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**THORPEX**  
A World Weather Research Programme

# INTERNATIONAL CORE STEERING COMMITTEE FOR THORPEX

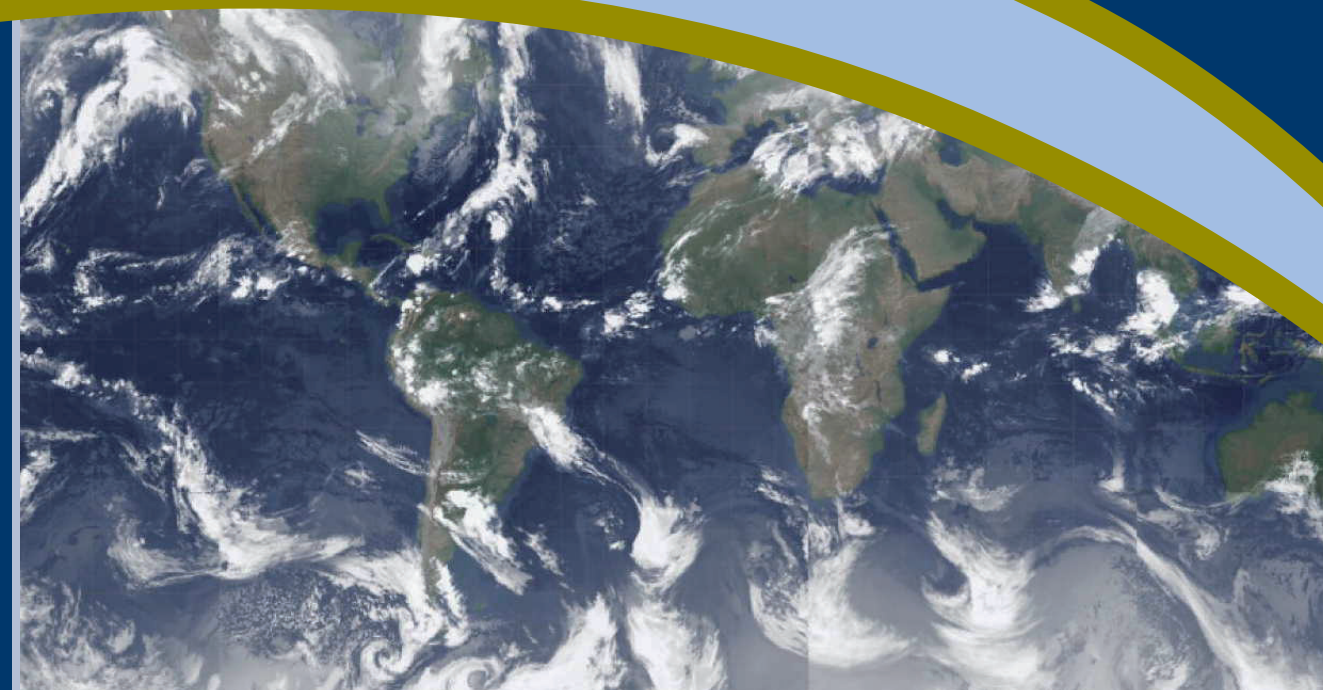
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**World  
Meteorological  
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World Weather Research Programme

# WORLD METEOROLOGICAL ORGANIZATION

## WORLD WEATHER RESEARCH PROGRAMME

COMMISSION FOR ATMOSPHERIC SCIENCES

### INTERNATIONAL CORE STEERING COMMITTEE FOR

### THORPEX

TENTH SESSION

(GENEVA, SWITZERLAND, 3-5 OCTOBER 2012)

FINAL REPORT





## **EXECUTIVE SUMMARY**

The tenth session of the CAS International Core Steering Committee (ICSC) for THORPEX was held at the Secretariat of the World Meteorological Organization Geneva from the 3-5 October 2012. The ICSC proceeded with the work assigned to it by the CAS, the WMO Executive Council and the World Meteorological Congress. This included reviews of the progress in planning and further development of THORPEX on the global and regional level, financial and administrative matters related to THORPEX management, the International Programme Office (IPO) and the Trust Fund. Particular attention was paid to the THORPEX legacy and formulation of a process for the development of a possible new programme in the post-THORPEX era. All documents and presentations considered and discussed at the ICSC 10 may be downloaded from <http://www.wmo.int/thorpex>.



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## **1. ORGANIZATION OF THE SESSION**

### **1.1 Opening of the Session**

1.1.1 The Tenth Session of the CAS International Core Steering Committee for THORPEX (ICSC 10) was opened by Dr Alan Dickinson (Chair of the ICSC) at 09.00 am on Wednesday the 3 October 2012 at the Headquarters of the World Meteorological Organization, Geneva. He invited Deon Terblanche, Director of the ARE, to address the meeting. The Director welcomed participants and expressed his gratitude on behalf of the WMO for the time they had set aside for the meeting. He especially welcomed the Presidents of the CBS and CAS.

He noted that THORPEX still had two years to run and it was important to get the maximum benefit in the time remaining. High impact weather issues are evolving as the population becomes more urbanised and vulnerable. There are therefore more opportunities for further research.

He noted that THORPEX was a very important programme of the WMO and element of the WWRP and said that great progress has been made in recent years. It was now necessary to look to the future and discuss possible post THORPEX arrangements and structures. This meeting would be a valuable step in that direction.

### **1.2 Adoption of the agenda and working arrangements**

1.2.1 The ICSC adopted the agenda (as listed in the contents page above) and agreed the working arrangements for the meeting.

## **2. REPORTS**

### **2.1 Report of the Chair**

2.1.1 Dr Alan Dickinson noted that significant work was now being carried out to gear up for the post THORPEX era. We already have two well formulated Sub-seasonal to Seasonal (S2S) and Polar Prediction (PPP) projects. The THORPEX EC had met in March 2012 at the Met Office and prepared a paper setting out various options for the way ahead. Discussion of this paper was a major item for this meeting.

2.1.2 The THORPEX Progress Report (TPR) has been reviewed by the WWRP JSC and a revised version was now on the website. However, it was now necessary to decide the next steps in this area.

2.1.3 Finally, he invited ICSC members to keep presentations short and to top level issues as far as possible.

2.1.4 The actions from ICSC 9 were then reviewed (see the summary in Doc. 2.1). These were found to be in a good state and mainly completed, underway or would be discussed further at this meeting.

### **2.2 Report of the President of CAS – including the outcome from EC-64**

2.2.1 Dr Michel Beland summarized some of the main outcomes from EC 64. There had been positive decisions from the EC to go ahead with the S2S and PPP projects. WMO members are encouraged to support these projects and contribute to the Trust Funds that will be set up. At present there is no support available from the WMO budget for these new projects.



2.2.2 He noted that CAS regarded THORPEX as “the jewel in the crown”. It has been a very successful programme and had many achievements as reflected by the TPR. Now the focus turns to what should happen next. Option C in the EC paper is strongly supported but with significant variations in the detail. Further progress would be made here and at ICSC 11 in 2013 leading to final endorsement of the new programme at Congress 15. Links with the WCRP continue to develop and remain very important, thus ongoing close co-operation and continuing discussion are needed for the success of joint activities.

2.2.3 During discussion it was noted that the SG holds some funds for new initiatives and that in principle it is possible to bid for access to some of that resource. In terms of the WMO budget an increase in allocation in one area inevitably means a reduction elsewhere. It is thus necessary to sell new programmes effectively to WMO members to gain financial support for Trust Funds. By the middle of 2013 the full proposed post THORPEX programme content should be much clearer and an overall picture should be presented to CAS 7.

### **2.3 Report from the fifth meeting of the WWRP/JSC**

2.3.1 Dr Michel Beland provided an update on the WWRP JSC on behalf of Dr Gilbert Brunet. He reviewed the long term objectives of the WWRP which show a strong emphasis on high impact weather. The programme is delivered through a range of RDPs and FDPs. There is also capacity building through summer schools etc. A strategic plan has been published covering the years out to 2017. The detailed structure of the WWRP was then outlined. The Open Science Conference planned for 2014 in Montreal, Canada was described. It is also hoped to hold a summer school in the USA during 2013.

Turning to THORPEX he noted that a comprehensive TPR has been completed and on the website and the THORPEX EC has initiated important discussions about the legacy and post THORPEX arrangements.

A strong feature of the WWRP is increasing collaboration with the WCRP, good examples were YOTC (and the MJO TF), WGNE, S2S, PPP and the Grey Zone (with GASS).

2.3.2 Four new FDPs/ RDPs were noted. These were related (a) to the Sochi 2014 Winter Olympics and development of a harmonized nowcasting system (b) INCA-CE which addressed nowcasting in central Europe (c) the La Plata basin project and (d) the Southern China Monsoon Rainfall experiment.

2.3.3 He then outlined the S2S and PPP projects. Once funding decisions are clear it is intended to set up international coordination offices for these projects.

2.3.4 Finally, some proposed structural changes were noted. These were intended to achieve more efficient co-operation, help push the limits of predictive skill, build better linkages, achieve better alignment of the WWRP with user needs, ensure a smooth transition post THORPEX and make a better distinction between Working Groups/ Expert teams and projects.

### **2.4 THORPEX Progress Reports**

#### **2.4.1 Report from the IPO**

2.4.1a Dr Tetsuo Nakazawa provided an update from the IPO. He outlined the eight core objectives from the original THORPEX research plan and noted that the TPR shows how these are being addressed. This document was on the website and has been reviewed by the WWRP JSC. The major successes of the programme so far were noted including the TReCs, T-PARC, IPY, AMMA, YOTC plus the excellent progress made by the working groups GIFS-TIGGE, DAOS and PDP and the five Regional Committees (RCs) . Major science symposia have been held regularly along with important summer schools.

2.4.1b The ICSC then discussed how to build upon the work carried out to prepare the TPR. It was decided to comprehensive a fully comprehensive report covering the complete THORPEX programme. This would require a consultant working for perhaps 3-6 months. It was agreed that a reduced version of this report should be published in BAMS.

***ICSC 10(1): Arrange for the preparation of a comprehensive paper recording the scientific achievements of the full THORPEX programme. Prepare a summary paper for open publication. Engage a consultant to carry out the work. Present an outline of the proposed contents of the paper(s) to ICSC 11.***

***ICSC 10(2): Propose suitable individuals for the consultant role in action 10(1) to the ICSC Chair and IPO.***

## **2.4.2 Report from PDP Working Group**

2.4.2a Heini Wernli introduced the work of the PDP WG. He noted that the website was now available <http://lacweb.ethz.ch/thorepexpdp> . He then outlined a range of activities of interest. T-PARC work was now focussed on process studies, especially using Eldora data. PANDOWAE has been very successful; seven Ph.D students have now graduated and all remain working in science, more than twenty publications have appeared so far in the literature and the second phase has now been funded. DIAMET (which considers diabatic processes in severe storms) is underway. Field campaigns have collected several weeks of data including in IOP8 a cyclone case with a sting jet (low level jet) which is believed to be the first case of measurement by aircraft.

2.4.2b The PDP WG maintains strong links with WGNE and is looking to the challenge of monsoon precipitation prediction. New techniques are now being employed including looking at short term forecast tendencies. The group was now better engaged with the atmospheric river research community, especially the work of Marti Ralph which has considered intense precipitation along the American West Coast. In the UK the top 10 winter flood situations were all associated with the transport of very moist air from the tropics to western Europe.

2.4.2c During discussion it was noted that there remains a need to further engage the global academic community in dynamical problems. The wider academic community is still not sufficiently involved. The situation is rather better in Europe where there is significant interaction. WGNE Workshops will help but these need to be publicised. The academic research can directly support model development which would be very useful but it needs to be focussed on specific problems of importance. Publicising successful examples of cooperation would be productive.

2.4.2d The Davos Atmosphere and Cryosphere Assembly 2013 (DACA 2013) was then noted. The ICSC encouraged full participation of the THORPEX community in this meeting.

***ICSC 10(3): Strong THORPEX participation in DACA 13 is encouraged, especially the sessions related to High Impact Weather (HIW) and Data Assimilation (DA)***

## **2.4.3 Report from the DAOS Working Group**

2.4.3a Roger Saunders introduced the work of the DAOS WG. He noted the recent meeting in Madison, Wisconsin at which topics including targeted observations were discussed. The WMO report prepared by DAOS on targeted observations was noted. It is the intention to prepare a shortened version for BAMS. The re-analysis of the Winter Storm Reconnaissance Programme was outlined. ECMWF has looked at impacts from denial of dropsondes in the 2010/11 campaign. The results showed a broadly neutral impact. This confirmed previous results from the mid-latitudes. It seems the main benefit from targeting at present is in improving TC track prediction.

2.4.3b The successful Concordiasi campaign was reviewed. Larger analysis differences between different NWP centres in the areas around the Antarctic coastline were noted suggesting these areas are particularly sensitive to assimilation of observations. These differences were reduced when the dropsonde data from the gondolas were assimilated. The total impact of the dropsonde data during Concordiasi was equivalent to an addition of three regular radiosonde stations providing profiles daily at 00UTC and 12 UTC.

2.4.3c Satellite data now have major impacts in the accuracy of NWP analyses and forecasts. The most important sensors are AMSU-A and IASI/AIRS. However, at NRL the AMVs have more impact (the NRL AMV data set is larger and includes GEO-LEO AMVs). The GEO-LEO AMVs are a new product and have useful positive impacts because they tend to be in sensitive areas between 50-70deg latitude. Efforts are underway to try and make these data more widely available to the operational centres. At Meteo France improved assimilation of AMSU-B data over land has proven beneficial.

2.4.3d GeoMetWatch is a commercial enterprise which is planning to put a high resolution infrared spectral sounder in GEO orbit and then sell the data. This model may become more common in the future as up-front public funding becomes more difficult.

2.4.3e Some messages for THORPEX included the fact that research satellites are proving very useful in NWP but may fail suddenly and there is no back up (e.g. ENVISAT). New satellite programmes are emerging from other countries e.g. FY-3 (China) and Oceansat-2 (India) and are beginning to be used operationally.

2.4.3f In-situ data were then discussed. Including the E-ASAP and E-SURFMAR programmes of EUMETNET(EUCOS). A decline in the number of drifting buoys because of system failures has now been addressed.

2.4.3g There are some significant advances now being made. These include the transition to BUFR for radiosonde data (which will improve the vertical resolution and provide positional data), increased measurements of humidity data from commercial aircraft, wider availability of ground based GPS total zenith delay data on the GTS. There are also initiatives in WMO working towards a common format for rain radar data and improving the accuracy of measurements of solid precipitation.

2.4.3h Turning to data assimilation matters it was shown that differences in analyses from the different centres averaged over long time periods were smallest in areas with good radiosonde coverage and near some aircraft flight paths. This approach is proving to be a good diagnostic for the observing system potentially showing the usefulness of individual sites. An example of the influence of aerosol assimilation on a tornadic storm development was described.

2.4.3i A review of DA terminology by the DAOS WG was outlined. Proposals have been developed and are being reviewed by the WG and WGNE.

2.4.3j Links between the MWFR group on mesoscale data assimilation will be strengthened through a joint meeting in the future. The DAOS WG will consider mesoscale data assimilation but be complimentary to the activities in the MWFR group. It was also recognised that the DAOS WG would inevitably move into the area of coupled DA in the future.

2.4.3k The ICSC 9 actions allocated to the DAOS WG were then reviewed. Good progress was being made in all areas.

2.4.3l The ICSC 10 then approved the changes to membership and agreed that the DAOS WG should take the lead in organising the 2013 WMO DA Symposium. Regarding WG meetings it was recognised that in common with the other WGs the DAOS WG invites experts as required. Normally other people from the organisation hosting the meeting also attend. In any event it was

considered necessary to keep the membership of the WGs under review and to engage a wider community in WG activities was considered useful.

***ICSC 10(4): The ICSC approved the change to DAOS membership and the appointment of Tom Hamill as a new Co-Chair.***

***ICSC 10(5): The ICSC endorsed the DAOS WG taking the lead in organising the WMO DA Symposium in 2013. It was recommended that DAOS identify the WMO funding sources for previous Symposia.***

***ICSC 10(6): All the WGs are encouraged to ensure a balanced representation, engage a wider community and to strengthen links with the academic community (as appropriate).***

#### **2.4.4 Report from the GIFS-TIGGE Working Group**

2.4.4a Richard Swinbank introduced the work of the GIFS-TIGGE WG. He noted the need for the appointment of a new Co-Chair following the resignation of Ms Young-Youn Park from Korea. Masayuki Kyouda from JMA has agreed to take up the role.

2.4.4b The structure of the TIGGE project was described including the 3 archive centres and 10 forecast centres supplying data. The archive was proving very useful for research in forecasting methods, predictability and dynamical processes. The Bureau of Meteorology in Australia has not supplied data for about one year due to development of their EPS system. More than 60 publications based on the TIGGE datasets were now in the literature and the archive was now more than 600TB and expanding at about 1TB a week. Of about 1600 registered users around 100 were very active.

2.4.4c The TIGGE-LAM panel is now organized on a regional basis and the archive centres have agreed to hold priority data from the LAM EPSs. The WG wished to keep TIGGE-LAM as part of their activities.

2.4.4d The GEOWOW project was outlined. This is a 3 year EC programme involving, for the meteorological part, the Met Office, ECMWF, Meteo France and KIT. The work is directed at improving access to the TIGGE archives and developing prototype products.

2.4.4e Attention then turned to GIFS which is intended to realise some of the benefits of THORPEX research. The real time exchange of TC predictions has been implemented using CXML format. Now forecasts of gridded fields are being addressed for parameters including heavy rainfall, strong winds etc.,. Close dialogue with the SWFDPs continues. Representatives have been exchanged and the prototype products fully documented for forecasters. Feedback from the SWFDP regional centres has been sought to guide future priorities. The forecast priorities turned out to be heavy rain, strong winds and state of sea for a few days ahead and without the current 48h delay. Work is underway within GEOWOW, led by the Met Office, to provide products in near real time. It is hoped to obtain agreement to develop a heavy rainfall product based on the ECMWF, JMA, Met Office and NCEP ensembles and deliver it in near real time in the near future.

2.4.4f TIGGE research was described including the benefits of the multi model approach compared to the use of re-forecast data to improve the ensemble predictions. At present it was clear that the use of a re-forecast bias correction was providing a similar improvement to the multi model approach. This suggested the optimal method would be to do the re-calibration and then form the multi-model ensemble.

2.4.4g Some significant papers that have appeared in the last few years related to Southern Hemisphere cyclones, the MJO and the impact of ET on mid-latitude cyclones were noted. It was also noted that the GIFS-TIGGE and PDP WGs are planning a review paper on TIGGE research for open publication.

2.4.4h The GIFS-TIGGE WG intends to address a number of important research topics including initial condition perturbations, representing model error, the verification of ensemble forecasts, seamless forecasting and convective scale ensembles. It is recognised that TIGGE is an excellent resource for comparing EPS techniques.

2.4.4i Regarding the future it was noted that the GIFS-TIGGE and PDP WGs propose a merger to possibly become the Predictability and Ensembles Expert Team of the WWRP in a revised structure. The WG strongly supports continuing the TIGGE archive beyond 2014. ECMWF noted that it would continue archiving post 2014. After THORPEX ends the WG proposes that the archives might be managed by a Liaison Group. Also, some of the product development work could be transferred to CBS.

2.4.4j In discussion it was noted that engagement with CBS is essential as progress is made towards operational implementation. The scientific basis for going operational is still rather weak and needs more work. Also, the process to achieve full operational status for validated products needs to be investigated and defined.

***ICSC 10(7): The GIFS -TIGGE WG is invited to work closely with CBS to identify the process needed to put delivery of agreed (following assessment and evaluation) multi model EPS products on an operational basis for the SWFDPs.***

***ICSC 10(8): The GIFS-TIGGE WG is invited to consider, in consultation with the archiving centres, potential future archiving requirements (e.g. addition of supplementary data) and how these might be met in the post THORPEX era (including consideration of the number of archive centres needed and their possible roles).***

***ICSC 10(9): The ICSC agreed that TIGGE LAM should remain part of the TIGGE WG whilst maintaining close links with the MWFR WG.***

***ICSC 10(10): The ICSC also approved the changes to the membership of the GIFS-TIGGE WG, including a new Co-Chair, Masayuki Kyoda.***

## **2.5 Report from the WWRP/SERA Working Group**

2.5.1 Brian Mills introduced the work of the WWRP SERA WG. He noted that social science occupies the space between the humanities and the natural sciences. The objectives include description, explanation and prediction. Attention is paid to the development of the best techniques for surveys, direct observations, experimentation and simulation. Social science looks upon the “risk” associated with an event as the probability multiplied by the consequences.

2.5.2 There has been an upward trend in insured losses and at least part of that is probably associated with climate change. Meteorological events pose a large element of the risk. The sensitivity of the US economy to weather is estimated at about 3.4% or \$485 billion. How much this could be reduced by new or improved weather services is not clear. The whole process is important in realising benefits including the way the forecast is prepared, delivered and whether it is actually used decision making. A major application of SERA techniques is in the design, testing and implementation and evaluation of system changes and improvements.

2.5.3 The SERA WG has now established a formal relationship with the Integrated Research on Disaster Risk (IRDR) which is sponsored by ICSU, ISSC and UNISDR. The IRDR carries out a forensic investigation of disasters including those with a weather element.

2.5.4 The WG is also preparing a guidance document concerning building social science topics into projects. There has been direct involvement with the formulation of the S2S and PPP projects and inputs to plans. A SERA RDP is planned “Understanding the social and economic dimensions of weather related warning systems”. Other activities include supporting Regional Committees,

analysis of the TIGGE prototype probability products and the possibility of a THORPEX benefit assessment to complement the reporting work in the TPR (e.g. concerning the 100 active users of the TIGGE data).

2.5.5 In discussion the ICSC agreed to the preparation of a proposal to carry out a benefit assessment.

***ICSC 10(11): The SERA WG is invited to prepare a proposal (including indicative costs) for a benefit assessment of some aspects of the THORPEX programme (e.g. the TIGGE archives) linking to the GEOWOW project as appropriate.***

## **2.6 WCRP update**

2.6.1 Vladimir Ryabinin provided an update on the work of the WCRP on behalf of the WCRP Director. The main objectives of WCRP are to study the predictability of climate, determine the human effects on climate and facilitate the analysis and prediction of climate. Structural changes have been introduced to arrive at a more responsive “second generation” WCRP. The top level of the WCRP now comprises a Joint Scientific Committee and Joint Planning Staff supported by a WCRP Modelling Advisory Council and a WCRP Data Advisory Council. Six “grand challenges” have been identified these are: climate extremes, changes in water availability, regional sea level rise, actionable and skillful regional climate information, climate sensitivity and roles of aerosols, precipitation and cloud systems in it. There are four core WCRP projects (CliC, CLIVAR, GEWEX and SPARC) and four WGs, on coupled modelling (WGCM), seasonal to interannual prediction (WGSIP), regional climate (WGRC), and WGNE.

2.6.2 The WCRP Open Science Conference was a very successful event attracting around 2000 people including a large number of early career scientists and scientists from developing countries.

2.6.3 There is a series of major developments including the Future Earth initiative, a 10-year collaboration led by an alliance of stakeholders including ICSU. There are several associated calls for research funding, with initial opportunities in the research areas of coastal zones and freshwater availability. The other Future Earth stakeholders include ICSU, International Social Science Council (ISSC), the Belmont Forum, UNESCO, UNEP, UNU, and WMO (as an observer). It was launched at the Rio+20 in June 2012. Later in October 2012 there will be an Extraordinary WMO Congress on the Global Framework for Climate Services (GFCS). It includes a component on modelling and prediction on which WCRP and WWRP will work closely together.

WCRP runs several modelling experiments including a coupled model intercomparison experiment (CMIP5), the Co-ordinated Regional Downscaling Experiment (CORDEX), the Climate system Historical Forecast Project (CHFP), etc.. The CMIP5 outputs are being served by a distributed archive supported by the Earth System Grid Federation (ESGF). Similar arrangements are considered for hosting CORDEX, WGSIP and observational products as well.

2.6.4 Efforts continue to improve the connection between the data experts and the scientists. The WCRP 4<sup>th</sup> International Reanalysis Conference has reviewed the state-of-the-art in reanalysis of the atmosphere, land and ocean, observational requirements, current scientific challenges and opportunities for the future. Strong links exist between WCRP and WWRP/THORPEX on S2S, PPP, YOTC and WGNE. WCRP wishes to co-operate with WWRP and develop new activities especially related to high impact events, coupling with ocean, DA, the observations system, impacts on skill etc.,

2.6.5 It was noted in discussion that the GEOWOW project will provide the TIGGE data in NetCDF format which should facilitate its use by climate scientists. Actionable science was interpreted as providing scientific information on which sound decisions can be taken.

## **2.7 Report from the President of CBS**

2.7.1 The President of CBS introduced the activities of CBS related to THORPEX. In general CBS wishes to see improvements in observations and predictive services outcomes. It is hoped to implement the SWFDPs in all WMO Regions. CBS 15 addressed a number of important topics including progression of the manual for the GDPFS, verification (deterministic and EPSs), integration of EPSs into operational centres, integration of satellite based products, informal exchange of multi-annual to decadal predictions, support provided to IAEA and WHO and technical information concerning the siting of nuclear plants,

2.7.2 There remains a need for CBS and CAS to work and collectively together. Working with separate disjointed systems will simply limit benefits. THORPEX is itself a good example of working together with CBS. There is significant collaboration already although links with the CBS OPAG GDPFS could be improved. It was recognised that the Met Office was working to provide multi-model ensemble products available in near real time for evaluation. This would be a big step forward. The close links with the SWFDPs are especially important but equally there is a need not to overload these activities with research aspects.

2.7.3 Important issues remain for example, how to fully combine different sources with different resolutions and skill and how to use multi-model EPSs in impact prediction. The latter could be a very useful topic for a follow on THORPEX programme.

2.7.4 The links between the DAOS WG and the CBS ET EGOS were especially fruitful. THORPEX has played a major role in all the regular impacts workshops e.g. the 5<sup>th</sup> Workshop held recently in Sedona. All the major operational centres were present at this event.

## **2.8 Severe Weather Forecasting Demonstration Projects (SWFDP)**

2.8.1 Peter Chen recalled that the SWFDP has been underway since 2006, and the project is under the guidance of Commission on Basic Systems, and provided an update on developments since ICSC 9.

2.8.2 Effort was being devoted to improving services, lead times, disaster risk reduction and the interaction of NMHSs with their end users. Capacity building and contributing to severe weather aspects of climate change adaption were important elements. There were now initiatives in Southern Africa, the South Pacific Islands, Eastern Africa and two others in Asia involving a total of 41 countries. The projects organized a data flow from the global to regional and the NMC levels. The NMCs remained responsible for the issue of forecasts and warnings within national responsibilities. Regional Centres provide a key role in offering guidance and additional products to NMCs. Project Management groups decide on project activities and what new products will be introduced employing formal change management methods.

2.8.3 It was recognized that GIFS-TIGGE research could in principle add important new ensemble products. There was also the need to deal with the short range using e.g. improving satellite-based products as very short-range forecasting tools. The SWFDP focus was very much on high impact weather out to 3-5 days ahead e.g., heavy rain and strong winds, with potential impacts of flash floods, landslides, and agricultural losses. Also included were technical training programmes for forecasters and managers. There were identified gaps in expertise and skill in relation to tropical convection, localized and rapid on-set of severe weather and a general lack of appropriate forecasting tools. There were little data to help with the first 12 hours of the forecast period (very few observations and usually no radar data) so a major reliance is placed on satellite data products.

2.8.4 Concerning links with the WWRP it was noted that the essential links were with the GIFS-TIGGE WG and on verification, nowcasting research, sub-seasonal activities and on SERA related topics. The GIFS products being developed were especially interesting. These products were being assessed and feedback provided. The planned move to near real time provision was welcomed. This should also result in much better assessment of the products by operational forecasting offices in the SWFDPs.

### **3. DISCUSSION /RECOMMENDATION ON POST THORPEX**

#### **3.1 Discussion on THORPEX legacy and options for a follow on programme**

3.1.1 Deon Terblanche, D/RES, provided some thoughts on post THORPEX activities and the probable evolution of the WWRP more generally. He noted that it was vital to address the key predictions required on timescales from hours to a season. He outlined the main societal needs, essential science questions and some technological and resource realities. It was important that WMO members should be given an “end to end” vision of how WWRP will address societal needs. Links with CBS initiatives were very important including to the GDPFS (Global Data Processing and Forecast System). WMO needed to embrace a global partnership and make optimal use of regional structures. Expertise needs to be fostered and applied to international co-operation and large projects. A better distinction is recommended between how expert teams (or groups) are funded and projects which have a fixed lifetime.

3.1.2 A new WWRP Strategic Plan is now needed since the last one was written in 2009. It should be supported by a separate science plan containing a cluster of projects which address clear societal needs. Some projects already formulated are S2S, PPP, etc. There needs to be a continuing process of defining future plans and projects. This ICSC 10 meeting was very important in that regard. Discussion of proposals would continue at the CAS MG meeting, EC 65, ICSC11 (in conjunction with WWRP 6) and the WWRP OSC in 2014.

3.1.3 A schematic of a possible new WWRP structure was discussed. This included Expert Teams and Working Groups (funded by WMO) as horizontal strands supporting projects (funded by Trust Funds) as vertical strands. The exact nature and number of Expert teams, Working Groups and Projects needs further discussion and agreement.

3.1.4 The Chairman asked whether there should a follow on programme from THORPEX and if so what this should be? He summarised the Options contained in the EC paper and the responses to it. Of the 18 replies received 12 favoured Option C in one form or another. Canada and South Africa also stated that they supported Option C. The S2S and PPP projects were fully supported but not considered sufficient. Ten replies stressed the need for an initiative focused on HIW/extreme weather on timescales form hours to weeks, although some suggested a longer timescale out to perhaps as long as a year ahead. Strengthening links with the academic and operational communities and the WCRP were seen as important in any new programme. Only three respondents stated that they were willing to contribute financially to a new programme so funding could be a challenge.

3.1.5 Following discussion there was a general consensus that a process should be set up to try and formulate a project focused on HIW. Links to the operational community would be essential and should help drive the agenda. Similarly, it was necessary to capture the attention of the academic community since the NMHSs could not resolve some scientific questions on their own. In some senses the academic community has just got going on THORPEX research given the inevitable time lags in funding cycles. The doors must be kept open. It is essential to build on what we have. A new project would also need to recognise the technological realities and identify the gaps in knowledge and set a few “grand challenges”. There were also opportunities from new observations becoming available e.g. advanced IR sounders on GEO satellites and expected advances in DA. A key question was how far into the future we could forecast HIW in real detail.



This would be best addressed through an international programme. Weather impacts should be considered as a new element of the project.

3.1.6 The outcome might be a cluster of projects e.g. S2S, PPP and HIW which are synergistic and complement each other.

### **3.2 Recommendation for the way forward**

3.2.1 Following further discussion the ICSC agreed the following actions for this topic,

***ICSC 10(12): Continue to liaise closely with the WCRP concerning proposed future joint activities and arrange appropriate representation at the next WCRP JSC in May 2013 and WWRP in July 2013.***

***ICSC 10(13): (a) Convene a Workshop to identify those specific aspects of the THORPEX programme that should be taken forward in an international collaborative framework. Consider the inclusion of new topics (e.g. forecasting weather impacts) and a strong SERA component. Ensure close consultation and synergy with the S2S and PPP projects and foster the active participation of the operational and academic communities in the process.***

***(b) Set up a small Task Force and employ a consultant to develop a draft Implementation Plan and consolidating framework for the S2S, PPP and new initiative for agreement by the ICSC 11 and WWRP JSC 6. Present the Plan to CAS (in 2013) and CBS.***

***ICSC 10(14): Develop a proposal for a new structure to take the “cluster” of projects (S2S, PPP, YOTC etc..) forward taking into account the need to appeal to funding agencies, ensure active engagement of the academic community in the key scientific challenges and the close link to WCRP.***

## **4. REGIONAL COMMITTEES**

### **4.1 African Regional Committee**

4.1.1 Dr Benjamin Lamptey introduced the report from the African Regional Committee. He noted the previous publication of Science and Implementation Plans for this programme. However, bids for resources had not been successful and so the RC decided to try to make progress with what was available. During a meeting at the WMO in May 2012 it was decided to concentrate on completion and publication of the case studies. This would also serve to bring the operational community into the work. Work on Case Studies uses the following approach; a description of the High Impact Weather, synoptic analysis and “extremeness” of the event, development of conceptual models of the events (including influences at regional and global), and forecast model assessments.

4.1.2 The THORPEX WGs were all represented at the May 2012 meeting and invited to support the RC in this work. Various tasks were accepted by the WG representatives to help progress in the case studies. There are 4 cases being studied:

(1) A heavy rainfall event on 29 and 30 November 2010 in Northern Africa brought severe flooding to Casablanca. This event is classified as having a severity of class 2 on the Global Disaster Alert and Coordination System (which means an extreme event with an estimated recurrence interval of more than 100 years). Thirty four people died and significant damage was done to transport infrastructure. Case Study lead: Siham Sbihi.

(2) A flooding event on 11 and 12 November 2008 in Southern Africa. Forty seven people were killed, thousands evacuated and bridges were swept away. This event was associated with cut-off lows and frontal troughs. Case Study lead: Isaac Ngwana.

(3) The October 1997 severe flooding episode in Eastern Africa. This caused severe loss of life and property, affecting Ethiopia, Kenya, Tanzania and D.R. Congo. In Ethiopia 60 to 90% of the month total rainfall was observed within 11 days (18-28 October). In parts of Tanzania 50 to 70% of monthly total rainfall was observed within 7 days (17-23 October). Case Study lead: Miloud Besafi.

(4) A heavy rainfall event in August to early September 2009 in Western Africa. In Ouagadougou on 1<sup>st</sup> September, 97mm of rain fell between 0700-0800UTC and 263 mm between 0400-1600 UTC. About 150,000 out of the 1.5 million people living there were displaced. The wet spell was characterized by passage of African Easterly waves. The extreme case at Ouagadougou occurred under favourable conditions for major MCS: vertical shear, cyclonic vorticity, moist air at low levels and dry air aloft. Case Study lead: Aida Diongue-Niang.

4.1.3 Wider THORPEX PDP, TIGGE and DAOS support is welcomed to ensure the case studies can be completed by 2014. The case studies are hosted on the Africa Climate Exchange (AfClix) website (<http://www.afclix.org/groups/profile>) and the PDP WG website. Some THORPEX Africa Deterministic and Ensemble Products for West Africa are hosted at <http://www.rsmas.miami.edu/personal/smajumdar/africa>

## **4.2 Asian Regional Committee**

4.2.1 Masaomi Nakamura introduced the report from the Asian Regional Committee. Brief reports from the members of the ARC were then provided. THORPEX China continues to host one of the TIGGE websites. The archive now exceeds 580TB and about 460GB of new data is added each day. The system is being updated and missing data reduced. THORPEX related research continues including sensitivity experiments applied to adaptive observing of typhoons, the combination and downscaling of EPSs and planning for the 3<sup>rd</sup>. Tibetan Plateau Experiment.

4.2.2 India has held several successful workshops related to THORPEX research. A nowcasting seminar has been arranged and enhanced forecaster training is being carried out. A TC Ensemble Forecast project has been started using software supplied by JMA which generates TC ensemble tracks and strike probability maps. An FDP/RDP on land falling tropical cyclones in the Bay of Bengal is ongoing and includes use of aircraft and a drone. Study of intense convection in TCs is underway. Study of the Continental Tropical Convergence Zone (CTCZ) is taking place as a contribution to the S. Asia SWFPD.

4.2.3 Recent updates to the Japanese EPS system were outlined. Three EPSs are in use; for typhoons, one week ahead and one month ahead. Given upgrades to the supercomputing system it was now intended to integrate these EPSs into a single system.

The JMA MRI TIGGE website was described. Objective verification of the TIGGE results was taking place and showed that the “grand” ensemble outperformed the ECMWF ensemble. However, there some instances in which the ensemble does not capture the TC track. The TIGGE data was also proving useful in generating TC genesis forecasts.

4.2.4 Korea is building a national network of radars and in-situ data to improve forecasting of severe weather events. Special observation periods were being carried out. PROBX 2012 is ongoing and studies the predictability of heavy rain in mountainous areas and involves capture a wide range of data. There is also an intensive winter observations campaign. A targeted observations system is being developed which involves placing a ship within sensitive areas. The

performance of a “grand” ensemble has been studied and shown to be better when compared with each centre.

4.2.5 In Russia FROST 2014 is being developed to support the SOICHI Winter Olympics. This is a mixed FDP/RDP. Research into use of a 3DVAR system is underway including estimation of model errors and assimilation of satellite data. Investigation is taking place concerning the estimation of rain rate from satellites over remote areas of Siberia.

### 4.3 European Regional Committee

4.3.1 Professor Sarah Jones introduced the European report. The European plan had been completed and published to the web. It is a “living document” and can be modified as necessary. Amongst the active or planned THORPEX research projects in the region were GEOWOW, CONCORDIASI, DIAMET, HyMeX, T-NAWDEX, PANDOWAE, PREVASSEMBLE, YOTC, advances in DA and ensemble forecasting, and applications of convective scale models to field campaigns. The main role of the RC is in providing communication and synergy between the various active groups in Europe. It was not clear yet whether another meeting of the RC should be held in 2013 before the OSC. It is important to appreciate that the RC is the only place in Europe where the operational and academic communities come together and an effective forum for discussion of research plans across Europe. Therefore change to the current arrangement and possible disbandment of the RC needs to be carefully considered.

4.3.2 Regarding the THORPEX legacy it was noted that the THORPEX framework has helped when writing proposals for funding since the topics could be placed in a truly international collaborative context. The legacy was also very much related to getting research students interested in weather research. Enabling links with the operational community and providing access to models and data by the academic community has also been extremely beneficial.

***ICSC 10(15): Give further consideration to the future of the Regional Committees in the post THORPEX era***

### 4.4 North American Regional Committee

4.4.1 Dr Zoltan Toth introduced the report on behalf of Malaquias Pena Mendez. NARC renewal and mandate questions were first raised at the joint 5<sup>th</sup> NAEFS workshop and THORPEX NARC meeting in Cuernavaca in May 2010: *A set of country reports/activities vs. truly multi-lateral projects, demonstrations, and exchanges across the Americas?* Since then not much progress has been made. An update on the ICSC 9 actions was provided. Regarding *Action Item (21)*. NARC members contacted Celeste Saulo (Argentina) with the purpose of exchanging information on possible collaborative projects. A draft proposal for the La Plata Basin Research Development Project (RDP) for heavy precipitation was exchanged. The RDP was presented at the 9th GIFS-TIGGE meeting and Re. *Action Item (22)*. The NARC did not hold an official meeting in conjunction with the 6<sup>th</sup> NAEFS workshop in Monterey, California and therefore did not request resources for South and Central American and Caribbean participation.

4.4.2 A new Mexican National Committee promoted by NARC is now in place. An organizational meeting took place at the Mexican annual meteorological congress, where different areas of THORPEX research were discussed. A list of activities was prioritized, including: a national science plan update, regional modelling experiment for heavy precipitation in southern states of Mexico and a plan for a training workshop on ensemble forecasting. There is also a Mexican intercomparison regional model forecast experiment involving 7 national meteorological institutions each using identical initial conditions and distinct model parameterizations. Mexican Servicio Meteorologico Nacional personnel and NARC members enabled a 3D-Var data assimilation scheme to provide initial conditions to permit evaluation of the effects of model parameterization and the impact of local observations. Some preliminary results have been

produced and a workshop to discuss final results with collaborating institutions is plan to be held in November 2012.

4.4.3 Canadian THORPEX contributions include: completion of activities associated with the THORPEX -IPY cluster and Vancouver 2010 Olympics, active involvement in NAEFS, S2S and PPP projects and planning for SERA activities including a potential Canadian extension to the Lazo *et al.* 2012 economic sensitivity analysis as well as planning for a new expanded “SNARC” initiative once future THORPEX directions are clarified ( e.g. large multinational river basin studies in the Great Lakes-St. Lawrence, Rio Grande, La Plata Basin)

4.4.4 The US THORPEX Executive Committee comprised four agencies, NASA, NOAA, NSF and the US Navy. Major investments, amounting to \$20M have been made since 2004 as well as significant in-kind contributions to field campaigns. Major changes were however now taking place. THORPEX no longer appeared in the NOAA budget and 1.3 M\$ has been cut from the budget line. There could therefore be no expectation of a contribution to the Trust Fund in future years. Other agencies e.g. NASA were continuing to fund some THORPEX research. The US Science Steering Committee was active and chaired by Edmund Chang.

4.4.5 The US THORPEX Science Plan is approved and available on the web. It focuses on process studies, research related to the forecast system and development of forecasting applications. A Workshop was held in September 2012 at NCEP hosted by the Science Committee. It considered forecast applications and economics and how science interests could be mapped onto the various agency research programmes.

4.4.6 The US NWS has launched an initiative concerning forecast impacts i.e. going beyond traditional forecast parameters to predict the impact on society and the economy from specific events. This might be, for example, a forecast of the number of accidents likely to follow severe overnight frost and ice on the road network. The US was interested to take this work forward in an international context. NSF has launched the SEES project which addresses prediction of meteorological hazards. ESPC is a multi agency programme aimed at improving forecasts on the timescale from hours to seasons. It closely links with the S2S project.

## **4.5 Southern Hemisphere Regional Committee**

4.5.1 Mrs Khambule Gaboekwe introduced Doc. 4.5. The benefits of THORPEX in terms of scientific interaction and collaboration amongst Southern Hemisphere scientists were recognized. However, even with a modest plan progress has been slow.

4.5.2 Some successful activities were related to interaction with the regional SWFDPs , including that in the South Pacific and in organizing scientific collaboration around the Met Office Unified Model. The use of EPS products was also a topic of interest and the relative benefits of 4dVAR and 3dVAR were being explored. Links were also being developed with the Typhoon Landfall Demonstration project.

4.5.3 Funding and resources remain an issue. The Co-Chairs met recently in Melbourne and have started preparation of an inventory of SHRC projects and activities.

## **5. INTERNATIONAL COLLABORATION**

### **5.1 GEO**

5.1.1 Dr Jim Caughey introduced the document. The development of the new GEO Work Plan for 2012-2015 was noted. The Plan adopts a more target driven approach and has a three part structure devoted to infrastructure, institutions/ development and information on societal benefits.

The number of GEO Tasks has been reduced compared to the previous Plan. In addition an improved Work Plan management structure has been introduced.

5.1.2 The GEO 2015 strategic target for Weather was noted. This would be achieved through the programmes of the WMO. The THORPEX activities will contribute to the achievement of this target in areas such data assimilation, modelling systems and verification and assessment.

5.1.3 There are several THORPEX projects that appear within the Plan. These are WE-01 C1 Global Multi- Model Prediction system for High Impact Weather ( the GIFS-TIGGE activities) and WE-01 C2 Use of high Impact Weather Information (which involves, amongst other things, supporting the implementation of THORPEX Africa)

5.1.4 It was through EC funding for GEO implementation that a successful bid for GIFS-TIGGE development was made possible. The GEOWOW project involves further development of the TIGGE archive at ECMWF and testing and trialing of prototype products. It was already providing a significant impetus to GIFS-TIGGE WG plans and objectives.

## **5.2 WGNE**

5.2.1 Dr Andy Brown, Co-Chair of WGNE, introduced Doc. 5.2 and noted that WGNE is jointly sponsored by CAS and WCRP and considers the development of numerical models for all timescales. Close links are maintained with many groups including WWRP and the THORPEX – PDP WG, GEWEX, SPARC, and other WCRP programmes such as GCSS, GABLS and GLASS. Activities included the Transpose AMIP experiments, cloudy radiances, the “grey –zone”, the importance of aerosols, quality of monsoon predictions, etc. Verification was an important topic and the performance of NWP models was continuously assessed. The performance of models in polar regions and the development of climate model metrics were also being addressed.

5.2.2. Very successful workshops have been held, in association with the PDP WG, at ECMWF and ETH Zurich. Future meetings include a Workshop on Ocean Coupling (2013) and a Systematic Errors in Weather and Climate Models Workshop (2013).

5.2.3 Future interests include model development (improving model performance) and cross timescale issues, bringing the weather and climate communities together. Links with WWRP/THORPEX are considered crucial and close contact will be maintained with the mesoscale WG, DAOS, PDP and YOTC.

5.2.4 During discussion it was noted that the priority topics in WGNE are the well known NWP problem areas. It is also possible to track back sources of error and identify issues that need further research. The TIGGE database was not particularly useful for this work since more diagnostic information is needed so the analysis tended to be carried out on a case by case basis.

## **5.3 YOTC**

5.3.1 Dr Duane Waliser introduced document 5.3. In 2007 the YOTC Science Plan was completed followed by a comprehensive Implementation Plan. A YOTC Project Office is in place under the auspices of the US THORPEX Executive Committee. A website provided access to all YOTC documents, meetings and future plans. The programme has been widely publicized at international conferences and the AGU. A highly successful First Science Symposium was organized in Beijing in May 2011 and kindly hosted by CMA and the Chinese Academy of Science.

5.3.2 YOTC data includes global NWP fields from ECMWF, NASA and NOAA at high resolution. The ECMWF data in particular have been key to initiating a number of major modelling experiments (see below). They span the entire 2-year period, including initial conditions, 2-day forecasts, and tendency fields. All data links can be found on the YOTC website, with the ECMWF data available at ECMWF and also from NCAR. The NASA GIOVANNI satellite system has been

extended to support YOTC. A special YOTC A-Train data sets, with all relevant sensors sampled on CloudSat footprints, is now available to the community through the CloudSat website (see link on YOTC website).

5.3.3 The YOTC “year” runs from May 2008 until April 2010 includes El Nino, La Nina and Arctic Oscillation conditions giving unique information on climate variability. There is a wide range of on-going collaborative work. This includes multi-model transpose-AMIP experiments, global cloud-system resolving experiments, tropical intra-seasonal multi-model 20-year hindcast experiments with additional output and analysis focused on the YOTC period. In particular, there have been 4 key modelling studies initiated via YOTC: 1) the formal CMIP5-related Transpose AMIP experiment, 2) a number of multi-model, physics ensemble transpose AMIP studies carried out by CAPT/DOE, 3) the U. Reading led CASCADE MJO case studies, and 4) the MJO TF – GASS multi-model MJO physical processes and vertical structure experiment. Most of the initial/main analysis of these experiments should be completed over the coming two years. .

5.3.4 YOTC has set up a Task Force to study the MJO (YOTC MJO TF). Four sub-projects are being implemented. These were related to: 1) the MJO TF – GASS modelling projection mentioned above, 2) boreal summer ISV forecasting metrics, 3) process oriented MJO diagnostics and metrics to aid model development and 4) identification of a simplified MJO metric for the WGNW-GCM Climate Metrics Panel. The close links of YOTC research to the S2S project were noted, with the MJO TF expected to act as the research arm of the S2S in regards to the MJO and related variability.

5.3.5 Several important papers concerning YOTC have appeared recently in BAMS these are: 1) Progress and Directions in Tropical Convection Research by Moncrieff et al. (2012), 2) Multiscale Convective Organisation and the YOTC Virtual Global Field Campaign by Moncrieff et al., (2012), and 3) The “Year” of Tropical Convection (May 2008-April 2010) by Waliser et. al. (2012). A recent literature survey indicated over 40 peer-reviewed papers making reference to YOTC.

5.3.6 During discussion it was noted that YOTC has lost some funding for the Project Office based at NCAR. There is also a desire to arrange a second Science Symposium in late 2013 or early 2014, bring YOTC to a formal close in two years once the above mentioned 4 model experiments have culminated to their expected conclusions, and extend the MJO TF for another three years.

***ICSC 10(16): The ICSC agreed to support the YOTC Project Office for 2013 and 2014 in principle to the level of \$10K/annum, provided there is a matching contribution from the WCRP. It also agreed to extend the MJO TF for a further 3 years, again assuming there is matching funding from the WCRP. The proposed YOTC Science Symposium in 2013 requires further discussion within WWRP and WCRP including considering possible alignment with other international meetings including the OSC in 2014.***

## **5.4 HyMeX**

5.4.1 Dr Philippe Bougeault introduced HyMEX and said it was directed at improving understanding of the water cycle in the Mediterranean basin. HyMeX has now been integrated into the wider international Mistrals programme which provides for better political visibility and improved funding. The emphasis is on hydro-meteorological hazards and modelling the atmosphere-land-ocean coupled system on the event to seasonal and inter-annual timescales. The project runs from 2010-2020. Also included is the assessment of social and economic vulnerability to hydro-meteorological hazards. HyMEX is organized into a series of WGs which will focus on the water budget of the Mediterranean basin, the hydrological continental cycle, heavy precipitation and flash flooding and vulnerability factors and capacity building. The multi disciplinary research and data bases within HYMEX are expected to improve observational and modelling systems (especially coupled systems), prediction of extreme events and the accurate simulation of the long term water cycle and definition of adaptation measures.

5.4.2 The Data Targeting System (DTS) is being used to add additional radiosondes in sensitive areas. There are two SOPs – SOP1 (5 Sept 2012 – 6 Nov 2012) which investigates heavy precipitation and flash flooding and SOP 2 (1 Feb 2013 – 15 March 2013) which will address intense air sea interactions. A wide range of over 200 instruments and platforms is being employed including gliders, data buoys, ARGO floats, aircraft and ships. Several IPOs have been mounted including IPO2 (12 Sept - heavy precipitation in NE Italy), IOP6 (23-24 Sept heavy precipitation in SE France), IOP7 (26 Sept - heavy precipitation across SE France) and IPO8 (28 Sept. – heavy precipitation across parts of Spain). None of the events studied was particularly extreme. During IPO2 lidar data are available showing clouds and aerosols. Cases of weak predictability are especially interesting and the performance of the AROME-WMED (2.5km resolution model) out to 48 hours is being assessed.

5.4.3 The first SOP1 month was therefore successful with 4 IOPs covering France, Italy and Spain and different types of events: a MCS ahead of a frontal system with embedded convection (IOP2), a propagating convective line (frontal line)( IOP6), a quasi-stationary MCS ahead of a front ( IOP7) which was particularly well documented: atmosphere, ocean and hydrological mobile platforms were activated simultaneously.

5.4.4 In discussion it was suggested that rapid scan Meteosat winds might be of value in future HyMeX IOPs.

## **5.5 MEDEX**

5.5.1 Dr Augusti Jansa introduced MEDEX. He noted that the programme had taken place in two phases from 2000-2005 and 2006 -2010. The first phase concentrated on the climatology and processes involved in severe storms in the Mediterranean area whilst the second concentrated on ways of improving forecasts, forecasting techniques and SERA studies. In Phase 2 the Data Targeting System (DTS) developed by ECMWF for EUCOS was employed. During the campaigns additional radiosondes and AMDAR data were collected.

5.5.2 The programme has led to some important publications in the literature. MEDEX has now been incorporated into HyMeX and it is expected that the MEDEX studies will be continued by HyMeX. Some work is still ongoing and it is intended to keep the MEDEX website open until the MEDEX Final Conference.

5.5.3 During discussion it was noted that the impact of the additional data commissioned through the DTS was broadly in line with other mid-latitude results i.e. some improvement in forecasts but typically these were small. However, some individual cases did show some more definite improvement. Analysis is continuing.

## **5.6 T-NAWDEX**

5.6.1 Heini Wenrli outlined the current position concerning T-NAWDEX. He noted that the lead organisation was DLR. A preliminary campaign starts in mid-October using the Falcon aircraft. It will be a 3 week campaign flying across warm conveyor belts and adopting a Lagrangian approach. The full programme was scheduled for 2015. It is expected to attract wide interest and would aim to operate across the Atlantic Ocean. It is hoped to study a sequence of weather systems including ET and diabatic processes. DIAMET 2 would probably be a part of this full programme. A US proposal for participation was expected to be submitted in January 2013.

## **5.7 Polar Prediction**

5.7.1 Dr Thomas Jung described the recent activities to set up a Polar Prediction Project (PPP). There was a desire to develop a legacy to the THORPEX IPY cluster of projects and to co-ordinate with the WCRP, YOTC etc., A Workshop hosted by MetNo in October 2010 had been very valuable and made clear recommendations for the way ahead. Amongst these was the formation

of a Steering Group (and appointment of a Chair person) to prepare an Implementation Plan. The Steering Group has met twice and looked at the specific issues affecting polar regions. The main research areas were in observations, modelling, DA and EPS systems with underpinning research in predictability, diagnostics and teleconnections. The main drivers were very different from the tropics i.e. there is a broad balance between warm air advection and radiation. Also, the role of sea ice in the medium range is very important.

5.7.2 A Year of Polar Prediction (YOPP) is planned for 2017/8. The intention is to have a period of intensive modelling and observations to advance prediction capabilities. Preparations would take place from 2012 to 2016 and a consolidation phase would be from 2018 -2022.

5.7.3 The project is being widely publicised through distribution of a flyer, attending meetings and education outreach. A draft Implementation Plan has been prepared and hopefully will be finalised by the end of the year. It is hoped to launch the project in January 2013 followed by a Workshop on Polar Prediction in June 2013. An International Coordination Office will be set up. There is cross membership with other relevant groups. However, closer links with the WCRP on this topic still need to be developed. The intention is, if possible, to construct a joint programme with the WCRP. If this proves not to be possible then very close co-ordination will be maintained.

5.7.4 It was noted in discussion that the record low summer ice level in the Arctic basin seems to have an influence on mid-latitude weather. Also, the Arctic and Antarctic situations are very different – was this really a bi-polar project or mainly focused on the Arctic? It was noted that the intention is to consider both poles. Significant new work was required because current EPS and DA techniques do not take polar conditions fully into account.

5.7.5 It was also noted that the WCRP plans in this area were moving ahead more slowly. It is not clear yet what the key climate issues are and there is no desire to rush the formulation of a project. The WCRP JSC has asked SRARC to develop an Implementation Plan and then for CliC to implement the work. D/RES and D/ECRP are working closely on this topic to eliminate duplication.

## **5.8 Subseasonal to Seasonal Prediction**

5.8.1 Dr Frederic Vitart introduced document 5.5. A meeting hosted by the Met Office in Exeter during December 2010 had made recommendations for the way ahead, toward further development and applications of forecasts in the intervening time range between medium-range weather forecasts and seasonal climate predictions. This involved setting up a Planning Group to develop an Implementation Plan for a WWRP/THORPEX-WCRP joint research project. This Plan gives high priority to a few international research activities, improving co-ordination with operational centres, facilitating wide use of the CHFP, TIGGE and YOTC data sets and developing a SERA component.

5.8.2 An article describing the Subseasonal to Seasonal Prediction Project (S2S) will appear in the next issue of the WMO Bulletin. A flyer has also been written. It is expected that the Planning Group will meet again in early 2013. The timescale of interest has been decided as from 14 days to 90 days and special attention will be given to high impact events e.g. droughts, floods and the humanitarian, agricultural, disease and other consequences. The intention is to bridge the predictability gap between weather and climate.

5.8.3 Specific research topics will be addressed e.g. the MJO, monsoons, sea ice and other modelling issues with the intention of understanding model errors and biases whilst focusing on extreme events. High priority will be given to identify windows of opportunity for increased forecast skill. There are proposals for an S2S data base in Grib and NetCDF the same protocols as TIGGE. Ocean variables will be included but it is expected that the data base size will be less than 10% of TIGGE. ECMWF has offered to host the data base. A few demonstration projects have been proposed e.g. concerning the Pakistan Floods (2010), the Australian Floods (2009/10) and the European cold spell (2010).



5.8.4 Close linkages will be maintained e.g. with the GFCS, CLIVAR/GEWEX/WGNE, YOTC and the MJO TF, CBS and the Verification WG. The EC has approved the project along with the establishment of a Trust Fund. The project will last 5 years and an S2S Project team is expected to be established soon.

5.8.5 During discussion it was noted that there will be a CBS team member. CBS will use the project output to improve monthly and longer range forecasts.

5.8.6 It was also noted that the intention is to send letters to the PRs seeking support both for the S2S and PPP projects and donations to Trust Funds. After discussion it was agreed that one letter would be better and that this should describe the longer term vision for the WWRP and should also stress the need to continue to support the ongoing THORPEX programme.

***ICSC 10(17): Regarding the proposed letter from WMO to the PRs it is considered important to (i) give the longer term “big picture” (ii) indicate the probable component projects (iii) invite contributions to the TFs for S2S and PPP whilst stressing the importance of continuing contributions to the THORPEX TF to enable completion of the programme (iv) provide reassurance about the efficiency of the WMO management of multiple TFs.***

## **6. PROGRAMME OF WORK**

6.1 Dr Tetsuo Nakazawa, Chief of the WWRP, outlined the programme of meetings for 2012 and 2013 and the OSC in 2014. This was reviewed and ICSC members were invited to send any revisions to the IPO. The budgets for 2011 and 2012 were then discussed. Although the contributions have reduced somewhat the position at the end of 2012 is expected to be reasonably good.

***ICSC 10(18): The ICSC encourages full participation of the THORPEX community in the OSC scheduled for the 17-23 August 2014 in Montreal.***

***ICSC 10(19): ICSC members are invited to submit revisions to the list of meetings planned for 2013.***

## **7. WRITING UP SESSION**

7.1 It was agreed that the IPO would prepare a draft report of the meeting in the next few weeks.

## **8. DECISIONS AND ACTIONS**

8.1 The decision and actions arising from the meeting were reviewed and agreed and are summarized at Annex (1).

## **9. DATE AND PLACE OF THE NEXT MEETING**

9.1 It was noted that ICSC11 would be held at the WMO Geneva during July 2013 in conjunction with the WWRP JSC 6 meeting.

## **10. CLOSURE OF THE MEETING**

10.1 The Chairman thanked the participants for making the meeting so productive. He noted that good progress was being made in developing further ideas for the THORPEX legacy and follow on programmes.

## INTERNATIONAL CORE STEERING COMMITTEE FOR THORPEX

## TENTH SESSION

(Geneva, Switzerland, 3-5 October 2012)

## List of Participants

| Affiliation   | Name               | Email                              | Country            |
|---|--------------------|------------------------------------|--------------------|
| Chair and Representative of United Kingdom          | DICKINSON Alan     | alan.dickinson@metoffice.gov.uk    | United Kingdom     |
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| Representative of DWD and Chair ERC                 | JONES Sarah        | sarah.jones@dwd.de                 | Germany            |
| Representative of Météo France                      | BOUGEAULT Philippe | phillippe.bougeault@meteo.fr       | France             |
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| President of CAS                                    | BELAND Michel      | michel.beland@ec.gc.ca             | Canada             |
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| Chair of WWRP SERA WG                               | MILLS Brian        | brian.mills@ec.gc.ca               | Canada             |

|                        |                        |                                   |                   |
|------------------------|------------------------|-----------------------------------|-------------------|
| Co-chair of WGNE       | BROWN Andy             | andy.brown@metoffice.gov.uk       | United Kingdom    |
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| Co-chair GIFS-TIGGE WG | SWINBANK Richard       | richard.swinbank@metoffice.gov.uk | United Kingdom    |
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| Chair ARC              | NAKAMURA Masaomi       | manakamu@mri-jma.go.jp            | Japan             |
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| Co-chair S2S           | VITART Frederic        | nec@ecmwf.int                     | United Kingdom    |
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| Chair TMRP WG          | DUAN Yihong            | duanyh@cma.gov.cn                 | China             |
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| Director RES           | TERBLANCHE Deon        | dterblanche@wmo.int               | WMO               |
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## LIST OF ACTIONS AND DECISIONS ARISING FROM ICSC 10

| ICSC 10 Action/Decision  | Responsibility        | Status  |
|--|-----------------------|---|
| ICSC 10(1): Arrange for the preparation of a comprehensive paper recording the scientific achievements of the full THORPEX programme. Prepare a summary paper for open publication. Engage a consultant to carry out the work. Present an outline of the proposed contents of the paper(s) to ICSC 11                          | ICSC Chair/IPO        | Arrangements in place by mid 2013. Work complete early 2015 |
| ICSC 10(2): Propose suitable individuals for the consultant role in action 10(1) to the ICSC Chair and IPO.  | ICSC members          | 1 January 2013  |
| ICSC 10(3): Strong THORPEX participation in DACA 13 is encouraged especially the sessions related to HIW and DA  | ICSC members          | ASAP  |
| ICSC 10(4): The ICSC approved the change to DAOS membership and the appointment of Tom Hamill as a new Co-Chair.   | DAOS WG/GIFS-TIGGE WG |   |
| ICSC 10(5): The ICSC endorsed the DAOS WG taking the lead in organising the WMO DA Symposium in 2013. It was recommended that DAOS identify the WMO funding sources for previous Symposia.   | DAOS WG               | ASAP  |
| ICSC 10(6): All the WGs are encouraged to ensure a balanced representation, engage a wider community and to strengthen links with the academic community (as appropriate).   | WG Co-Chairs          | ASAP  |
| ICSC 10(7): The GIFS -TIGGE WG is invited to work closely with CBS to identify the process needed to put delivery of agreed (following assessment and evaluation) multi model EPS products on an operational basis for the SWFDPs.   | GIFS-TIGGE WG         | ASAP  |
| ICSC 10(8): The GIFS-TIGGE WG is invited to consider, in consultation with the archiving centres, potential future archiving requirements (e.g. addition of supplementary data) and how these might be met in the post THORPEX era (including consideration of the number of archive centres needed and their possible roles). | GIFS-TIGGE WG         | 1 March 2013  |
| ICSC 10(9): The ICSC agreed that TIGGE LAM should remain part of the TIGGE WG whilst maintaining close links with the MWFR WG.   | GIFS-TIGGE WG         |   |
| ICSC 10(10): The ICSC also approved the changes to the membership of the GIFS-TIGGE WG   | GIFS-TIGGE WG         |   |

|  |                              |                                   |
|--|------------------------------|-----------------------------------|
| ICSC 10(11): The SERA WG is invited to prepare a proposal (including indicative costs) for a benefit assessment of some aspects of the THORPEX programme (e.g. the TIGGE archives) linking to the GEOWOW project as appropriate.   | SERA WG                      | Jan 2013                          |
| ICSC 10(12): Continue to liaise closely with the WCRP concerning proposed future joint activities and arrange appropriate representation at the next WCRP JSC in May 2013 and WWRP in July 2013.   | Chair ICSC/D RES             | Ongoing                           |
| ICSC 10(13): (a) Convene a Workshop to identify those specific aspects of the THORPEX programme that should be taken forward in an international collaborative framework. Consider the inclusion of new topics (e.g. forecasting weather impacts) and a strong SERA component. Ensure close consultation and synergy with the S2S and PPP projects and foster the active participation of the operational and academic communities in the process.<br>(b) Set up a small Task Force and employ a consultant to develop a draft Implementation Plan and consolidating framework for the S2S, PPP and new initiative for agreement by the ICSC 11 and WWRP JSC 6. Present the Plan to CAS (in 2013) and CBS. | Chair ICSC /IPO/WG Co-Chairs | (a) Jan 2013<br><br>(b) June 2013 |
| ICSC 10(14): Develop a proposal for a new structure to take the “cluster” of projects (S2S, PPP, YOTC etc..) forward taking into account the need to appeal to funding agencies, ensure active engagement of the academic community in the key scientific challenges and the close link to WCRP.   | D/RES, Chair ICSC, IPO, CAS  | March 2013                        |
| ICSC 10(15): Regarding the proposed letter from WMO to the PRs it is considered important to (i) give the longer term “big picture” (ii) indicate the probable component projects (iii) invite contributions to the TFs for S2S and PPP whilst stressing the importance of continuing contributions to the THORPEX TF to enable completion of the programme (iv) provide reassurance about the efficiency of the WMO management of multiple TFs.   | Chief WWRP/D RES             | ASAP                              |



## LIST OF PERMANENT THORPEX ICSC ACTIONS

| Number    | Reference              | Action  | Responsible                    | Status/Due                   |
|-----------|------------------------|---|--------------------------------|------------------------------|
| ICSC-P/01 | Cg-XIV<br>ICSC-2       | To encourage WMO Members to actively participate in implementation of THORPEX   | ICSC, RCs, IPO                 | Ongoing                      |
| ICSC-P/02 | Cg-XIV<br>ICSC TOR     | To assist WMO Members in the International coordination of THORPEX  | ICSC, IPO, SSC-WWRP, WGNE, CBS | Ongoing                      |
| ICSC-P/03 | Cg-XIV                 | To assist WMO Members from developing countries in their utilization of THORPEX-related forecast product  | ICSC, RCs, CBS, IPO            | Ongoing                      |
| ICSC-P/04 | Cg-XIV                 | To assist THORPEX in coordination with CBS, WCRP, JCOMM and other WMO programmes as appropriate   | ICSC, IPO                      | Ongoing                      |
| ICSC-P/05 | Cg-XIV                 | To facilitate the participation in THORPEX of other international bodies  | ICSC, IPO                      | Ongoing                      |
| ICSC-P/06 | ICSC TOR               | To provide the global and regional priorities with respect to the THORPEX sub-programmes  | ICSC, RCs                      | Ongoing                      |
| ICSC-P/07 | ICSC TOR               | To provide guidance to the NMHSs on the timely transition of THORPEX research and development to operations   | ICSC, RCs, CBS                 | Ongoing with CBS involvement |
| ICSC-P/08 | Cg-XIV<br>ICSC TOR     | To identify and mobilize national and international resources, financial, technical and human, to support THORPEX activities  | ICSC, RCs, IPO, all members    | Ongoing                      |
| ICSC-P/09 | ICSC-3/17              | ICSC members and Regional Committees to provide quarterly progress reports on activity and plans to the Chair of ICSC and IPO. Regional Committees to submit reports to the Chair of ICSC and IPO not later than at least 6 weeks prior the session of the ICSC | ICSC Chair, members, RCs, IPO  | Ongoing                      |
| ICSC-P/10 | ICSC-2/02<br>ICSC-3/15 | All THORPEX members to make annual contributions to the THORPEX Trust Fund in accordance with the approved budget and not later than 31 March   | All THORPEX members            | Ongoing                      |
| ICSC-P/11 | ICSC-2/02<br>ICSC-3/16 | All THORPEX members to make provisions and ensure allocation of necessary funds for next year before 31 October   | All THORPEX members            | 31 October                   |

|           |                        |   |                     |         |
|-----------|------------------------|---|---------------------|---------|
| ICSC-P/12 | ICSC-2/04<br>ICSC-3/14 | ICSC members to consider secondment of experts to serve at the THORPEX IPO and to inform the ICSC Chair and WMO/AREP Director on any progress   | All THORPEX members | Ongoing |
| ICSC-P/13 | ICSC-3/18              | ICSC Members to regularly update status of implementation of actions and inform the IPO   | ICSC, IPO           | Ongoing |
| ICSC-P/14 | ICSC-3/09              | ICSC members to pursue national inputs to GEO framework and Implementation Plan. ICSC with assistance of IPO to provide when appropriate related THORPEX requirements for consideration in relevant GEO deliberations | ICSC, IPO           | Ongoing |
| ICSC-P/15 | ICSC-3/11              | The Regional Committees to ensure that regional plans are developed in coordination with ICSC core sub programmes, and between regions, and are consistent with the International Science and Implementation Plans    | ICSC, RCs           | Ongoing |

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## LIST OF THORPEX SERIES PUBLICATIONS

1. International Core Steering Committee for THORPEX, Third Session, 16-17 December 2003, Montreal, Canada. Final Report. WMO/TD-No. 1217, WWRP/THORPEX No. 1.
2. M.A. Shapiro, A.J. Thorpe, 2004: THORPEX International Science Plan Version 3. WMO/TD-No.1246, WWRP/THORPEX No. 2.
3. International Core Steering Committee for THORPEX. Fourth Session 2-3 December 2004, Montreal, Canada. Final Report. WMO/TD-No. 1257, WWRP/THORPEX No. 3.
4. THORPEX International Research Implementation Plan Version 1. WMO/TD-No. 1258, WWRP/THORPEX No. 4.
5. First Workshop on the THORPEX Interactive Grand Global Ensemble (TIGGE), Reading, United Kingdom, 1-3 March 2005, WMO/TD-No. 1273, WWRP/THORPEX No. 5.
6. Symposium Proceedings - The First THORPEX International Science Symposium, 6-10 December 2004, Montreal, Canada, WMO/TD-No. 1237 WWRP/THORPEX No. 6.
7. Symposium Proceedings – The Second THORPEX International Science Symposium, 4-8 December 2006, Landshut, Bavaria, Germany, WMO/TD-No. 1355, WWRP/THORPEX No. 7.
8. International Core Steering Committee for THORPEX. Sixth Session 25-27 April 2007, Geneva, Switzerland. Final Report. WMO/TD-No. 1389, WWRP/THORPEX No. 8.
9. The YOTC Science Plan – A Joint WCRP-WWRP/THORPEX International Initiative. WMO/TD-No. 1452, WCRP-130, WWRP/THORPEX No. 9.
10. African Science Plan – Version 1. WMO/TD-No. 1460, WWRP/THORPEX No. 10.
11. WWRP/THORPEX African Implementation Plan – Version 1. WMO/TD-No. 1462, WWRP/THORPEX No. 11.
12. International Core Steering Committee for THORPEX. Seventh Session 18-20 November 2008, Geneva, Switzerland. Final Report. WMO/TD-No. 1495, WWRP/THORPEX No. 12.
13. International Core Steering Committee for THORPEX. Eighth Session 2-4 November 2009, Offenbach, Germany. Final Report. WMO/TD-No. 1522, WWRP/THORPEX No. 13.
14. Weather Research in Europe – A THORPEX European Plan, Version 3.1. WMO/TD-No. 1531, WWRP/THORPEX No. 14.
15. Targeted Observations for Improving Numerical Weather Prediction: An Overview. WWRP/THORPEX No. 15.
16. International Core Steering Committee for THORPEX. Ninth Session 21-22 September 2011, Geneva, Switzerland. WWRP/THORPEX No. 16.
17. THORPEX Interactive Grand Global Ensemble Limited Area Model Plan (TIGGE LAM), WWRP/THORPEX No. 17.
18. International Core Steering Committee for THORPEX. Tenth Session 3-5 October 2012, Geneva, Switzerland. WWRP/THORPEX No. 18.