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sigma

Natural catastrophes and man-made disasters in 2013: large losses from floods and hail; Haiyan hits the Philippines

Executive summary

Almost 26 000 people died in disasters in 2013.

In 2013, there were 308 disaster events, of which 150 were natural catastrophes and 158 man-made. Almost 26 000 people lost their lives or went missing in the disasters.

Typhoon Haiyan was the biggest humanitarian catastrophe of the year.

Typhoon Haiyan struck the Philippines in November 2013, one of the strongest typhoons ever recorded worldwide. It killed around 7 500 people and left more than 4 million homeless. Haiyan was the largest humanitarian catastrophe of 2013. Next most extreme in terms of human cost was the June flooding in the Himalayan state of Uttarakhand in India, in which around 6 000 died.

Economic losses from catastrophes worldwide were USD 140 billion in 2013. Asia had the highest losses.

The total economic losses from natural catastrophes and man-made disasters were around USD 140 billion last year. That was down from USD 196 billion in 2012 and well below the inflation-adjusted 10-year average of USD 190 billion. Asia was hardest hit, with the cyclones in the Pacific generating most economic losses. Weather events in North America and Europe caused most of the remainder.

Insured losses amounted to USD 45 billion, driven by flooding and other weather-related events.

Insured losses were roughly USD 45 billion, down from USD 81 billion in 2012 and below the inflation-adjusted average of USD 61 billion for the previous 10 years, due largely to a benign hurricane season in the US. Of the total, natural catastrophes generated USD 37 billion of losses, and man-made disasters the other USD 8 billion in claims. The biggest losses came from large scale floods in Europe and Canada, record-level hail losses and multiple windstorm events in Europe, convective thunderstorm and tornado events in the US, and Haiyan in the Philippines.

Disaster events continue to generate increasing financial losses alongside ongoing economic development.

Emergency preparedness and disaster risk management progressed in 2013. However, disaster events continue to generate increasing financial losses alongside ongoing economic development, population growth and global urbanisation. This *sigma* edition includes a special chapter on climate change, which will likely be an additional and increasingly important loss-generating force in the future.

Climate change could contribute to rising losses in the future.

Climate change is widely acknowledged to be caused by greenhouse gas emissions from human activity, and could lead to increasing frequency and intensity of extreme weather events. According to the Stern Review on the Economics of Climate Change[1], if left unchecked the cost of climate change could increase to around 20% of global GDP by the end of this century. Dealing with climate change requires a reduction in greenhouse gas emissions alongside an integrated approach to disaster risk management. This report describes how cost-effective adaptation measures could avoid up to 68% of climate change risks.[2]

By pricing disaster risk, the re/insurance industry can help lower the costs of catastrophic events.

Along with local prevention and mitigation measures, insurance is a powerful measure to strengthen resilience against catastrophe events. The wide gap between economic and insured losses caused by natural disasters places a significant burden on the public sector and, ultimately, uninsured individuals and businesses. By pricing risk and thus incentivizing investments in prevention measures, the reinsurance and insurance industries can help reduce the economic and social costs of catastrophes.

[1] Stern Review on the Economics of Climate Change, Lord Nicholas Stern, 2006
[2] Shaping Climate Resilient Development, Economics of Climate Adaptation Working Group, 2009

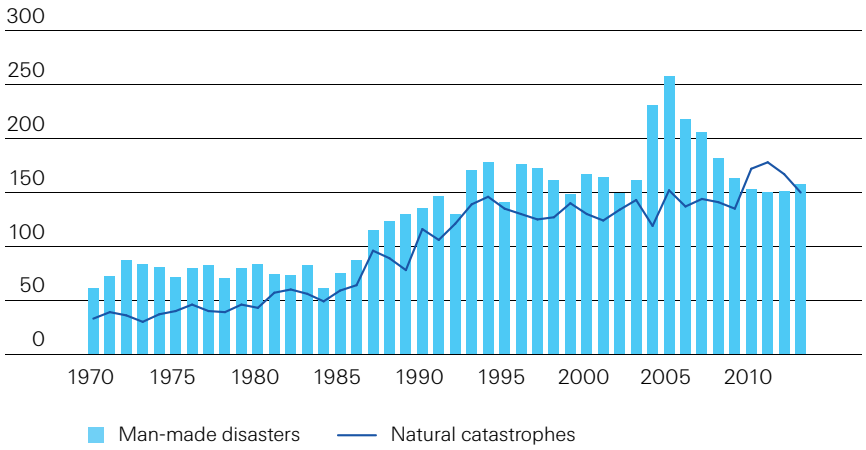
Catastrophes in 2013 – global overview

Number of events: 308

There were 150 natural and 158 man-made disasters in 2013.

Based on *sigma* criteria, there were 308 catastrophic events in 2013, down from 318 in 2012. Of the total, 150 were natural catastrophes, down from 167, and 158 were man-made, up from 151.

Figure 1
Number of catastrophic events, 1970–2013



Source: Swiss Re Economic Research & Consulting

The *sigma* event selection criteria.

In *sigma* terminology, an event is classified as a catastrophe and included in the *sigma* database when insured claims, total economic losses or the number of casualties exceed a certain threshold. The following table details the thresholds.

The sigma event selection criteria, 2013

Insured losses (threshold in USD m)	
Maritime disasters	19.3
Aviation	38.6
Other losses	48
or Total economic losses (threshold in USD m)	96
or Casualties	
Lost or missing lives	20
Injured	50
Homeless	2000

Number of victims: 26 000

Last year ranks as the 20th most deadly year on *sigma* records.

In 2013 almost 26 000 people lost their lives or went missing due to natural catastrophes and man-made disasters, making the year the 20th most deadly on *sigma* records. The number of lives lost was up 83% from the previous year but was well below the yearly average since 1990 of around 68 000 deaths. Typhoon Haiyan caused most human loss in 2013, with around 7 500 people dead or missing in the Philippines. Some of the victims of Haiyan were in Vietnam and China also.

About 20 000 people died in natural catastrophes in 2013.

Globally around 20 000 people were killed or went missing in natural disasters in 2013, the majority in storms, floods and other severe weather events. In addition to Typhoon Haiyan, the June flooding in the Himalayan state of Uttarakhand claimed approximately 6 000 lives. Heat waves also took their toll. It is believed there were 760 premature deaths in the UK and 531 in India from high summer temperatures. Elsewhere, 399 people died in an earthquake in Pakistan in September.

There were 6 000 deaths in man-made disasters, 1 127 of which came in a fire at a garment factory in Bangladesh.

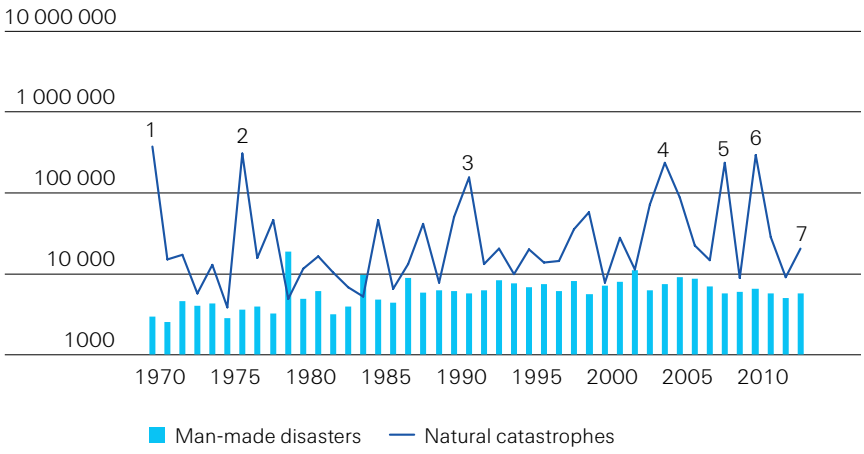
Roughly 6 000 people were killed in man-made disasters, about the same number as in 2012. The event that resulted in most victims was a fire in a garment factory in Bangladesh in April, with 1 127 deaths, making it one of the world's deadliest industrial fire events in modern history.

Maritime disasters and a fire at a night club in Brazil also claimed a number of lives.

Other man-made disasters claiming a high number of lives in 2013 include the capsize, after catching fire, of a boat in the Mediterranean carrying immigrants from North Africa to Lampedusa, Italy (366 deaths), and a fire in a nightclub ignited by fireworks in Brazil (235 deaths). Maritime disasters meeting the *sigma* thresholds accounted for 1 135 lives, down from over 1 700 in 2012, and major fires and explosions in commercial and residential buildings killed 2 113 people, up from 1 367. Terrorism attacks in different parts of the world claimed 1 192 lives, up from 800 in 2012. Aviation disasters killed 179, down from 400.

Figure 2
Number of victims, 1970–2013

1 1970: Bangladesh storm
2 1976: Tangshan earthquake, China
3 1991: Cyclone Gorky, Bangladesh
4 2004: Indian Ocean earthquake and tsunami
5 2008: Cyclone Nargis, Myanmar
6 2010: Haiti earthquake
7 2013: Typhoon Haiyan, Philippines



Note: Scale is logarithmic: number of victims increases tenfold per band
Source: Swiss Re Economic Research & Consulting

Economic losses: USD 140 billion

Economic losses in 2013 were well below the 10-year average.

Estimated total economic losses from natural catastrophes and man-made disasters were around USD 140 billion in 2013, down from USD 196 billion in 2012 and well below the inflation-adjusted average of USD 190 billion for the previous 10 years. Catastrophes losses in 2013 were equivalent to 0.19% of GDP, also below the 10-year average of 0.30%.

Natural catastrophe-related losses were around USD 131 billion.

Natural catastrophe-related losses were around USD 131 billion in 2013, stemming mostly from floods and other extreme weather events in Asia, North America and Europe.

Table 1
Economic losses, 2013

	in USD bn	in % of GDP
North America	32	0.17%
Latin America & Caribbean	9	0.16%
Europe	33	0.15%
Africa	1	0.05%
Asia	62	0.26%
Oceania/Australia	3	0.16%
Seas / Space	1	
Total	140*	0.19%
10-year average**	190	0.30%

* rounded number
** inflation adjusted

Source: Swiss Re Economic Research & Consulting

Man-made disasters generated USD 9 billion in total losses.

Man-made disasters are estimated to have caused more than USD 9 billion of the total USD 140 billion damages in 2013, up from USD 8 billion in 2012.

Insured losses: USD 45 billion

Insured losses in 2013 were also below average.

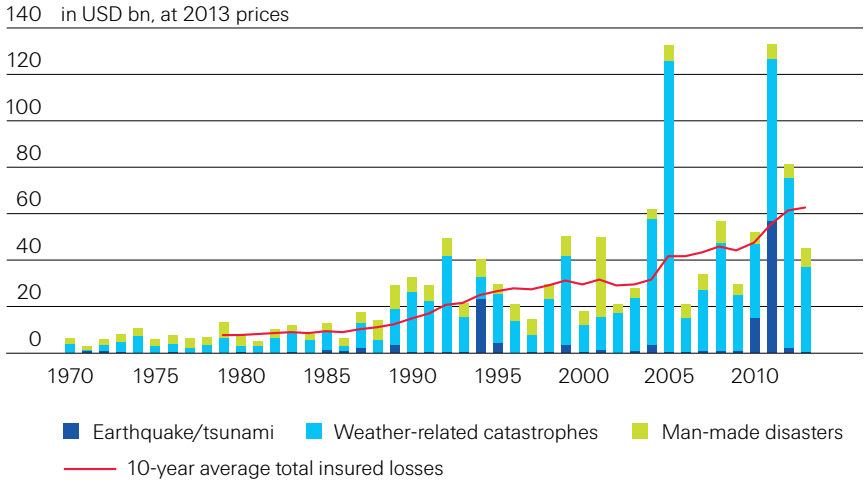
It is estimated that almost one third, or USD 45 billion, of the USD 140 billion in total economic losses from natural and man-made disasters in 2013 were covered by the insurance industry. Natural catastrophes generated claims of USD 37 billion, the lowest since 2009 and well below the previous 10-year inflation-adjusted average of approximately USD 55 billion. Large man-made disasters generated insurance claims of USD 8 billion in 2013, up from USD 6 billion in 2012. Fires at large oil refineries and other industrial facilities were a main factor in the higher insured losses.

Insured losses were equivalent to 0.05% of GDP.

Relative to GDP and direct non-life premiums written (DPW), the 2013 natural catastrophe losses were 0.05% of GDP and 2.2% of DPW, below the respective 10-year averages of 0.09% and 3.7%.

Figure 3
Insured catastrophe losses, 1970–2013

1992: Hurricane Andrew
1994: Northridge earthquake
1999: Winter Storm Lothar
2001: 9/11 attacks
2004: Hurricanes Ivan, Charley, Frances
2005: Hurricanes Katrina, Rita, Wilma
2008: Hurricanes Ike, Gustav
2010: Chile, New Zealand earthquakes
2011: Japan. New Zealand earthquakes, Thailand flood
2012: Hurricane Sandy



Source: Swiss Re Economic Research & Consulting

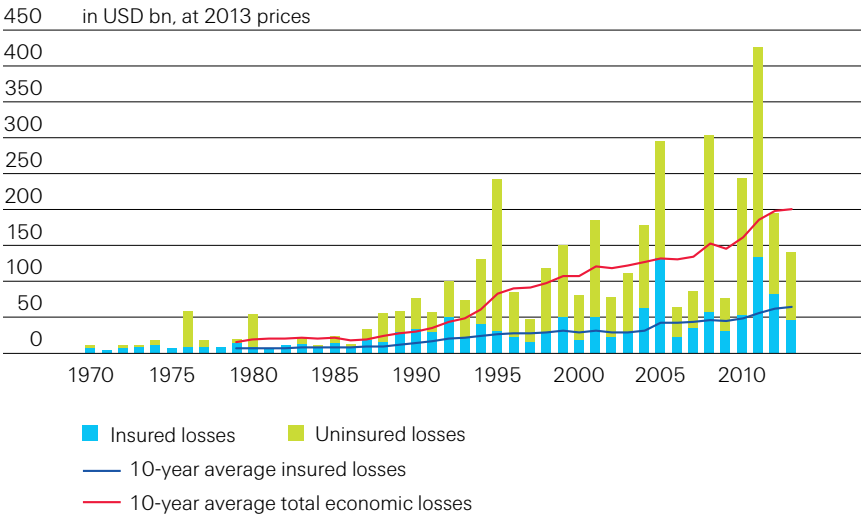
The largest single insured-loss event was in Europe.

Twelve disasters triggered insured claims of USD 1 billion or more in 2013 (see Table 5, page 26). The summer floods in central Europe were the costliest single event of the year causing an estimated USD 4 billion of insured loss and approximately USD 16 billion in economic losses. The second costliest was large hail storms in Germany in July, which triggered claims of USD 3.8 billion. The last time that the two top loss-inducing events happened in Europe was in 2007, when massive floods led to record losses in the UK and central Europe.

The global insurance protection gap in 2013 was USD 95 billion.

Figure 4 shows the development of insured and total losses over time. The difference between the two, which is the level of uninsured losses or protection gap, has widened over the last 30 years. This the amount of financial loss generated by catastrophes not covered by insurance. In 2013, the global protection gap was USD 95 billion.

Figure 4
Insured losses vs uninsured losses, 1970–2013



Economic loss = insured + uninsured losses
Source: Swiss Re Economic Research & Consulting

The protection gap can be narrowed with greater insurance penetration.

Economic development, population growth, urbanisation and a higher concentration of assets in exposed areas are increasing the economic cost of natural disasters. In addition, climate change is expected to increase weather-related losses in the future. All of the above, if not accompanied by a commensurate increase in insurance penetration, results in a widening protection gap.

Regional overview

North America and Europe had the highest insured losses in 2013.

Floods in Canada and Europe, and several tornadoes in the US meant that insured losses were highest in North America and Europe in 2013. In Asia, Typhoon Haiyan and other major storms caused the biggest losses in the region including, unfortunately, of lives.

Table 2
Number of catastrophes, victims and economic and insured losses by region, 2013

				Insured loss		Economic loss	
Region	**Number**	**Victims**	**in %***	**in USD bn***	**in %**	**in USD bn***	**in %***
North America	52	249	1.0%	19	42.0%	32	22.7%
Latin America & Caribbean	20	1 055	4.1%	2	5.4%	9	6.3%
Europe	38	1 167	4.5%	15	33.8%	33	23.4%
Africa	44	1 751	6.8%	1	1.4%	1	0.7%
Asia	125	20 653	79.7%	6	12.5%	62	44.1%
Oceania/Australia	6	21	0.1%	1	2.9%	3	2.0%
Seas / Space	23	1007	3.9%	1	2.2%	1	0.8%
World	**308**	**25 903**	**100.0%**	**45**	**100.0%**	**140**	**100.0%**

* rounded numbers
Source: Swiss Re Economic Research & Consulting

North America

Victims 249
Total losses (USD) 32 bn
Insured losses (USD) 19 bn

In North America, insured losses were USD 19 billion in 2013, the largest in any region. Losses were primarily caused by the floods in Canada, and several tornadoes outbreaks and related thunderstorms in the US. There were four independent events that each caused insured losses of US 1 billion or above.

The Alberta floods caused the biggest loss in the region, and the highest-ever in Canada.

The largest loss event was the flooding that hit Alberta, Canada in June. A strong storm system brought six days of torrential rain, causing extensive flooding in the city of Calgary and triggering many towns in the province to declare a state of emergency. Four people died in the floods. With an estimated USD 4.7 billion in economic losses and an estimated USD 1.9 billion in insured losses, the event ranks as the largest loss-making catastrophe on *sigma* records in Canada. Damage to infrastructure was particularly severe. Then in July, thunderstorms and flash floods hit Toronto, producing an additional USD 0.9 billion in insured losses.

There were violent tornadoes in the US Plains in May.

A round of severe weather in the Plains of the US spawned a massive outbreak of violent tornadoes, the most devastating of which was an EF5[3] event that hit the city of Moore in Oklahoma on 20 May, killing 24 people, and generating insured losses of USD 1.8 billion, the most from a single weather event in the US in 2013. This was the second severe tornado to strike in Moore in recent years: in 1999 there were 36 deaths when a previous EF5 twister hit the city.

The tornado season in the US ran from March through to November.

The tornado season in the US began in March with a series of thunderstorms and very large hail storms in the Mississippi Valley, causing insured losses of USD 1.6 billion. Also, a late-season outbreak of severe thunderstorms accompanied by high winds, large hail stones and numerous tornadoes struck the Midwest on 17 November, killing 11 people and injuring at least 185. The tornado outbreak generated insured losses of USD 1 billion, the costliest November convective storm event in *sigma* records.

[3] EF = Enhanced Fujita scale

However, the number of tornadoes in the US in 2013 was below average.

However, the number of recorded tornadoes in the US was below average for the second year running. A preliminary count from the Storm Prediction Centre of the National Oceanic and Atmospheric Administration tallied 891 tornadoes in 2013, well below the yearly average of 1 300 since 1990, and less than half the 1 894 of the record season in 2011.

The 2013 tornado season ranks as the sixth most expensive in terms of insured losses.

Stable weather patterns at the height of the season meant that 2013 had one of the least active tornado seasons on record. Nevertheless, with an estimated USD 10 billion in insured losses from tornadoes and related thunderstorms in the US, 2013 ranks as the sixth costliest in *sigma*'s database. Loss potential from tornadoes and related thunderstorms is rising along with urbanisation and increases in property values. Three of the tornadoes and related thunderstorms events caused losses of USD 1 billion and above. There were six such loss-making events in 2012 and eight in 2011.

The 2013 North Atlantic hurricane season was very quiet.

The 2013 North Atlantic hurricane season produced 13 named storms, two of which, Ingrid and Humberto, reached hurricane status. This was the fewest number of hurricanes since 1982 and well below the yearly average of 6.3 for the period 1950–2012. Neither of the hurricanes was classified as major, something that hasn't happened since 1994. Last year was also the sixth consecutive year with no Category 5 hurricanes. Tropical storm Andrea, the first of the season, was the only named storm to make landfall in the US. It caused just minor damage in parts of Florida, Georgia and South Carolina. No major (Category 3 and above) hurricane has made US landfall for eight consecutive years now, representing the longest stretch of no major hurricane since the 1860s.

Dry weather conditions limited the formation of storms.

Overall, in terms of numbers, collective strength and duration of named storms and hurricanes, 2013 ranks as the sixth-least active Atlantic hurricane season since 1950. According to the Climate Prediction Centre of the National Oceanographic and Atmospheric Administration (NOAA), the combination of exceptionally dry weather conditions and high wind shear in the large parts of the main hurricane generation area curbed the development of storms.

The derailment of a train carrying oil and subsequent explosion claimed 47 lives in Lac-Megantic in Quebec.

In July, a train carrying crude oil from North Dakota to Eastern Canada, which was left unmanned, derailed and exploded in the center of Lac-Megantic (Quebec). It destroyed nearby buildings in the town's centre and claimed 47 lives, the highest loss of life from a single event in North America and the worst train disaster in Canada since 1864. In the last three years, shipment of oil by railway has proliferated to meet increased demand in the absence of sufficient pipeline capacity, particularly in areas such as North Dakota and Canada's oil sands. The accident sparked debate in Canada and the US, and demands for a review of current safety practices and regulations.

The collapse of a pit wall at a copper mine caused the highest insured loss from a man-made disaster.

On 10 April, a rockslide believed to be the largest non-volcanic slide in modern North American history, fell into the world's largest open-pit copper mine. The collapse of the pit wall halted operations, causing what is believed to be the highest loss generated by a man-made disaster in the region last year.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Europe

Victims	1 167
Total losses (USD)	33 bn
Insured losses (USD)	15 bn

Natural catastrophes and man-made disasters caused total losses of more than USD 33 billion in Europe in 2013. Insured losses were USD 15 billion. Most losses came from the summer flooding in central Europe, hail storms in Germany, and a cluster of winter storms in northern Europe.

Improved flood defences did contain losses in central Europe …

Early in the summer, a low pressure system called Frederik formed over the Mediterranean. It moved northwards, carrying large amounts of moisture and collided with a cold air mass from northern Europe. The result was heavy rainfall for four days, causing massive flooding in the upper Danube basin and along the Elbe. The impact was exacerbated by the month of May having been the wettest in the last 50 years, so the soil was already highly saturated. Damage was particularly severe in Germany. The Czech Republic, Hungary, Poland also suffered. The total economic loss was estimated to be USD 16 billion. The strengthening of the flood protection measures in recent years did help contain the damage. For example, the defences built after extensive flooding hit the same region in 2002 protected the centre of Prague, and there was less damage to commercial and residential property than 10 years earlier.

… but more can be done.

However, the overall economic losses were still substantial due to the sheer scale of the event. Both the severity and the affected area were larger than in 2002. Also more property and infrastructure has been built since 2002. In addition, levees that effectively protected many places upstream may have exacerbated the flooding downstream. This shows that although flood resilience has progressed, more can be done in terms of integrated flood risk management.

The 2013 summer floods are the biggest flood-induced loss event in Europe ever.

Insured losses of USD 4 billion made this event the biggest flood loss in Europe ever, and the second costliest worldwide after the Thailand floods of 2011. Part of the reason is that the take-up of residential insurance is much higher today than in 2002. For example, in Germany 32% of residential buildings were insured in 2012, compared with only 19% in 2002. Insured losses can be high even with improved flood defences.

Table 3
The 10 largest flood loss events, 1970–2013

in USD bn at 2013 prices		Insured losses	Economic losses
2011	Thailand	16.2	49.6
2013	Germany & Czech Republic	4.1	16.5
2002	Germany & Czech Republic	3.1	14.1
2007	UK	2.9	4.4
2005	Switzerland	2.6	4.3
2011	Australia	2.4	6.6
1997	Poland & Czech Republic	2.4	7.6
2007	UK	2.3	3.5
2010	Australia	2.3	5.7
1973	US	2.0	5.5

Source: Swiss Re Economic Research & Consulting.

Hail storms in Germany and France led to at least USD 3.8 billion in insured losses.

After a prolonged period of above-average temperatures in central Europe there were severe hailstorms in northern Germany on 27 July and also on the following day in the heavily populated areas of Reutlingen, Nürtingen, and Kirchheim unter Teck in southern Germany. Around 100 000 buildings and 50 000 vehicles were damaged. The same weather pattern also caused hail damage in France, resulting in overall insured losses of USD 3.8 billion combined. That's the largest loss ever from hail in any part of the world in *sigma* records. While homeowners need to buy additional insurance cover for flooding, hail risk is a standard component of building insurance contracts. This is the reason for high claims when hail storms hit densely populated areas.

The losses may have been magnified by use of buidling materials which can be easily damaged by large hailstones.

Hail damage to buildings is usually confined to windows, roofs and roof-maintained equipment such as skylights, solar panels and siding but it also includes subsequent moisture penetration from blocked roof and yard drainage systems. Property claims related to the July hailstorm events in Germany were very high, prompting discussion on the impact of new building technologies such as solar panels and residential insulations. In fact, the damage may have been magnified by the widespread use of clay or concrete tiling for roofing, and by the increasing use of styrofoam or mineral wool as insulation. All these materials can be damaged by large hailstones.

Windstorms Christian and Xaver together generated USD 2.5 billion in insured losses.

A cluster of storms originating in the Atlantic hit north-western Europe in close succession towards the end of October, generating further losses. Windstorm Christian brought damaging winds, heavy rainfall and large waves causing destruction in the UK and moving fast across the other northern European countries. Insured losses are estimated to be USD 1.5 billion. Later in December, Windstorm Xaver triggered the highest storm surge on the UK coast since the North Sea floods of 1953, and the second highest water levels ever recorded in Hamburg since 1825. Overall insured losses from Xaver are estimated at USD 1billion. The coastal flood defences, including dikes and flood barriers in the UK, the Netherlands and Germany, together with emergency preparedness measures prevented major infrastructure damage, despite the magnitude of the event.

Heat waves caused the most loss of life in Europe in 2013.

In July, temperatures of above 30°C for a period of nine days in the UK, the longest stretch in seven years, are believed to have caused 760 premature deaths,[4] mainly among the more vulnerable segments of the populations, such as the elderly. Of the various weather events, heat waves caused the most loss of life in Europe last year.

Asia

Victims	20 653
Total losses (USD)	62 bn
Insured losses (USD)	6 bn

Asia was hardest hit in terms of human loss, with close to 21 000 victims from natural and man-made catastrophes in 2013. The region also suffered the most loss of life in 2012 and 2011. The total economic cost of disaster events in the region in 2013 is estimated to be about USD 62 billion. Insured losses were USD 6 billion.

Typhoon Haiyan was the biggest humanitarian disaster in 2013.

The biggest loss-inducing event was Haiyan, the Category 5 strength super typhoon that was the largest humanitarian catastrophe of the year globally. Haiyan made multiple landfalls in central Philippines with record wind speeds. It was the strongest typhoon to ever hit the country, and one of the strongest to have ever been recorded, worldwide. It triggered coastal storm surges with subsequent flooding and mudslides that wiped out entire coastal towns such as Tacloban, where the water level was estimated to have risen to 6.5m.

A preliminary estimate puts the property, agriculture and infrastructure loss from Haiyan at USD 12 billion.

Around 7 500 people died or went missing, and more than 28 000 were injured. Haiyan is the deadliest disaster event in the history of the Philippines. It also caused massive damage to residential buildings, public infrastructure and cropland. Over 1 million houses were destroyed or severely damaged, leaving at least 4 million people homeless. Prolonged power, communications and water supply failures severely hindered the relief effort, adding to the misery of the already severely tried populations. The Philippine authorities provisionally estimate the property, agriculture and infrastructure damage from Typhoon Haiyan to be at least USD 12 billion. Insured losses are estimated to be USD 1.5 billion, including losses from public infrastructure insurance.

[4] The estimate is from the London School of Hygiene & Tropical Medicine

The Philippines

The Philippines is highly exposed to a range of natural hazards.

The Philippines is highly exposed to cyclonic risk, and is also located in zones of high seismic activity and volcanic eruptions. Situated in a vast expanse of warm ocean water on the western rim of the Pacific Ocean, it is the most exposed country in the world to tropical storms. Haiyan was the third typhoon of Category 5 to make landfall in the Philippines since 2010. Before Haiyan, the strongest storm was Typhoon Megi which struck the Luzon region in 2010 with winds of up to 290 km/h.

With 7 000 islands in the archipelago, storm surges can have very damaging impact.

Although typhoon-induced storm surges are localised, with 7 000 islands in the archipelago, storm surge inundation can be dramatic. The record highest storm surge in modern history in East Asia was 7.3m in 1897 on Samar Island, Philippines. The storm surge height at Tacloban during Haiyan, if confirmed, would become the second highest on record. Since 1970, when *sigma* began collecting disaster losses, there have been nine typhoons in the Philippines with more than 1 000 victims each time.

Manila is one of the most high-risk metropolitan areas in the world.

The capital Manila is among the 10 most heavily exposed urban centres in the world to earthquakes and storms. A typhoon like Haiyan could potentially affect some 12.6 million residents in the metropolitan area of Manila alone, with massive disruption to the economy. A recent Swiss Re study[5] reveals that in terms of productivity losses from severe storms like this, Manila ranks no. 6 worldwide, and no. 1 from the perspective of impact on the national economy. The country has recently been investing considerably in strengthening capacity for forecasting and early warning, and this has contributed to limiting the loss of life from what is likely to pass as the strongest storm in history. However, climate change is likely to put further pressure on disaster risk management in the Philippines.

Heavy flooding in India claimed around 6 000 lives in June.

Elsewhere in Asia, around 6 000 people died or went missing in heavy flooding in the Himalayan state of Uttarakhand, northern India, in June 2013. It was the state's heaviest flood in the last 80 years, and India's deadliest catastrophe since the 2004 tsunami. Many of the victims were pilgrims in their annual visit to the remote Kedarnath Shrine, who were caught stranded by earlier than expected monsoon rains. The area has seen significant economic and property development in the last two decades, and also an increase in the numbers of pilgrims. Insured losses from the June flood were estimated at USD 0.5 billion, out of USD 1.1 billion in total losses, mainly from agriculture and commercial insurance (hydropower stations).

Effective evacuation planning saved many lives when Cyclone Phailin hit the Indian state of Odisha in October ...

On 12 October, Cyclone Phailin made landfall in Odisha, India, with winds of up to 260 km per hour. Before making landfall, the Odisha State Disaster Management Authority evacuated 984 000 people from 18 000 villages. According to local authorities, the success of the evacuation effort meant that only 38 people died in the cyclone. Phailin was the strongest cyclone on the Indian coast since 1999, when Cyclone Odisha struck the same coast, claiming an estimated15 000 lives. Last year's evacuation effort has earned international praise as an example of effective disaster risk management. The framework was established after the experience of the 1999 cyclone, and many lives were saved when nature hit again.

... but the cyclone generated estimated total losses of USD 4.5 billion, with only a small part covered by insurance.

Despite the comparatively low number of victims, the storm did destroy over 100 000 houses and damage another 300 000, while over 1.3 million hectares of cropland were lost. The estimated total cost was USD 4.5 billion. Owing to the low insurance take-up, insured losses were minimal. The disaster events in 2013 highlight the country's substantial exposure to natural catastrophe threat. While catastrophe insurance penetration remains low, the protection gap in India remains large.

[5] Mind the risk - A global ranking of cities under threat from natural disasters, Swiss Re, 2013

Typhoon Fitow was the most expensive event in China in 2013.

Typhoon Fitow landed in eastern China in October, after first skirting Japan. It was the strongest typhoon to reach mainland China since 1949. Fitow brought heavy rainfall resulting in major flooding, which led to most of the estimated total losses of USD 10 billion. The insured losses of USD 1.1 billion make it the second largest claims event ever in China.

In Bangladesh, 1 127 people died in a garment factory fire.

The collapse of a five-storey building housing, amongst others, garment factories supplying foreign brands, killed 1 127 workers in Bangladesh. Last year was the second year in a row that a deadly fire at garment factories in the country claimed many lives. The fire has heightened concerns about safety standards in an industry that has grown rapidly in the past two decades.

Latin America and the Caribbean

Victims	1 055
Total losses (USD)	9 bn
Insured losses (USD)	2 bn

Natural catastrophes and man-made disasters created total damage of at least USD 8 billion in Latin America and the Caribbean in 2013, and insured losses of over USD 2 billion.

Mexico was hit by eight storms in 2013.

Unlike the US, Mexico had an active storm season and was hit by eight storms. Of these, two made landfall as hurricanes on opposite sides of the country within 24 hours in mid-September. Hurricane Manuel struck western Mexico while Ingrid made landfall on the east coast. The double onslaught led to severe flooding rains and landslides, and around 200 people died.

Hurricane Manuel caused the most damage.

Hurricane Manuel was the most damaging. With insured losses of USD 0.9 billion and total economic losses of over USD 4 billion, it was one of the costliest tropical cyclones in Mexico's history. Insured claims from Hurricane Ingrid were less than USD 0.2 billion. More floods occurred in Argentina in April and towards the end of the year in Rio de Janeiro, Brazil.

Freezing temperatures killed 275 people in Peru.

In August, 275 died due to freezing temperatures in Peru and many more suffered acute respiratory infections and pneumonia. Earlier in the year, on 27 January, a fire in a nightclub in Santa Maria, Brazil claimed 235 lives.

Oceania

Victims	21
Total losses (USD)	3 bn
Insured losses (USD)	1 bn

Natural catastrophes and man-made disasters in 2013 caused total losses of around USD 2.7 billion, of which some USD 1.3 billion was covered by insurers. Floods and bushfires affected the region after a relatively benign 2012.

Cyclone Oswald in Australia caused insured losses of USD 1 billion.

Tropical Cyclone Oswald in January caused heavy rainfall and flooding across Queensland and New South Wales in Australia, and also tidal surges and tornadoes in which six people died. The insured claims from this event were USD 1 billion. In addition, a heat wave brought extreme temperatures to most of the Australian continent, breaking long-standing records of both average maximum temperatures and for the longest time period, forcing the Australian Bureau of Meteorology to redraw its charts.[6] The heat sparked damaging bushfires in Tasmania and New South Wales. There were more bushfires in October. The combined insured losses from last year's fires were around USD 0.3 billion.

Drought in New Zealand impacted milk production.

Dry weather caused severe soil moisture deficits in New Zealand also, the worst since 1972. The drought curtailed milk production, a staple of the country's agriculture sector and an important export. Losses were estimated at around USD 0.8 billion, largely uninsured.

[6] In January 2013, the Australian Bureau of Meteorology extended the temperature range on its charts from the previous cap of 50 to 54°C. In addition, it has added two entirely new colours to show the new extreme range on its interactive weather maps.

Africa

Victims	1 751
Total losses (USD)	1 bn
Insured losses (USD)	0.6 bn

Floods in southern Africa caused the most loss of life.

Natural catastrophes and man-made disasters in Africa claimed 1 751 lives in 2013, and caused total losses of USD 0.8 billion. Insured losses were around USD 0.5 billion, originating mostly from incidents at oil and gas facilities.

Early in the year, 246 people died in floods in Mozambique and Zimbabwe, and 10 000 were left homeless. Later in the year, 162 people died in flooding in Somalia. In September, a mass shooting event at the Westgate shopping mall in Nairobi, Kenya killed 72 people, raising further concerns about terrorism risk in the country.

Fostering climate change resilience

Rising temperatures are the central component of climate change.

The term 'climate change' encompasses the changing nature of weather characteristics over long periods of time, usually longer than 10 to 15 years. Since the beginning of industrialization, rapid population growth and human activity has led to a significant increase in greenhouse gas emissions which, alongside natural variability, have pushed global temperatures higher. While temperatures had averaged around 14°C since the last ice age 11 000 years ago, they started to rise in the 20th century. According to the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report[7], 1983 to 2012 was likely the warmest 30-year period of the last 1400 years in the northern hemisphere. "Likely" as used by the IPCC means a probability between 66% and 100%.

Climate change can lead to changes in the frequency, intensity and duration of extreme weather events ...

The rise in global average temperatures changes the energy balance of the climate, leading to higher atmospheric humidity. This disrupts a complex, well-balanced system and will likely lead to shifts in the frequency, intensity and duration of extreme weather events such as floods, heat waves and other natural disasters. These events in turn generate increasing risks such as rising sea levels, drought, crop failures and water shortages. These risks engender significant environmental, social and economic costs. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions. Indeed, if left unchecked, it is estimated that the overall costs of the effects of climate change could amount to 20% of global gross domestic product by the end of this century.[8]

... which in turn can generate significant social and economic costs.

An important contributing factor to the overall costs is the marked increase of wealth accumulation and settlement in areas highly-exposed to severe weather events. The good news, however, is that up to 68% of climate change risks can be avoided with cost-effective adaptation methods.[9] And, alongside local prevention and mitigation measures, risk transfer to re/insurers is a powerful adaptation measure to offset the impact of extreme weather events.

The reality of climate change

Climate change is caused by greenhouse gas emissions, as a result of human activity.

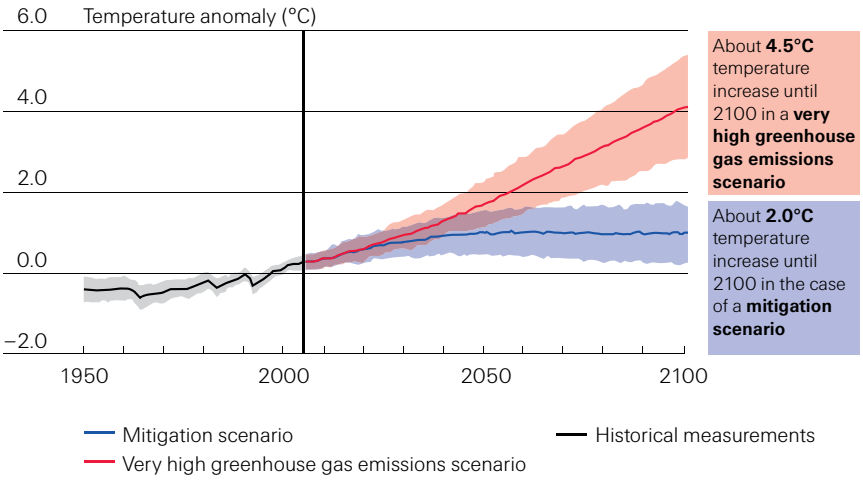
Land and ocean surface temperatures rose by 0.85°C in the period 1880 to 2012. The observed rise is due to increasing concentration of greenhouse gases, mainly carbon dioxide (CO_2), in the atmosphere. Since pre-industrial times CO_2 concentrations in the atmosphere have risen by 40%. The emissions are "very likely" (ie, with a probability of 90% or more) to have been caused by human activity, primarily the burning of fossil fuels and agriculture.[10]

Global mean temperatures are expected to rise by 2°C to 4.5°C by 2100.

The IPCC projects that global mean temperatures will continue to rise by between 2°C and 4.5°C by 2100. The extent of increase will strongly depend on the level of greenhouse emissions today and in the future. In the last decade, however, the increase in atmospheric temperature was lower than in the previous one. According to the IPCC, the reason for this is that most of the energy stored in today's climate system accumulates in the oceans, manifesting as warming ocean waters. Since 1971, the global oceans have absorbed more than 90% of the energy stored in the climate system.[11]

[7] Fifth Assessment Report: Climate Change 2013, Intergovernmental Panel on Climate Change (IPCC), 2013 http://www.climatechange2013.org
[8] Stern Review on the Economics of Climate Change, Lord Nicholas Stern, 2006 http://webarchive.nationalarchives.gov.uk/20080814121010/http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm
[9] Shaping Climate Resilient Development, Economics of Climate Adaptation Working Group, 2009 http://media.swissre.com/documents/rethinking_shaping_climate_resilent_development_en.pdf
[10] Fifth Assessment Report, IPCC, 2013
[11] Fifth Assessment Report, IPCC, 2013

Figure 5
Global average surface warming, 1950–2100

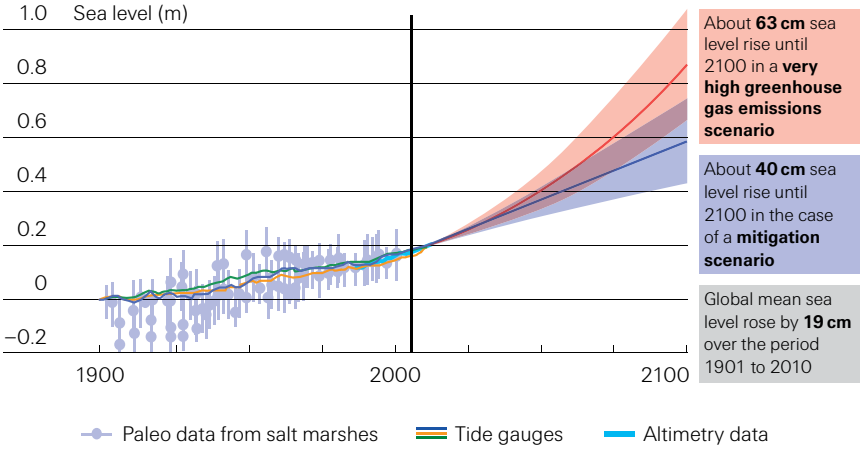


Source: IPCC AR5, September 2013, modified from SPM. 7a Final Draft

Sea levels continue to rise.

The increase of temperature has led to thermal expansion of the oceans. Additionally water that previously was stored in glaciers and ice sheets is melting into the oceans. The now exposed ocean absorbs solar radiation instead of reflecting it as ice would, leading to additional warming, continuing ice melt and rising sea levels. According to the IPCC, the global mean sea level rose by 19 cm over the period 1901 to 2010. It is forecast to rise another 40 cm by 2100 ***if*** society is able to reduce greenhouse gas emissions, and by up to 63 cm if CO_2 emissions continue unchecked.

Figure 6
Rising sea levels, 1900–2100



Source: IPCC AR5, September 2013, modified from Fig 13.27 and Final Draft

Climate change can lead to more frequent and intense rainfall over most land masses.

Furthermore the IPCC says changes in the global water cycles in response to the warming will likely not be uniform. The contrast in precipitation between wet and dry regions and between wet and dry seasons will increase, although there may be regional exceptions. An increase in heavy precipitation events (increase in the frequency, intensity, and/or amount of heavy precipitation) are "very likely" over most of the mid-latitude land masses and over wet tropical regions.[12]

[12] Fifth Assessment Report, IPCC, 2013

IPCC is the international body for the study of the science of climate change.

Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) is the international body for the study of the science of climate change. The IPCC was set up in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to provide policymakers with regular assessments of the scientific basis of climate change, its impacts, future risks, and options for adaptation and mitigation. The IPCC embodies a unique opportunity to provide rigorous and balanced information to decision-makers given its scientific and intergovernmental nature.

At the IPCC, 259 authors, 800 experts and 195 countries come together.

Participation in the IPCC is open to all member countries of the WMO and United Nations. It currently has 195 members. IPCC assessments are written by hundreds of leading scientists who volunteer their time and expertise as authors of the reports. They enlist hundreds of other experts as contributing authors to provide complementary expertise in specific areas. Swiss Re experts have served as review authors for IPCC reports.

Humans are "extremely likely" to have been the dominant cause of rising temperatures.

In its Fifth Assessment Report published in September 2013, the IPPC states: "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased … It is *extremely likely*[13] that human influence has been the dominant cause of the observed warming since the mid-20th century."

To find out more about the IPCC, see www.ipcc.ch

The dangers and costs of climate change

Climate change poses significant challenges and costs to economies and societies.

The rise in global average temperatures disrupts a complex, well-balanced climatic system and this has the potential to develop into the planet's greatest environmental challenge of the 21st century. Climate change exposes local populations to mounting challenges and costs of protecting assets, including human lives, against weather related risks. The Special Report on Extreme Events[14] published by the IPCC lists the following projected changes in climate extremes as a result of global warming.

- *Very likely* increase in the length, frequency and/or intensity of warm spells or heat waves over most land areas;
- *Likely increase* in the frequency of heavy precipitation events or an increase in proportion of total rainfall from heavy falls over many areas of the globe;
- *Medium confidence* in a projected increase in duration and intensity of droughts in some regions of the world;
- *Very likely* earlier spring peak flows in snowmelt- and glacier-fed rivers;
- *Very likely* that mean sea level rise will contribute to upward trends in extreme coastal high water levels;
- *High confidence* that changes in heat waves, glacial retreat, and/or permafrost degradation will affect high mountain phenomena, such as slope instabilities, mass movements and glacial lake outburst floods; and
- *High confidence* that changes in heavy precipitation will affect landslides in some regions.

[13] In the Fifth Assessment Report (2013), the IPPC states that for each assessment, the confidence level for the given assessment is first assessed (*low, medium*, or *high*), as follows. For assessments with *high confidence*, likelihood assessments of a direction of change are also provided (*extremely likely* for 99–100%, *very likely* for 90–100%, *likely* for 66–100%, *more likely* than not for 50–100%, *about as likely as not* for 33–66%, *unlikely* for 0–33%, *very unlikely* for 0–10%, and *exceptionally unlikely* for 0–1%). In a few cases for which there is *high confidence* (e.g., based on physical understanding) but for which there are not sufficient model projections to provide a more detailed likelihood assessment (such as 'likely'), only the confidence assessment is provided. For assessments with *medium confidence*, a direction of change is provided, but without an assessment of likelihood.

[14] Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX), IPCC, 2012, https://ipcc-wg2.gov/SREX

Since pre-industrial times CO_2 concentrations have increased by 40%.

Currently, 195 governments acknowledge that it is extremely likely human influence has been the dominant cause of the observed warming since the mid-20th century. Since pre-industrial times CO_2 concentrations in the atmosphere have increased by 40%, primarily from fossil fuel emissions and secondarily from net land-use-change emissions. Total greenhouse gas emissions since pre-industrial times have added 550 gigatonnes of carbon (GtC). CO_2 emissions from fossil fuel combustion and cement production are 8.3 GtC per year.[15]

Limiting the increase of global average temperature to 2°C by 2050 will require a substantial reduction of CO_2 emissions.

In terms of overall social and economic impact, the point at which climate change becomes dangerous is difficult to assess and is ultimately a societal value judgment. The consensus is that the rise in global average temperatures should be limited to no more than 2°C by 2050.[16] In terms of global carbon emissions, limiting the warming to 2°C corresponds to a global carbon budget – cumulative amount of greenhouse gases that can be released into the atmosphere – of 1200 GtC, with 550 GtC already emitted. This substantial emission reduction, it is hoped, will prevent worst case climate change impacts and still allow societies to cope with the consequences.

If left unchecked, climate-change related losses could be 20% of global GDP by the end of the century.

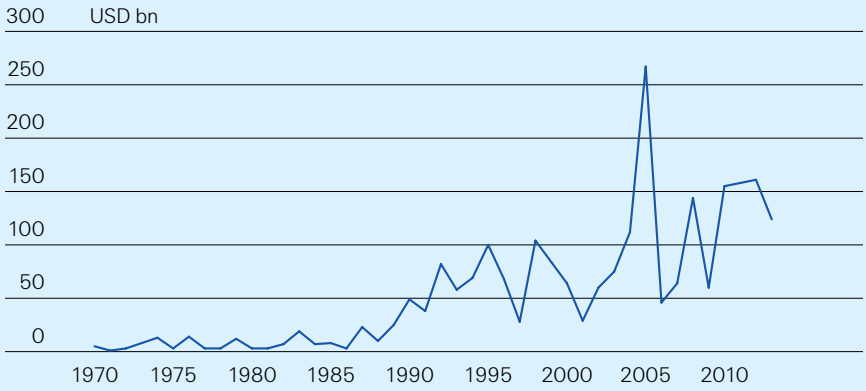
A rise in temperature well beyond 2°C, however, would likely cause massive[17] economic and social costs. If left unchecked, the costs of ongoing climate change could rise to around 20% of global GDP by the end of the century.[18]

Economic losses have been rising in recent decades.

Extreme weather events: a history of rising losses

Total losses from natural catastrophes such as storms and floods and other weather-related events have risen significantly over recent decades.

Figure 7
Economic losses from extreme weather events, 1970–2013



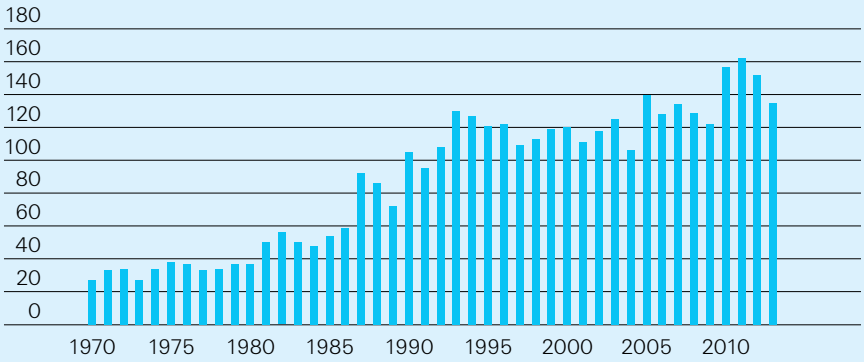
Source: Swiss Re Economic Research & Consulting

There are a number of reasons for the increasing losses:

- *An increase in the number of catastrophic* events. *Sigma* data shows a marked upward trend in the number of weather-related events since 1970. This may in part be due to more comprehensive and inclusive reporting of disaster events and associated losses, in parallel with heightened public awareness of disasters and their consequences.

[15] Fifth Assessment Report, 2013, (IPCC)
[16] Copenhagen Accord, 15th Conference of the Parties, 2009
[17] Turn down the heat, World Bank, 2012 http://documents.worldbank.org/curated/en/2012/11/17097815/turn-down-heat-4%C2%B0c-warmer-world-must-avoided
[18] Stern Review on the Economics of Climate Change, Lord Nicholas Stern, 2006

Figure 8
Number of weather-related catastrophes, 1970–2013



Source: Swiss Re Economic Research & Consulting

- *Rapid urbanization*. For the first time in history more people live in cities than in rural areas. Many of the growing cities are located in high-risk coastal or flood-prone areas.
- *Failure of infrastructure construction to keep pace with rate of urbanization*. People and assets have become increasingly concentrated in urban conurbations, often in disaster-prone regions. In emerging economies, rapid urban expansion has outpaced the construction/establishment of infrastructure and impact-reduction measures such as coastal defences, improved building codes, land-use zoning and planning, improved early-warning systems and disaster preparedness, and response and recovery procedures.
- *Increased vulnerability of assets and goods*. Today's productive processes are more complex, involving assets and inputs with overall higher economic value. The destruction of productive assets in a disaster event can therefore entail a higher overall financial loss than previously. With the interconnectedness of the global economy, the business interruption implications/costs can also be severe.
- *Environmental degradation*. Factors such as soil degradation, deforestation and changes in land-use can heighten the impact of extreme weather events.

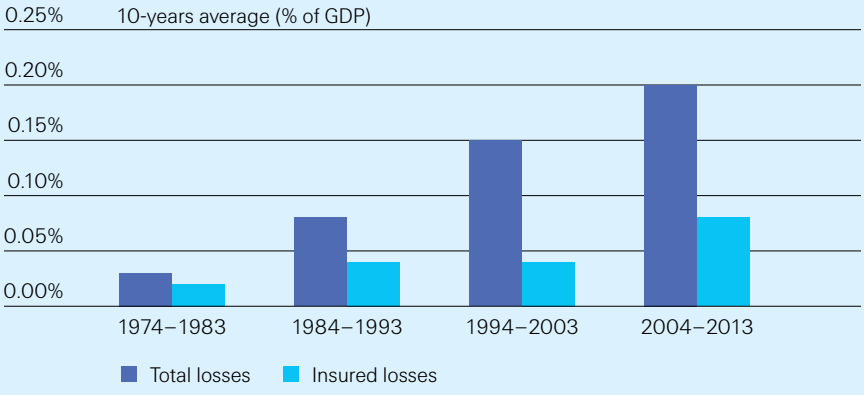
In the future climate change will be an increasingly important loss-generating factor.

In the future, climate change is expected to gradually lead to shifts in the frequency, intensity, spatial extent, duration and timing of extreme weather events. If no mitigating action is taken, these events will be an increasingly important contributing factors to rising losses from natural catastrophe events.

The protection gap relating to weather events has widened also.

In addition to widening economic losses, the level of insured claims generated by extreme weather events has risen over time also. However, the rate of growth of total losses has outpaced the growth of insured losses. Figure 9 compares the real growth in global total losses resulting from weather-related natural catastrophes with associated insured losses, as a percentage of GDP, over the period 1974 to 2013. As shown, the protection gap, that is the difference between insured and total losses, has widened over time, highlighting the ongoing under-insurance of society at large.

Figure 9
Total global losses versus insured losses resulting from weather-related catastrophes, 1974–2013



Source: Swiss Re Economic Research & Consulting

Fostering climate change resilience

"We need to avoid the unmanageable in order to manage the unavoidable." (James Hansen[19])

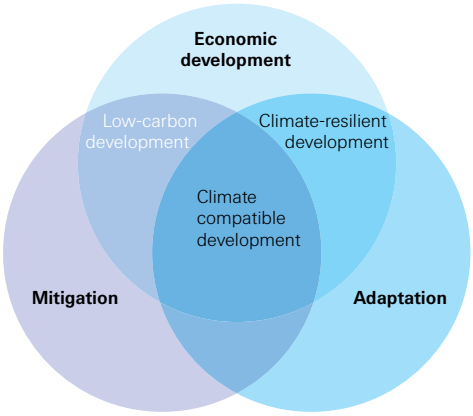
Carbon dioxide remains in the atmosphere for 100 years or more, thus creating a cumulative effect. Even if all emissions are stopped immediately, most aspects of climate change will persist for many centuries. That does not mean, however, that nothing can be done. Risk prevention and avoidance measures as well as disaster risk management measures can be implemented to build resilience to the impacts of climate change. Two kinds of measures need to be implemented together:

- *Climate change mitigation* – reducing greenhouse gas emissions as substantially and quickly as possible; and
- *Adaptation to climate change* – undertaking measures to deal with the impact of climate change. Adaptation measures include infrastructure improvements such as strengthening buildings against storms or constructing reservoirs and wells to combat drought; technological measures such as improved fertilizers use; systematic or behavioral initiatives such as awareness campaign, and disaster relief and emergency response programs. Risk transfer or insurance measures also play a key role in addressing low-frequency/high-impact weather events such as a once-in-100-year storm surge.

Both mitigation and adaptation are essential and complementary.

Climate-resilient development combines adaptation to climate change with economic development. Though adaptation will be indispensable, it cannot be a substitute for mitigation. As economies develop, they also need to change production and consumption patterns to reduce carbon emissions.

Figure 10
Climate-resilient development combines adaptation and economic development.



Source: Swiss Re, Our positions and objectives

[19] James Hansen http://www.columbia.edu/~jeh1

The ECA offers the facts to understand climate risk and identifies the actions to economically minimize weather impacts.

Economics of Climate Adaptation

The re/insurance industry can take a leading role in tackling climate change. With understanding of the risks and tailor-made risk transfer options, the industry can compile data for climate adaptation and to protect livelihoods from catastrophic events. In a seminal study on the "Economics of Climate Adaptation"[20] (ECA) in 2009, Swiss Re and other leading organizations developed a methodology to quantify local climate risks and provide decision-makers with the necessary facts to design a cost-effective climate adaptation strategy. With a time horizon of 2030 or 2050, the ECA offers countries and local decision-makers the facts and framework to pro-actively manage climate risks and to systematically integrate adaptation to climate change within development processes.

Up to 68% of climate-change generated losses can be avoided with cost-effective adaptation measures.

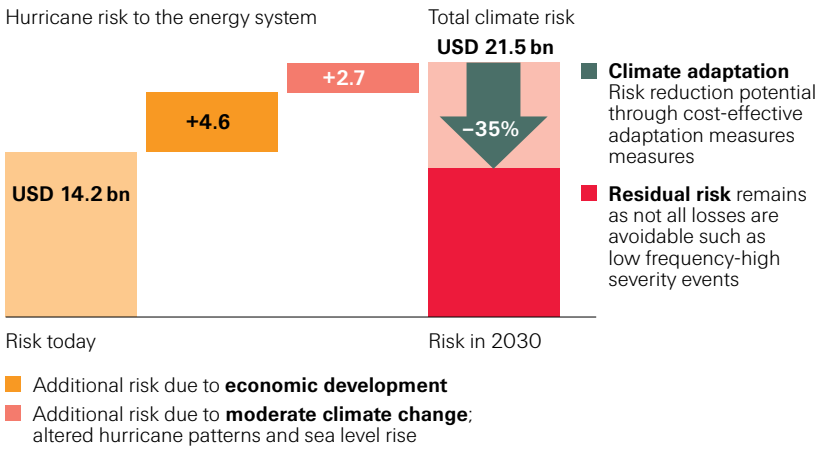
Case studies in 20 different regions around the globe, ranging from New York City, the Caribbean, to Northern England and Maharashtra in India, show that up to 68% of loss from climate change can be prevented using cost-effective adaptation measures. In a first step, the ECA methodology assesses the total climate risk. The total climate risk starts with today's climate risk, charts out the economic development paths that put greater population and assets at risk and considers the additional risks presented by climate change. A second step builds a balanced portfolio of adaptation measures assessing the loss aversion potential as well as the costs for each measure.

Case study: the US Gulf Coast

The US Gulf Coast is exposed to hurricane and storm surges.

One of the locations assessed using the ECA methodology was the US Gulf Coast – a strip of land comprising coastal Texas, Mississippi, Alabama and Louisiana. This is America's energy coast, which is a major part of the US oil and gas industry. Entergy Corp., America's third-largest utility company, commissioned a study[21] to assess the impact of natural hazards on the Gulf Coast's economy. The area already faces significant risk of hurricane wind and storm surge damage. Based on the ECA methodology, the report estimates today's average weather-related economic loss for the US Gulf Coast to be USD 14.2 billion per year.

Figure 11
Total climate risk at the US Gulf Coast



Source: Swiss Re, ECA Group, Building a Resilient Energy Gulf Coast

[20] Shaping Climate Resilient Development, Economics of Climate Adaptation Working Group, 2009 http://media.swissre.com/documents/rethinking_shaping_climate_resilent_development_en.pdf
[21] Building a Resilient Energy Gulf Coast, ECA Working Group, 2010 http://media.swissre.com/documents/Entergy_study_exec_report_20101014.pdf

Economic loss potential from weather events is estimated at USD 14.2 billion per year today, rising to USD 21.5 billion by 2030 or USD 23.4 billion per year in the case of extreme climate change scenario.

The economic loss potential may rise to USD 21.5 billion per annum by 2030, taking into account an estimated additional USD 4.6 billion in potential average yearly loss generated by the increase in asset accumulation as a result of economic development during that period (see Figure 11). Additionally, a moderate climate change scenario featuring rising sea levels, more severe hurricanes and land subsidence adds another USD 2.7 billion for a total amount of USD 21.5 billion expected annual losses by 2030. Assuming an extreme climate change scenario (not shown in Figure 11), the ECA methodology estimates that the average annual economic loss could rise to as much as USD 23.4 billion by 2030.

Cost-efficient adaptation measures

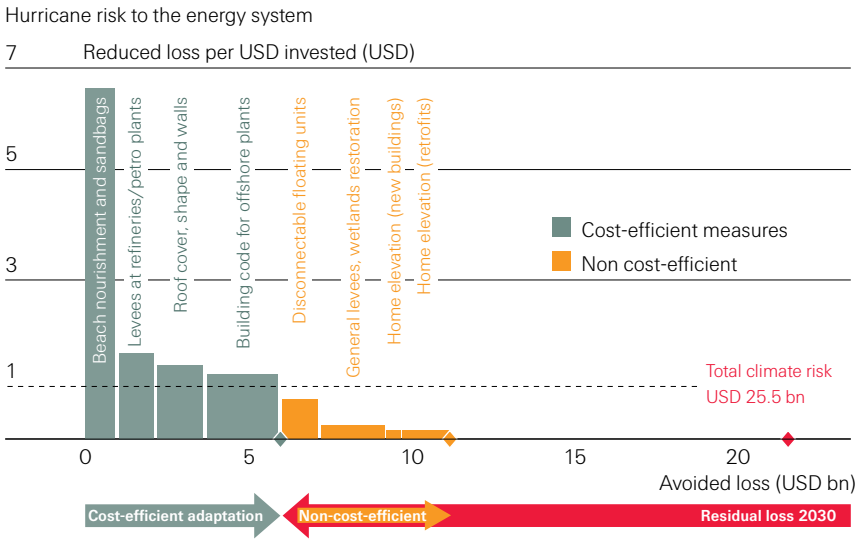
The ECA methodology identified over 20 adaption measures for the US Gulf region case study.

The ECA methodology identified over 20 adaptation measures for the US Gulf and assessed their risk reduction efficiency. The cost-benefit ratio is the loss reduction compared to the mitigation costs, including capital and operating expenses. A cost-efficient measure will prevent more losses than the mitigation costs. The reduced losses per US dollar invested are shown in the adaptation cost curve (see Figure 12).

Cost-efficient adaptation measures could reduce damages by 35%.

The study shows that a number of cost-efficient adaptation measures are available and that together these could lower damages by 35%. Among the most attractive adaptation measures are beach nourishment, levees at refineries, roof cover retrofits and improved building codes. Beach nourishment, for instance, can lower losses by USD 1 billion annually for an annual cost of only USD 0.15 billion, or USD 6.70 for every US dollar.

Figure 12
Adaptation cost curve for the US Gulf Coast



Source: Swiss Re, ECA Group, Building a Resilient Energy Gulf Coast

Risk transfer

Risk transfer is an important adaptation measure for natural disaster events.

While cost-efficient adaptation/prevention measures are available in different locations, no individual, business and public institution can afford to prevent losses from every conceivable risk event. This is especially true for events that are unlikely to occur or that can only be avoided at an enormous cost, as is the case with natural disasters. In these cases, re/insurance can play an important role in helping individuals, communities and businesses recover from the devastation wreaked by severe weather events.

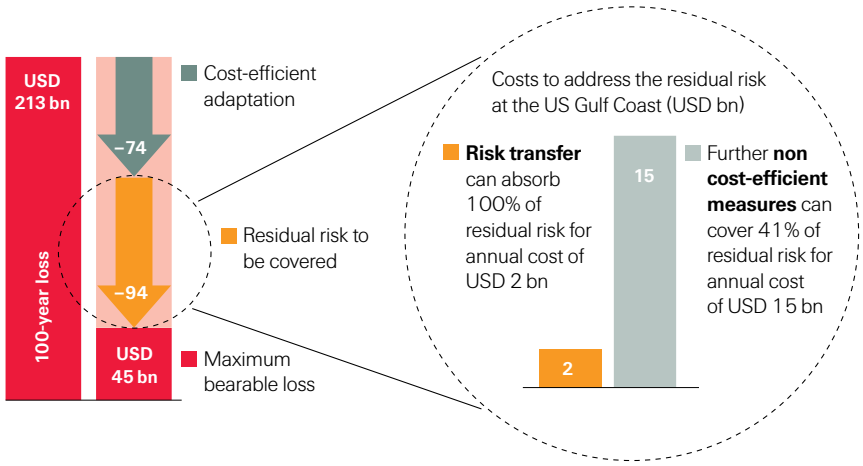
Risk prevention and risk transfer are mutually reinforcing.

Transfer of such risks is an efficient way to obtain additional protection for low-frequency natural catastrophe events. Important, however, is that risk prevention and risk transfer are mutually reinforcing. While insurance is a useful component in a given adaptation portfolio, keeping insurance prices in check by minimizing residual risks through prevention measures is equally important. The ECA study shows that a balanced portfolio of prevention, intervention and insurance measures is available to pro-actively manage total climate risk and to strengthen the region's resilience.

Risk transfer can be a more cost-efficient solution.

Going back to the US Gulf example, the ECA study estimates a once-in-100-year economic loss of USD 213 billion for the region, comprising additional risk due to economic development and assuming a moderate climate change scenario. Cost-efficient adaptation measures could lower this by about USD 74 billion for such low-frequency/high-impact events. Meanwhile, the region's public authorities assessed the maximum affordable damage from a single event to be around USD 45 billion. The remaining USD 94 billion in economic damage is residual risk that also needs to be addressed through non-cost-efficient measures or risk transfer. Non-cost-effective measures costing USD 4.7 billion per year, such as home elevation and opening protection (for example, shutters) for all existing buildings, could cover only 41% of the residual risk. Risk transfer, however, presents a more cost-efficient solution by providing more comprehensive coverage for only USD 2 billion a year.

Figure 13
US Gulf Coast: hurricane risk to the energy system



Source: Swiss Re, ECA Group, Building a Resilient Energy Gulf Coast

Implementing adaptation measures is less expensive than waiting.

The ECA case studies highlight economic development and climate change as the key drivers for future climate-related losses. The analysis presents a strong case for immediate action. Implementing adaptation measures, including risk transfer, can help build global resilience to climate change. It is also less expensive than doing nothing and dealing with the rising costs only after they are incurred.

The role of re/insurers

Understanding climate change is critical to developing good risk-transfer solutions.

Natural catastrophes such as floods, storms and earthquakes constitute key risks in property & casualty (P&C) re/insurance. Understanding natural catastrophe risks and the impact of climate change is critical to assessing the re/insurance industry's P&C business accurately and to structuring sound risk-transfer solutions. This is why some re/insurers invest in proprietary, state-of-the-art natural catastrophe models and collaborate with universities and scientific institutions. Urbanization, the clustering of properties and commercial activity and migration to high-risk areas such as coast and flood plains need to be closely monitored. This enables the industry to stay abreast of the latest knowledge on the economic impact of natural disasters, including the effects of climate change.

Risk models will adjust to the continuing rise in natural catastrophe losses.

While the impact of climate change will manifest itself over the coming decades, most of the industry's business is renewed annually and risk models are refined regularly. Risks are usually covered for 12 months by re/insurance and up to five years by catastrophe bonds. Thus, re/insurance premiums do not reflect long-term expected loss trends. Instead, for underwriting and risk management purposes, the models provide an estimate of today's risk. However, as natural catastrophe losses continue to rise, risk models will gradually reflect this trend as they are updated.

The re/insurance industry is highly exposed to future impacts of climate change.

The re/insurance industry – given its role as ultimate risk taker – is highly exposed to the future impacts of climate change. In the last 20 years, concerns around climate change have increasingly featured in re/insurers' long-term risk management strategies. Along with economic losses, insured losses from weather events have also increased significantly over recent decades. *Sigma* data shows that in the period 1974 to 1983, insured losses from weather-related events averaged 0.018% of global GDP. The 10-year average in 2004 to 2013 rose to 0.077% of global GDP.

Re/insurers can play a central role in building global resilience to climate change.

Even so, the gap between economic and insured losses remains large, and natural disasters continue to place a significant burden on the public sector, uninsured individuals and businesses. Risk transfer can protect livelihoods from catastrophic events and increase the willingness of decision-makers to invest in economic development. Additionally risk transfer puts a price tag on risk and thereby incentivizes investments in prevention measures. In continuing to further push the boundaries of insurability, the re/insurance industry can make an effective contribution by developing the numerous business opportunities that climate change has and will create in the future. In this way, re/insurance is a powerful tool to strengthen the resilience of local and national economies, and humanity at large.

Tables for reporting year 2013

Table 4
List of major losses in 2013, according to loss category

	Number	in %	Victims[22]	in %	Insured loss[23] (in USD m)	in %
Natural catastrophes	**150**	**48.7%**	**20 201**	**78.0%**	**37 047**	**82.5%**
Floods	53		8 633		9 137	
Storms	60		8 344		20 819	
Earthquakes	12		1 095		45	
Droughts, bush fires, heat waves	8		1 335		609	
Cold, frost	5		727		139	
Hail	8				6 164	
Other natural catastrophes	4		67		134	
Man-made disasters	**158**	**51.3%**	**5 702**	**22.0%**	**7 870**	**17.5%**
Major fires, explosions	**51**	**16.6%**	**2 113**	**8.2%**	**5 148**	**11.5%**
Industry, warehouses	18		1 276		2 081	
Oil, gas	17		98		2 991	
Department stores	1		54			
Other buildings	11		615		76	
Other fires, explosions	4		70			
Aviation disasters	**11**	**3.6%**	**176**	**0.7%**	**814**	**1.8%**
Crashes	9		176		408	
Space	2				406	
Maritime disasters	**25**	**8.1%**	**1 135**	**4.4%**	**814**	**1.8%**
Freighters	2				54	
Passenger ships	16		1 079		20	
Tankers						
Drilling platforms	3		1		453	
Other maritime accidents	4		55		287	
Rail disasters (incl. cableways)	**13**	**4.2%**	**231**	**0.9%**	**98**	**0.2%**
Mining accidents	**11**	**3.6%**	**447**	**1.7%**	**920**	**2.0%**
Collapse of buildings/bridges	**1**	**0.3%**	**21**	**0.1%**		**0.0%**
Miscellaneous	**46**	**14.9%**	**1 579**	**6.1%**	**76**	**0.2%**
Social unrest	8		121			
Terrorism	34		1 192		76	
Other miscellaneous losses	4		266			
Total	**308**	**100.0%**	**25 903**	**100.0%**	**44 917**	**100.0%**

Source: Swiss Re Economic Research & Consulting

[22] Dead or missing
[23] Property and business interruption, excluding liability and life insurance losses

Table 5
The 20 most costly catastrophes in 2013, in insured loss terms

Insured loss[24] (in USD m)	**Victims**[25]	**Date** (start)	**Event**	**Country**
4 134	25	27.05.2013	Floods	Germany, Czech Republic, Austria, Slovakia
3 838	–	27.07.2013	Hailstorms	Germany, France
1 882	4	19.06.2013	Floods	Canada
1 776	28	18.05.2013	Severe thunderstorms, tornadoes (EF5 tornado in Moore, OK)	United States
1 615	2	18.03.2013	Thunderstorms, tornadoes, hail	United States
1 486	7 345	08.11.2013	Typhoon Haiyan, storm surge	Philippines, Vietnam, China, Palau
1 471	13	27.10.2013	Windstorm Christian (St Jude)	Germany, Denmark, Netherlands, United Kingdom, Sweden, Belgium
1 425	27	28.05.2013	Severe thunderstorms, tornadoes, large hail	United States
1 204	4	07.04.2013	Winter storm, ice, tornadoes, heavy rains	United States
1 133	10	29.09.2013	Typhoon Fitow	China, Japan
ns	–	02.04.2013	Large fire at refinery	Argentina
1034		05.12.2013	Windstorm Xaver	United Kingdom, Germany, Netherlands, Norway, Sweden
983	6	21.01.2013	Floods caused by cyclone Oswald	Australia
947	169	13.09.2013	Hurricane Manuel	Mexico
931	11	17.11.2013	Thunderstorms, tornadoes (2 EF4) with winds up to 305 km/h	United States
ns	–	10.04.2013	Collapse of pit wall at copper mine due to landslide	United States
ns	–	04.09.2013	Fire at major high-tech semiconductor plant	China
888	–	08.07.2013	Severe storms, flooding	Canada
827	–	20.06.2013	Hailstorms	Germany
805	–	06.08.2013	Thunderstorms, hail, tornadoes	United States

[24] Property and business interruption, excluding liability and life insurance losses; US natural catastrophe figures: with the permission of Property Claim Services (PCS)/incl. NFIP losses (see page 45, "Terms and selection criteria").
[25] Dead and missing

Table 6
The 20 worst catastrophes in terms of number of victims, 2013

Victims[26]	Insured loss[27] (in USD m)	Date (start)	Event	Country
7 345	1 486	08.11.2013	Typhoon Haiyan, storm surge	Philippines, Vietnam et al
5 748	500	14.06.2013	Floods caused by heavy monsoon rains	India
1 127	20	24.04.2013	Eight-storey building housing garment factories collapses	Bangladesh
760	–	06.08.2013	Heat wave	United Kingdom
531	–	01.04.2013	Heat wave	India
399	–	24.09.2013	Earthquake M_w* 7.7, aftershocks	Pakistan
388	–	01.01.2013	Cold wave	India, Bangladesh, Nepal
366	–	03.10.2013	Boat carrying immigrants catches fire and capsizes	Mediterranean Sea, Italy
275	–	24.08.2013	Heavy snowfall, freezing temperatures	Peru
246	–	17.01.2013	Floods caused by heavy seasonal rains	Mozambique, Zimbabwe
235	2	27.01.2013	Fire at nightclub ignited by fireworks on stage, stampede	Brazil
234	–	01.08.2013	Floods caused by heavy monsoon rains	Pakistan
230	20	15.10.2013	Earthquake M_w 7.2	Philippines
218	2	15.09.2013	Floods; Mekong River burst its banks	Cambodia, Vietnam
217	25	20.04.2013	Earthquake M_w 7.0	China
200	–	05.07.2013	Severe floods	China
174	–	09.07.2013	Severe floods	India
169	947	13.09.2013	Hurricane Manuel	Mexico
162	–	08.11.2013	Tropical cyclone, heavy rains and flash floods	Somalia
150	–	13.05.2013	Boat carrying evacuees capsizes	Indian Ocean, Myanmar (Burma)

* M_w = moment magnitude scale

Source: Swiss Re Economic Research & Consulting

[26] Dead and missing
[27] Property and business interruption, excluding liability and life insurance losses

Table 7
Chronological list of all natural catastrophes in 2013

Floods

Date	Country Place	Event	Number of victims Amount of damage (where data available)
1.1.–20.1.	Peru	Floods	31 dead 1 413 homeless
8.1.–16.1.	Sri Lanka	Floods	52 dead
8.1.–27.2.	Bolivia Chuquisaca, La Paz, Potosí, Oruro, Tarija, Santa Cruz	Floods caused by heavy rains; 582 houses damaged, 10 657 hectares (ha) flooded	24 dead USD 3m total damage
13.1.–22.1.	Indonesia Jakarta	Floods caused by heavy monsoon rains; over 100 000 houses destroyed or damaged	32 dead IDR 3 000bn (USD 251m) insured loss IDR 32 000bn (USD 2.63bn) total damage
13.1.–17.1.	Kenya Nairobi, Nyanza, North Rift	Floods caused by heavy rains	18 dead 2 000 homeless
16.1.–23.1.	Botswana, South Africa	Floods caused by heavy rains	12 dead 3 459 homeless
17.1.–4.3.	Mozambique, Zimbabwe	Floods caused by heavy seasonal rains	246 dead 10 000 homeless USD 100m total damage
21.1.–31.1.	Australia Queensland, New South Wales	Floods caused by cyclone Oswald	6 dead AUD 1.1bn (USD 983mn) insured loss AUD 1.65bn (USD 1.48bn) total damage
3.2.–6.2.	Pakistan	Floods	34 dead
16.2.–18.2.	Indonesia Rokan Hulu, Riau	Floods caused by heavy torrential rains	17 dead 3 452 homeless
17.3.–18.3.	Brazil	Floods	30 dead
28.3.–30.4.	Kenya	Floods caused by heavy rains	96 dead 20 injured 18 633 homeless USD 36m total damage
2.4.–4.4.	Argentina La Plata	Floods	59 dead ARS 1bn (USD 163m) insured loss USD 1.3bn total damage
5.4.–20.4.	Indonesia Java	Floods caused by heavy rains; over 24 000 houses flooded	11 dead 2 000 homeless
23.4.	Afghanistan Balkh Province	Flash floods; over 2 000 houses destroyed or damaged	14 dead, 10 missing
1.5.–5.5.	Uganda Kasese	Floods caused by heavy rains	8 dead, 5 missing 25 455 homeless USD 3m total damage
2.5.	Saudi Arabia Bicha	Floods caused by heavy torrential rains	20 dead
6.5.–8.5.	China Guangxi, Hunan, Guizhou	Thunderstorms, heavy rains, hail, flash floods; 5 000 houses destroyed, 46 000 houses damaged, 26 900 ha of cropland destroyed	19 dead, 1 missing CNY 1bn (USD 165m) total damage
14.5.–28.5.	China Guangdong, Guizhou	Floods caused by heavy monsoon rains, landslides	55 dead CNY 4bn (USD 661m) total damage
25.5.–30.6.	Nepal Darchula, Kailali, Kanchanpur, Bardiya, Baitadi, Kalikot	Floods caused by heavy monsoon rains; 862 houses destroyed, 2 200 houses damaged	49 dead, 16 missing 23 injured 8 160 homeless

Date	Country Place	Event	Number of victims Amount of damage (where data available)
27.5.–17.6.	Germany, Czech Republic, Austria, Slovakia	Floods: damage to property, infrastructure and farmland	25 dead EUR 3bn (USD 4.13bn) insured loss EUR 12bn (USD 16.5bn) total damage
8.6.	Sri Lanka	Floods caused by heavy monsoon rains	58 dead
13.6.–18.6.	China Gansu, Sichuan	Heavy rains, floods, landslides	11 dead USD 500m total damage
14.6.–18.6.	India Uttarakhand, Bihar, Karnataka, Himachal Pradesh, Kerala, Gujarat, West Bengal	Floods caused by heavy monsoon rains; 35 875 houses destroyed, 245 400 houses damaged, 797 969 ha of cropland flooded	1 537 dead, at least 4 211 missing 271 931 homeless USD 500m insured loss USD 1.1bn total damage
18.6.–19.6.	France, Spain Garonne	Flash floods	3 dead EUR 370m (USD 510m) insured loss EUR 500m (USD 689m) total damage
19.6.–24.6.	Canada Calgary (Alberta)	Floods	4 dead CAD 2bn (USD 1.89bn) insured loss CAD 5bn (USD 4.72bn) total damage
23.6.–15.7.	India Assam	Floods caused by heavy monsoon rains	80 dead
29.6.–1.7.	China	Heavy rains, hail, landslides	55 dead CNY 8.5bn (USD 1.4bn) total damage
5.7.–10.7.	China Sichuan	Severe floods	200 dead 100 000 homeless CNY 20bn (USD 3.3bn) total damage
9.7.–10.7.	India Uttar Pradesh	Severe floods	174 dead
10.7.–31.8.	Nepal Jhapa, Morang, Sunsari, Saptari, Rautahat	Flash floods caused by heavy rains; 413 houses destroyed, 2 344 houses damaged	118 dead, 1 missing 6 injured 4 314 homeless
12.7.–23.7.	North Korea North Pyongan, South Pyongan	Floods caused by heavy seasonal rains; 6 000 houses destroyed, severe damage to farmland	51 dead 23 000 homeless
1.8.–21.8.	Pakistan Sindh,	Floods caused by heavy monsoon rains	234 dead 93 000 homeless
1.8.–4.8.	Sudan Khartoum, Gezira, Blue Nile, River Nile, White Nile, Northern	Floods; 51 572 houses destroyed, 38 669 houses damaged, 3 500 water sources contaminated, 377 schools destroyed, 103 schools damaged	76 dead 133 injured
1.8.–7.8.	Russia, China Zeya district (Amur Region)	Floods caused by heavy rains	1 500 homeless RUB 25bn (USD 761m) total damage
3.8.–4.8.	Afghanistan Kabul, East Afghanistan	Flash floods	69 dead
7.8.–14.10.	China Liaoning, Jilin, Heilongjiang	Severe floods	118 dead 260 000 homeless CNY 2.46bn (USD 406m) insured loss CNY 30bn (USD 4.96bn) total damage
10.8.–14.8.	Afghanistan Chakardar, Chak, Jaghatu	Flash floods	31 dead
13.8.–21.8.	Philippines Manila City, Luzon	Floods caused by heavy monsoon rains	27 dead, 4 missing 30 injured USD 100m insured loss PHP 97.3bn (USD 2.19bn) total damage
16.8.–17.8.	Yemen Taizz, Dhamar, Al Mahwit	Floods caused by heavy rains	40 dead

Date	Country Place	Event	Number of victims Amount of damage (where data available)
18.8.–21.8.	China Qinghai	Floods caused by heavy monsoon rains	43 dead CNY 2.8bn (USD 463m) total damage
22.8.–27.8.	India Uttar Pradesh, Madhya Pradesh, Assam	Floods caused by heavy monsoon rains	73 dead
11.9.–16.9.	United States Colorado, New Mexico	Floods; over 1 800 houses destroyed, over 5 500 houses damaged, 30 bridges swept away, 485 miles of damaged or destroyed highways	9 dead USD 100–300m insured loss USD 1.9bn total damage
15.9.–14.10.	Cambodia, Vietnam Battambang, Banteay Meancheay, Prey Veng	Floods, Mekong River burst its banks; 160 000 houses, 1 350 schools, 24 000 Km of roads damaged; 125 011 ha of rice fields destroyed	218 dead USD 2m insured loss USD 500m total damage
17.9.–14.10.	Thailand	Floods caused by heavy monsoon rains	61 dead
19.10.–22.10.	Peru Leoncio Prado	Floods caused by heavy torrential rains, Rivers Huallaga and Supte burst their banks; 71 houses destroyed	1 dead 355 injured
21.10.–28.10.	India Odisha, Andra Pradesh	Floods caused by heavy torrential rains	58 dead
14.11.–19.11.	Vietnam Binh Dinh, Quang Ngai, Quang Nam, Phu Yen, Gia Lai, Kon Tum	Tropical Depression Podul brings heavy rains and floods; water forces 10 hydroelectric power plants to release reservoir water, 410 houses destroyed, over 3 000 ha of cropland destroyed	42 dead, 5 missing 74 injured USD 65m total damage
15.11.–22.11.	Saudi Arabia, Iraq, United Arab Emirates, Oman, Bahrain	Flash floods caused by heavy torrential rains	17 dead, 10 missing
18.11.–19.11.	Italy Olbia (Sardinia)	Cyclone Cleopatra causes heavy rains and flooding	16 dead, 1 missing EUR 400m (USD 551m) total damage
20.11.–8.12.	Thailand Nakhon Si Thammarat, Songkhla, Narathiwat, Phatthalung, Trang	Floods caused by heavy rains	23 dead 15 254 homeless
1.12.–8.12.	Malaysia	Floods caused by heavy torrential rains	2 000 homeless
23.12.–31.12.	Brazil Rio de Janeiro	Floods caused by heavy torrential rains	64 dead 43 200 homeless USD 540m total damage

Storms

Date	Country Place	Event	Number of victims Amount of damage (where data available)
19.1	Portugal Abrantes	Heavy storms	1 dead 21 injured 46 homeless EUR 100m (USD 137.8m) insured loss
27.1.–2.2.	Madagascar, Seychelles	Tropical Cyclone Felleng	18 dead 2 000 homeless USD 50m total damage
29.1.–31.1.	United States TN, GA, NC, PA, VA	Thunderstorms, tornadoes, flooding	3 dead 18 injured USD 100–300m insured loss USD 300m total damage
10.2.	United States MS, SD, ND, NE,	Blizzard, EF-4 tornado	82 injured USD 100m total damage

Date	Country Place	Event	Number of victims Amount of damage (where data available)
21.2.–22.2.	Madagascar Toliary, Sakaraha	Tropical Cyclone Haruna with winds up to 200 km/h; 1 120 houses destroyed, 6 351 ha of cropland flooded	23 dead, 16 missing 84 injured 9 965 homeless USD 25m total damage
24.2.–25.2.	United States LA, TX, OK	Winter storm, heavy snowfall, tornadoes, hail	1 dead USD 600m–1bn insured loss USD 1.1bn total damage
18.3.–19.3.	United States MS, GA, AL, TN	Thunderstorms, tornadoes, hail	2 dead USD 1–3bn insured loss USD 2.2bn total damage
18.3.–20.3.	China Guangdong, Jiangxi, Hubei, Sichuan, Guizhou	Thunderstorms, hail, tornadoes	25 dead 272 injured CNY 1.31bn (USD 215m) total damage
22.3.	Bangladesh Sadar, Akhaura, Bijoynaga	Thunderstorms	35 dead
29.3.–31.3.	United States LL, TX, OK	Thunderstorms, tornadoes, hail	USD 100–300m insured loss USD 300m total damage
1.4.–3.4.	United States TX	Thunderstorms, hail, tornadoes	USD 100–300m insured loss USD 230m total damage
7.4.–11.4.	United States NE, IN, CA, KS, MO, SD, WI	Winter storm, ice, tornadoes, heavy rains	4 dead USD 1–3bn insured loss USD 1.6bn total damage
16.4.–19.4.	United States IL, IN, MO	Thunderstorms, large hail, flooding	3 dead USD 600m–1bn insured loss USD 1.1bn total damage
26.4.–28.4.	United States OK, TX	Thunderstorms, tornadoes, flooding, hail	USD 100–300m insured loss USD 300m total damage
28.4.–2.5.	China Jangxi, Guangxi	Thunderstorms, hail, heavy rains, flash floods	12 dead USD 100m total damage
8.5.–11.5.	United States Texas	Thunderstorms, large hail	USD 100–300m insured loss USD 180m total damage
13.5.–16.5.	Bangladesh, Myanmar (Burma), Sri Lanka	Cyclone Mahasen; over 20 000 houses destroyed, over 124 000 houses damaged	23 dead 116 000 homeless
15.5.–16.5.	United States Granbury (Texas)	Thunderstorms, tornadoes; 200 houses destroyed	6 dead 100 injured USD 100–300m insured loss USD 300m total damage
18.5.–22.5.	United States OK, KS, GA, IL, IA, MO, NY, TX	Severe thunderstorms, tornadoes (EF5 tornado in Moore, OK), winds up to 340 km/h, hail	28 dead 390 injured USD 1–3bn insured loss USD 3.1bn total damage
28.5.–31.5.	United States OK, TX, MO, IL, KS, NY, IN	Severe thunderstorms, tornadoes, large hail	27 dead USD 1–3bn insured loss USD 3bn total damage
28.5.–2.6.	Canada Quebec, Ontario	Thunderstorms, flash floods, one tornado	CAD 55m (USD 52m) insured loss CAD 70m (USD 66m) total damage
12.6.–14.6.	United States NA, GA, VA, IL, IN, MD, OH	Thunderstorms, tornadoes, hail, low-end derecho	4 dead USD 300–600m insured loss USD 900m total damage
20.6.–22.6.	United States Minnesota	Thunderstorms, hail, tornadoes	2 dead USD 100–300m insured loss USD 250m total damage
24.6.–27.6.	United States WI, IL, IN, OH, PA	Derecho, heavy rains, hail, tornadoes	USD 300–600m insured loss USD 450m total damage
29.6.–2.7.	China, Philippines	Typhoon Rumbia; 4 241 houses destroyed or damaged	7 dead 4 injured CNY 1.1bn (USD 182m) total damage

Tables for reporting year 2013

Date	Country Place	Event	Number of victims Amount of damage (where data available)
8.7.–9.7.	Canada Toronto, Ontario	Severe storms, flooding	CAD 944m (USD 888m) insured loss CAD 1.5bn (USD 1.41bn) total damage
9.7.–11.7.	United States OH, PA	Thunderstorms, hail, tornadoes	USD 100–300m insured loss USD 180m total damage
13.7.–15.7.	China, Taiwan, Japan	Typhoon Soulik with winds up to 220/km h, storm surge	12 dead 150 injured USD 460m total damage
19.7.	Canada Ontarion, Quebec	Thunderstorms, flooding, hail	CAD 200m (USD 188m) insured loss CAD 250m (USD 237m) total damage
19.7.–21.7.	United States SD, OH, NY, MI, PA	Flooding, Hail, Tornadoes, Wind	USD 100–300m insured loss
23.7.–24.7.	United States KS, OK	Flooding, Hail, Tornadoes, Wind	USD 100–300m insured loss USD 230m total damage
2.8.	France	Thunderstorms, hail	EUR 120m (USD 165m) insured loss
2.8.–4.8.	United States Colorado	Thunderstorms, hail, tornadoes	USD 100–300m insured loss USD 300m total damage
6.8.–7.8.	United States	Thunderstorms, hail, tornadoes	USD 600m–1bn insured loss USD 1.3bn total damage
10.8.–21.8.	China, Philippines	Tropical Storm Utor with winds up to 195km/h	97 dead, 3 missing USD 1.5bn total damage
22.8.–23.8.	United States Colorado	Thunderstorms, flash floods, hail	USD 100–300m insured loss USD 240m total damage
30.8.–1.9.	United States South Dakota	Flooding, hail, tornadoes, wind	USD 100–300m insured loss USD 260m total damage
10.9.–11.9.	New Zealand	Thunderstorms	NZD 68m (USD 55m) insured loss
12.9.–17.9.	Mexico Eastern Coast	Hurricane Ingrid	23 dead MXN 2bn (USD 153m) insured loss MXN 20bn (USD 1.53bn) total damage
13.9.–19.9.	Mexico North West Coast	Hurricane Manuel, flooding, landslides	169 dead MXN 12.4bn (USD 947m) insured loss MXN 57bn (USD 4.35bn) total damage
21.9.–26.9.	China, Philippines, Taiwan	Typhoon Usagi	25 dead CNY 23.5bn (USD 3.86bn) total damage
29.9.–7.10.	China, Japan Fujian, Zhejiang, Shanghai (China)	Typhoon Fitow	10 dead CNY 6.86bn (USD 1.13bn) insured loss CNY 62.3bn (USD 10.3bn) total damage
30.9.–2.10	Vietnam	Typhoon Wutip	11 dead, 5 missing 214 injured VND 5 000bn (USD 237m) total damage
4.10.–8.10.	Philippines Visayas, Palawan, Mindanao	Thunderstorms bring heavy rains, flooding, landslides	20 dead, 2 missing PHP 143m (USD 3m) total damage
11.10.–17.10.	Philippines, Vietnam	Typhoon Nari with winds up to 195/km h	35 dead, 5 missing 186 injured 100 000 homeless USD 151m total damage
12.10.–14.10.	India, Myanmar (Burma) Gopalpur (Odisha)	Cyclone Phailin with winds up to 200 km/h, floods; over 100 000 houses destroyed, over 3 000 000 houses damaged, 1 336 325 ha of cropland damaged, 162 430 livestock killed	58 dead USD 100m insured loss USD 4.5bn total damage
15.10.–16.10.	Japan Oshima, Honshu, Hokkaido	Typhoon Wipha	29 dead 107 injured
27.10.–29.10.	Germany, Denmark, the Netherlands, United Kingdom, Sweden, Belgium	Windstorm Christian (St Jude)	13 dead EUR 1.07bn (USD 1.45bn) insured loss EUR 2bn (USD 2.72bn) total damage

Date	Country Place	Event	Number of victims Amount of damage (where data available)
30.10.–1.11.	United States TX, OH	Thunderstorms, flash floods, tornadoes	USD 25–100m insured loss USD 90m total damage
31.10.	Philippines Luzon	Typhoon Krosa; 3 837 houses destroyed, 32 745 houses damaged	4 dead, 2 missing 1 injured 70 658 homeless PHP 279m (USD 6m) total damage
8.11.–10.11.	Philippines, Vietnam, China, Palau	Typhoon Haiyan, storm surge; >1.1 mn houses destroyed or damaged	6 284 dead, 1 061 missing 28 729 injured 4 095 280 homeless PHP 66bn (USD 1.49bn) insured loss USD 12.5bn total damage
8.11.–19.11.	Somalia (Dangorayo, Bandar Beyla, Garowe, Eyl) Puntland	Tropical cyclone causes heavy rains and flash floods; over 1 000 houses destroyed	162 dead
17.11.–18.11.	United States Illinois, Indiana, Kentucky, Michigan, Missouri, Ohio, Wisconsin	Thunderstorms, tornadoes (2 EF4) with winds up to 305 km/h, hail	11 dead 185 injured USD 600m–1bn insured loss USD 1.3bn total damage
22.11.–24.11.	India Andhra Pradesh	Cyclone Helen	10 dead USD 262m total damage
5.12.–10.12.	United States	Winter storms Cleon and Dion; heavy snow, icy rains and conditions.	20 dead USD 25–100m insured loss USD 100m total damage
5.12.–6.12.	United Kingdom, Germany, Netherlands, Norway, Sweden	Windstorm Xaver	EUR 750m (USD 1.03bn) insured loss EUR 1bn (USD 1.38bn) total damage
11.12.–14.12.	Israel, Lebanon, Jordan, Syrian Arab Republic, Egypt	Winter Storm Alexa; blizzards, icy rains, storm surge, floods	100 injured USD 100m total damage
14.12.–16.12.	China Hainan, Yunnan, Sichuan	Winter storm, floods	2 000 homeless
20.12.–26.12.	Canada, United States	Winter storm, icy rains, heavy snowfall	27 dead USD 300–600m insured loss USD 356m total damage
23.12.–25.12.	United Kingdom, France, Poland, Netherlands, Belgium	Windstorm Dirk; floods	6 dead EUR 275m (USD 379m) insured loss USD 500m total damage

Earthquakes

Date	Country Place	Event	Number of victims Amount of damage (where data available)
6.2.	Solomon Islands Santa Cruz	Earthquake M_w 8.0, tsunami	13 dead 3 329 homeless USD 36m total damage
9.4.	Iran Bushehr	Earthquake M_w 6.3; 700 houses damaged	37 dead 850 injured IRR 7 370bn (USD 297m) total damage
16.4.	Iran, Pakistan	Earthquake M_w 7.8	36 dead 1 500 homeless
20.4.	China Lushan (Sichuan Province)	Earthquake M_w 7.0	196 dead, 21 missing 13 484 injured USD 25m insured loss USD 6.8bn total damage
24.4.	Afghanistan Mehtar Lam	Earthquake M_w 5.5	18 dead 110 injured

Date	Country Place	Event	Number of victims Amount of damage (where data available)
2.7.	Indonesia Aceh (Sumatra)	Earthquake M_w 6.2, landslides; 7 766 houses destroyed, 10 111 houses damaged	42 dead, 6 missing 558 injured 53 403 homeless IDR 1 380bn (USD 113m) total damage
22.7.	China Gansu	Earthquake M_w 6.6; 402 houses destroyed, 5 630 houses damaged	75 dead, 14 missing 604 injured 27 300 homeless USD 466m total damage
24.9.–28.9.	Pakistan Awaran (Balochistan)	Earthquakes M_w 7.7 and M_w 6.8, aftershocks; 32 368 houses destroyed, 14 118 houses damaged	399 dead 599 injured 185 150 homeless USD 100m total damage
15.10.	Philippines Catigbian	Earthquake M_w 7.2; 13 249 houses destroyed, 53 683 houses damaged	222 dead, 8 missing 796 injured 87 146 homeless USD 20m insured loss USD 100m total damage
22.11.–23.11.	China Changling (Jilin)	Earthquake M_w 5.5, series of aftershocks; 310 houses destroyed, 36 000 houses damaged	16 000 homeless
28.11.	Iran Borazjan	Earthquake M_w 5.6; > 250 houses destroyed	8 dead 210 injured
1.12.	China Keping County (Xinjiang)	Earthquake M_w 5.3; 468 houses destroyed or damaged	2 000 homeless

Droughts, bush fires, heat waves

Date	Country Place	Event	Number of victims Amount of damage (where data available)
1.1.–1.5.	New Zealand North Island	Drought impacts milk production	NZD 1bn (USD 823m) total damage
4.1.–10.1.	Australia Tasmania	Wildfires triggered by high temperatures and dry weather conditions	AUD 89m (USD 80m) insured loss AUD 110m (USD 98m) total damage
5.1.–11.1.	Sierra Leone Bo, Moyamba, Bonthe, Port Loko	Wildfires fuelled by Harmattan wind; 279 houses destroyed	2 257 homeless
1.4.–30.5.	India	Heat wave	531 dead
11.6.–16.6.	United States Colorado	The Black Forest Fire; 511 houses destroyed	2 dead USD 300–600m insured loss USD 500m total damage
1.7.–15.8.	China Shanghai	Heat wave	40 dead
6.8.–14.8.	United Kingdom England, Wales	Heat wave	760 dead
17.10.–27.10.	Australia Blue Mountains (New South Wales)	Bushfires; over 200 houses destroyed, over 110 houses damaged	2 dead AUD 183m (USD 164m) insured loss AUD 300m (USD 268m) total damage

Cold, frost

Date	Country Place	Event	Number of victims Amount of damage (where data available)
1.1.–23.1.	India, Bangladesh, Nepal	Cold wave	388 dead
7.1.–9.1.	Israel, Jordan, Lebanon, Turkey	Winter Storm, blizzard, flooding	17 dead USD 100m total damage
7.2.–9.2.	United States, Canada NY, MA, CT, RI,	Winter Storm (Nor'easter) Nemo	17 dead USD 100m total damage
12.3.–31.3.	France, United Kingdom, Belgium, Hungary, Russia, Poland	Winter weather, blizzards, heavy snowfall, icy conditions	30 dead EUR 101m (USD 139m) insured loss USD 1bn total damage
24.8.–30.8.	Peru Puno, Cusco, Ayacucho, Apurimac	Heavy snowfall, freezing temperatures; 872 houses destroyed, 6 259 houses damaged, 26 640 livestock dead	275 dead 5 247 homeless

Hail

Date	Country Place	Event	Number of victims Amount of damage (where data available)
29.4.	United States Iowa	Hailstorm	USD 25–100m insured loss USD 110m total damage
17.6.	France Touraine	Hailstorm	EUR 295m (USD 407m) insured loss
20.6.	Germany	Hailstorms	EUR 600m (USD 827m) insured loss
20.6.–21.6.	Switzerland Geneva, Lausanne	Thunderstorms, hail	84 injured CHF 100m (USD 112m) insured loss
27.7.–28.7.	Germany, France Baden-Wurttemberg	Hailstorms	EUR 2.79bn (USD 3.84bn) insured loss EUR 3.5bn (USD 4.82bn) total damage
6.8	France, Rhône-Alpes	Large hail, thunderstorms	EUR 70m (USD 96m) insured loss EUR 110m (USD 152m) total damage
6.8.	Germany Saxony, Baden-Württemberg	Hailstorms	EUR 500m (USD 689m) insured loss
28.11	South Africa Gauteng	Hailstorms	ZAR 1.2bn (USD 115m) insured loss ZAR 3bn (USD 286m) total damage

Other natural catastrophes

Date	Country Place	Event	Number of victims Amount of damage (where data available)
11.1.	China Zhenxiong (Yunnan)	Landslide; 35 houses destroyed, 928 houses damaged	46 dead CNY 46m (USD 8m) total damage
25.1.	Indonesia	Landslide	21 dead
12.2.	United Kingdom Stainforth	Landslide destroyes part of railway	GBP 81m (USD 134m) insured loss
15.2.	Russia Chelyabinsk	Shock wave caused by meteorite; 3 000 buildings damaged including 361 schools	1 200 injured RUB 1bn (USD 30m) total damage

Table 8
Chronological list of all man-made disasters in 2013

Major fires, explosions

Date	Country Place	Event	Number of victims Amount of damage (where data available)
1.1.	South Africa Cape Town	Fire at shanty town	3 dead 1 injured 4 000 homeless
6.1.	Benin Alloya	Fire at a house spreads	1 dead 2 759 homeless
8.1.	South Africa Johannesburg	Fire at plastic factory	
11.1.	Nigeria Arepo (Ogun State)	Fire and explosion at an oil pipeline fire, probably caused by suspected vandals	30 dead
12.1.	United Kingdom Ellesmere Port	Fire and explosion at oil refinery	
16.1.	Egypt Alexandria	Residential building collapses	25 dead 12 injured
26.1.	Bangladesh Dhaka	Fire at garment factory	7 dead 50 injured
27.1.	Brazil Santa Maria	Fire at nightclub ignited by fireworks on stage, stampede	235 dead 100 injured USD 5m total damage
30.1.	United States Burlington (Wisconsin)	Fire at food processing plant	
31.1.	Mexico Mexico City	Gas explosion at 51-storey office building	37 dead 100 injured
4.2.	India Bombay	Building under construction collapses	72 dead
4.3.	Italy Naples	Fire destroys museum	
11.3.	Oman Sohar	Fire at refinery	
29.3.	Ukraine Svitlodarske	Fire at coal-fired power plant	1 dead 8 injured
30.3.	Tanzania Dar es Salaam	Multi-storey building under construction collapses	36 dead
31.3.	United States Arkansas	Accident at nuclear power plant	1 dead 8 injured
2.4.	Argentina La Plata	Large fire at refinery	
4.4.	United States Euharlee (Atlanta)	Explosion at coal-fired power plant	
6.4.	India Thane	Illegal residential building collapses	74 dead
17.4.	United States West (TX)	Explosion at fertiliser plant; 140 nearby homes destroyed	15 dead 200 injured USD 200m total damage
24.4.	Bangladesh Dhaka	Eight-storey building housing garment factories collapses	1 127 dead 1 200 injured
26.4.	Russia Ramensky	Fire at a psychiatric hospital	38 dead
3.5.	South Korea Ahnsung City	Fire at food processing plant	
28.5.	Philippines Batangas	Fire at gas plant	

Date	Country Place	Event	Number of victims Amount of damage (where data available)
3.6.	China Baoyuan (Dehui, Jilin)	Fire at poultry slaughterhouse	119 dead 77 injured
4.6.	Netherlands Oldenzaa	Fire at bakery	
13.6.	United States Geismar, Louisiana	Explosion and fire at a petrochemical plant	2 dead 76 injured
29.6.	United States Chandler (Arizona)	Gas leak at electronics manufacturing plant	54 injured
6.7.–6.7.	Ivory Coast	Fire at cosmetics plant	
22.7.–23.7.	France Phalsbourg	Fire at particleboard plant	
14.8.	Thailand Map Ta Phut	Explosion at gas plant	
23.8.	India Visakhapatnam (Andhra Pradesh)	Explosion and fire at refinery	2 dead 37 injured
4.9.	China Wuxi	Fire at major high-tech semiconductor plant	1 injured
6.9.	Netherlands Zevenaar	Fire at plastic plant	
13.9.	Russia Luka-Oksochi (Novgorod)	Fire at timber-built psychiatric hospital	37 dead
17.9.–18.9.	Russia Sergiev Posad	Damage at hydroelectric power	
21.9.	United States West Virginia	Explosion and fire at a natural gas plant	
27.9.	India Mumbai	Fve-story building collapses	61 dead 32 injured
8.10.	Bangladesh Gazipur	Fire at garment factory	7 dead 50 injured
9.10.	Sri Lanka Puwakpitiya	Burst causes leak at chlorine pipeline	200 injured
12.10.	Vietnam Phu Tho province (Thanh Ba district)	Explosion at military-run fireworks factory; 6 nearby houses destroyed, 877 houses damaged	24 dead 97 injured
22.10.	Sri Lanka Piliyandala	Gas leak at chemical factory	72 injured
24.10.	Mexico Ciudad Juarez	Explosion at candy factory	1 dead 51 injured
27.10.	Mexico Tabasco	Explosion at oil rig	
2.11.	France Fos-sur-Mer	Fire at incinerator	
18.11.	United States Carson (CA)	Sulphuric acid leak at a chemical plant	70 injured
21.11.	Latvia Riga	Roof of supermarket collapses during shopping hours	54 dead 29 injured
22.11.	China Qingdao	Explosion and fire at oil pipeline during repair works following a leak; damage to nearby vehicles and buildings	62 dead 136 injured CNY 750m (USD 124m) total damage
4.12.	Uganda Kampala	Fire destroys market building and triggers riots among the traders	81 injured
24.12.	Canada Saskatchewan	Fire at refinery	

Aviation disasters

Date	Country Place	Event	Number of victims Amount of damage (where data available)
29.1.	Kazakhstan Almaty	Canadair CRJ-200 crashes on landing	21 dead
1.2.	Space Pacific Ocean	Zenit-3SL rocket carrying the Boeing-built Intelsat 27 satellite plunges into sea shortly after take-off	
13.4.	Indonesia Bali	Lion Air Boeing 737-800 lands on water	22 injured
29.4.	Afghanistan Bagram	National Airlines Boeing 747-428BCF crashes during take-off	7 dead
2.7.	Space Baikonur (Kazakhstan)	Russian Proton-M rocket carrying 3 Glonass satellites crashes shortly after launch	RUB 6bn (USD 183m) total damage
6.7.	United States San Francisco	Asiana Airlines Boeing 777-28EER crashes on landing	3 dead 182 injured
14.8.	United States Birmingham Airport (AL)	UPS Airbus A300F4-622R crashes on landing	2 dead
16.10.	Lao People's Democratic Republic Pakse	Lao Airlines ATR-72 crashes in bad weather	49 dead
17.11.	Russia Kazan	Tatarstan Airlines Boeing 737-53A crashes on landing	50 dead
29.11.	United Kingdom Glasgow	Helicopter crashes on a pub	10 dead
29.11.	Namibia Bwabwata National Park	Linhas Aéreas de Moçambique Embraer ERJ-190AR crashes	33 dead

Maritime disasters

Date	Country Place	Event	Number of victims Amount of damage (where data available)
4.1.	Tanzania Lake Tanganyika	Boat capsizes	28 dead
9.1.	United States New York	Commuter ferry crashes against pier near Wall Street	57 injured
27.1.	North Pacific Ocean, Japan	Other maritime accidents	20 dead
16.3.	Indian Ocean, Comoros Mayotte	Fishing vessel sinks	35 dead
21.3.	South Atlantic, Gabon Libreville	Boat carryng migrants sinks	30 dead
21.3.	North Atlantic, Nigeria Malabo	Passenger ship capsizes	99 dead
24.3.	North Atlantic, Senegal Saint-Louis	Boat capsizes	23 dead
19.4.	Brazil Marajo Island	Boat capsizes on Amazon River	27 dead
13.5.	Indian Ocean, Myanmar (Burma) Pauktaw (Rakhine State)	Boat carrying evacuees ahead of Cyclone Mahasen capsizes	150 dead

Date	Country Place	Event	Number of victims Amount of damage (where data available)
28.5.	Indian Ocean, Malaysia Borneo	Boat capsizes	23 dead
14.6.	Indian Ocean, India	Boat capsizes	27 dead
17.6.	Indian Ocean, Bahrain	Mol Comfort cargo vessel catches fire and breaks in two	USD 300m total damage
1.7.	Angola Cabinda	Jack up sinks during pipeline laying in Congo River	1 dead
23.7.	Gulf of Mexico, United States Timbalier Bay	Blowout at oil rig	
1.8.	North Pacific Ocean, Russia Sea of Okhotsk	Blowout at oil rig	
3.8.	North Pacific Ocean, Malaysia Johor	Boat carrying pilgrims capsizes	40 dead
17.8.	North Pacific Ocean, Philippines Cebu	Passenger ferry collides with cargo ship	112 dead, 25 missing
7.9.	South Atlantic, Brazil Ponta da Madeira	Bulk carrier runs aground	
18.9.	Indian Ocean, South Africa Richards Bay	Bulk carrier runs aground and breaks in two	
21.9.	Red Sea, Saudi Arabia Yanbu	Fire on desalination barge	
3.10.	Mediterranean Sea, Italy Lampedusa	Boat carrying immigrants catches fire and capsizes	366 dead
11.10.	Mediterranean Sea, Malta Malta	Boat carrying immigrants capsizes	27 dead
12.10.	Mali Mopti	Passenger boat capsizes on the Niger River	72 dead 11 injured
25.11.	North Atlantic, Bahamas Harvey Cays	Overcrowded boat carrying immigrant runs aground and capsizes	5 dead, 25 missing
29.11.	North Pacific Ocean, Hong Kong Hong Kong	High-speed ferry collides with unidentified object	87 injured

Rail disasters, including cableways

Date	Country Place	Event	Number of victims Amount of damage (where data available)
14.1.	Egypt Cairo	Military train carrying army recruits derails	19 dead 120 injured
17.5.	United States Fairfield (Connecticut)	Passenger train derails and collides with an outbound train	72 injured
13.6.	Argentina Buenos Aires	Two commuter trains collide	3 dead 300 injured
7.7.	Canada Lac-Megantic (Quebec)	Train carrying crude oil derails and explodes; 40 nearby buildings destroyed	47 dead CAD 250m (USD 235m) total damage
7.7.	Russia Kislyakovskaya (Krasnodar)	Passenger train derails	70 injured

Date	Country Place	Event	Number of victims Amount of damage (where data available)
12.7.	France Brétigny-sur-Orge	Passenger train derails and hits the station platform	6 dead 192 injured
24.7.	Spain Santiago de Compostela	Passenger train derails	79 dead 140 injured EUR 100m (USD 138m) total damage
19.8.	India Dhamara Ghat	Train kills pilgrims crossing tracks	37 dead 24 injured
11.10.	United States Randolph County (West Virginia)	Logging truck collides with a passenger train	1 dead 67 injured
19.10.	Argentina Buenos Aires	Commuter train crashes at rail stop	105 injured
18.11.	Egypt Dahshur	Freight train crashes into several vehicles	29 dead 30 injured
1.12.	United States New York	Passenger train derails	4 dead 67 injured
9.12.	Indonesia Jakarta	Commuter train collides with truck hauling fuel	6 dead 59 injured

Mining accidents

Date	Country Place	Event	Number of victims Amount of damage (where data available)
13.3.	China Jilin	Gas explosion at coal mine	36 dead
29.3.	China Baishan (Jilin)	Explosion at coal mine	28 dead
29.3.	China Maizhokunggar (Tibet)	Massive landslide at gold mine	66 dead, 17 missing
10.4.	United States Utah	Collapse of pit wall at copper mine due to landslide	
2.5.	Sudan Jebel Amir (North Darfur)	Collpase of gold mine	109 dead
11.5.	China Anshun (Guizhou)	Explosion at coal mine	27 dead
14.5.	Indonesia Papua province	Tunnel collapes at gold and copper mine	28 dead
23.6.	Central African Republic Ndassima	Explosion at gold mine	62 dead
14.9.	Afghanistan Ruyi Du Ab (Samangan)	Gas explosion at coal mine	28 dead 17 injured
20.11.	Guinea Siguiri	Landslide at an illegal goldmine	25 dead
13.12.	China Hutubi (Xinjiang Uygur)	Gas explosion at coal mine	21 dead

Collapse of building/bridges

Date	Country Place	Event	Number of victims Amount of damage (where data available)
7.8.	Argentina Rosario	Gas leak causes explosion at 10-story residential building	21 dead 60 injured

Miscellaneous

Date	Country Place	Event	Number of victims Amount of damage (where data available)
1.1.	Pakistan Karachi	Bomb explosion at politcal party rally	4 dead 50 injured
1.1.	Ivory Coast Abidjan	Stampede at New Year's Eve fireworks display at a stadium	61 dead 200 injured
10.1.	Pakistan Quetta	Series of suicide bombing attacks	126 dead 270 injured
16.1.–19.1.	Algeria Amenas	Siege and mass shooting at gas plant	69 dead
21.1.–23.1.	Nigeria	Series of mass shootings against civilians	31 dead
25.1.	Venezuela Uribana	Prison riots	54 dead 100 injured
25.1.	Egypt Suez	Anti-government demonstrations on 2nd Revolution anniversary	7 dead 545 injured
26.1.	Egypt Port Said	Clashes over football verdict related to football riots	22 dead 200 injured
1.2.	Pakistan Hangu	Suicide bomb explosion outside a mosque	27 dead 55 injured
10.2.	India Allahabad	Stampede at railway station during religious festival	36 dead 39 injured
16.2.	Pakistan Quetta	Bomb explosion at market	84 dead 169 injured
21.2.	India Hyderabad	Two blasts at city's crowded intersections	17 dead 100 injured
28.2.	Bangladesh	Clashes between opposite factions over sentence of party leader	44 dead
3.3.	Pakistan Karachi	Bomb explosions outside a prayer hall	48 dead 180 injured
18.3.	Nigeria Kano	Suicide bomb attack at bus station	41 dead 44 injured
22.3.	Nigeria Ganye	Simultaneous gun attacks at a bank and a local bar	25 dead
14.4.	Somalia Mogadishu	Suicide bomb attacks at Supreme Court building	35 dead 40 injured
15.4.	United States Boston	Two bomb explosions at finishing line of marathon	3 dead 264 injured
16.4.	Pakistan Balochistan	Suicide bomb attack at political rally	22 dead 49 injured
6.5.	Pakistan Kurram Agency	Bomb explosion at political gathering	25 dead 65 injured
20.5.	Russia Makhachkala	Two car bombs detonated outside court marhsal building	4 dead 52 injured
22.5.	Niger Arlit	Suicide bomb explosion at uranium mine	35 dead 14 injured
25.5.	India Darbha valley	Attack at convoy of political party leaders	27 dead 32 injured

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Date	Country Place	Event	Number of victims Amount of damage (where data available)
18.6.	Pakistan Khyber Pakhtunkhwa	Suicide bomb explosion at funeral	34 dead 52 injured
26.6.	China Xinjiang	Attacks against police officers	27 dead
30.6.	Pakistan Quetta	Suicide bomb explosion at a mosque	30 dead 65 injured
6.7.	Nigeria Mamudo (Yobe)	Gunmen attacks at secondary school	42 dead
8.8.	Pakistan Quetta	Suicide bomb explosion at funeral	37 dead 50 injured
13.8.	Nigeria Kane	Mass killing at mosque	44 dead 26 injured
15.8.	Lebanon Beirut	Bomb explosions at residential compound	20 dead 200 injured
7.9.	Somalia Mogadishu	Car explosion outside restaurant	30 dead 50 injured
21.9.	Kenya Nairobi	Mass shooting at shopping mall	72 dead 172 injured KES 10bn (USD 116m) total damage
24.9.	Pakistan Peshawar	Suicide bomb explosions outside church	85 dead 100 injured
29.9.	Nigeria Gujba (Yobe)	Mass shooting at college dormitory	44 dead
13.10.	India Ratangarh (Datia District, Madhya Pradesh)	Stampede at temple during religious festival	115 dead 100 injured
17.10.–20.10.	Libyan Arab Jamahiriya Ajdabiya	Egyptian truck drivers taken hostage	80 injured
19.11.	Lebanon Beirut	Sucide bomb attacks at Iranian embassy	23 dead 160 injured
24.11.–29.11.	Bangladesh	Clashes between opposition activists and law enforcers; damange to vehicles, locomotives, government offices and rail tracks	17 dead 100 injured
24.11.	Bangladesh Dhaka	Clashes between garment workers and police, following attack to fire station; damage to nearby vehicles	53 injured
26.11.	Nigeria Barkin Ladi (Plateau)	Gunmen attack four village	40 dead
30.11.–2.12.	Thailand Bangkok	Anti-government demonstrations	3 dead 127 injured
2.12.–3.12.	Argentina Cordoba	Riots and looting during police strike	1 dead 60 injured
27.12.	Lebanon Beirut	Car bomb strikes convoy of former politician and ambassador	8 dead 70 injured
29.12.	Russia Volgograd	Bomb attack at railway station	18 dead 54 injured
30.12.	Russia Volgograd	Bomb explosion on trolley-bus	15 dead 50 injured

Table 9
The 40 most costly insured loss events (1970–2013)

Insured loss[28] (in USD m, indexed to 2013)	Victims[29]	Date (start)	Event	Country
80 373	1 836	25.08.2005	Hurricane Katrina; storm surge, levee failure, damage to oil rigs	US, Gulf of Mexico, Bahamas, North Atlantic
37 665	19 135	11.03.2011	Earthquake (M_w 9.0) triggers tsunami; aftershocks	Japan
36 890	237	24.10.2012	Hurricane Sandy; storm surge	US et al
27 594	43	23.08.1992	Hurricane Andrew; floods	US, Bahamas
25 664	2 982	11.09.2001	Terror attack on WTC, Pentagon and other buildings	US
22 857	61	17.01.1994	Northridge earthquake (M* 6.6)	US
22 751	136	06.09.2008	Hurricane Ike; floods, offshore damage	US, Caribbean: Gulf of Mexico et al
17 218	181	02.09.2004	Hurricane Ivan; damage to oil rigs	US, Caribbean; Barbados et al
16 519	124	27.07.2011	Floods caused by heavy monsoon rains	Thailand
16 142	815	22.02.2011	Earthquake (M_w 6.3), aftershocks	New Zealand
15 570	35	19.10.2005	Hurricane Wilma; floods	US, Mexico, Jamaica, Haiti et al
12 510	34	20.09.2005	Hurricane Rita; floods, damage to oil rigs	US, Gulf of Mexico, Cuba
11 594	123	15.07.2012	Drought in the Corn Belt	US
10 313	24	11.08.2004	Hurricane Charley; floods	US, Cuba, Jamaica et al
10 031	51	27.09.1991	Typhoon Mireille/No 19	Japan
8 924	71	15.09.1989	Hurricane Hugo	US, Puerto Rico et al
8 876	562	27.02.2010	Earthquake (M_w 8.8) triggers tsunami	Chile
8 648	95	25.01.1990	Winter storm Daria	France, UK, Belgium, Netherlands et al
8 426	110	25.12.1999	Winter storm Lothar	Switzerland, UK, France et al
7 856	354	22.04.2011	Severe torms, tornadoes	United States (Alabama et al)
7 587	155	20.05.2011	Severe storms, tornadoes	United States (Missouri et al)
7 112	54	18.01.2007	Winter storm Kyrill; floods	Germany, UK, Netherlands et al
6 602	22	15.10.1987	Storm and floods in Europe	France, UK, Netherlands et al
6 593	38	26.08.2004	Hurricane Frances	US, Bahamas
6 274	55	22.08.2011	Hurricane Irene, extensive flooding	United States et al
5 909	64	25.02.1990	Winter storm Vivian	Europe
5 869	26	22.09.1999	Typhoon Bart/No 18	Japan
5 548	–	04.09.2010	Earthquake (M_w 7.0), over 300 aftershocks	New Zealand
5 240	600	20.09.1998	Hurricane Georges; floods	US, Caribbean
4 925	41	05.06.2001	Tropical storm Allison; floods	US
4 872	3 034	13.09.2004	Hurricane Jeanne; floods, landslides	US, Caribbean: Haiti et al
4 593	45	06.09.2004	Typhoon Songda/No 18	Japan, South Korea
4 216	45	02.05.2003	Thunderstorms, tornadoes, hail	US
4 134	25	27.05.2013	Floods: damage to infrastructure and farmland	Germany, Czech Republic, Austria et al
4 100	70	10.09.1999	Hurricane Floyd; heavy rain, floods	United States, Bahamas, Colombia
3 979	59	01.10.1995	Hurricane Opal; floods	United States, Mexico, Gulf of Mexico
3 926	6 425	17.01.1995	Great Hanshin earthquake (M 7.2) in Kobe	Japan
3 838	–	27.07.2013	Hailstorms	Germany, France
3 487	45	27.12.1999	Winter storm Martin	Spain, France, Switzerland, Italy
3 406	25	24.01.2009	Winter storm Klaus, winds up to 170 km/h	France, Spain

* M = moment magnitude

[28] Property and business interruption, excluding liability and life insurance losses; US natural catastrophe figures: based on Property Claim Services (PCS)/incl. NFIP losses (see page 45 "Terms and selection criteria")
[29] Dead and missing

Table 10
The 40 worst catastrophes in terms of number of victims (1970–2013)

Victims[30]	Insured loss[31] (in USD m, indexed to 2013)	Date (start)	Event	Country
300 000	–	14.11.1970	Storm and flood catastrophe	Bangladesh, Bay of Bengal
255 000	–	28.07.1976	Earthquake (M_w 7.5)	China
222 570	111	12.01.2010	Earthquake (M_w 7.0)	Haiti
220 000	2 562	26.12.2004	Earthquake (M_w 9), tsunami in Indian Ocean	Indonesia, Thailand et al
138 300	–	02.05.2008	Tropical cyclone Nargis; Irrawaddy Delta floods	Myanmar (Burma), Bay of Bengal
138 000	4	29.04.1991	Tropical cyclone Gorky	Bangladesh
87 449	412	12.05.2008	Earthquake (M_w 7.9) in Sichuan, aftershocks	China
73 300	–	08.10.2005	Earthquake (M_w 7.6); aftershocks, landslides	Pakistan, India, Afghanistan
66 000	–	31.05.1970	Earthquake (M 7.7); rock slides	Peru
55 630		15.06.2010	Heat wave in Russia	Russia
40 000	213	21.06.1990	Earthquake (M 7.7); landslides	Iran
35 000	1 659	01.06.2003	Heat wave and drought in Europe	France, Italy, Germany et al
26 271	–	26.12.2003	Earthquake (M 6.5) destroys 85% of Bam	Iran
25 000	–	07.12.1988	Earthquake (M 6.9)	Armenia, ex-USSR
25 000	–	16.09.1978	Earthquake (M 7.7) in Tabas	Iran
23 000	–	13.11.1985	Volcanic eruption on Nevado del Ruiz	Colombia
22 084	319	04.02.1976	Earthquake (M 7.5)	Guatemala
19 737	137	26.01.2001	Earthquake (M_w 7.6) in Gujarat	India, Pakistan, Nepal et al
19 184	35 665	11.03.2011	Earthquake (M_w 9.0) triggers tsunami	Japan
19 118	1 453	17.08.1999	Earthquake (ML* 7) in Izmit	Turkey
15 000	–	11.08.1979	Macchu dam bursts in Morvi	India
15 000	–	01.09.1978	Floods following monsoon rains in the North	India, Bangladesh
15 000	145	29.10.1999	Cyclone 05B devastates Orissa state	India, Bangladesh
11 069	–	25.05.1985	Tropical cyclone in Bay of Bengal	Bangladesh
10 800	–	31.10.1971	Floods in Bay of Bengal and Orissa state	India
10 000	320	12.12.1999	Floods, mudflows, and landslides	Venezuela, Colombia
10 000	–	20.11.1977	Tropical cyclone in Andhra Pradesh	India, Bay of Bengal
9 500	724	19.09.1985	Earthquake (M 8.1)	Mexico
9 475	–	30.09.1993	Earthquake (M 6.4) in Maharashtra	India
9 000	742	22.10.1998	Hurricane Mitch in Central America	Honduras, Nicaragua et al
7 345	1 486	08.11.2013	Typhoon Haiyan	Philippines, Vietnam, China, Palau
7 079	–	17.08.1976	Earthquake (M 7.9), tsunami in Moro Gulf	Philippines
6 425	3 724	17.01.1995	Great Hanshin earthquake (M_w 7.2) in Kobe	Japan
6 304	–	05.11.1991	Typhoon Thelma	Philippines
6 000	–	02.12.1984	Accident in chemical plant in Bhopal	India
6 000	–	01.06.1976	Heat wave, drought	France
5 749	46	27.05.2006	Earthquake (ML 6.3); Bantul almost destroyed	Indonesia
5 748	500	14.06.2013	Floods	India
5 422	–	25.06.2013	Earthquake (M 7.1)	Indonesia
5 734	–	10.04.1972	Earthquake (M 6.9) in Fars	Iran

* ML = local magnitude scale

Terms and selection criteria

A natural catastrophe is caused by natural forces.

Natural catastrophes
The term 'natural catastrophe' refers to an event caused by natural forces. Such an event generally results in a large number of individual losses involving many insurance policies. The scale of the losses resulting from a catastrophe depends not only on the severity of the natural forces concerned, but also on man-made factors, such as building design or the efficiency of disaster control in the afflicted region. In this *sigma* study, natural catastrophes are subdivided into the following categories: floods, storms, earthquakes, droughts/forest fires/heat waves, cold waves/frost, hail, tsunamis, and other natural catastrophes.

A man-made or technical disaster is triggered by human activities.

Man-made disasters
This study categorises major events associated with human activities as 'man-made' or 'technical' disasters. Generally, a large object in a very limited space is affected, which is covered by a small number of insurance policies. War, civil war, and war-like events are excluded. *sigma* subdivides man-made disasters into the following categories: major fires and explosions, aviation and space disasters, shipping disasters, rail disasters, mining accidents, collapse of buildings/bridges, and miscellaneous (including terrorism). In Tables 7 and 8 (pages 28–42), all major natural catastrophes and man-made disasters and the associated losses are listed chronologically.

Losses due to property damage and business interruption that are directly attributable to major events are included in this study.

Economic/total losses
For the purposes of the present *sigma* study, economic or total losses are all the financial losses directly attributable to a major event, ie damage to buildings, infrastructure, vehicles etc. The term also includes losses due to business interruption as a direct consequence of the property damage. Insured losses are gross of any reinsurance, be it provided by commercial or government schemes. A figure identified as "total damage" includes all damage, insured and uninsured. Total loss figures do not include indirect financial losses – ie loss of earnings by suppliers due to disabled businesses, estimated shortfalls in gross domestic product, and non-economic losses, such as loss of reputation or impaired quality of life.

The amount of the total losses is a general indication only.

Generally, total (or economic) losses are estimated and communicated in very different ways. As a result, they are not directly comparable and should be seen only as an indication of the general order of magnitude.

The term 'losses' refer to insured losses, but do not include liability.

Insured losses
Losses refer to all insured losses except liability. Leaving aside liability losses, allows a relatively swift assessment of the insurance year. However, it tends to understate the cost of man-made disasters. Life insurance losses are also not included.

NFIP flood damage in the US is included.

NFIP flood damage in the US
The *sigma* catastrophe database also includes flood damage covered by the National Flood Insurance Program (NFIP) in the US, provided that it fulfils the *sigma* selection criteria.

Selection criteria

sigma has been publishing tables listing major losses since 1970. Thresholds with respect to casualties – the number of dead, missing, severely injured, and homeless – also make it possible to tabulate events in regions where the insurance penetration is below average.

Thresholds for insured losses and casualties in 2013

For the 2013 reporting year, the lower loss thresholds were set as follows:

Insured losses (claims):

Maritime disasters	USD 19.3 million
Aviation	USD 38.6 million
Other losses	USD 48.0 million

or Total losses: USD 96.0 million

or Casualties:

Dead or missing	20
Injured	50
Homeless	2 000

Adjustment for inflation, changes to published data, information

Losses are determined using year-end exchange rates and are then adjusted for inflation.

sigma converts all losses for the occurrence year not given in USD into USD using the end-of-year exchange rate. To adjust for inflation, these USD values are extrapolated using the US consumer price index to give current (2013) values.

This can be illustrated by examining the insured property losses arising from the floods which occurred in the UK between 29 October and 10 November 2000:

Insured loss at 2000 prices: USD 1 045.7million

Insured loss at 2013 prices: USD 1 392.8 million

Alternatively, were one to adjust the losses in the original currency (GBP) for inflation and then convert them to USD using the current exchange rate, one would end up with an insured loss at 2013 prices of USD 1 568 million, 13% more than with the standard *sigma* method. The reason for the difference is that the value of the GBP rose by almost 9% against the USD in the period 2000–2013, ie more than the difference in inflation between the US (33.3%) and the UK (35.6%) over the same period.

Figure 14
Alternative methods of adjusting for inflation, by comparison

Floods UK		**Exchange rate**		**US inflation**
29 October–10 November 2000	GBPm	USD/GBP	USDm	USDm
Original loss	700.0	1.492	1 044.5	1 044.5
Level of consumer price index 2000	93.1			172.2
Level of consumer price index 2013	126.1			229.6
Inflation factor	1.356			1.333
Adjusted for inflation to 2013	948.9	1.653	1 568.3	1 392.8
Comparison			113%	100%

Changes to loss amounts of previously published events are updated in the *sigma* database.

If changes to the loss amounts of previously published events become known, *sigma* takes these into account in its database. However, these changes only become evident when an event appears in the table of the 40 most costly insured losses or the 40 disasters with the most fatalities since 1970 (See Tables 9 and 10 on pages 43–44).

Only public information used for man-made disasters

In the chronological lists of all man-made disasters, the insured losses are not shown for data protection reasons. However, the total of these insured losses is included in the list of major losses in 2013 according to loss category. *sigma* does not provide further information on individual insured losses or about updates made to published data.

Newspapers, direct insurance and reinsurance periodicals, specialist publications and other reports are used to compile this study.

Sources

Information is collected from newspapers, direct insurance and reinsurance periodicals, specialist publications (in printed or electronic form) and reports from insurers and reinsurers.[30] In no event shall Swiss Re be liable for any loss or damage arising in connection with the use of this information (see the copyright information on page 49).

Exchange rate (per USD), 17 national currencies

Country	Currency	Exchange rate, end 2013
Argentina	ARS	6.5200
Australia	AUD	1.1178
Canada	CAD	1.0625
Switzerland	CHF	0.8892
China,P.R.C.	CNY	6.0540
Europe	EUR	0.7257
United Kingdom	GBP	0.6039
Indonesia	IDR	12165.0000
Iran	IRR	24799.0000
Kenya	KES	86.3000
Mexico	MXN	13.0965
New Zealand	NZD	1.2153
Philippines	PHP	44.4100
Russia	RUB	32.8585
Saudi Arabia	SAR	3.7505
South Africa	ZAR	10.4738
US	USD	1.0000
Vietnam	VND	2108.0000

[30] Natural catastrophes in the US: those *sigma* figures which are based on estimates of Property Claim Services (PCS), a unit of the Insurance Services Office, Inc (ISO), are given for each individual event in ranges defined by PCS. The estimates are the property of ISO and may not be printed or used for any purpose, including use as a component in any financial instruments, without the express consent of ISO.

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