SEIZ	Delegate
Mr Gerhard ULMANN	Delegate

Syrian Arab Republic

Mr Mohammad ARNOUS	Principal Delegate

Tajikistan

H.E. Mr Salohiddin NASRIDDINOV	Principal Delegate

Thailand

Mr Somsri HUNTRAKUL	Alternate
Ms Platima ATTHAKOR	Delegate
Mr Pongsthakorn SUVANPIMOL	Delegate

The former Yugoslav Republic of Macedonia

Mr Vancho DIMITRIEV	Principal Delegate
Mrs Nina ALEKSOVSKA	Delegate
Mr Burim BILALI	Delegate
Mr Zoran DIMITROVSKI	Delegate
H.E. Mr Aziz POLOZHANI	Delegate
Mr Vlado SPIRIDONOV	Delegate

Timor-Leste

H.E. Mr Joaquim DA FONSECA	Principal Delegate
Ms sonia MAIA	Alternate
Mr marcos DA COSTA	Delegate
Mr Sebastiao DA SILVA	Delegate
Mr Terencio FERNANDES	Delegate

Togo

Mr Awadi EGBARE	Principal Delegate
Mr Komlan Agbelenkon NARTEH-MESSAN	Delegate

Trinidad and Tobago

Mr Emmanuel MOOLCHAN	Principal Delegate
Mr Shakeer BAIG	Delegate

Tunisia

Mr Mohamed HFAIEDH	Principal Delegate
Mr Mohamed Abderraouf BDIOUI	Delegate
Mr Mohamed HAJJAJ	Delegate

Turkey

Mr Mehmet ÇAGLAR	Principal Delegate
H.E. Mr Oguz DEMIRALP	Alternate
Mr Murat ALTINYOLLAR	Delegate
Mr Hayreddin BACANLI	Delegate
Ms Nursel BERBEROGLU	Delegate
Mr mustafa COSKUN	Delegate
Ms Ebru EKEMAN	Delegate
Ms Gonul KILIC	Delegate
Mr Cemal OKTAR	Delegate
Mr Yasar OZBEK	Delegate
Mr Haci Murat PULLA	Delegate
Mr Serhat SENSOY	Delegate

Turkmenistan

Mr Esen AYDOGDIEV	Principal Delegate

Uganda

Mr Michael S. Z. NKALUBO	Principal Delegate
Ms Pamela AGABA	Delegate
Ms Margaret N. SERWANJA	Delegate
Mr Emg. Nebert WOBUSOBOZI	Delegate

Ukraine

Mr Denys YEHOROV	Principal Delegate
Mr Mykola MAIMESKUL	Delegate

United Arab Emirates

Mr Abdulla Ahmed EL MANDOOS	Principal Delegate
Mr Yousef AL KALBANI	Alternate
Mr Rashed AL SHAMSI	Delegate
Mr Omar AL YAZEEDI	Delegate
Mr Saeed ALBEDWAWI	Delegate
Mr Abdullatif FAKHFAKH	Delegate

United Kingdom of Great Britain and Northern Ireland

Mr John HIRST	Principal Delegate
Mr Simon GILBERT	Alternate
Mr Mike GRAY	Alternate
Ms Ann CALVER	Delegate
Mr Wayne ELLIOTT	Delegate
Mr Steve FOREMAN	Delegate
Mr Peter GOODERHAM	Delegate
Mr Chris HEWITT	Delegate
Mr Mark HODKINSON	Delegate
Mr Alan JENKINS	Delegate
Mr Ian LISK	Delegate
Ms Karen MCCOURT	Delegate
Ms Catherine MOORE	Delegate
Mr Stephen PALMER	Delegate
Mr Mark RUSH	Delegate
Ms Aileen SEMPLE	Delegate
Mr Stewart TURNER	Delegate
Mr Robert VARLEY	Delegate

United Republic of Tanzania

H.E. Mr Omari NUNDU	Principal Delegate
H.E. Mr Matern Y.C LUMBANGA	Alternate
Mr Deusdedit B. KAGANDA	Delegate
Mr Augustine KANEMBA	Delegate
Mr Suleiman KHAMIS	Delegate
Mrs Agnes KIJAZI	Delegate
Mr Alphonce MWINGIRA	Delegate

United States of America

Mr John HAYES	Principal Delegate
Ms Courtney DRAGGON	Alternate
Ms Laura FURGIONE	Alternate
Ms Ko BARRETT	Delegate
Mr Fredrick BRANSKI	Delegate
Ms Lisa BRODEY	Delegate
Mr Caroline CORVINGTON	Delegate
Ms Robyn DISSELKOEN	Delegate
Mr Harry LINS	Delegate
Mr William LINZEY	Delegate
Mr Michael MORGAN	Delegate
Mr Terrance ONSAGER	Delegate
Mr Mark PAESE	Delegate
Ms Irene PARKER	Delegate
Mr Thomas PETERSON	Delegate
Mr (David) Brent SMITH	Delegate
Mr Timothy SPANGLER	Delegate
Ms Kathryn SULLIVAN	Delegate
Mr Jason TUELL	Delegate
Mr Peter NEILLEY	Observer
Mr Lars Peter RIISHOJGAARD	Observer

Uruguay

Mr Rodolfo PEDOCCHI	Principal Delegate
Ms Estela QUEIROLO FERRARI	Delegate

Uzbekistan

Mr Viktor CHUB	Principal Delegate

Venezuela (Bolivarian Republic of)

Mr Ramon Jesus VINAS GARCIA	Principal Delegate
Mr Jose Gregorio SOTTOLANO	Alternate
Mr Fabio DI CERA	Delegate
Mr Luis Alfonso FERNANDEZ HERNANDEZ	Delegate

Viet Nam

Mr Ha TRAN HONG	Principal Delegate
Mr Tan PHAM VAN	Alternate
Mr Duc BUI VAN	Delegate
Mr The Hung DINH	Delegate
Ms Thi Thuan HA	Delegate
Ms Binh Minh NGUYEN	Delegate
Mr Dai Khanh NGUYEN	Delegate
Ms Thuy Hang NGUYEN	Delegate
Mr Thang NGUYEN VAN	Delegate

Yemen

H.E. Mr Ibrahim AL-ADOOFI	Principal Delegate
Mr Omer AL-QUTAISH	Delegate

Zambia

Mr Jacob NKOMOKI	Principal Delegate
Mr Joseph K. KANYANGA	Alternate
Mrs Loveness n. SHABALENGU	Delegate

Zimbabwe

Mr Partson Itai MBIRIRI	Principal Delegate
Mr Amos MAKARAU	Alternate
H.E. Mr James MANZOU	Alternate
Mr Elliot BUNGARE	Delegate
Mr Nicholas Tasunungurwa GOCHE	Delegate
Mr Gilbert MAWERE	Delegate
Mr Francis MUNHUNDIRIPO	Delegate
Mr Cleophas, Nyikadzino MUTHABIRE	Delegate
Mr Maurice Vengesayi SAHANGA	Delegate

3. Observers

Palestine

Mr Yousef ABU ASAD	Observer
Mr Ibrahim MUSA	Observer

Holy See

H.E. Mr Massimo DE GREGORI	Observer
Mr Alexandre FRADIQUE	Observer
Mr Daniel TILLSON	Observer

4. Presidents of constituent bodies and chairs of other bodies reporting to the Congress

Regional Association I (Africa)

Mr Mamadou L. BAH	President

Regional Association II (Asia)

Mr Victor CHUB	President

Regional Association III (South America)

Myrna ARANEDA FUNTES (Ms)	President

Regional Association IV (North America, Central America and the Caribbean)

Mr Arthur W. ROLLE	President

Regional Association V (South-West Pacific)

Sri Woro B. HARIJONO (Ms)	President

Regional Association VI (Europe)

Mr Ivan ČAČIĆ	President

Commission for Basic Systems (CBS)

Mr Fredrick BRANSKI	President

Commission for Instruments and Methods of Observation (CIMO)
Mr Bertrand CALPINI — President

Commission for Atmospheric Sciences (CAS)
Mr Michel BELAND — President

Commission for Aeronautical Meteorology (CAeM)
Mr Chi Ming SHUN — President

Commission for Agricultural Meteorology (CAgM)
Mr Byong-Lyol LEE — President

Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM)
Mr Peter DEXTER — President

Commission for Hydrology (CHy)
Mr Julius WELLENS-MENSAH — President

Commission for Climatology (CCl)
Mr Thomas PETERSON — President
Mr Serhat SENSOY — Vice-president

Intergovernmental Panel on Climate Change (IPCC)
Mr R. PACHAURI — Chair

Steering Committee for the Global Climate Observing System (GCOS)
Mr Adrian Simmons — Chair

Joint Scientific Committee for the World Climate Observing System (WCRP)
Mr Antonio J. BUSALACCHI — Chair

5. Invited experts

Mrs Manola BRUNET
Mr CHEN Deyou
Mr HU Yanzhao
Mrs Aida DIONGUE-NIANG
Mr G.R. HOFFMAN
Mr JANG Hyon Chol
Mr Colin JONES
Mr Wolfgang KUSCH
Mrs Josefina MAESTU
Mr Rodney MARTINEZ
Mr Simon MASON
Mr Tillmann MOHR
Mr Roger PULWARTY
Mr James PURDOM
Mr Bob RIDDAWAY
Mr Lars Peter RIISHOJGAARD

6. Lecturers

Mr Brian Hoskins — IMO Lecturer
Mr Taroh Matsuno — Scientific Lecturer
Mr Adrian Simmons — Scientific Lecturer

7. Representatives of organs and organizations of the United Nations system

Food and Agriculture Organization of the United Nations (FAO)
Mr Alexander MULLER — Observer

International Atomic Energy Agency (IAEA)
Mr Günther WINKLER — Observer

International Civil Aviation Organization (ICAO)

Mr G. BROCK	Observer
Mr O. TURPEINEN	Observer

International Telecommunication Union (ITU)

Mr Houlin ZHAO	Observer
Mr Vadim NOZDRIN	Observer

United Nations Convention to Combat Desertification (UNCCD)

Dr Mansour N DIAYE	Observer

United Nations Educational, Scientific and Cultural Organization (UNESCO)

Ms Wendy WATSON-WRIGHT	Observer

United Nations Environment Programme (UNEP)

Mr Ron WITT	Observer

United Nations Framework Convention on Climate Change (UNFCCC)

Ms Rocio PLICHTE	Observer

United Nations World Food Programme (WFP)

Ms Katrine LEGARTH	Observer
Ms Darlene TYMO	Observer

Universal Postal Union (UPU)

Mr Edouard DAYAN	Observer

World Trade Organization (WTO)

Ms Amanda MCKEE	Observer
Mr Patrick RATA	Observer

8. Representatives of intergovernmental organizations

African Centre of Meteorological Applications for Development (ACMAD)

Mr Adama Alhassane DIALLO	Observer

European Centre for Medium-Range Weather Forecasts (ECMWF)

Mr Dominique MARBOUTY	Observer
Mr Walter ZWIEFLHOFER	Observer

European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)

Mr Lars PRAHM	Observer
Mr Paul COUNET	Observer
Mr Vincent GABAGLIO	Observer

9. Representatives of other organizations

Agency for Air Navigation Safety in Africa and Madagascar (ASECNA)

Mr Jean-Paul MAKOSSO	Observer

Association of Hydro-Meteorological Equipment Industry (HMEI)

Ms Christine CHARSTONE	Observer
Mr Ben DIETERINK	Observer
Mr Andy MCDONALD	Observer
Mr Bruce SUMNER	Observer
Mr Jeremy USHER	Observer

Caribbean Meteorological Organization (CMO)

Mr Tyrone SUTHERLAND	Observer
Mr Glendell DE SOUZA	Observer

Global Institute for Water, Environmental Health (GIWEH)

Mr Nidal SALIM	Observer
Mrs Armelle DE VIENNE	Observer

International Council of Academies of Engineering and Technological Sciences, Inc (CAETS)

Mr Rene DÄNDLIKER	Observer
Mr Klaus RAGALLER	Observer

International Federation of Red Cross and Red Crescent Societies (IFRC)

Ms Katiuscia FARA	Observer
Mrs Joy MULLER	Observer

International Organization of La Francophonie (OIF)

H.E. Mr Ridha BOUABID	Observer

International Research Institute for Climate and Society (IRI)

Mrs Judy OMUMBO	Observer

International Union of Geodesy and Geophysics (IUGG)

Mr Arthur ASKEW	Observer

League of Arab States (LAS)

H.E. Mr Djamel Eddine DJABALLAH	Observer
Mr Youcef TILIOUANT	Observer

Southern African Development Community (SADC)

Mr Bradwell J. GARANGANGA	Observer

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