Munich RE

TOPICS GEO

Natural catastrophes 2010
Analyses, assessments, positions

Table of contents

In the spring of 2010, Eyjafjallajökull erupted several times in Iceland, spouting vast amounts of volcanic ash into the atmosphere. The ash cloud drifted southeast towards continental Europe, leading to flight bans over large parts of Europe and causing unprecedented chaos in air traffic.

Editorial

Fire, water, earth and air – the four basic elements have seldom been so destructive as in 2010. Wildfires in Russia, the devastating flood in Pakistan, major earthquakes in Haiti, Chile, China and New Zealand, and Winter Storm Xynthia caused losses worth billions and destroyed the homes and possessions of millions of people. Although the hurricane season proved extremely active as predicted, it did not cause any major losses, but that was only due to the fortunate circumstance that the hurricanes followed a less destructive track.

All in all, 2010 was the year with the second-highest number of loss-related natural catastrophes, 2007 being the highest, since we began keeping global statistics in 1980. With 960 loss events due to natural hazards, the number of catastrophes documented in 2010 far exceeded the average for the last ten years (785 events). The overall economic loss amounted to some US$ 150bn, with earthquakes alone accounting for almost one-third of this total. Altogether, the insurance industry had to shoulder losses in the order of US$ 37bn for natural catastrophes worldwide in 2010.

Australia's east coast was hit by severe floods from the end of 2010 to mid-January 2011, primarily affecting coal mining areas in Central Queensland around the turn of the year, and the city of Brisbane from the beginning of January 2011. Overall losses amount to several billion US dollars and the insured losses are also significant. The amounts are subject to considerable uncertainties due to the complexity of the event and unresolved coverage issues relating to the insured losses.

Following the disappointing outcome of the climate negotiations in Copenhagen, progress was once again made at the Cancún Climate Summit in December 2010. At least a minimum objective has been achieved with the points adopted in the Cancún agreement, leaving the door open for a follow-up agreement to the Kyoto Protocol. We analyse the results of the negotiations and show how Munich Re actively contributes to the process. For the first time, this issue of Topics Geo also includes an opinion column in which we discuss current topics – in this issue, climate protection strategies.

As in previous years, special issues have been published for readers in the United States and Asia featuring topics and statistics of local relevance. A detachable World Map of Natural Catastrophes 2010, providing information on the main loss events, can be found on the inside back cover.

I hope you enjoy reading Topics Geo and find many of the articles useful for your work.

Munich, February 2011

Dr. Torsten Jeworrek
Member of the Board of Management and
Chairman of the Reinsurance Committee

NOT IF, BUT HOW


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0755 R6601 Fagernes Cancelled
0800 DY604 Bergen Cancelled
0800 SK2301 Kristiansund Cancelled
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0840 SK336 Trondheim
0840 SK4516 Molde
0845 DY202 Bodø
0850 DY606 Bergen

Eyjafjallajökull – When ash throws a spanner in the global works

The volcanic eruption on Iceland in spring 2010 demonstrated to the globalised world just how ill-prepared it is.

2010 hurricane season – Fortunately no record losses

2010 was an unusually active season with numerous hurricanes but few losses: most of the 19 tropical storms that developed over the Atlantic never made landfall.

Rien ne va plus: The ash cloud from Eyjafjallajökull brought air traffic to a total halt throughout much of Europe. More than 100,000 flights were cancelled, stranding more than ten million passengers worldwide.

Eyjafjallajökull – When ash throws a spanner in the global works

The volcanic eruption unleashed unprecedented air traffic chaos and, although it did not cause major direct losses, it nevertheless demonstrated how far-reaching the consequences of a natural catastrophe can be in our globalised world.

Author: Dr. Anselm Smolka

This photograph taken on 21 April 2010 shows the cloud of smoke hanging over Eyjafjallajökull. Vulcanologists feared that the eruption might rouse neighbouring Katla, one of the largest and most active volcanoes in Iceland, but this fortunately did not happen.

In the spring of 2010, Eyjafjallajökull, on Iceland, erupted several times, spouting vast amounts of volcanic ash into the atmosphere. Air traffic over many parts of northern and central Europe was repeatedly disrupted in the weeks that followed.

The event

20 March 2010: The volcano emits smoke and ash. It was one of those not uncommon eruptions which usually occur at intervals of several years – a routine occurrence on Iceland. Four weeks later it was followed by a further, stronger, but still not especially alarming eruption on 14 April. This time, however, trouble was in the offing. Changing meteorological conditions gradually drove the cloud of ash southwards, off its original eastward path, towards central Europe. Since the early 1980s, ash from active volcanoes in eastern Siberia, Alaska and Indonesia has been known to shut down jet engines. Temporarily rerouting flights is therefore a routine matter in these parts of the world.

But not so in Europe. Only a few days after the eruption, computer models by the Volcanic Ash Advisory Centre in London showed that the cloud had spread enormously. Air traffic safety authorities had to react, as it was covering a number of major European airports, including London, Paris, Frankfurt and Munich. As a result, the air space was closed and air traffic in central Europe was brought to a standstill. The consequences were considerable: hundreds of thousands of passengers were stranded at airports or unable to depart on their journeys in the first place. Several companies also had to halt production after a few days when material supplies were disrupted.

National economies incurred losses totalling hundreds of millions and possibly even billions of euros – losses that were not insured. For in cases of business interruption, cover is only provided if the interruption is preceded by physical damage affecting either the insured property itself or – with extended cover – a supplier of parts or utility company. However, this requirement was not met: aircraft were not damaged, they were simply grounded for up to a week in some countries. The volcano remained active throughout the following weeks until early May, causing further occasional flight bans. It then calmed down and it seems that the memory of this hazardous episode has disappeared along with the ash.

Lessons learned

Europe was clearly not prepared for the consequences of an eruption such as that of Eyjafjallajökull. The following conclusions can be drawn:

- There was no plan for measuring the actual ash concentration with the aid of specially equipped aircraft. The first flight by the German Aerospace Center (DLR) in Oberpfaffenhofen did not take off until three days after the flight ban. Public authorities had to base their decisions solely on the Volcanic Ash Advisory Centre (VAAC) in London. However, the VAAC models only simulate the extent and movement of the ash cloud, but do not provide any information whatsoever as to its density, and consequently the real hazard involved.

- First reactions after the event indicate that too little is known about the precise mechanisms causing damage to the aircraft. This applies particularly with regard to the size and density of the particles in the ash clouds. Corresponding documented empirical findings are either not available or not publicly accessible.

- Instead of mounting a concerted European response, the individual national air traffic safety authorities reacted in different ways. Coordination between countries was poor and there was no central European authority.

- The same applies to the public health authorities in the individual countries, each of which took a different view of the health hazard. The UK, for example, took a much more cautious approach than other countries.

- Last but not least: contingency planning in the private and the public sector appears to be inadequate where incidents last more than three days.

What would have happened if the volcano had remained active for several months or even years, as occurred last in 1821 to 1823, and a typical scenario in Iceland? And what would have been the outcome if 122 million tonnes of sulphur dioxide had been expelled into the atmosphere, as when the Laki volcano erupted on Iceland in 1783, causing global temperatures to decline for a period of several years? In addition to the direct conclusions drawn above, this raises two further fundamental questions:

1. Are volcanic eruptions an underestimated risk?

2. How well prepared is our modern, hi-tech society to deal with prolonged incidents, whatever their origin may be? Do we have the associated systemic risks sufficiently "under control"?

Volcanic eruptions – An underestimated risk

The probability of a flight ban, as in the spring of 2010, depends on the frequency of such eruptions and on meteorological conditions. If an Icelandic volcano emits smoke and ash for months on end, wind conditions driving the cloud towards the UK or continental Europe will inevitably arise at some point in time during the eruption. In conjunction with the probability of an eruption on Iceland, such an event must be expected at least once in about 50 years. The volcanoes of southern Europe, on the other hand, have no more than a marginal impact on central Europe. Southerly air streams are very rare and the probability of their coinciding with an eruption is exceedingly small.

An event such as the Laki eruption in 1783 would no doubt give rise to consequences extending far beyond what was observed in the year 2010. At least three or four volcanic eruptions worldwide are known to have significantly changed the global climate in the last one thousand years. The best known is the 1815 eruption of Mount Tambora in Indonesia. The year following the event went down in history as "the year without a summer". From what we know today and on the basis of data from the past 1,000 years, an event of global impact must on average be expected at least once in every 250 to 300 years – and the two eruptions mentioned above, Laki and Tambora, were only 32 years apart.

The consequences of an eruption on a scale similar to that of the volcano Eyjafjallajökull can still be effectively controlled through suitable technical and organisational measures. In the case of major eruptions too, the sectors affected and possible interactions must be identified in order to establish a basis for loss prevention programmes. Although the effects of the Laki and Tambora eruptions have been relatively well studied, they have not been applied to our modern globalised world. The analysis should be based on three-dimensional modelling of the ash clouds, as well as on modelling of the stratospheric aerosol cloud responsible for the effects on global climate. At present, such analyses are only undertaken for extreme eruptions which are correspondingly less common. Even without computer models, four neuralgic points can nevertheless be identified:

- Aviation: Particularly in an Iceland scenario, the customary route over the North Atlantic would be more or less blocked for many months. The obvious response of rerouting flights cannot apply when aircraft are grounded, as in spring 2010. This would have a massive impact on both the tourist industry and the manufacturing industry, which is dependent on deliveries by air freight.

- Shipping: Shipping was severely affected by "dry fog" following the Laki eruption. GPS could alleviate the problem to some extent today. However, the possibility of signal transmission via satellite being impaired has not yet been studied.

- Agriculture: The key question is to what extent staple foods, such as rice, soya and cereals, can withstand a lasting drop in temperature of 2–3°C over more than one growing season and simultaneously affecting several major farming regions. A food shortage, such as that documented after Laki and Tambora, could trigger considerable social upheaval.

- Health risks: The dry fog containing a high percentage of sulphate which spread over the whole of Europe in 1783/84 caused considerable damage to health.

Systemic risks

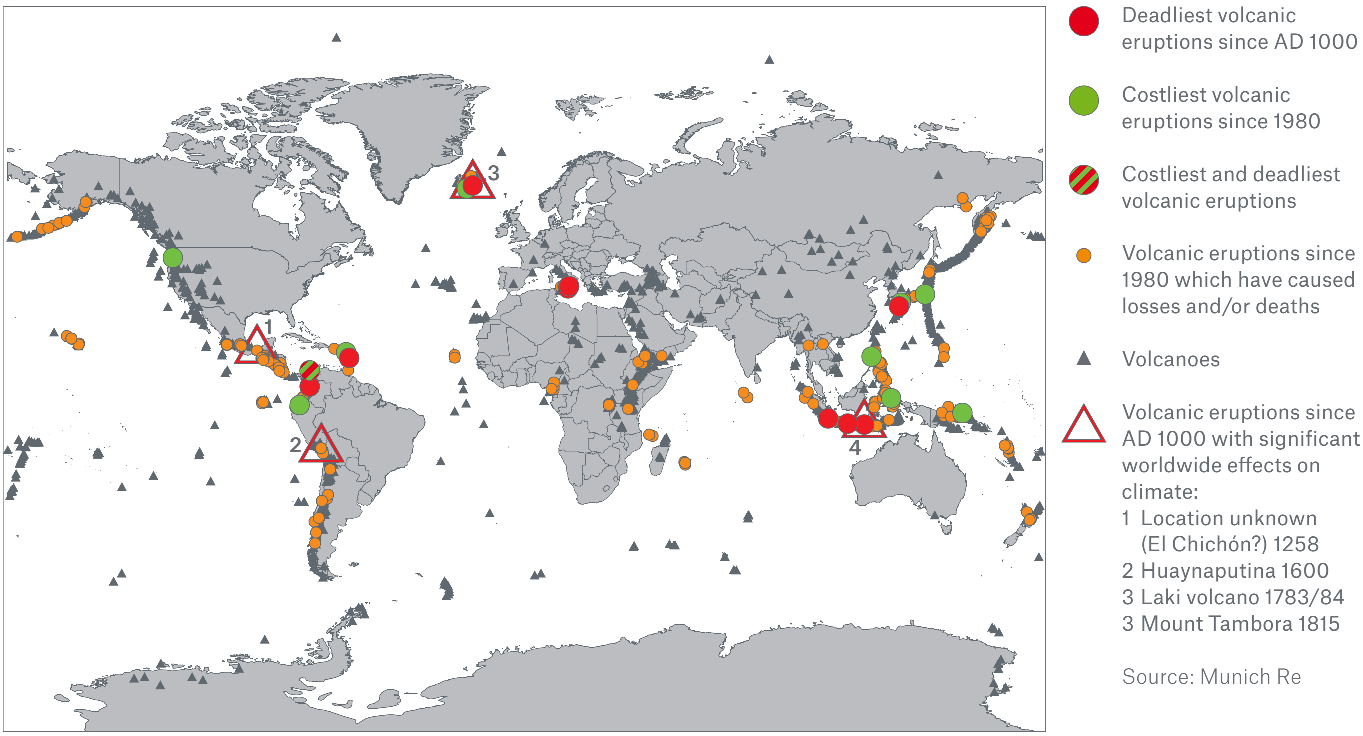
Even the relatively moderate Eyjafjallajökull eruption showed that politics, industry and society are ill-prepared for such events. Contingency plans encompassing more than two or three days are rare. Yet a major volcanic eruption is only one of several possible scenarios. In addition to natural events, the range includes technical or other anthropogenic disturbances. The most general and by no means improbable cases would be a supraregional power failure or collapse of the worldwide web lasting several weeks. The consequences for our networked world, with its dependence on technology and lack of preparation, would be devastating.

Countermeasures and insurance aspects

Drawing up possible scenarios is an insufficient response. Integrated prevention on all levels is essential in view of the immense loss potential. Specific research is needed to fill the gaps in our knowledge and analyse cause-and-effect chains. Loss prevention programmes must be implemented on a local, regional, national and international level, in both the private and the public sector. This does not necessarily require major investment. Intensive thought and awareness of critical interdependencies could suffice, for example, to prevent or shorten a production stoppage in a factory. Redundancy is the key word, for total dependence on a single supplier can spell disaster if a loss occurs. Successful loss prevention depends on a heightened awareness of the risk in politics, industry and the general public. This is where the insurance industry can make a valuable contribution, be it through professional risk expertise or suitable insurance products providing financial safety for new or residual risks.

The Global Earthquake Model (GEM) initiated by the OECD and strongly backed by Munich Re is one highly promising approach to integrated prevention. GEM was launched in early 2009 as a public-private partnership. Research facilities throughout the world, private industry, governmental and non-governmental organisations and international organisations cooperate here with the aim of effectively reducing losses due to earthquakes. Today, three years before conclusion of the project's first phase, GEM is already considered a model case which could also be applied to other perils, such as flood, windstorm and volcanic eruptions. The VOGRIPA (Volcano Global Risk Identification and Analysis) project headed by Bristol University and promoted by Munich Re is a step in this direction.

Deadliest and costliest volcanic eruptions 1000–2010



Source: Munich Re

The map shows the location of volcanoes worldwide, as well as the costliest and deadliest eruptions since AD 1000. Four eruptions – in 1258, 1600, 1783/84 and 1815 – had a significant worldwide impact on climate.

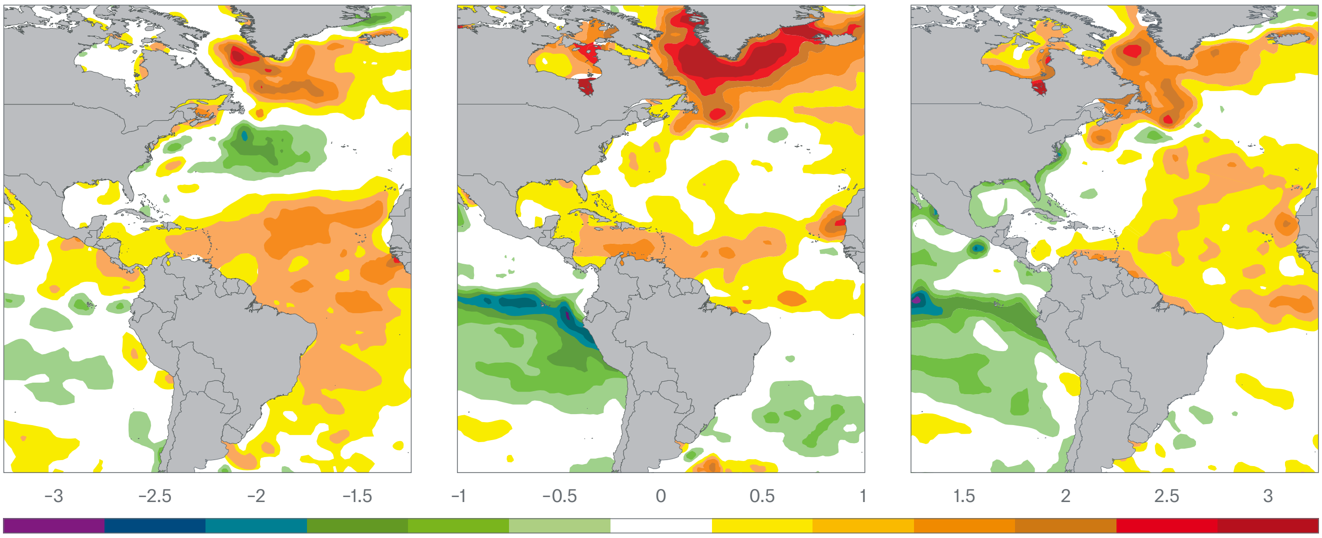
2010 hurricane season – Fortunately no record losses

The 2010 hurricane season was among the most active of the last 100 years. Fortunately, however, the losses inflicted were only moderate.

Authors: Dr. Eberhard Faust, Prof. Dr. Dr. Peter Höppe

Very few hurricane-strength windstorms actually made landfall in 2010. One of them was Hurricane Alex with wind speeds of up to 175 km/h, which ravaged Central America from late June to early July.

Sea surface temperature anomalies in relation to the weekly mean in May (16–22), September (12–18) and November (14–20) 2010



Regional deviation in sea surface temperature in 2010 from the corresponding weekly mean 1971–2000 in °C.

Source: National Weather Service/NOAA

With 19 named tropical cyclones, 2010 came joint third with 1995, topped only by 2005 (28) and 1933 (21). Twelve of the storms attained hurricane strength with wind speeds of more than 118 km/h, including five so-called "major hurricanes" with wind speeds in excess of 178 km/h. Favourable weather patterns, however, ensured that losses were comparatively low. Many of the storms remained at sea, far from population centres with their high concentration of values. The forecasts compiled by various leading institutes in spring 2010 with regard to the number of storms of different categories proved to be extraordinarily accurate.

Meteorological conditions and hurricane activity

The following conditions must be met before a tropical cyclone can form or intensify:

- Ocean temperatures of at least 27°C down to depths of roughly 50 m
- Major drop in temperature in the upper atmosphere, causing water vapour to rise up and condense
- High humidity at higher altitudes (promotes condensation)
- Weak high-altitude winds and little wind shear, i.e. largely stable wind conditions as regards direction and intensity at different altitudes

With its alternation of warm and cold phases, the Atlantic Multidecadal Oscillation (AMO) has a major effect on water temperature and consequently also on hurricane activity. Thanks to this natural oscillation, sea surface temperatures in the North Atlantic remain above or below the long-term average for several decades. The mean deviation in both phases is around 0.5°C. During the last cold phase, only 1.5 "major hurricanes" formed on average per year, compared to 3.7 per year during the present warm phase which has persisted since 1995. Corresponding values for the preceding cold (1903 to 1926) and warm phases (1927 to 1970) were 1.4 and 2.6, respectively.

Right at the start of the 2010 hurricane season, water temperatures were already unusually high in the breeding ground for tropical storms. Sea surface temperatures in the North Atlantic were up to 2°C above the long-term average, reaching record values that were far higher than would normally be expected in a warm phase. This situation remained more or less unchanged right up to the end of the hurricane season in November. As a result, the water temperature provided ideal conditions for the formation and high intensity of hurricanes.

At first, there was no notable decrease in temperature in the upper atmosphere or pronounced humidity at high altitudes. This was because, from June to mid-August, the air flow transported very dry, aerosol-laden air masses from the Sahara to the eastern tropical Atlantic. These warmed the upper air strata, stabilising the atmosphere and preventing the formation of windstorms. As a result, only three hurricanes occurred in the period up to mid-August – a highly atypical development in an active season. The situation changed only when wind conditions changed in the eastern Atlantic in mid-August. Before long, this resulted in the formation of several tropical storms, including three in the second half of August alone. The 2010 season would have proved even more extreme had it not been for the special retarding effect at the beginning.

Low wind shear in the upper strata was linked with the phase reversal associated with the El Niño Southern Oscillation (ENSO). El Niño tailed off rapidly at the beginning of 2010, to be followed by a period (April to July) in which there was a neutral ENSO phase before La Niña, the opposing cycle, developed in early August 2010.

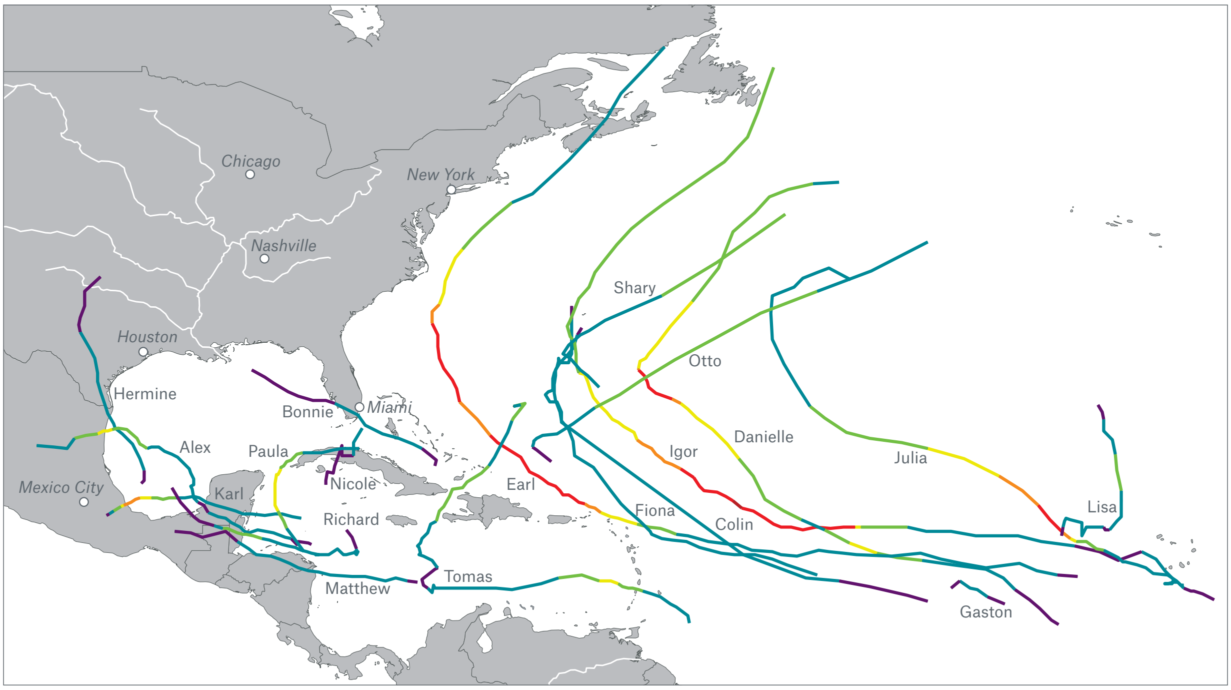
During El Niño, major differences between wind streams at high altitudes and those near the sea surface ensure that any cyclones forming are rapidly destroyed. El Niño was one of the main reasons why there were only nine named tropical cyclones in the North Atlantic in 2009, the lowest number since 1997. During La Niña conditions, on the other hand, the differences between wind streams are considerably smaller, leading to an increase in hurricane activity. However, the intensifying effect of La Niña is normally less pronounced than the damping effect of El Niño. This means that the difference between La Niña years and neutral phases is usually less marked than in the case of El Niño years.

Compared with the mean for the last 60 years (1950–2009), in quantitative terms, named tropical storms were up by 83%, hurricanes by 94% and "major hurricanes" by 85% in 2010. Such a significant increase is unusual, even in La Niña years.

The strongest hurricane of the 2010 season was Igor, with maximum wind speeds (peak sustained winds) of 250 km/h (135 knots). However, Igor only reached wind speeds qualifying it as a "major hurricane" while still over the Atlantic, grazing Bermuda as a weaker hurricane. When it next made landfall in Newfoundland, Igor caused damage and losses above all through heavy rainfall.

The most striking feature of the 2010 season was the unusual pattern of hurricane formation. Only nine storms formed in the "classical" region (10–20° N, 20–60° W). They all remained over the Atlantic and merely grazed a few islands (e.g. Bermuda). The other tropical cyclones originated in the western Caribbean and Gulf of Mexico, from where they predominantly proceeded over the Caribbean islands and east coast of Central America.

Tracks of Atlantic tropical cyclones in 2010



The map shows the tracks of all tropical cyclones in the North Atlantic in 2010. The most striking feature is that storms in the higher categories on the Saffir-Simpson Hurricane Scale rarely made landfall. Only nine of the 19 cyclones originated in the tropical region, the traditional breeding ground.

Wind speed in km/h
(SS: Saffir-Simpson Hurricane Scale)

- Tropical low-pressure zone (<63 km/h)
- Tropical storm (63–117 km/h)
- SS 1 (118–153 km/h)
- SS 2 (154–177 km/h)
- SS 3 (178–209 km/h)
- SS 4 (210–249 km/h)
- SS 5 (≥250 km/h)

Source: UNISYS

Number of Atlantic tropical storms in 2010 and forecasts of three scientific institutes

	Named hurricanes	Hurricanes	Windstorm (cat. 3–5)
Number	19	12	5
NOAA forecast 27 May	14–23	8–14	3–7
CSU forecast* 2 June	18	10	5
Updated 4 August	16	9	5
TSR forecast** 6 July	19.1	10.4	4.8
Updated 4 August	17.8	9.7	4.5

*Klotzbach/Gray **Lea/Saunders

Actual and mean number of Atlantic tropical storms in the past

	Named hurricanes	Hurricanes	Windstorm (cat. 3–5)
2010	19	12	5
2009	9	3	2
2008	16	8	5
2005	28	15	7
Mean values 1950–2009	10.4	6.2	2.7
Mean values 1995–2009	14.3	7.5	3.7

Hurricanes deflected by a stable high pressure zone

Another peculiarity of the 2010 season was that all the tropical cyclones forming in the eastern or middle tropical Atlantic very rapidly moved northwards, passing by the US coast. This is due to the distribution of air pressure throughout almost the entire season, with a distinct high pressure area prevailing over the southeastern USA.

Almost accurate hurricane forecasts

The forecasts made at the start of the 2010 season proved to be extremely accurate. All three forecasts by leading institutes accurately predicted not only the total number of tropical cyclones, but also their breakdown into different intensity classes. Following the season's weak start, both Colorado State University (Klotzbach and Gray, CSU) and the British Tropical Storm Risk Consortium (Lea and Saunders, TSR) marginally reduced their estimates in early August and ultimately underestimated the overall activity. Despite this, however, this year's forecasts were of very high quality due to continuous improvements in the scientific methods used to assess the factors contributing to the formation and intensity of tropical cyclones.

Moderate losses

Losses remained comparatively low in 2010, despite the extreme activity. Hurricane Karl proved to be the costliest by far, causing losses in Mexico totalling US$ 3.9bn, including insured losses of US$ 150m. It is followed by Hurricane Alex, which caused overall losses of US$ 1.5bn (insured losses, US$ 53m) in El Salvador, Belize, Guatemala, Nicaragua and Mexico. Overall, hurricane losses totalled almost US$ 6.5bn this year, thus remaining well below the average of US$ 30bn of the past ten years. At almost US$ 500m, total insured hurricane losses were also well below the ten-year mean of US$ 16bn.

The USA did not experience a single hurricane in 2010. Bonnie was the only weak tropical storm to make landfall in Florida's Biscayne Bay. The season's last hurricane was also its deadliest. Tomas claimed 36 lives, mostly in St. Lucia, but also in Haiti, which had already been devastated by the earthquake.

Classification of the 2010 season and outlook for coming years

The 2010 hurricane season was one of the most active since reliable records were first kept. That it should nevertheless have proved so benign can only be described as a stroke of good luck. Hurricane Earl, which at times reached Category 4 on the Saffir-Simpson Hurricane Scale, passed within a few hundred kilometres of the eastern seaboard of the USA. Had it moved just a little further west, it could have caused immense damage and losses in and around New York and the New England states.

The extremely high sea surface temperatures in the tropical and subtropical North Atlantic are attributable above all to the natural warm phase associated with the Atlantic Multidecadal Oscillation. At the same time, climate change is also contributing to the steady rise in sea temperatures. Both phenomena will continue to occur in the coming years too, but the effect of climate change on sea temperatures will intensify. A high level of hurricane activity must therefore be expected in the coming years, particularly when aggravated by unfavourable ENSO conditions, such as a neutral phase or a La Niña phase. Lesser activity is to be observed only in those years in which El Niño occurs, that is to say roughly every three to seven years.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2010 – A year of earthquakes

Violent tremors in Haiti, Chile, China and New Zealand caused losses running into billions.

February: Winter Storm Xynthia

An intense low-pressure system named Xynthia ravaged southwest Europe in particular, killing 65 people.

July–September: Floods in Pakistan

Heavy monsoon rain caused the Indus to burst its banks, flooding large areas. Some 15 million people had to seek safety from the floods.

Summer 2010: Wildfires in Russia

Extreme heat and dryness led to the outbreak of numerous wildfires. Moscow was cloaked in toxic smoke for weeks on end.

An earthquake with a magnitude of 8.8 struck Chile on 27 February 2010. The quake and the resultant tsunami destroyed hundreds of thousands of buildings, as well as numerous hospitals, roads and bridges. The photograph shows a demolished building in Talca, one of the more severely affected cities.

2010 – A year of earthquakes

While most people expected a lively hurricane season in the North Atlantic in 2010, exceptionally high losses were incurred instead on a completely different front, as several major earthquakes caused extensive damage.

Author: Dr. Anselm Smolka

The most devastating earthquake of the year with more than 220,000 deaths struck Haiti, a country that was in no way prepared for such an event. Chile and New Zealand, on the other hand, were very well prepared. As a result, the challenges presented for reconstruction and the underwriting aspects must be assessed differently.

Scientific analysis

On 12 January 2010, Haiti suffered the most devastating seismic catastrophe since the destruction of Tangshan in China in 1976. The quake, with a magnitude of 7.0, did not come as any great surprise for seismologists, for the danger had been clearly stated in a scientific publication dated 2008. The epicentre of the quake, which ravaged the capital Port-au-Prince and the surrounding area, was located near the boundary between the North American and Caribbean plates. The Enriquillo-Plantain-Garden Fault, which was originally considered to form the quake's epicentre, runs in an east-west direction here. The situation was further aggravated by the fact that the rupture in the earth's crust propagated towards the capital from its hypocentre west of Port-au-Prince. The associated interference of seismic waves magnified the vibrations. Intensive geological and geophysical investigations after the quake have revealed a highly complex rupture process. It appears that a previously concealed blind thrust fault was also involved and interacted with the Enriquillo-Plantain-Garden Fault. This is of significance for the future earthquake potential in the Port-au-Prince area. It may be assumed that the stresses accumulated in the Enriquillo-Plantain-Garden Fault since the earthquakes of 1751 and 1770 were not fully released on 12 January. Moreover, the investigations have also shown that strong shaking was not restricted only to areas with soft, unconsolidated sediments. Due to the topography, it also occurred on a hillside in the Pétionville district, south of the city centre.

The Chilean earthquake six weeks later did not strike unexpectedly either. The strongest earthquake ever recorded by instruments worldwide, with a magnitude of 9.5, had already occurred in the Valdivia/Puerto Montt region, on the boundary between the Nazca and South American plates, back in 1960. To the north of this region, a magnitude 8.0 quake off the coast of Valparaiso caused damage all the way to Santiago in 1985. The area between these two rupture zones, however, had remained relatively quiet since 1835. This "seismic gap" was filled by the Maule quake on 27 February, with a magnitude of 8.8.

A third earthquake, which struck Qinghai province in Central China on 13 April, paled in comparison to these two major catastrophes. Its magnitude was similar to that of the Haitian quake, and it claimed roughly 2,700 lives. The earthquake which struck New Zealand's South Island on 3 September attracted greater publicity. This was due not so much to its magnitude of 7.0, which was similar to that of the quakes in China and Haiti. What made this quake different was that, unlike the case in Haiti and Chile, an earthquake had not been expected here, 40 kilometres west of Christchurch. Experts had focused more on the Alpine Fault to the northwest, which marks the boundary between the Indo-Australian plate in the west and the Pacific plate in the east. The Darfield earthquake (named after the town closest to the epicentre), however, occurred along a previously unknown fault system under the sediments of the Canterbury Plains. Unlike Port-au-Prince, the rupture proceeded away from the city in this case, but the energy emitted was unusually high for a quake of this magnitude.

Loss characteristics

Buildings of every kind – from representative buildings, such as the government palace and the Hotel Montana, to mud huts – were damaged more or less indiscriminately by the earthquake in Haiti. It also caused the local UN headquarters to collapse. The corporate headquarters and production facilities of foreign companies remained structurally intact. Yet the few insured losses stemmed primarily from this sector. There are several reasons why the Haitian earthquake proved to be the most devastating ever in recent times, as expressed by the overall loss in relation to gross domestic product. Among others, they include the lack of building regulations, poor building material and a shortage of qualified labour, as well as the absence of an institutional framework ensuring that construction projects are completed in an orderly fashion.

The Maule quake in Chile was the first earthquake of high magnitude and correspondingly long duration (over 120 seconds) to test modern high-rise buildings. The high overall loss of US$ 30bn was not caused by instability. Both the quality of Chile's earthquake building code and its implementation are very good on a global scale. Only five of the 12,300 buildings erected since the last major earthquake in 1985 collapsed. Another 50 or so had to be demolished on account of massive structural damage. The magnitude of the overall loss is due above all to the damage to non-structural elements, in addition to the small number of major losses. Among other things, these include non-supporting walls, false ceilings and façade elements. Evidently, the building code must be updated in order to avoid or reduce the extent of such damage to property. In some cases, infrastructure also proved unexpectedly unstable, as in the case of the motorway linking the international airport and the city of Santiago.

In Chile, the load-bearing structure of mid-rise buildings (up to 20 floors) is primarily made up of shear walls parallel to the axis of the building. Compared with framed structures, such buildings are fairly rigid when exposed to seismic stresses. Newer buildings, however, tend to have thinner walls. The necessary transverse reinforcements also proved inadequate in some cases. Most of the few cases of major damage are attributable to such shortcomings. Low buildings with up to four floors are frequently built with confined masonry. In this case, the individual brick wall elements are connected by cast pillars of reinforced concrete. This type of construction has also proved to be very good.

Since buildings with shear walls or confined masonry are very much more widespread in Chile than in other countries, the experience gathered there cannot simply be applied to other regions. Framed constructions prevail in the American Pacific Northwest Region (Oregon, Washington), for example. As far as the earthquake mechanism as such was concerned, however, Chile provided a blueprint for a future quake at the Cascadia subduction zone, where the Juan de Fuca plate is subducting under the North American continent from the west. Portland, Seattle and Vancouver are all about the same distance from the epicentre of a future earthquake as Santiago was from the February quake.

In Christchurch, New Zealand, many residential buildings were damaged above all by collapsing chimneys. They frequently crashed through the roofs of homes, most of which were lightweight constructions. Many historical buildings of unreinforced masonry in the city centre also suffered significant damage. As in Chile, non-structural damage played a major part here, too. Unusually widespread soil liquefaction was one particular characteristic of the New Zealand quake. Near-surface sediment layers on the Canterbury Plains are particularly prone to this phenomenon, which causes extensive damage that is also difficult to repair, as the substrate settles to varying degrees during the liquefaction process, causing buildings to tilt.

Underwriting aspects

Countries with such disparate development levels as Haiti on the one hand and Chile or New Zealand on the other must be assessed differently from an underwriting point of view. About 200,000 individual claims were reported to insurers in both New Zealand and Chile. Settling such a large number of claims presented a major challenge for local markets. After a slow start, more than 90% of the Chilean claims had been settled seven months after the quake. The supervisory requirement that each survey must be signed by a locally registered loss adjuster proved to be an obstacle. As a result, foreign surveyors were unable to relieve the burden on local loss adjusters to the full extent. As usual in the case of major losses, settling the claims reported for damaged industrial plants will be a lengthy process. Some production facilities are still not working at full capacity, leaving the business interruption (BI) component of the claim unresolved. In some cases, the wording of the policies was not sufficiently clear. This applies not only with regard to insurance of the full or residual value in the case of mortgage protection covers, but also with regard to deductibles in BI insurance in the industrial sector.

In New Zealand, problems were encountered when activating the Catastrophe Response Programme of the state Earthquake Commission (EQC). The interaction between the EQC cover on a first-loss basis and the private-sector cover for the value of a building above and beyond this level was similarly fraught. Moreover, widespread soil liquefaction presented a very special challenge, for the EQC also covers the value of the land.

Despite this, however, both Chile and New Zealand prove that the insurance industry is in a position to make a substantial contribution towards financing the losses from major catastrophes. In New Zealand, the existence of the government-owned EQC with reinsurance in the global market has resulted in high insurance penetration. In Chile, there is more far-reaching potential for insurance of residential buildings, as well as of public infrastructure.

The situation in Haiti is different, the under-developed insurance sector reflecting the precarious condition of society in general. Insured losses account for only a marginal share of the overall loss and were confined almost exclusively to the local facilities of foreign enterprises. Here, state covers, such as those provided by the Caribbean Catastrophe Reinsurance Facility (CCRIF), offer a way for the insurance industry to make an effective contribution. Microinsurances for lower-income groups are another conceivable possibility. Both approaches, however, are virtually unviable without subsidisation by the international community, e.g. through development banks. The task of reconstruction alone presents an immense challenge for the financially weak state. CCRIF is a first step, but its volume is nowhere near enough to provide the help genuinely needed by a country like Haiti.

The large number of insured individual losses in Chile and New Zealand shows that the phenomenon known as "post-loss amplification" must be taken into account when assessing the risk in such markets. The term refers to bloated claims payments due either to higher repair costs resulting from a shortage of material and labour or to the fact that mass claims are settled on a blanket basis. For a quake of this magnitude, the proportion of policies affected in Christchurch was unusually high. Individual large claims by industrial plants with a high BI component pose a problem which has yet to be adequately solved when assessing and modelling risks. As was already experienced after other major catastrophes, such as the 1985 earthquake in Mexico or Hurricane Katrina in 2005, such cases contributed significantly to the insured market loss in Chile.

Conclusion

The earthquakes in Chile and New Zealand were the first natural catastrophes in recent times to have caused an insured loss of several billion US dollars outside the highly developed insurance markets of the USA, Japan and Europe. The global insurance industry has impressively demonstrated its ability to perform outside these core markets, too. Nevertheless, it is important to recall the fundamental underwriting requirements to be met worldwide when covering natural perils: among other things, they include reliable and increasingly detailed accumulation control, clear policy wording and the calculation and application of a technically reasonable price, as well as efficient claims settlement. What is more, the liability commitments which have been accepted must be controlled through a limitation of cover in both primary insurance and reinsurance.

Chile and New Zealand have shown that general preparation for a catastrophe and correct implementation of appropriate earthquake building codes are of decisive importance on a humanitarian level. Not a single life was lost in New Zealand. Despite this, however, there is still scope for further reducing the material damage suffered there. In Haiti, the earthquake struck a state that was already not fully functional. The country is not even sufficiently prepared for the floods and hurricanes, which befall it almost yearly. This also explains why the catastrophe on 12 January proved so destructive. Even if a national earthquake building code had existed, the country would have lacked the resources and institutional mechanisms needed to implement it. One thing which must not be overlooked when comparing the effects of the earthquakes, however, is that the quake itself constitutes a "worst case" in Haiti, in contrast with Chile and despite the high magnitude of the quake there. The earthquake in Haiti was stronger than that in Kobe, Japan, in 1995, its epicentre was located in the immediate vicinity of the capital and the fracture propagated directly towards the city, decisively increasing its damaging effect.

Successful and sustainable reconstruction will be put to the test in Haiti. For all its destruction, the catastrophe is a great opportunity for the country to establish an orderly public administration and smoothly functioning state in the course of its reconstruction effort. If that does not succeed, the entire reconstruction effort – which must to a large extent be considered an effort towards greater self-reliance – will be doomed to failure. Particularly in Haiti, reconstruction and preparations for future natural catastrophes must be integrated into an overall scheme. One aim must be to restore the authority of the state. At the same time, the ability of the country's agricultural sector to satisfy the basic needs of its population must also be assured. Suitable non-traditional insurance solutions, such as government covers for infrastructure and microinsurance products for the public in general, can play a valuable part in such an overall concept. A solution is urgently needed. The probability of another earthquake of comparable magnitude occurring in the next few years or decades must be considered disproportionately high. As is so often the case, however, experience since the quake has shown that, in the daily struggle for survival, an orderly, planned reconstruction remains a utopian concept for most of the victims.

Loss figures

Earthquake in Haiti, 12 January

Fatalities	222,570
Injured	310,000
Number of homes destroyed/damaged	285,000
Overall loss (US$ m)	8,000
Insured loss (US$ m)	200

The quake on 12 January 2010 ranked second in the list of deadliest earthquakes since 1950. More lives were claimed only by the 1976 Tangshan quake in China.

Loss figures

Earthquake in Chile, 27 February

Fatalities	>520
Injured	12,000
Number of homes destroyed/damaged	370,000
Overall loss (US$ m)	30,000
Insured loss (US$ m)	8,000

For the Chilean insurance industry, the Maule quake was the most expensive earthquake ever. In global terms, only the 1994 Northridge quake in the USA caused a higher insured loss.

Loss figures

Earthquake in China, 13 April

Fatalities	2,700
Injured	12,100
Number of homes destroyed/damaged	15,000
Overall loss (US$ m)	500
Insured loss (US$ m)	–

Due to the number of earthquakes in 2010, the Chinese earthquake paled in significance although it ranked sixth in the list of deadliest quakes in China since 1950.

Loss figures

Earthquake in New Zealand, 3 September

Fatalities	–
Injured	2
Overall loss (US$ m)	6,500
Insured loss (US$ m)	5,000

For New Zealand's insurance industry, the Christchurch earthquake proved to be the costliest natural catastrophe in the country's history. In a worldwide comparison of insured losses, it was the second costliest of the year 2010.

February: Winter Storm Xynthia in southwest Europe and Germany

In late February, Winter Storm Xynthia made its way from Portugal to Germany. In France, it proved to be yet another destructive winter storm following Klaus in 2009.

Authors: Ernst Bedacht, Thomas Hofherr

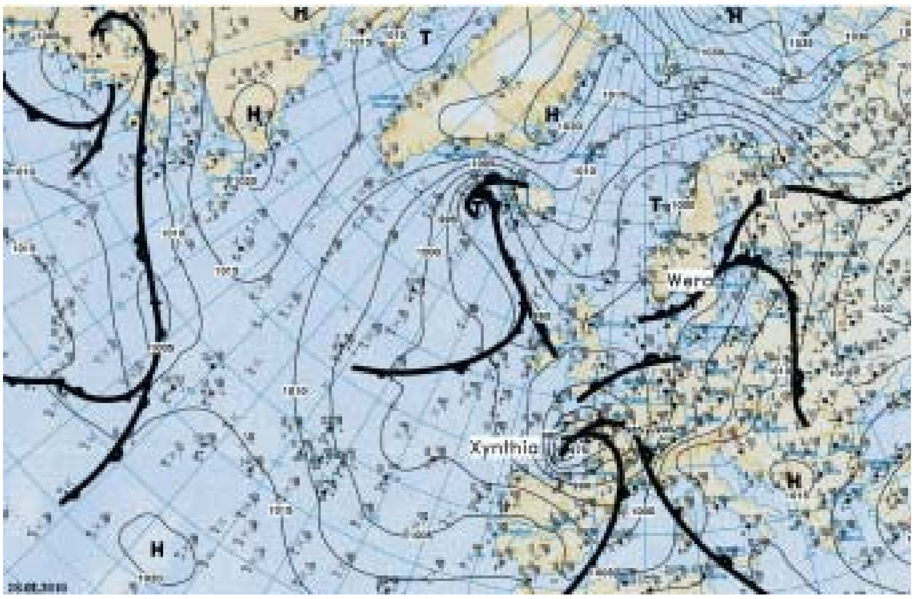
Meteorological development

A low-pressure system named Xynthia developed over the North Atlantic, southwest of Portugal, on 25 February. Located unusually far south, this low-pressure system came under the influence of an incoming upper-level trough on the following day. Extremely warm air masses from Africa rapidly reinforced the drop in pressure, with the result that Xynthia crossed the northwestern tip of Spain as an intense low-pressure system on 27 February, reaching the Bay of Biscay off the French coast. In the night before 28 February, the system's core pressure dropped to 968 hPa. Xynthia caused a heavy storm surge along parts of the French coast. This low-pressure system then proceeded rapidly over northern France and along the German coast towards the Baltic Sea, where Xynthia more or less dispersed on 2 March. Hurricane force gusts (>120 km/h) were experienced from northern Portugal to southwest Germany. Wind speeds of well over 200 km/h in some cases were encountered in exposed mountain areas which, however, are not considered further here; along the French Atlantic coast, the wind gusted at speeds of over 140 km/h. Gale-force gusts were still widely recorded over southwest Germany on 28 February. Although the storm's intensity rapidly diminished thereafter, occasional heavy gusts were still encountered in eastern Germany.

Losses

High wind speeds (100–130 km/h) in combination with heavy rainfall (20–50 mm) caused moderate losses in Portugal and Spain, particularly in Galicia's eucalyptus forests. The storm's impact in neighbouring France was considerably greater. The storm claimed 29 of the 65 lives lost in Europe along the west

Surface pressure chart of 28 February 2010



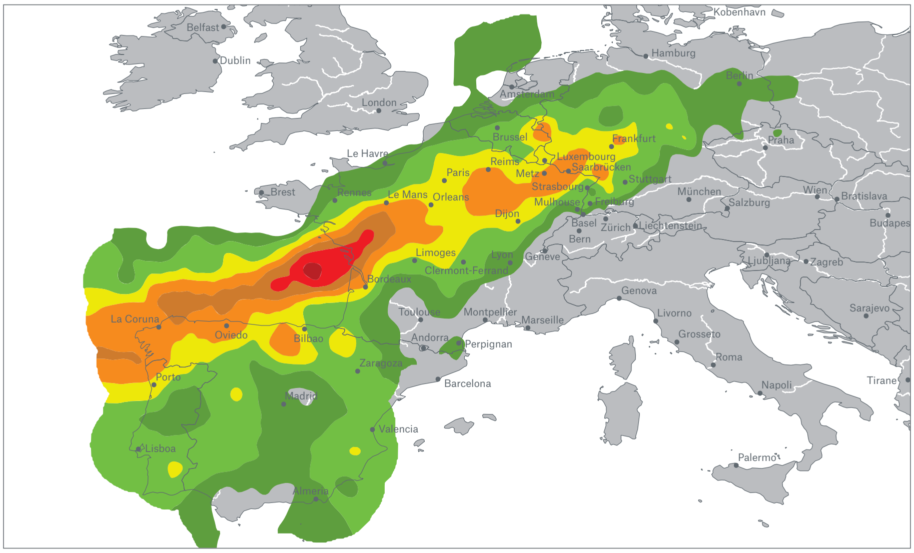
The surface pressure chart of 1 a.m. on 28 February 2010 shows Winter Storm Xynthia shortly before it reached the west coast of France. The densely packed isobars (lines connecting points of equal atmospheric pressure) convey a very good impression of the force of the storm.

Source: Verein Berliner Wetterkarte

The main areas affected by the winter storms are illustrated by the wind fields of Winter Storms Xynthia 2010 and Klaus 2009.

Xynthia struck on 28 February 2010, its highest wind speeds primarily affecting the west coast of France. The wind caused moderate damage to roofs and façades over large areas, in addition to major damage due to the storm surge along the coast. Buildings suffered extensive physical damage from numerous dam breaks, especially in the Vendée department.

Klaus caused heavy losses primarily in southwest France and northwest Spain in the period 24–25 January 2009. While France experienced considerable wind throw in forest areas, Spain suffered heavy losses to photovoltaic systems.

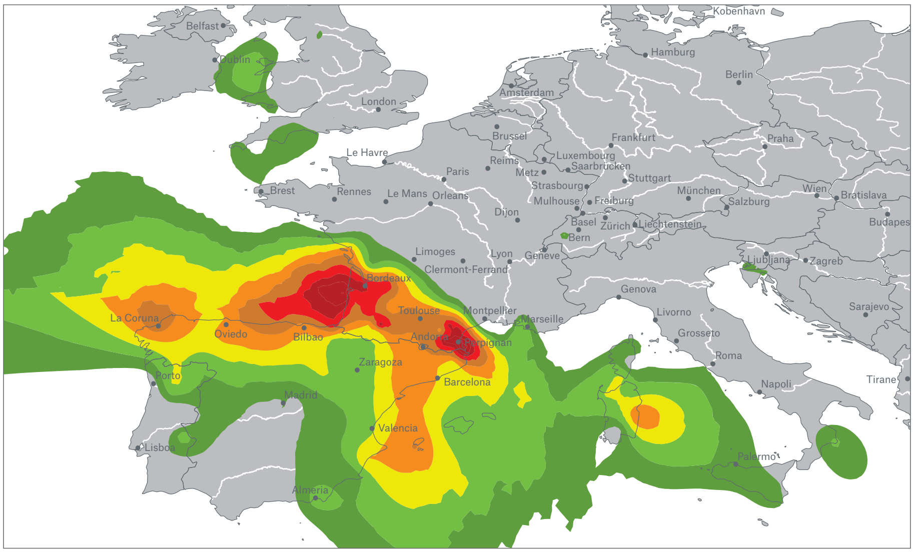


Wind field of Winter Storm Xynthia, 27 February to 1 March 2010

Gusts in km/h

- 80–90
- 90–100
- 100–110
- 110–120
- 120–130
- 130–140
- ≥140

Source: Munich Re



Wind field of Winter Storm Klaus, 24–27 January 2009

coast of France, where Xynthia reached its highest intensity. The Vendée department was hardest hit, as a storm surge additionally caused numerous dams to break there, leading to considerable physical damage to buildings, ships and vehicles worth around €800m. As in Spain, extremely high wind speeds (120–150 km/h) throughout large parts of France resulted in major regional power failures. The situation was further aggravated by heavy local rainfall with flooding, especially in Brittany. In Germany, the wind reached speeds of between 110 and 140 km/h, especially in the southwest, causing considerable traffic disruptions and property losses.

Xynthia in comparison to Winter Storms Klaus and Martin

Considering the storm's intensity along the French and Spanish coasts, Xynthia is best compared with Winter Storm Klaus, which had crossed large areas of southern Europe between 24 and 27 January 2009. In Germany, parallels can be drawn above all with Winter Storm Herta (3 February 1990). The comparison with Kyrill (18 January 2007), which was widely propagated in the media, is inappropriate, as the storm was more intense, lasted longer and covered a larger area.

The French media frequently compared Xynthia with the Winter Storms Lothar and Martin in 1999. Xynthia bears more resemblance to Martin, although the latter winter storm was more violent and affected other areas of France. Lothar caused extensive damage especially in northern France, including the Paris metropolitan area, and was also considerably stronger. In France, Lothar caused an insured market loss of €4.45bn in 1999 values.

Underwriting aspects

With Xynthia, yet another gale-force winter storm swept across Spain in 2010, following Klaus in the previous year, leaving the state-owned Consorcio de Compensación de Seguros to pick up the bill. First estimates indicate that between 30 and 40% of the loss will be covered by the state-owned insurer. Actually, losses are only covered at wind speeds of more than 135 km/h (gust), but these were few and far between during Xynthia. Following Winter Storm Klaus, however, the limit was lowered to 120 km/h due to public pressure.

The highest losses were sustained in France. The relevant ministries have established what is known as the "arrêté de catastrophe naturelle" for the departments affected by the storm surge. This means that the considerable storm surge losses (around €800m) must be covered by the French nat cat pool and not by the private insurance industry. According to the French insurance association (FFSA), insured pure wind losses total €715m. This makes Xynthia yet another winter storm with high impact, following Klaus in 2009 and Lothar and Martin in 1999. Losses in the amount of roughly €500m may be assumed for Germany. In the other countries affected, such as Portugal, Belgium and Switzerland, market losses should be around a few hundred million euros altogether.

Conclusion

Xynthia was the strongest winter storm of the 2009/10 season. From a European perspective, Xynthia was a loss event of a type that recurs on a comparable scale roughly every two years. In regional terms, however, it is marked by two distinctive features. For one thing, its point of origin was extremely far south for a European winter storm. This shows that not only the north coast of Spain, but also large parts of the entire country are threatened by winter storms. The second striking feature is the accumulation of major storm events in France. Lothar and Martin (both in December 1999), Klaus (January 2009) and Xynthia (2010) were four winter storms causing insured losses of more than €1.5bn each within a period of 12 years.

The storm surge losses were the highest incurred in France for several decades. The magnitude of this catastrophe and particularly the high number of deaths prompted public debate over the standard of coastal dams, the reasons leading to failure of the protective mechanisms and the practice of settling in highly exposed coastal areas. As a result, the French

Loss figures

Winter Storm Lothar 1999

	Overall losses*		Insured losses*	
	€m	US$ m	€m	US$ m
Germany	1,600	1,600	650	650
France	8,000	8,000	4,450	4,450
Switzerland	1,500	1,500	800	800
Europe as a whole	11,500	11,500	5,900	5,900

Winter Storm Martin 1999

	Overall losses*		Insured losses*	
	€m	US$ m	€m	US$ m
France	4,000	4,000	2,450	2,450
Europe as a whole	4,100	4,100	2,500	2,500

Winter Storm Klaus 2009

	Overall losses*		Insured losses*	
	€m	US$ m	€m	US$ m
France	2,500	3,200	1,680	2,100
Spain	1,500	1,900	700	900
Europe as a whole	4,000	5,100	2,380	3,000

Winter Storm Xynthia 2010

	Overall losses*		Insured losses*	
	€m	US$ m	€m	US$ m
Germany	750	1,000	500	680
France	3,100	4,230	1,500	2,100
Spain	250	340	100	135
Europe as a whole	4,500	6,100	2,250	3,100

*In original values

government decided to demolish buildings in highly exposed areas of the Vendée and Charente-Maritime departments, as well as to resettle the inhabitants.

However, Xynthia has also added fresh fuel to the debate over the structure of France's nat cat system. All losses from natural catastrophes other than gales and hail are reinsured in this state pool, i.e. earthquakes, soil subsidence, snow pressure and also flooding and storm surges. If the system is reformed, and even opened up to private reinsurance companies, it must be ensured that adequate account is taken of the risk posed by allied perils such as storm surge when calculating the loss potential.

Winter Storm Xynthia tore across Spain and France with high wind speeds. Dams broke following a heavy storm surge on the French Atlantic coast. The aerial photograph taken on 1 March 2010 shows flooded houses and streets in L'Aiguillon sur Mer in the Vendée department in western France.

July–September: Floods in Pakistan

For over six weeks in the summer of 2010, Pakistan struggled to master the worst floods in its history. One-fifth of the country was flooded, directly affecting 15 million people.

Author: Dr.-Ing. Wolfgang Kron

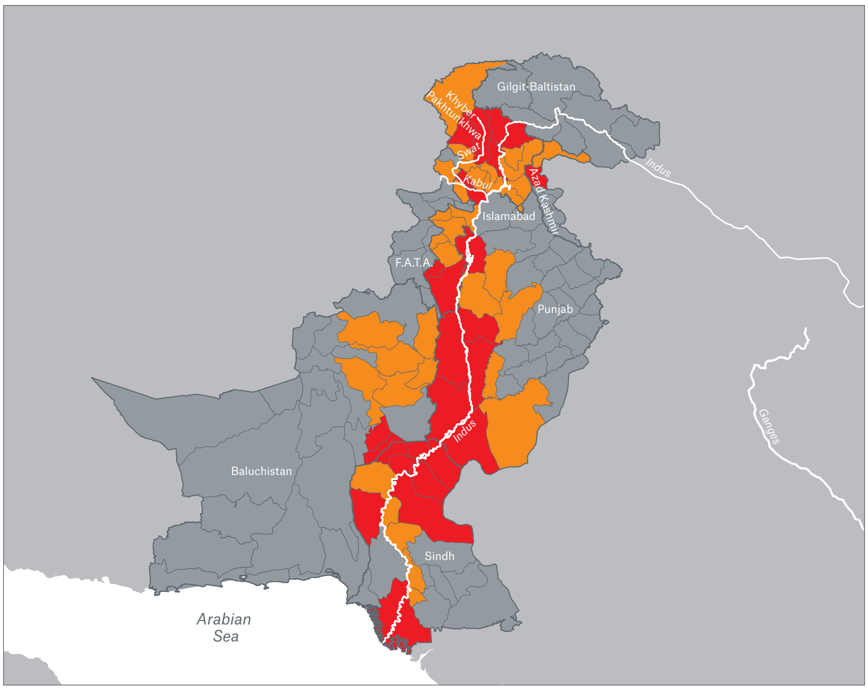
In global terms, the Indus river floods were the most widespread and enduring since the Yangtse flood in China in 1998. Due to living conditions in Pakistan, the flood was above all a humanitarian catastrophe.

Meteorological conditions

The summer monsoon – the rainy season that is of such importance to the people living on the Indian subcontinent – begins every year in July. It is a time when low-pressure systems carrying enormous amounts of water make their way from the southeast, parallel to the Ganges river valley, towards Pakistan. In 2010, the monsoon began on 22 July, a little later than usual.

Monsoon rain does not in any way fall steadily and more or less uniformly over large areas like "normal" rain. On the contrary: the intensity of precipitation varies considerably, both in space and in time, and is more in the nature of extended thunderstorms. Most low-pressure systems shed their rain before reaching the Indus. Sometimes, however, they advance as far as Pakistan's northwest province – as in late July 2010. Between 27 and 31 July, 333 mm of rain drowned the north of the provincial capital Peshawar. Of this, roughly 280 mm fell within the space of 24 hours, more than ever before in this region. The total rainfall of 402 mm measured in July was nine times as high as the long-term average. And this disproportionately strong rainfall continued in the following weeks.

Extent of the flooding



The most severely hit districts were also those with the most intensive land use. They line the banks of the Indus like pearls on a string.

Districts affected

- Not affected
- Moderately affected
- Severely affected
- Provincial borders
- District borders

Source: OCHA, National Disaster Management Authority Pakistan

The flood

The catastrophe began in northwestern Pakistan. More than 1,000 people were killed by flash floods and landslides in the valley of the Swat river, which flows into the Kabul river near Peshawar. The Kabul river carried the flood wave to the Indus. The Indus river is the country's lifeline, flowing through Pakistan from north to south. Its wide river plain is not only densely populated, but also home to most of the country's agricultural and industrial production.

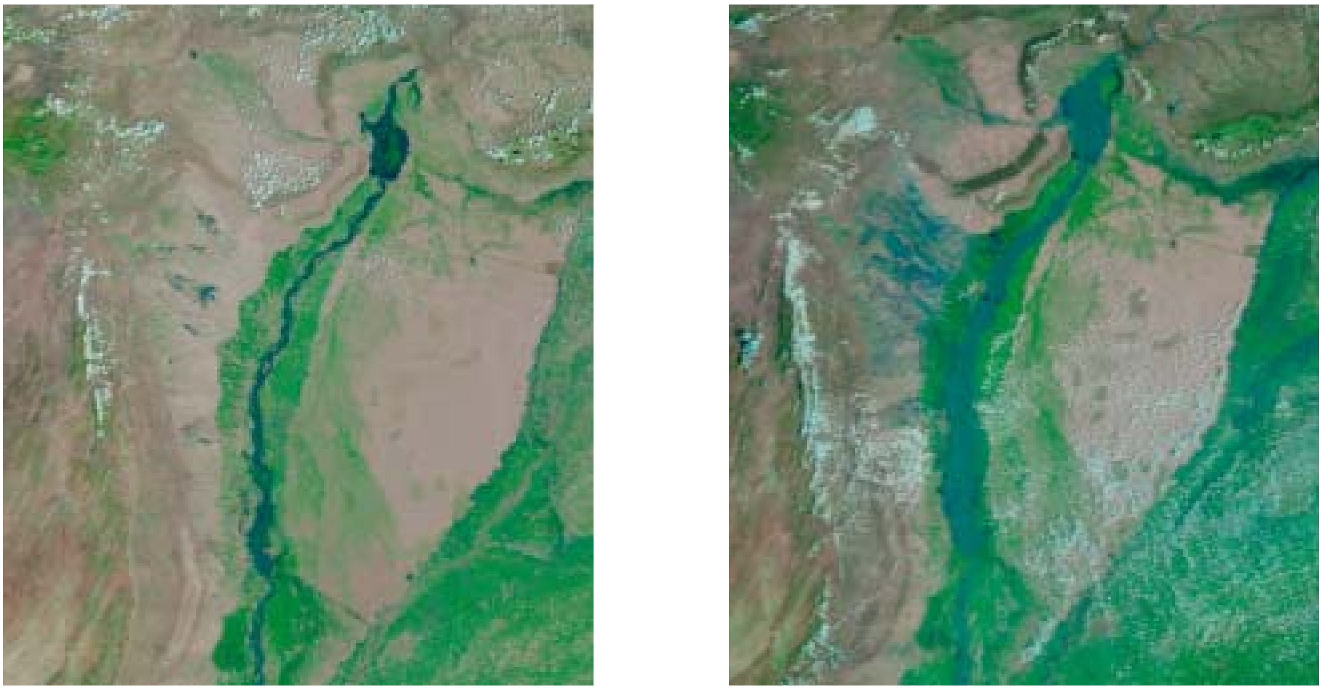
Persistent rainfall made it virtually impossible for the flood wave to recede. Instead, it grew steadily, maintaining a high level, although part of the water overflowed or escaped through dyke breaches. As a result, more and more areas on both sides of the river were inundated as the water made its way to the Arabian Sea. Almost all gauging stations reported the highest levels since continuous records began in 1947. The flood peak did not reach the Arabian Sea until early September, many areas remaining flooded for weeks on end.

Losses

Pakistan has suffered many great floods throughout its history, for instance in the mid-1950s and mid-1970s. The difference, however, is that fewer than 50 or 70 million people lived there at that time. Today, there are 175 million. This growth in population was accompanied by more intensive use of the land, especially in the Swat valley and in the fertile Indus plain – regions which also have the highest density of farm animals. Since both regions were most severely affected by the 2010 flood, its humanitarian impact was greater than any other in the past.

Infrastructure suffered serious damage. Hundreds of bridges were swept away, roads destroyed and water and electricity supplies disrupted. Production facilities for textiles, leather goods and food were destroyed and fields flooded. More than 80% of the country's arable land is located in the Indus plain. Floods destroyed 70% of the rice harvest, 60% of the vegetable harvest and 45% of the maize harvest. Livestock suffered immense losses, as hundreds of thousands of dairy cows, buffaloes, sheep and goats drowned in the floods. This is a particularly serious loss, as Pakistan is one of the world's biggest dairy producers, with an annual output of 30 million litres. Direct economic losses are estimated to lie in the region of US$ 10bn. Although this is hefty for a country such as Pakistan, the humanitarian impact was immeasurably greater. At least 1,760 people were killed and thousands injured; innumerable villages were flooded, in some cases to a depth of several metres. Entire regions were cut off from the outside world for days on end. Amidst all the floods, clean drinking water was frequently the greatest problem facing the population. Contaminated drinking water meant that diarrhoea and infections spread quickly, presenting yet another problem as 200 hospitals and medical centres were also flooded. Fears of a cholera outbreak, however, were exaggerated, there being no more than a few isolated cases.

The two satellite images show the Chashma Reservoir and a roughly 200-km long stretch of the Indus in Pakistan's northwest. The left-hand image shows the normal situation on 1 August 2009, the right-hand image showing the flood corridor up to 20 km wide along the river on 31 July 2010.



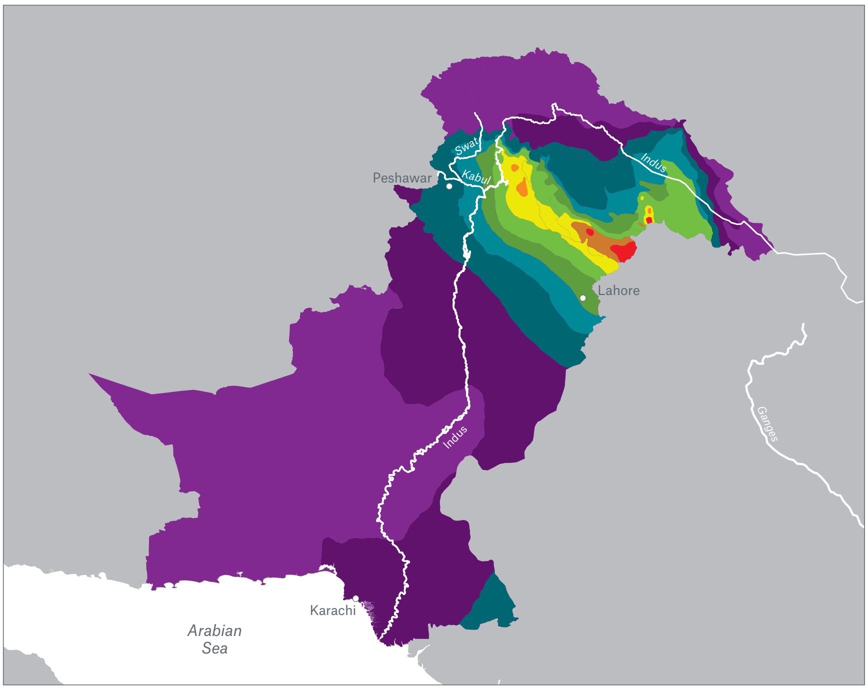
THE MONSOON CLIMATE IN SOUTHERN ASIA

Monsoon is the result of different warming of land and water. In summer, rising air over land is replaced by moist air streaming in from the sea and vice versa in winter, when the air is dry. The onset of the summer monsoon is fairly sudden and continues for about three months. The rainy season extends from early to mid-July until September.

Excellent precipitation records dating back more than 150 years are available for Pakistan. Sometimes, precipitation from the summer monsoon is distinctly higher or lower than "normal", leading to severe floods or droughts. Both have occurred seven times since 1844. Too little rainfall is more widely feared than too much, as droughts usually affect much larger areas and have a much deeper impact on society. Although there are no clearly identifiable trends in annual precipitation, there are clear signs indicating a dramatic increase in extreme summer rain periods in some areas of the subcontinent (see Topics Geo 2007, pages 5 to 9) and especially in the west, i.e. in Pakistan.

There is also a clear correlation between the intensity of the South Asian monsoon and the El Niño/La Niña phenomenon. La Niña increases convection over the Bay of Bengal, allowing more moisture to proceed in a northwesterly direction. This was the case in 2010, with the result that twice as much rain as in an average year fell over Pakistan's northwest province in July and August, more than ever before.

Distribution of mean summer precipitation in the Indus region



Most of Pakistan receives only little to moderate amounts of rainfall on average. Not so north of Lahore, where values of up to 1,000 mm are encountered.

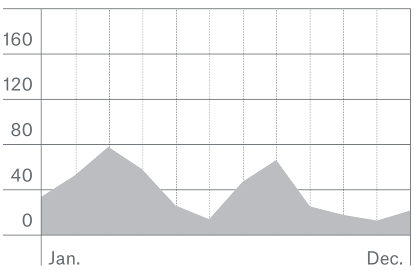
Mean precipitation (mm)
July–September, 1971–2000

- 0–100
- 100–200
- 200–300
- 300–400
- 400–500
- 500–600
- 600–700
- 700–800
- 800–900
- 900–1,000

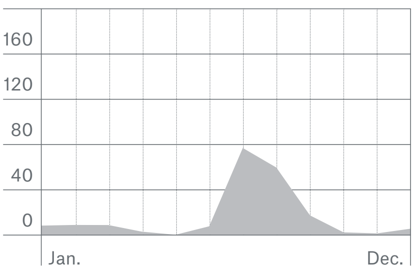
Source: Pakistan Meteorological Department

Mean monthly precipitation 1961–2009:

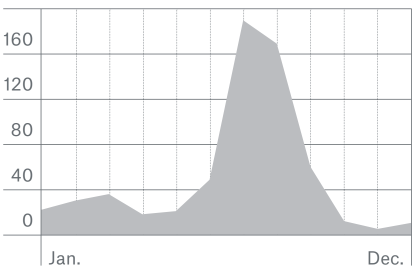
Peshawar (mm)



Karachi (mm)



Lahore (mm)



What made the situation even more serious was that millions of people lost not only their homes and their possessions, but also their livelihoods – farm animals, workshops or the entire year's harvest. Food shortages were widespread, as supplies were also swept away or perished. Even after the floods receded, food supply remained a problem, as it would be months before fresh crops could be planted on the muddy fields. In the north of the country, the situation was further aggravated by the onset of the cold season and the lack of shelter.

Insurance in Pakistan

Although the Pakistani insurance market offers enormous potential in personal lines business, the promise of sustainable business is damped by fierce competition over prices. In 2009, the country generated premium income in the amount of US$ 1bn, split more or less evenly between life and non-life business. Insurance density nationwide is 0.4%. The non-life sector is fragmented (around 35 active companies) and highly competitive. The market is traditionally dominated by three companies, which earn more than two-thirds of the market premiums: Adamjee Insurance Co. Ltd., EFU Gen. Insurance Ltd. and New Jubilee Insurance Co. Ltd. A significant part is played by coinsurance. As in many markets, motor insurance is the most important single class.

Life insurances are offered by six companies, with the formerly state-owned monopoly insurer State Life accounting for the lion's share (65%). Two of the four Islamic takaful insurers set up since 2007 sell life insurance as well. They are also striving to position themselves in the health microinsurance segment. Although non-life business is impeded by the market's structure, takaful insurers are gradually establishing themselves in the market, even if they are still by no means "big players". With their help, however, the concept of insurance could gradually gain ground among the population in general and in rural classes, as well as among those groups who – for religious reasons – have not had access to traditional insurance hitherto.

At present, private insurance solutions are requested almost exclusively by the middle and upper classes, i.e. roughly 20% of the population. The floods, however, primarily affected rural regions with low-income families. The average Pakistani spends about US$ 2 per year on insurance. Property insurance is only purchased for construction projects and industrial companies, if at all, and only because the banks insist. Insured losses from the flood catastrophe are consequently relatively low.

Conclusion

The biggest flood catastrophe of the last decade has shown how helpless people are in countries which do not have reliable assistance and support structures, be it from their government or insurance companies. In many cases, the shock of having lost their livelihoods after a natural catastrophe only turns into a genuine, personal disaster when there is no hope of quick relief. In order to face the future with optimism, people must at least have a realistic prospect of being able to satisfy their most essential needs within a foreseeable period and obtain financial assistance with which to start afresh.

The weaker the community, the state social welfare system or international connections, the more important it is to have contractually based insurance instead of simply hoping for aid from the government and voluntary sources. Whether classical or cooperative, high insurance penetration increases social and personal resilience after extreme events. This not only benefits the people and the national economies, but also the insurance industry, for with increasing insurance density, risks can be identified more reliably and spread over more shoulders.

Loss figures

Fatalities	1,760
Homeless	6 million
Overall losses (US$ bn)	9.5
Insured losses (US$ m)	100
Number of homes destroyed/damaged	approx. 1.5 million
Flooded fields	>69,000 km^2

Summer 2010 – Wildfires in Russia

From July to September 2010, Moscow and central parts of Russia were firmly locked in the grasp of an unprecedented heatwave. Extreme dryness led to the outbreak of numerous wildfires which cloaked parts of the country in toxic smoke.

Author: Dr. Peter Müller

Facts and background

The Russian summer of 2010 will go down in history as the hottest to date. In July and August, meteorologists measured the highest temperatures ever since records first began some 130 years ago. In Central Russia, the maximum temperature remained above 30°C for over a month, with temperatures between 30 and 35°C prevailing for a period of 60 days in some regions. The highest value in the Russian Federation was recorded by the Utta station in the Republic of Kalmykia on 12 July, when temperatures soared to 45.4°C. Moscow reached its peak temperature of 38.2°C on 29 July (Balchug station) and 6 August (Domodedovo).

Fire out of control

The extreme dryness which was associated with the heat also promoted the outbreak of fires. Just 12 mm of rain fell in Moscow in July, 13% of the usual amount. The flames were additionally fanned by strong winds. Yet that alone is not enough to explain the magnitude of the catastrophe. It is instead one of the consequences of sore neglect in forest management. Fewer and fewer forests are actually managed and dry undergrowth is rarely removed. Forest wardens, who could have reported and possibly fought the fires, have been dismissed. To make matters worse, Moscow is surrounded by vast areas of peat moor. In the past, these moors were drained in order to cut peat fuel for power plants. Then, as oil and gas increasingly came to be used, the peat moors were more or less left untended.

Causes of the fires

Almost all the fires in more densely populated areas were caused by people. The authorities have compiled the following cause statistics for the Bryansk area:

- Careless or negligent use of naked lights: 82%
- Agricultural work: 12%
- Forest work: 2%
- Short-circuiting in power cables, illegal refuse dumps: 4%

In the unpopulated regions of Siberia and the far east, roughly half the fires were caused by thunderstorms; 10% of the peat fires were ascribed to spontaneous combustion.

Shortcomings in combating the fires

Fighting the fires proved difficult, as there are often no fire brigades in the rural districts and the fire engines and equipment of those that do exist are frequently antiquated. Many fire brigades are also undermanned. As a result, many people had to defend their homes and villages against the flames without professional assistance. Even such strategic facilities as military bases in forest areas were unprotected. And although the technology exists, Russia has only a very rudimentary early-warning system. There are no structures for monitoring fires and no rapid reaction force that could be deployed flexibly and systematically to the focal areas. The condition and availability of installations delivering fire water (hydrants, ponds) and the information and control systems are similarly far from perfect.

Prognoses and return periods

According to Russian sources, the number of wildfires in the Russian Federation has more than doubled in the past 15 years. Area-wide forest and peat fires must now be expected roughly every ten years in and around Moscow. A dramatic situation had already arisen back in 2002, when – as in 2010 – the flames had advanced almost up to the motorway ring around Moscow. In 2002, the village of Shiryaevo in Shaturskii District burned down completely, shrouding the whole of Moscow in smog. Visibility was reduced to a mere 50 m on some days.

Direct fire losses

All in all, the 30,376 fires including 1,162 peat fires, claimed 130 lives. As many as 147 settlements were partly or completely destroyed and 2,500 houses burned down. Flames ravaged 1.25 million hectares of land including 2,092 hectares of peat moor. Fire-fighting efforts are estimated to have cost the Russian government 19 billion roubles (US$ 630m).

Forestry industry losses are more difficult to quantify, as there are no figures available regarding the amount of forest land burned, nor its quality (species of tree, age, productivity). The Biodiversity Conservation Center has estimated the cost at ten billion roubles (US$ 330m), assuming an average price for the trees and roughly 750,000 roubles (US$ 20,000) per hectare for afforestation. Agricultural losses are estimated to be about 43 billion roubles (US$ 1.4bn).

Indirect losses

The long heatwave, extreme dryness and smog caused considerable health problems. Moscow's inhabitants suffered under a dense cloud of smoke which enveloped the city. In addition to toxic gases, it also contained considerable amounts of particulate matter. Pollutant loads were several times higher than the permitted limits. This resulted in an increase in the number and intensity of heart attacks, strokes, asthma attacks and bouts of coughing, as well as skin and eye disorders. Mortality increased significantly: the number of deaths in July and August was 56,000 higher than in the same months in 2009.

Business operations were occasionally interrupted because production processes were disrupted by the heat or employees failed to report for work. Production by the GAZ car factory in Togliatti, for example, had to be halted as temperatures climbed as high as 45°C in the factory halls. Volkswagen also halted its production in Tula. Disturbances were reported by Moscow's airports, and flights had to be cancelled. Pipelines and power cables, on the other hand, sustained only minor losses.

Moscow's Red Square veiled in dense smog. Between June and September 2010, Russia experienced an unprecedented heatwave with devastating forest and peat fires. Toxic smoke and temperatures of almost 39°C made life intolerable for Muscovites.

Danger to nuclear plants

Wildfires posed a particular hazard in areas which had been contaminated by nuclear research and production, as well as by the Chernobyl reactor disaster of 1986. A total of 3,900 hectares of land contaminated with radionuclides caught fire between mid-June and mid-August. Fire also threatened nuclear power plants and nuclear research facilities. One wildland fire came dangerously close to the Sarov nuclear research centre. Disaster was averted, however, with considerable effort and the aid of heavy plant.

Underwriting aspects

Insurers were hardly affected by the direct losses. Fire insurance claims did not exceed the sum of 300 million roubles (US$ 10m). One reason why this sum remained small is that property and fire covers are relatively uncommon in the Russian Federation. Only about 7% of the dwellings in towns and cities are covered by such policies and only about 2% of the summer houses (dachas) in rural areas. In addition, the concentration of values in the affected areas is low and the sums insured are correspondingly moderate.

These moderate burdens are unlikely to have any impact on pricing in the Russian insurance market. A significant increase in demand for insurance cover is also unlikely, as it is virtually unaffordable for the rural population in particular.

Losses in the agricultural sector were high. Flames destroyed more than 30% of the crops. Although state-subsidised crop insurance has been available in the Russian Federation for several years, the response has been muted. Farmers are not obliged to purchase the insurance. It may be assumed that only about ten to at most 15% of the cereal acreage were insured. This may be due on the one hand to the absence of an area-wide network of insurers and insurance agents. On the other hand, agricultural producers have in the past received only marginal or no indemnity for their incurred losses. Some agricultural insurers were already insolvent before the fires. This meant that the government had to pay. At first, funds in the amount of 35 billion roubles (US$ 1.1bn) were only provided for the direct losses, mostly in the form of loans.

Despite this, however, the crop insurance companies' portfolios display very high loss ratios. Depending on the weighting in a company's overall portfolio, this will affect its profits and liquidity. Policies are reinsured through a large number of facultative, as well as through obligatory, treaties. Some insurers also concluded stop loss treaties.

Consequences

The Russian government has reacted and taken steps to increase the insurance density. Efforts to reform the agricultural insurance system were stepped up and a new draft bill introduced in the State Duma on 7 October 2010. The bill was adopted at its first reading on 1 November 2010. Under the new law, every agricultural operation which claims state aid of any kind must also buy insurance. The government will then pay 50% of the premium. Government authorities are also working on a bill introducing compulsory fire insurance for property owners.

Loss figures

Fatalities	56,000
Overall losses (US$ m)	3,600
Insured losses (US$ m)	20
Number of homes destroyed	2,500
Burned area	>12,500 km^2

GLOBAL WILDFIRE HAZARD MAP

Authors: Dr. Hans-Leo Paus, Markus Steuer, Bernd Wagner

As announced in Topics Geo 2009, global wildfire hazard has been analysed by Munich Re. The result is a world map showing this hazard.

Insurance-related aspects

The US southwest, Australia and the Mediterranean countries are known to be highly exposed to wildfires. California is particularly at risk. Since 1980, insured losses of more than US$ 8bn have been caused there (in original values), with an overall loss of roughly twice that amount. Property damage covered by homeowners' and householders' insurance is of particular importance to insurers; motor own damage insurance is also affected, but to a much smaller extent. Most losses stem from personal lines business, as commercial and industrial estates usually maintain a corresponding safe distance from forests and bushland. Unlike the case with storms, wildfires frequently result in a total loss, as buildings burn down completely once they are ablaze. Insurances covering losses to standing wood in plantations are widespread in the forestry sector. Natural forests, however, are usually not insured. Liability covers may attach when power cables, vehicles or people have caused a fire without wilful intent.

Modelling wildfire hazard

Wildfires are the result of a complex interaction between certain influencing factors. Ignition of the fire, the vegetation, meteorological conditions and the topography are among the most important. Fire prevention measures help to stop the fire spreading. These factors are taken into account in the probabilistic models of natural hazards offered by commercial suppliers, but at present they are only available for California. The hazard map compiled by Munich Re cannot replace a probabilistic model, but it is nevertheless of great value in identifying areas at risk.

To this end, data on climatic conditions and vegetation have been linked with historical data on wildfires. As expected, this yields the following findings:

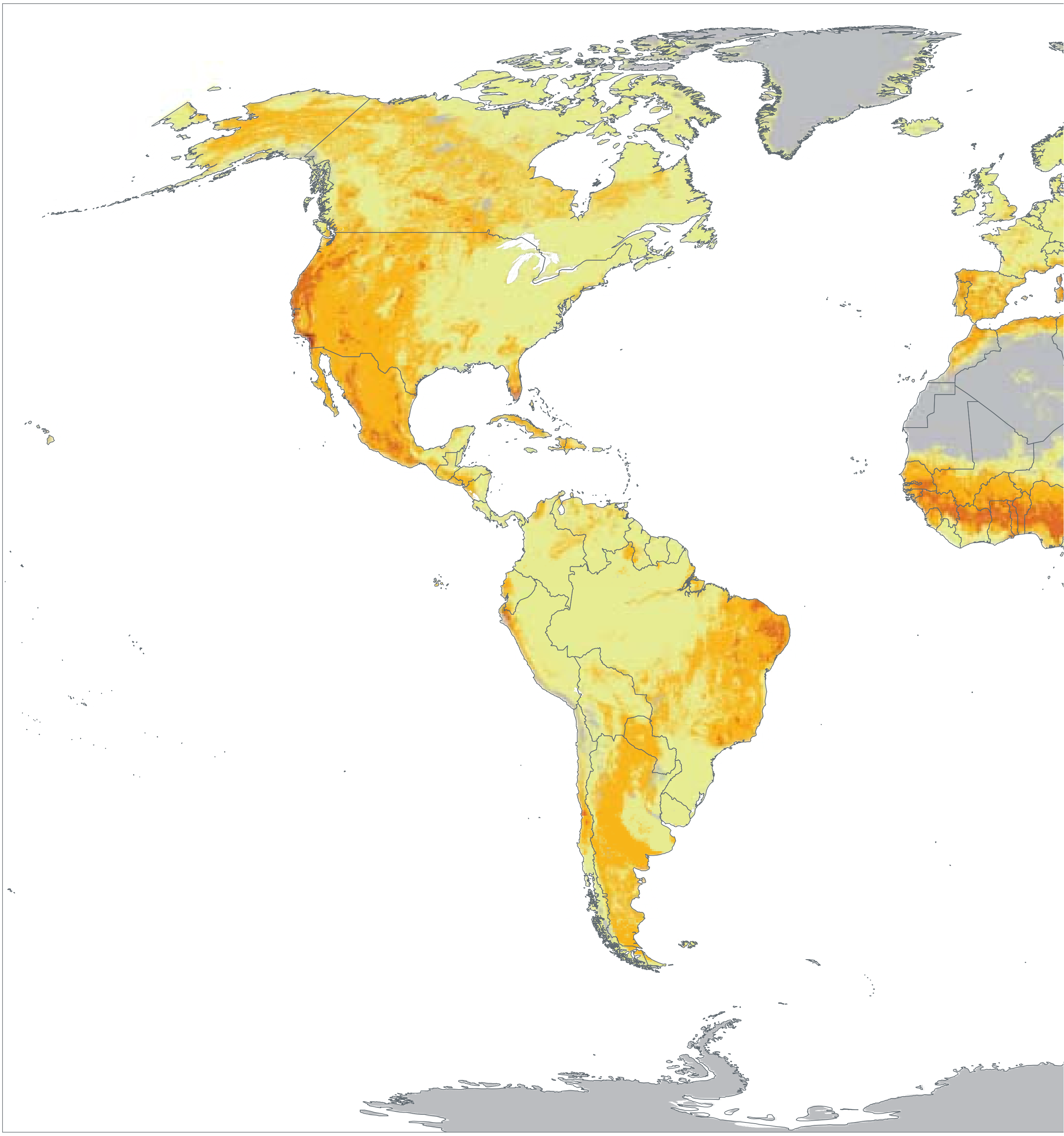
- Wildfires are rare in areas where rain is frequent and prolonged dry spells are few and far between. This finding is true regardless of vegetation and can therefore be applied throughout the world. Regions with sparse vegetation are also largely unlikely to be affected by wildfires, even in extremely dry periods.

- Fire potential is particularly high when coniferous forests are exposed to dry spells lasting several weeks or even months.

Between these two extremes – coniferous forests in dry areas on the one hand and vegetation of any kind in humid-temperate or cool zones on the other – experts have been able to use observations and known climate factors to work out the extent to which certain types of vegetation are more susceptible to fire during prolonged dry spells or can withstand them without harm. Graduations between extremely high and low natural fire potential have been derived from these findings. Since the hazard situation is directly influenced by man, the results have additionally been modified by a factor for densely and sparsely populated areas. Wind conditions and fire prevention measures, which can vary widely from one region to the next, have been disregarded. Risks due to controlled burn in agriculture or to arson have likewise been disregarded, as have those attributable to exceptional climatic conditions, like El Niño/La Niña.

The new global wildfire hazard map will be available in the new edition of the DVD "NATHAN – Globe of Natural Hazards" published in March 2011.

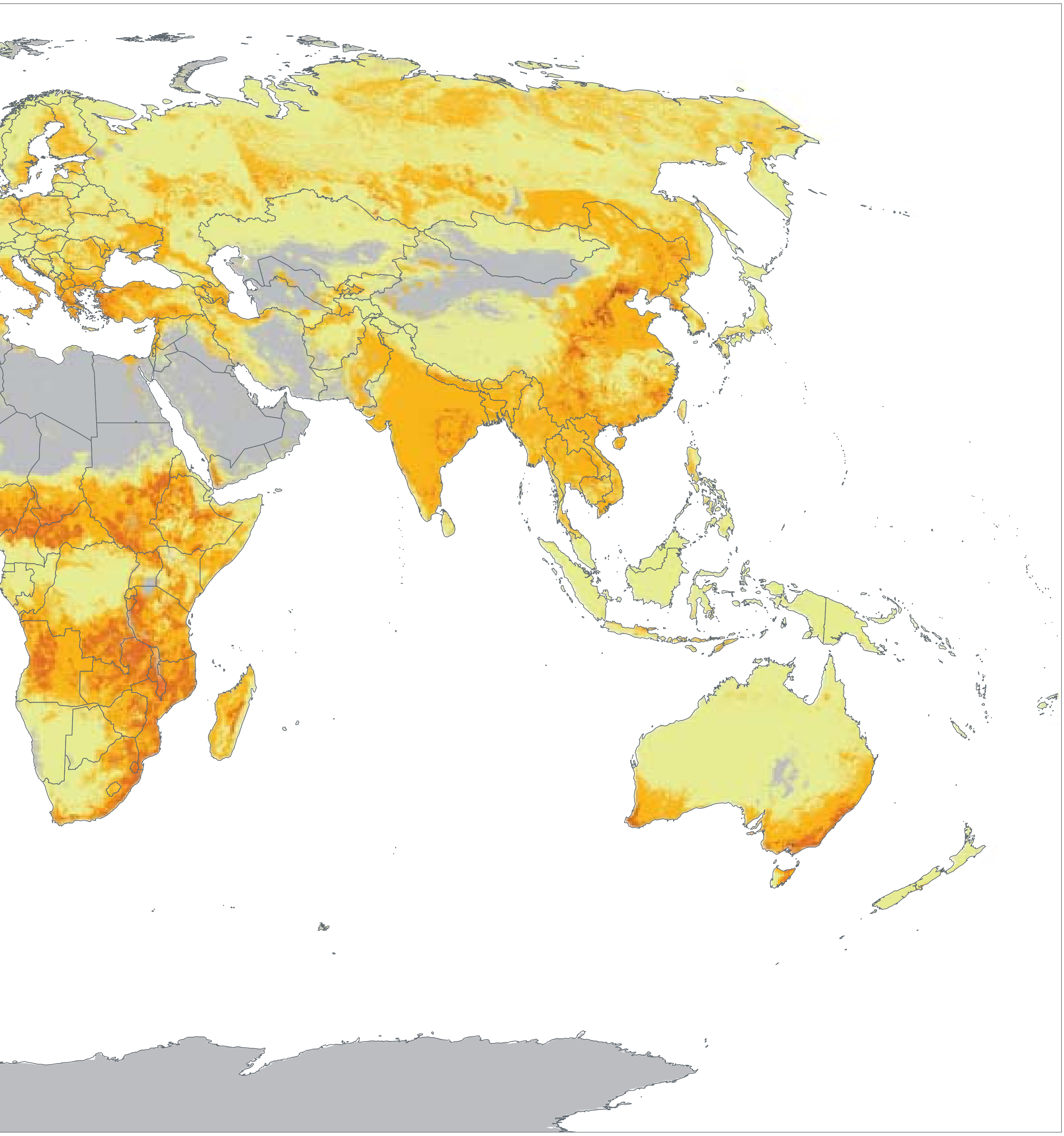
GLOBAL WILDFIRE HAZARD MAP



A region's average fire potential depends on the climatic conditions and vegetation prevailing there. Man has also been taken into account as a factor triggering numerous fires. However, the model does not include the influence of wind, exceptional climate conditions (El Niño/La Niña) and fires started intentionally. Fire prevention measures have similarly not been included.

Average wildfire hazard

- Zone 1: Low
- Zone 2: ↓
- Zone 3:
- Zone 4: High



Data resources:
GlobCover Project, ESA
Munich Re NatCatSERVICE
Joint Research Centre, European Commission
Department of Sustainability and Environment, Victoria (Australia)
Natural Resources Canada

Source: Munich Re

World Climate Conference in Cancún, 2010

After the disappointing outcome of the 2009 international climate change summit in Copenhagen, the climate change conference held in Mexico in December 2010 proved unexpectedly successful.

Facts, figures, background

2010 was among the hottest years since records began. It was marked by an accumulation of extreme weather-related events.

In early August 2010, a huge chunk of ice broke off from the Petermann Glacier in northwestern Greenland. With a total area of about 250 km^2, it is the largest ice floe to have broken off in the Arctic since 1962. The Petermann Glacier has lost one-quarter of its floating ice shelf as a result.

World Climate Conference in Cancún: Last-minute compromise

In contrast with the 2009 international climate change summit in Copenhagen, little was expected of the 2010 summit in Cancún. The international community was hopelessly and seemingly irreparably fragmented. For this reason, not a single key head of government planned to attend the negotiations.

Author: Prof. Dr. Dr. Peter Höppe

"Hope?" – Greenpeace was not alone in hoping for a successful climate conference in Cancún. In the end, that hope was fulfilled.

Ultimately, Cancún proved more successful than originally expected. After two weeks of tough negotiations, the delegates agreed on a compromise which can serve as a basis for future action. This compromise was achieved not least through the skilful leadership of conference president and Mexico's Foreign Minister Patricia Espinosa, and of Christiana Figueres, the new Executive Secretary of the UN Framework Convention on Climate Change (UNFCCC). Both performed excellently and accomplished the maximum possible. It would appear that the process of negotiating over climate change under the aegis of the UN can continue.

Bolivia was the only country to put up resistance and very nearly caused the negotiations to fail. This highlights the considerable danger of blockages inherent in the present ruling, according to which resolutions must be adopted unanimously. A big step forward could be taken by agreeing on a reasonable majority vote for future climate change conferences.

A minimum objective has been achieved with the points adopted in the Cancún Agreement, leaving the door open for a follow-up agreement to the Kyoto Protocol. However, since the USA never ratified the Kyoto Protocol, it is not bound by this decision either. Moreover, China continues to have the status of a developing country without binding emission reduction targets. If the two biggest CO_2 emitting countries were left out, however, the follow-up protocol to be negotiated in Durban in 2011 would be nothing more than a paper tiger. The climate can never be efficiently protected in this way.

A period without internationally binding emissions reduction targets can presumably no longer be prevented until a follow-up to the Kyoto Protocol is ratified. This could well have a negative impact on projects to reduce greenhouse gases within the framework of the Clean Development Mechanism (CDM). However, this must not deter regional emissions trading systems, such as those in Europe, for many measures to reduce CO_2 emissions will be deferred if there is no security for investments.

Fortunately, all the signatories of the UN Framework Convention on Climate Change in Cancún have, for the first time, agreed on a binding undertaking to limit the rise in average temperature to 2°C in relation to pre-industrial times. In Copenhagen, this target was only acknowledged by some of the delegations. It is also gratifying to see that the Cancún summit has agreed on a framework programme to protect the world's forests. The consensus to set up a fund (Green Climate Fund) to finance climate protection and adaptation has now also become binding. Between 2010 and 2012, the industrialised countries will deliver US$ 30bn to the fund, which will raise US$ 100bn per year from 2020 onwards. The concept proposed by the Munich Climate Insurance Initiative (MCII) for risk management in developing countries could also be financed through this fund. The creation of a centre for climate technology under UN leadership is another positive feature which will facilitate the transfer of corresponding technology to developing countries.

Inclusion of the topics loss and damage is a point of particular importance for the insurance solutions proposed by the MCII. It was also agreed to set up a separate programme for the Subsidiary Body on Implementation (SBI) in the next two years. This will be decided at the international climate change conference COP18 in 2012. The special insurance workshops included in the programme will, however, be held in 2011.

Under the present conditions, Cancún must be considered a success. Now, every effort must be made to include the USA and China in a follow-up to the Kyoto Protocol. Stricter targets for reducing CO_2 emissions must be defined than those voluntarily agreed by the individual countries in Copenhagen, otherwise the 2°C target cannot be achieved.

In addition to the official negotiations, Cancún also sent a number of other positive signals. These include parallel events, such as the first "World Climate Summit – Accelerating solutions to climate change", attended by more than 600 representatives from the world of business. The summit delivered a clear political signal showing that industry has, to a large extent, already pushed ahead on climate protection, and that a political framework must now be established to ensure the further development of climate protection.

China, the world's largest CO_2 emitter today, recently put forward its 12th Five Year Plan, which is to be implemented in 2011. This plan defines ambitious targets for boosting energy efficiency and rapidly increasing the use of renewable energy sources. In addition, China is planning to introduce a national emissions trading system and thus make its own major contribution towards protecting the climate, even without binding, internationally agreed commitments.

In the coming years, Munich Re will consistently continue its policy of supporting climate protection and the process of adapting to unavoidable changes. Among other things, this will include ensuring climate neutrality within Munich Re itself and promoting the world's largest renewable energy project, jointly initiated with the Desertec Foundation. Together with the UNFCCC, Munich Re will also work on insurance solutions for developing countries to help them adapt to the changing climate. At the same time, Munich Re will support the development of renewable energy sources by providing customised insurance solutions to safeguard investments in these innovative technologies.

Facts, figures, background

2010 was one of the warmest years since 1850, with record temperatures, record-breaking rainfall and a further decrease in Arctic ice cover.

Author: Dr. Eberhard Faust

Global mean temperature

According to provisional figures from the World Meteorological Organisation, 2010 will, at the very least, have been one of the three warmest years since the data series began in 1850. With a deviation of 0.55°C (± 0.11°C) above the average of 14°C for the period 1961–1990, the global annual mean temperature recorded at surface level in the first ten months of 2010 is the warmest ever recorded for the period of January to October.

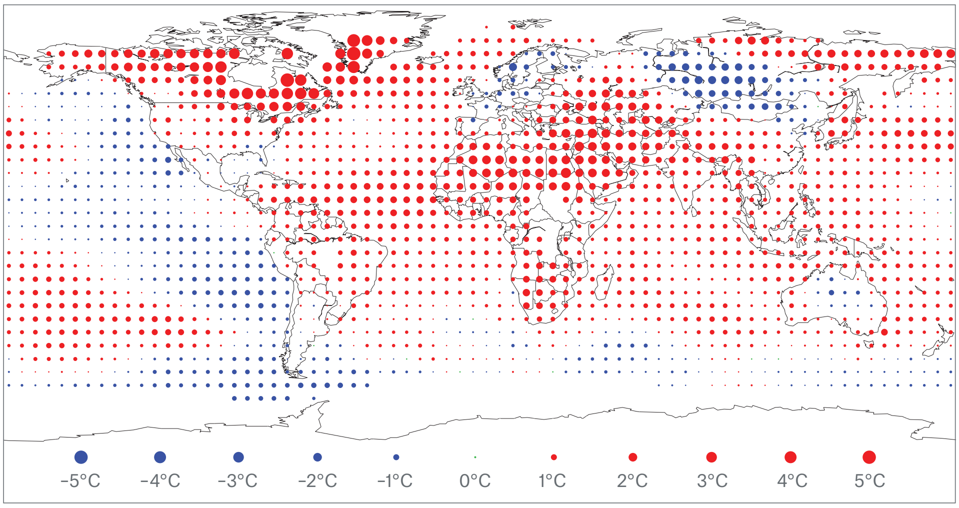
Greenland and the eastern half of Canada contributed disproportionately to this rise, with widespread warm anomalies of more than 3°C. North Africa, the Arab peninsula and southwest Asia were further hot spots, with many countries in this region, such as Turkey or Tunisia, experiencing temperatures higher than any before. At the same time, a large area of moderate cooling is observed in the course of the year along the eastern edge of the Pacific basin. This is associated with the transition from the El Niño conditions prevailing at the start of the year to the La Niña phase, which intensified from about mid-year onwards.

In January and February, large parts of western, central, northern and eastern Europe, and Russia were in the grip of icy cold, although in terms of global mean temperature it was the fourth warmest January and the sixth warmest February since 1880, according to the US weather office, NOAA. Model analyses by British researchers indicate that the cold late winter in parts of Europe and Russia may be a remote effect of the El Niño phenomenon.

Arctic

In keeping with the considerable temperature increases in Arctic latitudes, the mean extent of Arctic sea ice decreased to 4.9 million km^2 in September, the month with the minimum cover. This is the third-lowest value since the data series began in 1979. Even smaller ice covers were recorded only in 2007 and 2008. The absolute minimum for a month of June was also reached in that month. This means that the total September ice cover is already roughly one-third smaller than in the late 1970s. Temperatures in the Canadian sector were particularly high, allowing the meltdown to continue unchecked there. The ice cover was smaller than ever before.

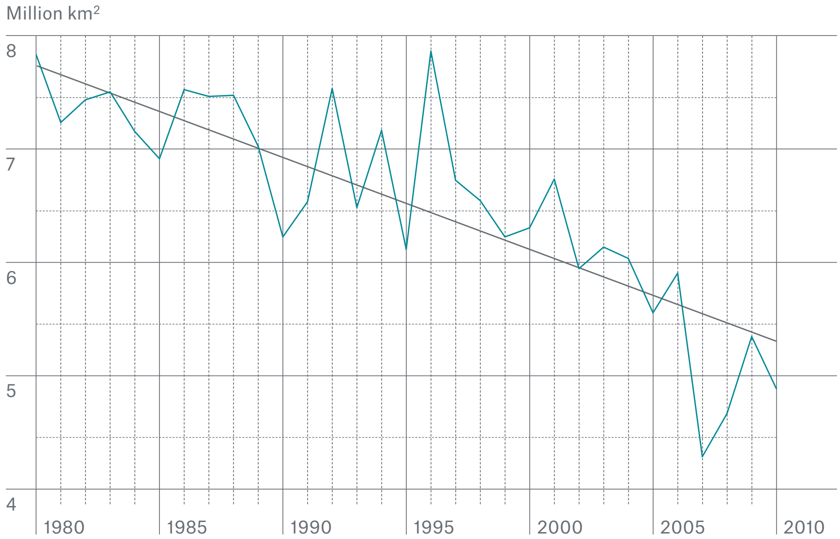
Regional anomalies of annual mean temperature 2010 with respect to the 1971–2000 mean



The temperature in many parts of the world was distinctly higher (red dots) in 2010 than on average for the years 1971–2000. Lower temperatures (blue dots) were only recorded in a small number of regions. The size of each dot reflects the magnitude of the deviation from mean temperature.

Source: National Climatic Data Center/NESDIS/NOAA

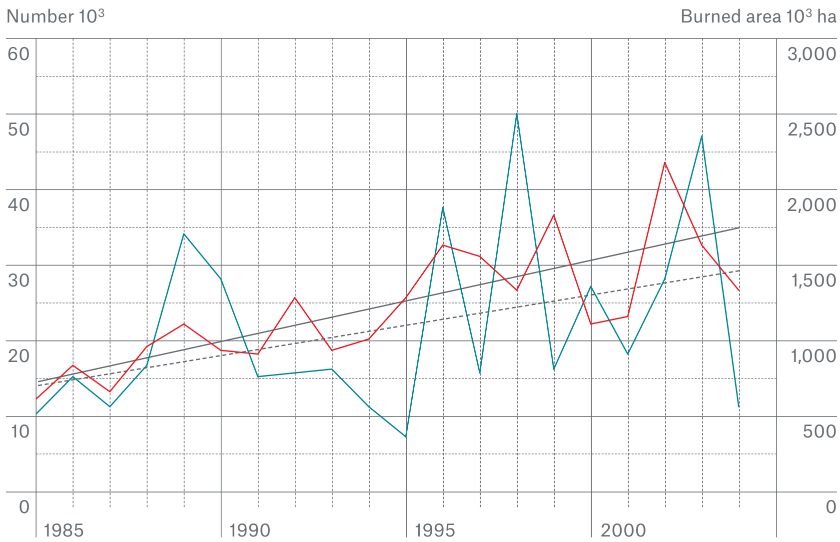
Arctic sea ice extent in September



The September extent of Arctic sea ice decreased strongly between 1980 and 2010.

Source: National Snow and Ice Data Center 2010

Wildfires in Russia



The number of wildfires and the area affected in Russia roughly doubled in the period from 1985 to 2004.

Number
Number (trend)
Area
Area (trend)

Source: Sherstyukov, B.G.; Sherstyukov A.B. 2007

As a result of the long-term decline in sea ice, the Arctic passages have become more easily navigable, facilitating exploration for and exploitation of the natural resources thought to exist there. This will lead to further expansion of the Arctic port facilities along the Canadian and Siberian coastal routes, as well as to the construction of technical installations and settlements, opening up a completely new field of specific natural hazard risks requiring special insurance solutions.

Extreme heat and drought

From June to August 2010, western Russia, eastern as well as southeastern Europe experienced the highest ever warm anomalies in global terms.

In July and August, fires blazed in western Russia, especially around Moscow, their smoke causing considerable health damage and tens of thousands of additional deaths in the capital. Although poor forest management made it easier for the fires to break out, the dryness associated with the heatwave was an essential parameter. A study by Russian researchers shows that corresponding changes associated with climate change have been observed in Russia since 1985. As a result, the number of wildfires recorded and the forest area burned per year more than doubled in the period from 1985 to 2004.

The study has predicted in a climate change scenario that, by 2025, the number of days with a high fire hazard index will be more than 50% above the mean for the period 1961–1990 in large areas of the southern half of western Russia. The event in 2010 already fits into the climate change trend.

Extremely hot summers were also recorded in Belarus, Ukraine and Finland; in Asia, China and Japan experienced the hottest summer on record. Southwest China had already suffered a severe drought in spring 2010. The highest temperature ever measured in Asia (53.5°C) was recorded in Pakistan on 26 May, also during a drought. As in 2005, large parts of the Amazon region were also stricken by drought, presumably as a consequence of the considerable rise in temperature of the tropical Atlantic. The Rio Negro dropped to its lowest level ever.

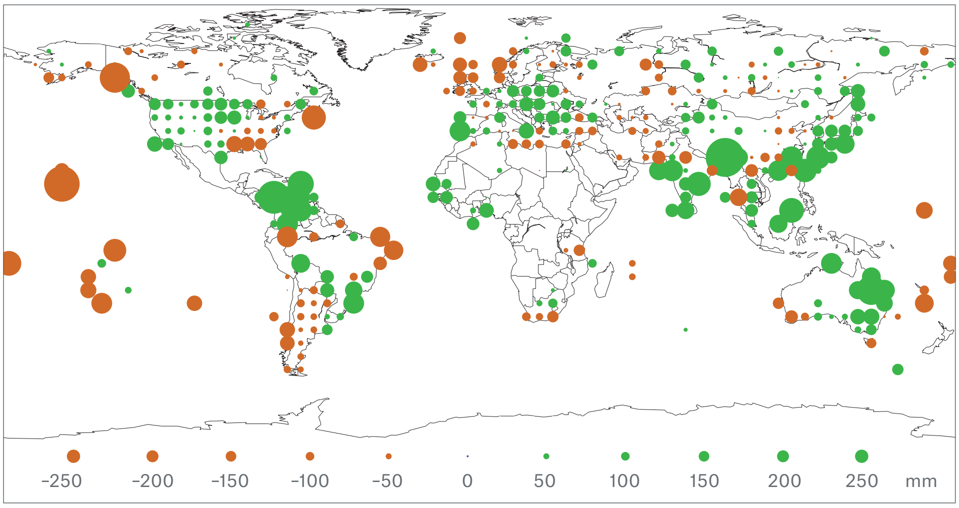
Extreme rainfall

The extreme nature of the Asian summer monsoon in late July/early August, which caused extensive flooding in Pakistan, must in all probability be associated with increased heavy rainfall due to climate change during the Indo-Pakistani summer monsoon. The total monsoon rain which fell in Pakistan in 2010 was the fourth-highest since records were first kept, although its extreme nature was further aggravated by the La Niña phase. A study has shown that heavy rain has accounted for an increasingly large part of the total annual rainfall in Asia during the past 50 years, particularly in northwest India and Pakistan. 2010 was consequently an extreme event within the framework of a longer-term trend. Western India and southeast China also suffered heavy monsoon flooding, which caused landslides in Gansu Province and claimed more than 1,400 lives, whilst West Africa experienced an extremely active summer monsoon, with major flooding.

The western edge of the Pacific basin and Colombia experienced heavy rainfall with flooding due to the La Niña phase in the second half of 2010. The northeast of Australia was hit by widespread floods which caused heavy losses in the latter part of the year.

Heavy rain and floods also caused extensive damage in Germany, Poland, Slovakia and other parts of eastern Europe in May, June and August. In many cases, this was associated with an atmospheric trough over Central Europe, a phenomenon now observed more frequently than in past decades. In Germany, 2010 brought the wettest August since records were first kept.

Regional anomalies in annual precipitation 2010 with respect to the 1961–1990 mean



The extreme nature of the Asian summer monsoon caused extensive flooding in Pakistan. West Africa also experienced an extremely active summer monsoon, with major flooding.

Source: National Climatic Data Center/NESDIS/NOAA

Tropical cyclones

Apart from the large number of tropical cyclones in the Atlantic basin, worldwide activity remained below average in 2010. Globally, 70 tropical cyclones were observed worldwide, including 35 with hurricane or typhoon strength, compared to the long-term average of 85 and 44, respectively. In the North Pacific, where the majority of tropical cyclones occur, the low level of activity was ascribed to development of the La Niña phase in the second half of 2010.

Outlook

The year 2010, with again a very high global mean annual surface temperature, supports the global warming trend of recent decades, and the hypothesis of climate change. On a global scale, regional cold phases, such as the late winter of 2009/10 in Europe, are more than compensated by warm anomalies elsewhere. Climate change becomes manifest above all when viewed from a global perspective, and it is totally misleading to base conclusions concerning the global climate on regional phenomena. Such catastrophes as the floods in Pakistan or the wildfires in Russia are extreme occurrences within the framework of regional trends which are in all probability attributable to climate change. The dense smoke which enshrouded Moscow is a scenario which could threaten other major cities if fire breaks out in adjacent large forest areas. Suitable forest management and adaptation are needed, including as regards the capacities available for fighting fires.

Some of the extreme occurrences and losses are attributable to natural climate fluctuations, such as the La Niña phase in the second half of the year. La Niña was partly responsible for the significant decline in typhoon activity in the Pacific, but Australia, Indonesia, Colombia, India and Pakistan experienced catastrophic rainfall. Seasonal forecasts can pave the way for more effective adaptation options here. In risk management, more attention should be paid to natural climate fluctuations in future. On time scales ranging from one to a few years, they have a considerable leverage effect on weather-related perils and the extent of damage or losses.

Floods and devastating landslides in early August 2010 claimed the lives of more than 1,400 people in Gansu Province in northwest China. Thousands of soldiers and helpers searched for survivors amidst the ruins for days.

We have nothing to lose

Author: Prof. Dr. Dr. Peter Höppe

We need look no further than this past year for evidence showing that climate change is real and continuing. The year 2010 sets the trend towards ever warmer years and an ever decreasing ice cover in the Arctic Ocean. Globally it was one of the warmest years since records began 130 years ago. The ice cover during the annual minimum in September was the third-lowest, reaching an absolute minimum for the month of June. Data collected by Munich Re also show that (after 2007) 2010 brought the second-highest number of loss-related weather catastrophes since 1980, when our data series began.

Despite these convincing figures and the very clear findings of international climate researchers, there is still a great deal of scepticism as regards climate change. Many politicians still do not see any urgent need for action to prevent uncontrollable changes. Negotiations at the climate change conference in Cancún have resulted in a number of advances, but an internationally binding agreement to reduce CO_2 emissions as a follow-up to the Kyoto Protocol has still not been concluded.

According to the International Panel on Climate Change (IPCC), CO_2 emissions account for more than 60% of the anthropogenic greenhouse effect. CO_2 remains in the atmosphere for more than 100 years on average and most of it is emitted as a result of burning fossil fuels. The key to sustainable, climate-friendly energy production lies in renewable energy sources.

They are available in abundance: the sun, for example, irradiates the earth's land masses with roughly 2,000 times more energy than we currently need as primary energy. Renewable energy sources are not only climate-friendly, they are also the only sustainable energy supply available without exhausting our limited natural resources.

I believe that future generations should also have access to oil, gas and coal, resources which they will no doubt put to more intelligent use than simply burning them. The price of renewable energy has dropped considerably in recent years and can already compete with that of fossil fuels in some regions. I not only hope but am also confident that this trend will continue. This development could be greatly speeded up by a global trading system that puts a price on CO_2 emissions.

Interestingly enough, the International Energy Agency (IEA) indicated for the first time this year in its World Energy Outlook that global oil production has already peaked, i.e. reached its maximum level. Any further increase in demand would cause prices to rise sharply, much to the benefit of renewables. The resultant market forces would make strict regulatory measures unnecessary. Until that point is reached, however, political action is called for. It must support the trend away from fossil fuels by putting a price on CO_2 emissions and promoting the use of renewable energy sources.

Some of our future energy could be supplied by the world's deserts, where solar irradiation and in some cases also the wind conditions are ideal for generating "clean electricity". Munich Re took a major step in this direction when it set up the desert electricity initiative Dii GmbH in 2009, together with the Desertec Foundation and many other leading companies.

Let us pursue the impending energy revolution even more resolutely so that 100% of our energy can be supplied from renewable sources as soon as possible. At least we would not have made any mistakes if – which I doubt – we discovered in a few decades that CO_2 emissions were not responsible for climate change after all. All that we would then have done is trigger the unavoidable changeover to other energy sources somewhat earlier. And we would leave some of that precious raw material called oil for future generations. Let us tackle this industrial change now – we have nothing to lose.

The year in figures

Great and devastating natural catastrophes 1980–2010

The year in pictures

Geo news

More than 1,700 people were killed in the worst floods experienced in Pakistan in decades. Direct losses due to the catastrophe are estimated at US$ 9.5bn, plus additional billions for reconstruction. The photograph shows flooded railway tracks at Sultan Kot in Sindh province.

The year in figures

Authors: Petra Löw, Angelika Wirtz

Topped only by 2007, 2010 was the year with the second-highest number of natural catastrophes since 1980. With 960 loss events due to natural hazards, the number of catastrophes documented in 2010 far exceeded the average for the last ten years (785 events). Overall losses amounted to approx. US$ 150bn, with the year's four major earthquakes (Haiti, Chile, China and New Zealand) accounting for no less than one-third of this sum. The insurance industry incurred losses totalling US$ 37bn.

Number of events

All loss events due to natural hazards resulting in property damage and/or bodily injury are recorded in Munich Re's NatCatSERVICE database. Events are divided into six categories according to their monetary or humanitarian impact – from minor loss events to great natural catastrophes. In 2010, five events met with the criteria qualifying them as "great natural catastrophes". In addition, there were 50 "devastating catastrophes" (category five with losses exceeding US$ 650m and/or more than 500 fatalities). There were 55 events classed as "severe catastrophes" (category four with more than US$ 250m in losses and/or more than 100 fatalities).

Out of all natural catastrophes worldwide, 91% were caused by atmospheric conditions and 9% were attributable to earthquakes and volcanic eruptions. The percentage breakdown of the main perils corresponds to the long-term average. The breakdown by continents shows that – as in the previous years – the majority of events occurred in America (367) and Asia (317), with 119 in Europe, 91 in Africa and 66 in Australia.

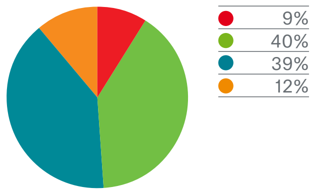
Fatalities

Last year saw more fatalities than any other year since 1983. With 295,000 deaths, 2010 was the second-deadliest year in the last three decades. The severe earthquake which struck Haiti in January alone claimed 222,570 lives, making it the deadliest single event of the year.

Overall losses and insured losses

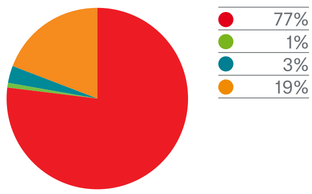
Overall losses in 2010 were the fifth-highest since 1980. Approximately half of the roughly US$ 150bn losses were in North and South America (US$ 74bn). Insured losses amounted to roughly US$ 37bn. The distribution of main perils in 2010 diverges strongly from the long-term average. Earthquakes accounted for 34% of all insured losses (average 1980–2009: 8%). The lion's share of insured losses occurred in North and South America, with 63%. Europe accounted for 15%, with Winter Storm Xynthia causing significant losses amounting to US$ 3.1bn. Australia and Oceania accounted for 20% of the losses incurred by the insurance industry. The costliest events were the earthquake in Christchurch, New Zealand, two hailstorms in Australia (Melbourne and Perth) and the floods in Queensland.

960 events



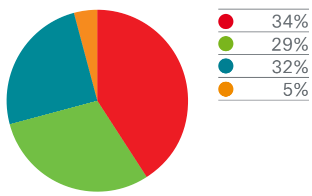
Percentage distribution worldwide

Fatalities: 295,000



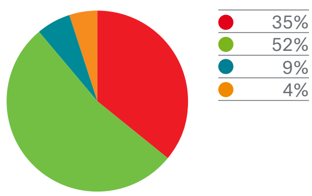
Percentage distribution worldwide

Overall losses: US$ 150bn



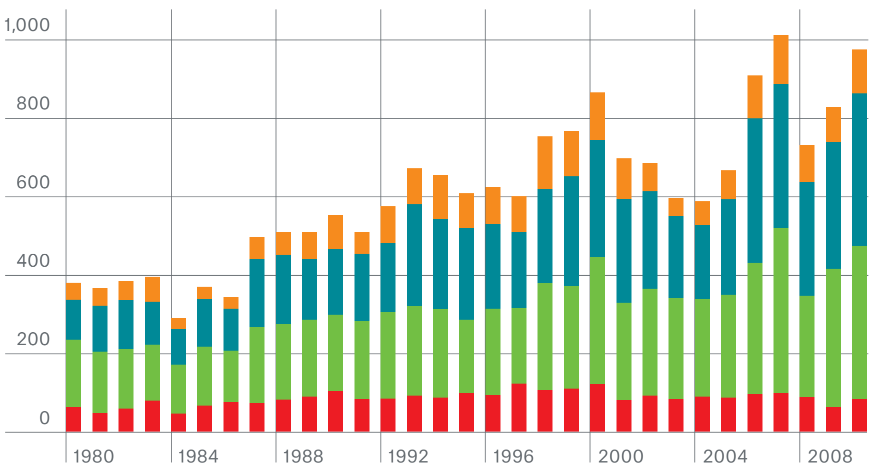
Percentage distribution worldwide

Insured losses: US$ 37bn



Percentage distribution worldwide

Number of natural catastrophes 1980–2010



Geophysical events: Earthquake, volcanic eruption

Meteorological events: Tropical storm, winter storm, severe weather, hail, tornado, local storms

Hydrological events: Flash flood, river flood, storm surge, mass movement (landslide)

Climatological events: Heatwave, freeze, wildland fire, drought

Great and devastating natural catastrophes 1980–2010

Authors: Petra Löw, Angelika Wirtz

Following the absence of great natural catastrophes in 2009, no less than five events met the criteria for the highest catastrophe category in 2010, namely the major earthquakes in Haiti, Chile and China, devastating floods in Pakistan and the heatwave with wildland fires in Russia.

Definition: Great natural catastrophe

Based on the United Nations definition, natural catastrophes are classified as great if a region's ability to help itself is distinctly overtaxed, making supraregional or international assistance necessary. As a rule, this is the case when there are thousands of fatalities, hundreds of thousands are left homeless and/or the overall or insured losses are of exceptional proportions given the economic circumstances of the country concerned.

In terms of our great natural catastrophe statistics, this means:

- Number of fatalities exceeds 2,000 and/or
- Number of homeless exceeds 200,000 and/or
- The country's GDP is severely hit and/or
- The country is dependent on international aid

Definition: Devastating natural catastrophe

Catastrophe category 5 – "devastating natural catastrophe" – is defined as follows:

- Number of fatalities exceeds 500 and/or
- Overall loss exceeds US$ 650m

Great natural catastrophes in 2010

The five "great natural catastrophes" claimed 280,000 lives. Overall losses amounted to US$ 52bn, including insured losses of around US$ 8bn. The humanitarian impact was particularly devastating in 2010. Four of the five major catastrophes qualify as "great" purely on account of the large number of fatalities and people left homeless. Only the earthquake in Chile met with the criteria of the highest loss category solely on account of the high economic damage sustained.

12 January – Earthquake, Haiti

The seismic shocks in Haiti triggered one of the most devastating earthquakes of the past 100 years. The magnitude 7 quake claimed some 222,570 lives and caused losses totalling US$ 8bn. It was the second-deadliest earthquake after the 1976 quake in Tangshan, China, with 242,000 fatalities.

27 February – Earthquake, Chile

520 people were killed by the major quake in Chile on 27 February. Overall losses were in the order of US$ 30bn. The earthquake, with a magnitude of 8.8, was the second most expensive for the insurance industry to date, with approximately US$ 8bn in insured losses.

13 April – Earthquake, China

The third major earthquake of the year, in Central China on 13 April, claimed at least 2,700 lives. It destroyed 85% of the buildings in the town of Jiegu. Overall losses amounted to US$ 500m.

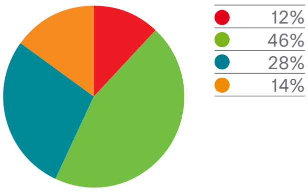
Great natural catastrophes since 1950

Deadliest events*

Year	Event	Country	Fatalities
1970	Tropical cyclone, floods	Bangladesh	300,000
1976	Earthquake	China	242,000
2010	Earthquake	Haiti	222,570
2004	Earthquake, tsunami	Esp. Indonesia, Sri Lanka, Thailand, India	220,000
2008	Cyclone Nargis	Myanmar	140,000
1991	Tropical cyclone, storm surge	Bangladesh	139,000
2005	Earthquake	Pakistan, India	88,000
2008	Earthquake	China	84,000
1970	Earthquake	Peru	67,000
1990	Earthquake	Iran	40,000

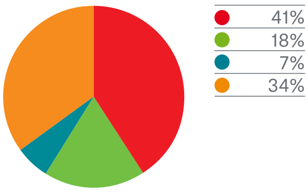
*Excluding droughts

773 events



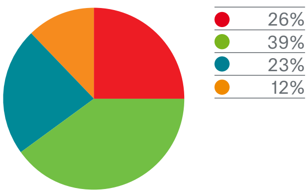
Percentage distribution worldwide

Fatalities: 2 million



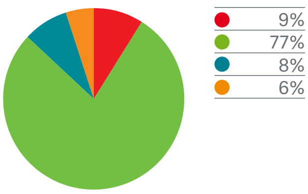
Percentage distribution worldwide

Overall losses: US$ 2,500bn



Percentage distribution worldwide

Insured losses: US$ 600bn



Percentage distribution worldwide

Great and devastating natural catastrophes since 1980

- Geophysical events: Earthquake, volcanic eruption
- Meteorological events: Tropical storm, winter storm, severe weather, hail, tornado, local storms
- Hydrological events: Flash flood, river flood, storm surge, mass movement (landslide)
- Climatological events: Heatwave, freeze, wildland fire, drought

July–September – Floods, Pakistan

Heavy monsoon rain caused Pakistan's most catastrophic floods. As many as 1,760 people were killed and millions lost everything they possessed, including their homes. Overall direct losses amounted to US$ 9.5bn.

July–September – Heatwave, Russia

At least 56,000 people died between July and September during the extreme heatwave in Russia, which was accompanied by forest and peat fires covering vast areas and causing harmful smog. The fires resulted in losses totalling US$ 1.5bn. The heatwave was the deadliest natural catastrophe in the country's history.

Analysis: Devastating and great natural catastrophes since 1980

Since 1980, 773 events have qualified as "great natural catastrophes" (catastrophe category 6) and "devastating natural catastrophes" (catastrophe category 5). Roughly 88% were weather-related catastrophes and 12% of geophysical origin, mostly earthquakes.

Fatalities

Since 1980, around two million lives have been lost due to "great" and "devastating" natural catastrophes. A storm surge in Bangladesh alone claimed 300,000 lives in 1970, while an earthquake in China claimed another 242,000 in 1976. The devastating earthquake in Haiti on 12 January 2010 ranks third in the list of deadliest natural catastrophes. With the three big quakes in 2010, geophysical events continue to account for the majority of fatalities. Earthquakes not only claimed 41% of lives lost due to "great" and "devastating" natural catastrophes, but also made up seven of the ten deadliest natural catastrophes since 1950.

Overall losses and insured losses

"Great" and "devastating" natural catastrophes since 1980 have caused overall losses in the order of US$ 2,500bn (in 2010 values). The costliest event was Hurricane Katrina, which caused devastation in the Gulf States of Louisiana and Mississippi in 2005. After adjustment for inflation, it caused overall losses in the amount of US$ 145bn and insured losses of US$ 72bn.

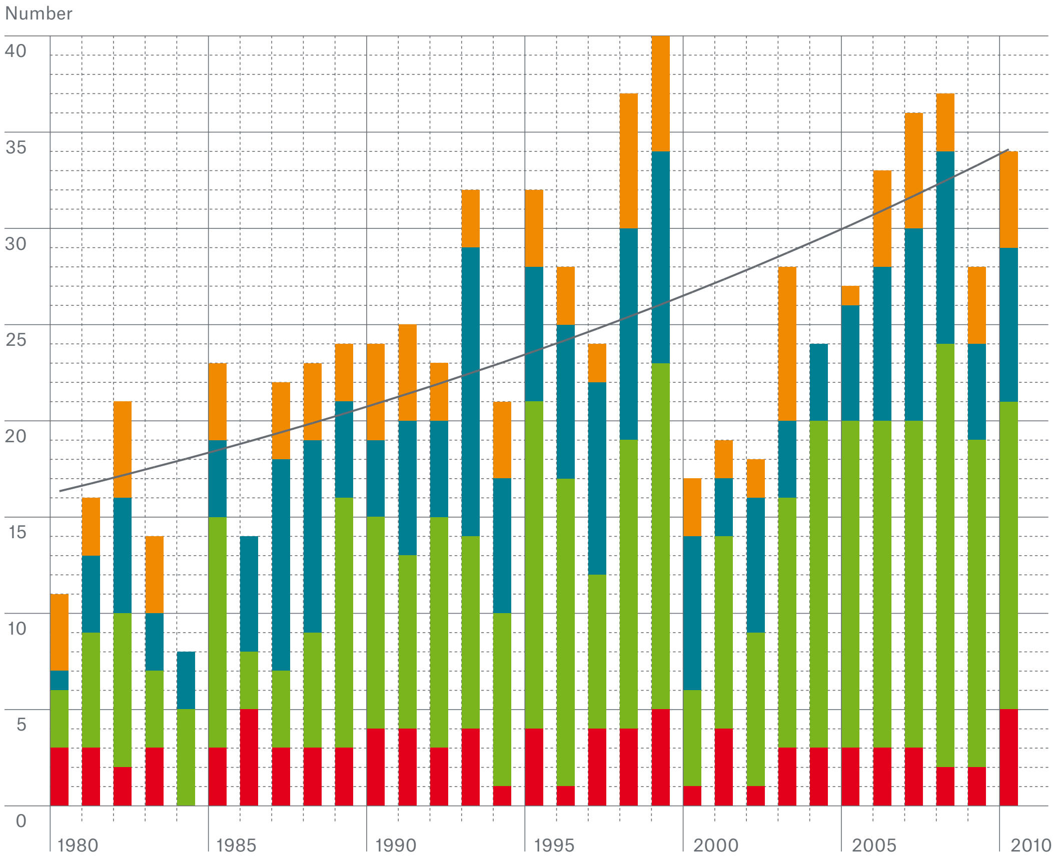
The insured losses attributable to all "great" and "devastating" natural catastrophes amount to roughly US$ 600bn in total. Due to the high worldwide insurance penetration for storms, meteorological events account for the lion's share of this total, with 78%.

Outlook

In order to adjust the losses due to "great" and "devastating" natural catastrophes in line with general developments in prices, both the overall and insured losses have been calculated in accordance with the applicable nominal consumer price index. The influence of population development and real increase in value, on the other hand, has been disregarded when calculating the amount of loss. The bars in the diagram on page 47 show the monetary impact of the respective catastrophes in today's prices under exactly the same conditions as those prevailing at the time.

Following the exceptional year 2009, the catastrophe year 2010 has once again confirmed the long-term trend in recent decades towards more frequent and more expensive major events. Severe earthquakes with extremely high fatalities dominated the year.

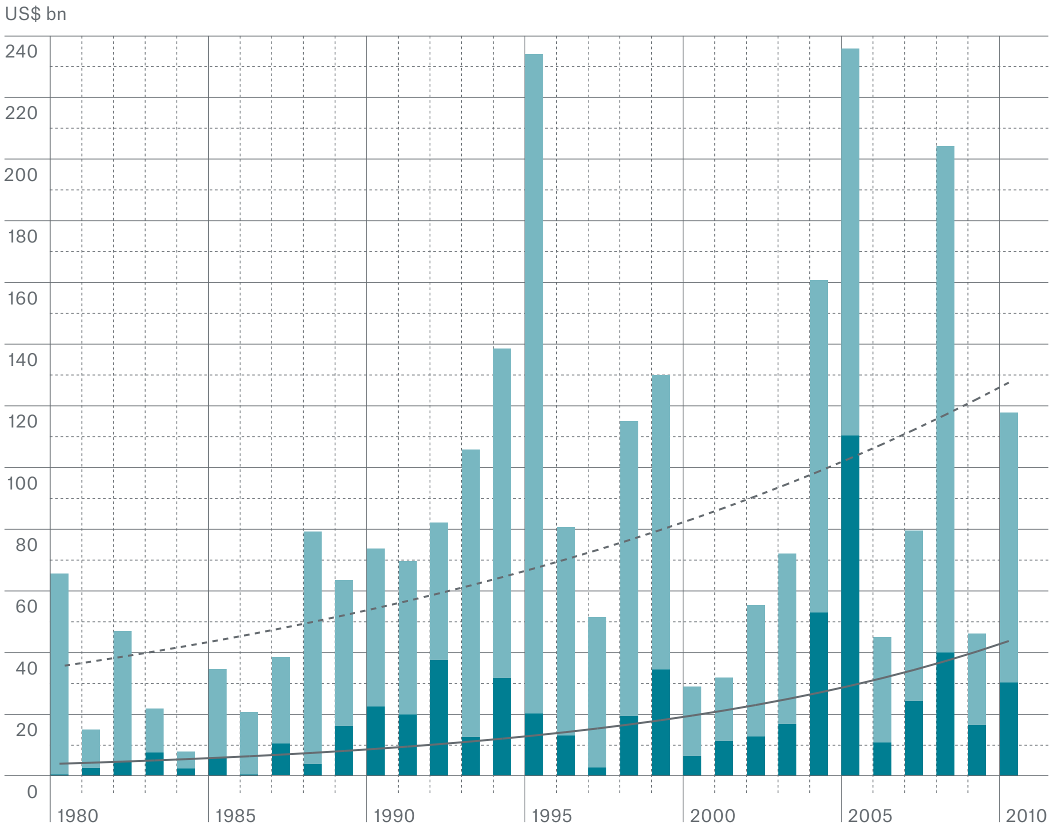
Number of events



The chart shows for each year the number of "great" and "devastating" natural catastrophes since 1980, divided up by type of event.

- Geophysical events: Earthquake, volcanic eruption
- Meteorological events: Tropical storm, winter storm, severe weather, hail, tornado, local storms
- Hydrological events: Flash flood, river flood, storm surge, mass movement (landslide)
- Climatological events: Heatwave, freeze, wildland fire, drought
- Trend

Overall losses and insured losses – Absolute values and long-term trends



The chart presents the overall losses and insured losses for "great" and "devastating" natural catastrophes – adjusted to present values.

- Overall losses (in 2010 values)
- Of which insured losses (in 2010 values)
- Trend: Overall losses
- Trend: Insured losses

The year in pictures

12 January
Earthquake: Haiti
Overall losses: US$ 8,000m
Insured losses: US$ 200m
Fatalities: 222,570

26 to 28 February
Winter Storm Xynthia: Europe
Overall losses: US$ 6,100m
Insured losses: US$ 3,100m
Fatalities: 65

27 February
Earthquake, tsunami: Chile
Overall losses: US$ 30,000m
Insured losses: US$ 8,000m
Fatalities: 520

March to May
Floods: Kenya, Uganda
Fatalities: 400

6 March
Hailstorm: Australia, Melbourne
Overall losses: US$ 1,330m
Insured losses: US$ 950m

13 April
Earthquake: China
Overall losses: US$ 500m
Fatalities: 2,700

April
Eyjafjallajökull volcanic eruption: Iceland
Air traffic disrupted

25 April
Landslide: Taiwan
Fatalities: 4

15 June
Flash floods: France
Overall losses: US$ 1,500m
Insured losses: US$ 1,070m
Fatalities: 25

25 June to 2 July
Hurricane Alex: El Salvador, Belize, Guatemala, Nicaragua, Mexico
Overall losses: US$ 1,500m
Insured losses: US$ 53m
Fatalities: 26

July to September
Floods: Pakistan
Overall losses: US$ 9,500m
Insured losses: US$ 100m
Fatalities: 1,760

Summer 2010
Wildland fires, heatwave: Russia
Overall losses: US$ 3,600m
Insured losses: US$ 20m
Fatalities: 56,000

6 to 16 August
Floods: Europe, esp. Germany
Overall losses: US$ 1,300m
Insured losses: US$ 50m
Fatalities: 16

3 September
Earthquake: New Zealand
Overall losses: US$ 6,500m
Insured losses: US$ 5,000m

15 to 19 September
Hurricane Karl: Mexico
Overall losses: US$ 3,900m
Insured losses: US$ 150m
Fatalities: 16

18 to 24 October
Typhoon Megi: Philippines, Taiwan, China
Overall losses: US$ 650m
Insured losses: US$ 100m
Fatalities: 46

26 October to 13 November
Volcanic eruption Merapi: Indonesia
Fatalities: 353

2 to 5 December
Wildfires: Israel
Overall losses: US$ 270m
Fatalities: 44

Author: Thomas Mahl

Innovative solution: Hedging credit risks with the aid of weather indices

Located within the typhoon belt, the Philippines are highly exposed to extreme weather events, such as torrential rain and strong wind. In October 2010, Typhoon Megi destroyed many people's livelihoods all over the Philippines. In the light of the rising number of weather-related natural catastrophes, Munich Re and the German Agency for Technical Cooperation (GTZ) entered into a development partnership (PPP) on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ) to provide suitable microinsurance solutions against extreme weather events.

Such events pose a financial risk to microfinance institutions like cooperatives, as their member borrowers often cannot repay their loans, thus increasing the rate of default. Currently, to offset this risk, cooperatives usually lend money to their borrowers at a higher interest rate, posing an additional burden to the member borrower. More often than not, this risk is not properly mitigated. Extreme weather events such as typhoons can affect the cash flow of a cooperative, leaving it in a state of insolvency.

The product

After analysing the situation, Munich Re and the GTZ developed microinsurance cover based on weather indices to limit cooperatives' losses on defaulted loans and to help them to meet their social commitments in the event of catastrophic events. Immediately after the event, the institution affected receives a sum which is disbursed to the members via emergency loans at advantageous conditions, depending on need.

Insurances based on a weather index are still relatively new in the Philippines. In other countries, they have already been used for a number of years, particularly as insurance against crop failures. However, a weather index microinsurance as a hedge for a credit portfolio is something totally new.

As a licensed composite insurance company, Cooperative Life Insurance Mutual Benefit Services (CLIMBS) was approached by the GTZ and Munich Re to be the primary insurance provider to cater for the needs of the cooperatives. In the Philippines, cooperatives are democratically organised associations promoting self-reliance and economic development by offering, among other things, services, loans and insurances. Because CLIMBS unites more than 1,600 cooperatives nationwide under a single umbrella, it can draw on a closely meshed network that facilitates outreach to local communities. CLIMBS safeguards the credit portfolios and pays out the insurance benefits in the event of a loss. Munich Re is the sole reinsurer for this product.

Underlying principle

Benefits from a policy are linked to certain threshold values for an event, and not to individual claims amounts. This means that the cooperatives receive a predetermined percentage of their credit volume as soon as a certain amount of rainfall or wind speed is reached.

The threshold values vary for each local government unit (municipality) subject to the area's exposure to wind and rain, its topographical conditions and location. This ensures that each municipality's vulnerability and individual perception of the risk is taken into account. Ten-minute mean wind speed, based on data from the RSMC (Regional Specialized Meteorological Center) of Japanese Meteorological Authority (JMA, is used as the threshold value for the intensity of a storm. Precipitation is based on the total amount registered within a 24-hour interval (mm/24 h). Evaluation is based on publicly available satellite data from the Tropical Rainfall Measuring Mission (TRMM), a joint venture between NASA and JAXA, the Japanese Aerospace Exploration Agency.

The amount of insurance benefit depends on the severity of the event: yellow stands for a return period of ten to 15 years, orange for 15 to 20 years and red for events recurring after more than 20 years.

Payout of the insurance benefit

The weather is monitored by independent consultant DHI. As soon as wind speed or rainfall exceeds the predefined threshold values, the event is classified according to the three colour codes, based on the severity of the expected impact for the municipality concerned. Each colour code is associated with a certain payout rate (5, 10 or 20%) of the cooperative's reported total loan portfolio in that municipality. The cooperatives are required to give a binding undertaking to use the insurance payments to the benefit of those most seriously affected. The money is used, for example, to help members rebuild their houses or replace their livestock or production equipment.

Administration

Transparency has highest priority with this kind of insurance. For this reason, daily updated meteorological data are disseminated via an online monitoring system to the cooperatives. In addition, CLIMBS has access to a web-based administrative tool to facilitate monitoring of the insurance portfolio and claims handling.

Conclusion

The financial crisis showed that, contrary to the conventional banks, microfinance service providers are more able to resist systemic risks. However, in the case of natural catastrophes, such institutions generally sustain a huge increase in loan defaults. Now, thanks to this innovative approach by Munich Re and the GTZ, they can insure against such risks. As the product operates with remote sensing data, we expect it to have major potential for replication – not only for the Philippines, but also globally. Since extreme weather events induced by climate change are likely to increase in the future, microinsurance instruments are expected to be of growing relevance for affected communities and for insurers' portfolios.

Lump-sum payments make handling easier

YELLOW CATEGORY	ORANGE CATEGORY	RED CATEGORY
PAYOUT of 5% of the average total credit volume per municipal unit	PAYOUT of 10% of the average total credit volume per municipal unit	PAYOUT of 20% of the average total credit volume per municipal unit

Depending on the severity of the expected loss, an event is assigned to one of the three categories yellow, orange or red. This determines the amount of benefit paid out under the insurance to the cooperatives affected.

Authors in this issue

Prof. Dr. Dr. Peter Höppe
Head of Geo Risks
Research/
Corporate Climate Centre

Dr. Eberhard Faust
Head of Research: Climate
Risks and Natural Hazards
Geo Risks Research/
Corporate Climate Centre

Dr.-Ing. Wolfgang Kron
Head of Research:
Hydrological Hazards
Geo Risks Research/
Corporate Climate Centre

Thomas Mahl
Business Development
Manager
Munich Re Singapore Branch

Dr. Hans-Leo Paus
Risk Solutions
KA Köln.Assekuranz
Agentur GmbH

Markus Steuer
Consultant Documentation
and Communication/
Nat Cat Analyst
Geo Risks Research/
Corporate Climate Centre

Angelika Wirtz
Head of MRNatCatSERVICE
Geo Risks Research/
Corporate Climate Centre

Ernst Bedacht
Expert Meteorological Risks
Corporate Underwriting/
Geo Risks

Thomas Hofherr
Expert Meteorological Risks
Corporate Underwriting/
Geo Risks

Petra Löw
Expert NatCatSERVICE
Geo Risks Research/
Corporate Climate Centre

Dr. Peter Müller
General Representative for
the Commonwealth of
Independent States
Managing Director
Munich Re Moscow Non-Life

Dr. Anselm Smolka
Head of Corporate
Underwriting/Geo Risks

Bernd Wagner
Geo Risks Manager
Corporate Underwriting/
Geospatial Solutions

The following contributed articles for the USA and Asian issues respectively:

Mark Bove
Senior Research
Meteorologist
Underwriting Services
Division Munich Re USA

Hua He, Ph.D.
Nat Cat Consultant, GEO
Non-Life Reinsurance
Munich Re, Beijing

Münchener Rückversicherungs-Gesellschaft
Königinstrasse 107
80802 München
Germany
Tel.: +49 89 38 91-0
Fax: +49 89 39 90 56
www.munichre.com

Responsible for content
Geo Risks Research (GEO/CCC1)

Contact person
Angelika Wirtz
Tel.: +49 89 38 91-34 53
Fax: +49 89 38 91-7 34 53
awirtz@munichre.com

Editor
Angelika Wirtz, Munich Re

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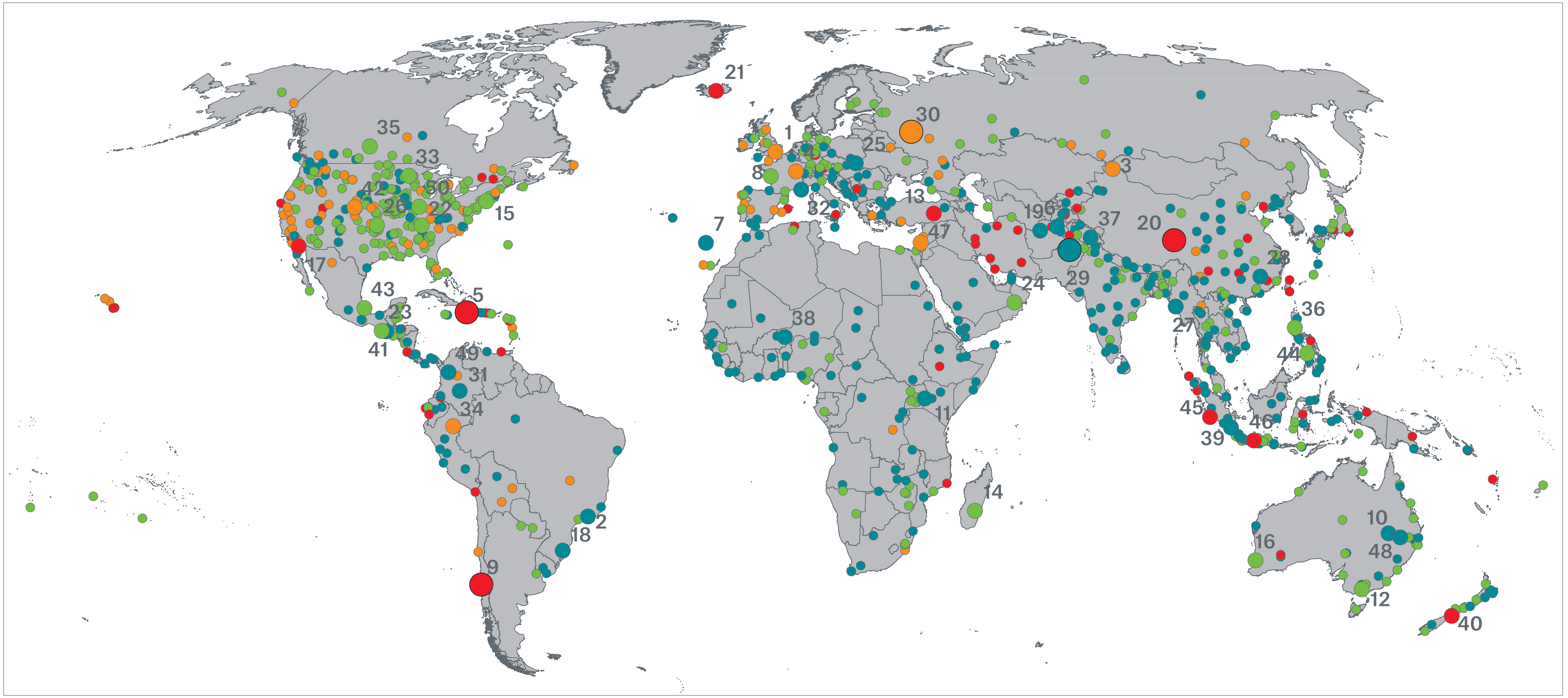
TOPICS GEO – 50 MAJOR EVENTS IN 2010

No.	Date	Loss event	Region	Fatal-ities	Overall losses US$ m	Insured losses US$ m	Explanations, descriptions
1	1–5.1.	Winter damage	Europe	10	210		Heavy snowfalls. Losses to infrastructure. Airports closed, train services suspended.
2	1–5.1.	Floods, landslides, severe storms	Brazil	76	15		Hillside collapse. >14,000 homes damaged/destroyed. Losses to infrastructure. Nuclear power station shut down.
3	1–27.1.	Winter damage, snowstorms	China	50	90		Temperatures as low as -43°C, heavy snowfall. 100,000 homes damaged/destroyed. Losses to crops and livestock.
4	8–13.1.	Winter damage	Europe		1,730	1,000	Snowstorms. Losses to buildings and infrastructure. Flights, train services disrupted.
5	12.1.	Earthquake	Haiti	222,570	8,000	200	Mw 7.0. Widespread severe destruction. Major losses to infrastructure and lifeline utilities. Water and food shortage. Diseases. More than 300,000 injured, 1.3 million displaced.
6	8–9.2.	Avalanches	Afghanistan	175			Series of avalanches. 2,600 cars, 11 buses damaged/destroyed. Roads damaged.
7	20.2.	Severe storms, flash floods	Portugal	43	1,350	70	Landslides. Hundreds of homes damaged/destroyed, >500 cars destroyed. Losses to infrastructure.
8	26–28.2.	Winter Storm Xynthia,	Southwestern and western Europe	65	6,100	3,100	Wind speeds up to 150 km/h, storm surge, waves up to 8m. Sea walls, dykes destroyed. >1,000 homes destroyed, thousands of homes damaged. A million people without electricity. Losses to infrastructure, agriculture and aquaculture.
9	27.2.	Earthquake, tsunami	Chile	520	30,000	8,000	Mw 8.8, tsunami. Hundreds of thousands of homes, cars, 4,200 boats damaged/destroyed. Roads, highways, bridges destroyed. Power outages, water supply affected. Severe losses to agriculture, esp. vineyards. Homeless: 800,000.
10	March–April	Floods	Australia		230	110	Hundreds of homes damaged. Losses to infrastructure, crops and livestock.
11	March–May	Floods, landslides	Kenya, Uganda	400			Mudslides, mountain slide (Mt. Elgon). Villages buried. Hundreds of homes, 16 bridges destroyed. Crops destroyed, livestock killed.
12	6.3.	Hailstorm	Australia, Melbourne		1,330	950	Thunderstorms, large hail. Thousands of homes and cars damaged. Losses to car dealership.
13	8.3.	Earthquake	Turkey	57			Mw 6.1. >280 buildings, minarets destroyed. Livestock killed.
14	10–15.3.	Tropical Storm Hubert, floods	Madagascar	83			Landslides. Homes, schools, infrastructure destroyed. Livestock killed. Homeless: 100,000.
15	13–15.3.	Severe storms, floods	USA: esp. NJ, NY	11	1,700	1,220	Thousands of homes, businesses, cars damaged/destroyed. Losses to airport facilities and infrastructure.
16	22.3.	Severe storm, hailstorm	Australia, Perth		1,390	990	Large hail. Hundreds of buildings, thousands of vehicles damaged. >160,000 without electricity. Losses to crops and fishery.
17	4.4.	Earthquake	Mexico, USA	2	1,150	400	Mw 7.2. 6,000 homes damaged. Water and sewage systems damaged. Telecommunication, electricity cut off. Injured: >230, evacuated/displaced: 25,000.
18	5–8.4.	Landslides, floods	Brazil	256	115		Hillside collapse. >3,500 homes damaged/destroyed. Roads blocked, air and rail traffic affected.
19	11.4–26.5.	Floods, flash floods	Afghanistan	120			Landslides. >10,000 homes damaged/destroyed. Losses to crops, livestock killed.
20	13.4.	Earthquake	China	2,700	500		Mw 6.9, landslides. >15,000 homes destroyed. Dam damaged. Telecommunications cut off. Injured: >12,000, missing: 270, homeless: 100,000.
21	April	Volcanic activity Eyjafjallajökull	Iceland				Emission of gas and ash. Widespread flight disruption across Europe due to cloud of volcanic ash.
22	30.4–3.5.	Severe storms, tornadoes, floods	USA: esp. TN	32	2,700	800	>70 tornadoes. Thousands of homes and cars damaged. Water supply affected. Crops destroyed, livestock killed. Losses to infrastructure.
23	29.5–1.6.	Tropical Storm Agatha, floods	El Salvador, Guatemala, Honduras	205	760	50	>60,000 homes, 250 bridges damaged/destroyed. Major losses to infrastructure, crops, fishery and livestock. Evacuated: >190,000.
24	1–6.6.	Cyclone Phet, storm surge	India, Oman, Pakistan	39	1,100	150	Wind speeds up to 230 km/h, storm surge. >1,000 homes, vehicles damaged/destroyed. Desalination plants, power lines, water pipes destroyed. Oil and gas production interrupted. Evacuated: >68,000.
25	2–12.6.	Floods	Eastern Europe	7	3,800	280	Rivers burst their banks, dykes damaged. Thousands of homes, cars damaged. Roads, railway lines flooded. Crops destroyed.
26	10–16.6.	Severe storms, tornadoes, flash floods	USA: esp. CO	1	850	625	Buildings, cars damaged. Losses to infrastructure and agriculture.
27	13–15.6.	Flash flood, landslides	Bangladesh, Myanmar	128			Heavy monsoon rain. Thousands of homes damaged/destroyed. Losses to infrastructure and crops.
28	June–July	Floods, landslides	China	>800	15,000	270	Rivers, reservoirs burst their banks. 1m buildings damaged/destroyed. Bridges collapse. Severe losses to infrastructure. 40,000 km^2 of crops damaged/destroyed. 2.7 million evacuated.
29	July–Sept.	Floods, flash floods	Pakistan	1,760	9,500	100	Torrential monsoon rains. 10,000 villages affected. 1.24 million homes damaged/destroyed. Severe losses to power facilities. Major damage to infrastructure. >69,000 km^2 of cropland damaged/destroyed. Food shortage. Affected: >15 million.
30	Summer 2010	Heatwave, drought, wildfires	Russia	56,000	3,600	20	Lack of rain, temperatures up to 45°C. Worst drought in 130 years. Toxic smog, esp. in Moscow. 2,500 homes burnt. Severe losses to agriculture, forestry and infrastructure.
31	June–Nov.	Floods, landslides	Colombia	100	>1,000		Mudslides. Rivers burst their banks, dykes breached. 230,000 homes damaged.
32	15.6.	Flash floods	France	25	1,500	1,070	Thousands of homes and cars damaged. Power outages. Major losses to infrastructure.
33	17–20.6.	Severe storms, tornadoes	USA, esp. MN, MT	4	830	620	Major losses to homes, businesses, mobile homes, cars. 450,000 people without electricity.
34	July	Cold wave	Argentina, Bolivia, Paraguay, Peru	175			Heavy snowfall. Crops damaged, thousands of head of livestock killed.
35	12.7.	Hailstorm	Canada		550	400	Large hail (up to 4.5 cm in diameter). Severe losses to homes, greenhouses and vehicles.
36	12–17.7.	Typhoon Conson	China, Philippines, Vietnam	114	15		Thousands of homes destroyed, 28,500 damaged. Losses to infrastructure. Power failure. Crops, vegetables, fruits damaged.
37	5–9.8.	Floods, mudslides	India	200			10,000 homes damaged. Severe losses to infrastructure. Cropland destroyed.
38	5.8–2.9.	Floods	Niger	7			Record level on Niger. 30,000 homes destroyed. Losses to agriculture. >200,000 homeless.
39	7.8.	Landslides, flash floods	China	1,467	500		>4,000 homes, cars destroyed. Major losses to infrastructure.
40	3.9.	Earthquake	New Zealand		6,500	5,000	Mw 7.0. Severe losses in Christchurch. >100,000 homes, businesses damaged. Roads, bridges, tunnel, port facilities damaged. Losses to power and communication lines network. Water pipes destroyed, water and gas supply disrupted.
41	4–13.9.	Landslides, floods	Guatemala	53	500		200 landslides. Homes, vehicles buried. Roads, highways blocked.
42	6–13.9.	Wildfires	USA: esp. CO		310	210	170 homes, mobile homes, numerous cars destroyed, thousands of buildings damaged.
43	15–19.9.	Hurricane Karl, floods	Mexico	16	3,900	150	Wind speeds up to 195 km/h. Thousands of homes, businesses, cars damaged/destroyed. Oil production interrupted. Losses to industry and infrastructure. >550,000 evacuated/displaced.
44	18–24.10.	Typhoon Megi	China, Philippines, Taiwan	46	650	100	Wind speeds up to 230km/h. 31,000 homes destroyed, 118,000 damaged. Major losses to infrastructure, crops and livestock.
45	25.10.	Earthquake, tsunami	Indonesia	448			Mw 7.7. Thousands of homes, roads, bridges destroyed. Displaced: 20,000.
46	26.10–13.11	Volcanic activity Mt. Merapi	Indonesia	353	100		Emission of ash and gas. 2,300 homes destroyed. Flights cancelled. 400,000 evacuated.
47	2–5.12.	Wildfires	Israel	44	270		40 km^2 of forest burnt. >100 homes destroyed. Evacuations.
48	December, Ongoing	Floods	Australia		>10,000*	up to 5,000*	Coal production affected. Losses to infrastructure and agriculture. Loss assessment is in process.
49	5.12.	Landslide	Colombia	100			>30 homes buried. Missing 70.
50	11–13.12.	Winter storm	USA: esp. IL	15			Heavy snowfall. Homes, cars, stadium damaged. Highways closed. Power failure.

TOPICS GEO – WORLD MAP OF NATURAL CATASTROPHES 2010

Munich RE



960 natural hazard events, thereof

50 major events (selection)

In 2010, 5 events fulfilled the criteria applicable to a great natural catastrophe.

- **Geophysical events:** Earthquake, volcanic eruption
- **Meteorological events:** Tropical storm, winter storm, severe weather, hail, tornado, local storm
- **Hydrological events:** River flood, flash flood, storm surge, mass movement (landslide)
- **Climatological events:** Heatwave, cold wave, wildfire, drought

Münchener Rückversicherungs-Gesellschaft
Königinstrasse 107, 80802 München
Germany

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