

# sigma

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## **Natural catastrophes and man-made disasters in 2015: Asia suffers substantial losses**

- 01 Executive summary
- 02 Catastrophes in 2015:  
global overview
- 07 Regional overview
- 13 Tianjin: a puzzle of risk  
accumulation and  
coverage terms
- 17 Leveraging technology in  
disaster management
- 21 Tables for reporting  
year 2015
- 43 Terms and selection criteria



# Executive summary

In 2015, there were a record 198 natural catastrophes.

Globally, total losses from disasters were USD 92 billion in 2015, with most in Asia. Close to 9000 people died in an earthquake in Nepal.

Insured losses were USD 37 billion, low relative to the previous 10-year average.

The biggest insured loss of the year came from the explosions that rocked the Port of Tianjin in China in August.

Another feature of 2015 was that it will go down as the hottest year on record. Many regions experienced drought and wildfires ...

... although some countries, such as India, the UK and the US, experienced severe rain and flooding events.

This *sigma* includes two feature chapters, one on the Tianjin explosions and another on the use of technology in disaster management.

There were 353 disaster events in 2015, of which 198 were natural catastrophes, the highest ever recorded in one year. There were 155 man-made events. More than 26 000 people lost their lives or went missing in the disasters, double the number of deaths in 2014 but well below the yearly average since 1990 of 66 000. The biggest loss of life – close to 9000 people – came in an earthquake in Nepal in April.

Total economic losses caused by the disasters in 2015 were USD 92 billion, down from USD 113 billion in 2014 and below the inflation-adjusted average of USD 192 billion for the previous 10 years. Asia was hardest hit. The earthquake in Nepal was the biggest disaster of the year in economic-loss terms, estimated at USD 6 billion, including damage reported in India, China and Bangladesh. Cyclones in the Pacific, and severe weather events in the US and Europe also generated large losses.

Global insured losses from catastrophes were USD 37 billion in 2015, well below the inflation-adjusted previous 10-year average of USD 62 billion. The relatively low level of losses was largely due to another benign hurricane season in the US. El Niño in 2015 contributed to weather patterns deviating from average climate norms. For instance, tropical cyclone activity in the North Atlantic was suppressed, while the Pacific Ocean basin had a very active season.

Of the insured losses in 2015, USD 28 billion were attributed to natural catastrophes (about the same as in 2014) and USD 9 billion to man-made events (up from USD 7 billion). The biggest insured-loss was caused by the two massive explosions at the Port of Tianjin in China in August, with an estimated property loss of USD 2.5 billion to USD 3.5 billion, making it the largest ever recorded man-made insured loss event in Asia. The next biggest insured-loss event was a winter storm in the US in February.

Despite a harsh winter season in the US, overall 2015 was the hottest year since 1850.<sup>1</sup> Exceptionally high temperatures and lack of rainfall caused drought and wildfires in many regions. In Europe, summer temperatures remained above 30°C for long stretches. Countries in Eastern Europe were particularly hard hit with drought conditions lingering through to the end of the year. The US experienced its worst year for wildfires since 1960 because of the heat and dry conditions. Heatwaves claimed a number of lives all over the world.

There were also severe precipitation events. In India, the city of Chennai was paralysed by flooding after accumulated rainfall of more than 500 mm in November alone. Large swathes of the northern UK were under water in December due to heavy rains from three separate storms. Preliminary estimates put the insured losses from the UK floods at around USD 2 billion. In several states in the US, tropical storm activity generated heavy rains and severe flooding in certain areas. Countries in Africa, in particular Malawi, Kenya and Madagascar, experienced severe floods also.

In view of the large earthquake that struck Nepal in April 2015, tremors of which were also felt in Delhi, this *sigma* assesses the loss potential of a similarly intense event closer to the Indian capital city. The result is total losses in Delhi of at least USD 4 billion, largely uninsured. The *sigma* also includes a special chapter on the explosions in Tianjin, which have put a spotlight on accumulation risk in large transportation hubs such as ports. Many assets in Tianjin – in particular high-value cars in transit at the port – were destroyed by the explosions. This, and the imposition of an exclusion zone at the site, made it very difficult for insurers to assess the losses. Finally, there is also a feature on the use of aerial and digital technologies in disaster risk management.

<sup>1</sup> "2015: the warmest year on record, scientists say", *metoffice.gov.uk*, 16 January 2016, <http://www.metoffice.gov.uk/news/releases/archive/2016/2015-global-temperature>

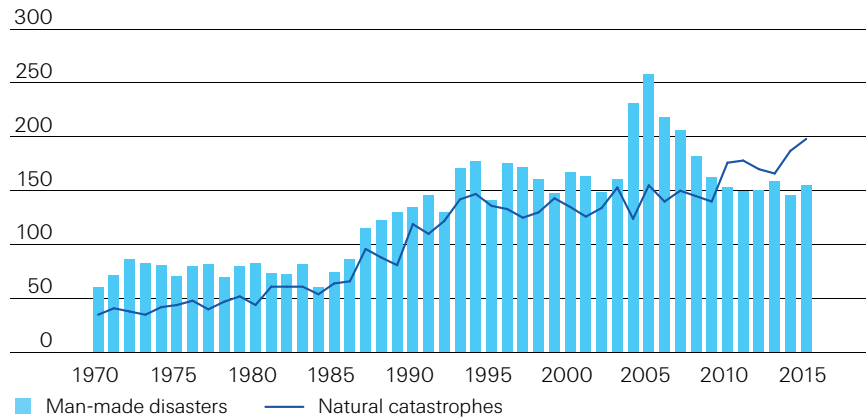
# Catastrophes in 2015: global overview

There were 198 natural catastrophes in 2015, and 155 man-made disaster events.

**Figure 1**  
Number of catastrophic events, 1970–2015

## Number of events: 353

Based on *sigma* criteria, there were 353 catastrophe events across the world in 2015, up from 339 in 2014. Of those, 198 were natural catastrophes, the highest ever recorded in one year, and up from 191 in 2014. The remaining 155 events were man-made disasters, also more than the 148 that occurred in 2014.



Source: Swiss Re Economic Research & Consulting and Cat Perils.

The *sigma* event selection criteria.

An event is classified as a catastrophe and included in the *sigma* database when insured claims, total losses or the number of casualties exceed certain thresholds, detailed in Table 1.

**Table 1**  
The *sigma* event selection criteria, 2015

Insured losses (claims)	
Maritime disasters	19.7 million
Aviation	39.3 million
Other losses	48.8 million
<hr/>	
or Total economic losses	97.7 million
<hr/>	
or Casualties	
Dead or missing	20
Injured	50
Homeless	2000

Source: Swiss Re Economic Research & Consulting and Cat Perils.

More than 26 000 people lost their lives in disaster events in 2015.

More than 19 000 people died in natural catastrophes.

There were nearly 7 000 deaths in man-made events, many due to maritime disasters.

A stampede, major fires and explosions and airplane crashes claimed many victims.

## Number of victims: more than 26 000

More than 26 000 people lost their lives or went missing in natural and man-made disasters in 2015. The number of lives lost was more than double that in 2014, but was still well below the yearly average of around 66 000 deaths since 1990.

More than 19 000 people were killed or went missing in natural catastrophes, the majority in the devastating earthquake that struck Nepal in April. Heatwaves and other severe weather events in many regions also claimed a number of lives.

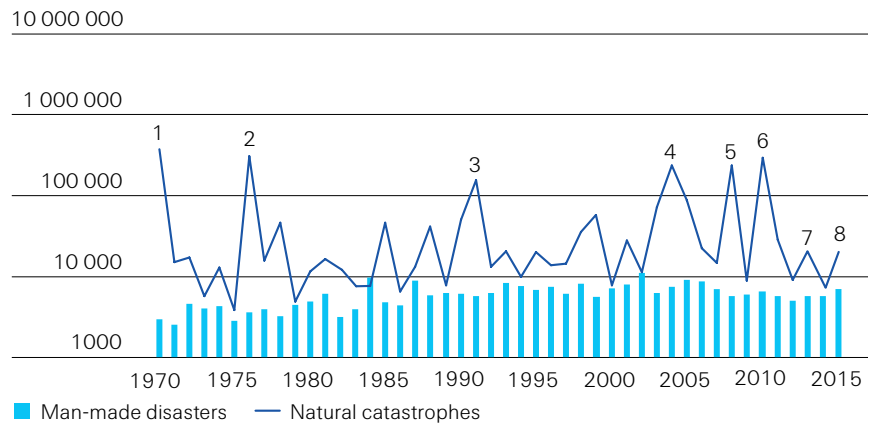
There were nearly 7 000 deaths in man-made disasters, compared to approximately 5 900 in 2014. The sinking of a boat carrying migrants off the Libyan coast on 19 April 2015 killed more than 800, the highest loss from a single event in the Mediterranean Sea on *sigma* records. The total number of reported deaths in maritime disasters rose to 2 487 from 2 118 in the previous year. Many more are believed to have died in unreported incidents of boats sinking while carrying migrants fleeing war-torn lands.

Other man-made catastrophes claiming a high number of victims included a stampede at the annual Hajj pilgrimage in Saudi Arabia where, according to government sources, 769 people died. Aviation disasters took 685 lives in 2015, down from 960 in 2014. Most of the fatalities were in two crashes. In March, a pilot committed suicide by crashing the plane he was flying into the French Alps, taking with his the lives of the other 149 people on board. And in October, a jet crashed in the Sinai in Egypt, allegedly due to a bomb blast on the plane, killing 224 people. There were other individual man-made disasters in 2015, including major fires and explosions which took 1 123 victims.

**Figure 2**

Number of victims, 1970–2015

- 1 1970: Bangladesh storm
- 2 1976: Tangshan earthquake, China
- 3 1991: Cyclone Gorky, Bangladesh
- 4 2004: Indian Ocean earthquake and tsunami
- 5 2008: Cyclone Nargis, Myanmar
- 6 2010: Haiti earthquake
- 7 2013: Typhoon Haiyan, Philippines
- 8 2015: Earthquake in Nepal



Note: scale is logarithmic – the number of victims increases tenfold per band.

Source: Swiss Re Economic Research & Consulting and Cat Perils.

## Catastrophes in 2015: global overview

Total economic losses in 2015 were well below the 10-year average.

Global natural catastrophe-related losses were around USD 80 billion.

**Table 2**

Total losses, in USD billion and % of global GDP, 2015

### Total economic losses: USD 92 billion

The estimated total economic losses<sup>2</sup> from natural catastrophes and man-made disasters across the world were USD 92 billion in 2015. This is less than the USD 113 billion total loss in 2014, and is well below the inflation-adjusted average of the previous 10 years (USD 192 billion). Catastrophe losses in 2015 were 0.12% of global gross domestic product (GDP) versus the 10-year average of 0.28%.

Natural catastrophe-related total losses were around USD 80 billion in 2015, stemming mostly from earthquakes, tropical cyclones, other severe storms and droughts in Asia, North America and Europe.

Regions	USD bn*	% of GDP
North America	29	0.14%
Latin America & Caribbean	7	0.14%
Europe	13	0.06%
Africa	1	0.05%
Asia	38	0.15%
Oceania/Australia	3	0.20%
Seas / space	1	
<b>Total</b>	<b>92</b>	
World total		0.12%
10-year average **	192	0.28%

\* rounded numbers      \*\* inflation adjusted

Source: Swiss Re Economic Research & Consulting and Cat Perils.

Man-made disasters caused USD 12 billion in total losses.

Man-made disasters are estimated to have caused USD 12 billion of the total global losses in 2015, up from USD 9 billion in 2014.

<sup>2</sup> From hereon, referred to as "total losses".

Insured losses were below average again last year ...

... and equivalent to 0.05% of GDP.

### Insured losses: USD 37 billion

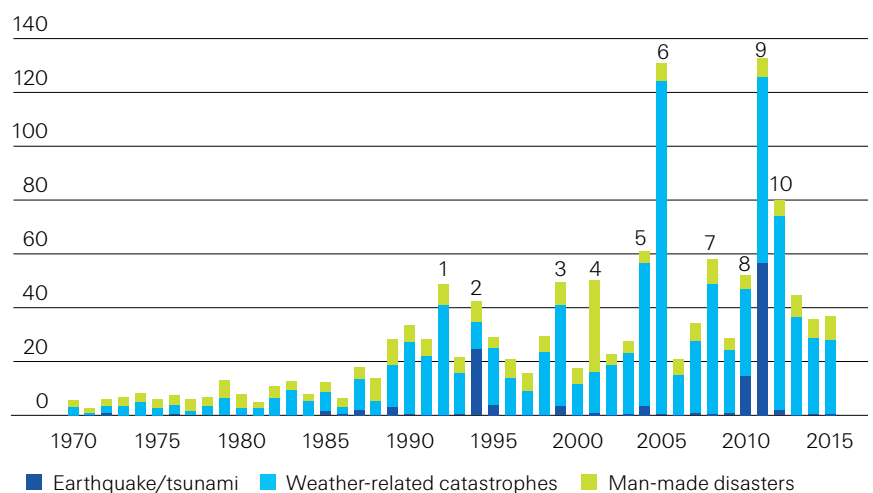
The insurance industry covered almost USD 37 billion – less than half – of the total losses from natural and man-made disasters in 2015, and well below the inflation-adjusted previous 10-year annual average of USD 62 billion. Natural catastrophes resulted in claims of USD 28 billion, the lowest since 2009 and again much lower than the previous 10-year inflation-adjusted annual average (USD 55 billion). Large man-made disasters led to claims of USD 9 billion, up from USD 7 billion in 2014.

The 2015 natural catastrophe insured losses amounted to 0.04% of GDP, and 1.8% of direct premiums written (DPW) on property globally, below the respective 10-year annual averages of 0.08% and 3.7%. Overall insured losses from natural catastrophes and man-made disasters were 0.05% of GDP and 2.4% of DPW.

**Figure 3**

Insured catastrophe losses, 1970–2015, USD billion at 2015 prices

- 1 1992: Hurricane Andrew
- 2 1994: Northridge earthquake
- 3 1999: Winter Storm Lothar
- 4 2001: 9/11 attacks
- 5 2004: Hurricanes Ivan, Charley, Frances
- 6 2005: Hurricanes Katrina, Rita, Wilma
- 7 2008: Hurricanes Ike, Gustav
- 8 2010: Chile, New Zealand earthquakes
- 9 2011: Japan, New Zealand earthquakes, Thailand flood
- 10 2012: Hurricane Sandy



Source: Swiss Re Economic Research & Consulting and Cat Perils.

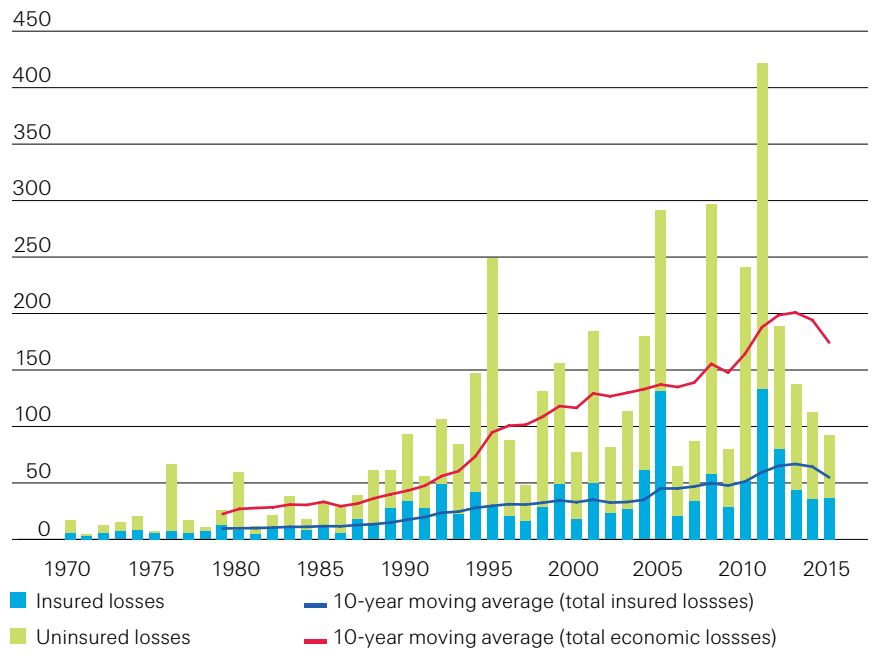
The largest single insured-loss event was the Tianjin port explosions in China.

The largest insurance loss event globally, of both natural and man-made disasters, was the two explosions at the Port of Tianjin in China, which triggered property claims of USD 2.5 to USD 3.5 billion. The next largest event was a February winter storm in the US resulting in insured losses of USD 2 billion. In 2015, seven disasters triggered insured claims of USD 1 billion or more (see Table 6), compared with 10 in 2014.

The global insurance protection gap was USD 55 billion in 2015.

Figure 4 shows the difference between insured and total losses over time, termed the insurance protection or funding gap. It is the amount of financial loss generated by catastrophes not covered by insurance. In 2015, the global protection gap was USD 55 billion. The rate of growth of total losses has outpaced the growth of insured losses over the last 35 years. In terms of 10-year rolling averages, insured losses grew at 10% between 1979 and 2015, and total losses by 10.4%. As a percentage of GDP, uninsured losses rose from 0.08% in 1976–1985 to 0.17% in 2006–2015.

**Figure 4**  
 Insured vs uninsured losses,  
 1970–2015, USD billion in 2015 prices



Total losses = insured + uninsured losses.

Source: Swiss Re Economic Research & Consulting and Cat Perils.

# Regional overview

The highest insured losses in 2015 were in Asia and North America.

Winter storms in the US, along with floods and tropical cyclones in many parts of the world caused the highest insured losses in 2015. In Asia, the explosions in Tianjin and major storms caused the biggest insured losses in the region, while the Nepal earthquake took most lives and caused the highest economic loss of the year.

**Table 3**

Number of events, victims, economic and insured losses by region, 2015

Region	Number	Victims	in %	Insured losses		Economic losses	
				in USD bn	in %	in USD bn	in %
North America	51	278	1.1%	17.3	47.1%	28.6	31.2%
Latin America & Caribbean	25	746	2.8%	3.2	8.7%	7.5	8.2%
Europe	41	2612	9.9%	6.2	17.0%	12.6	13.7%
Africa	49	3431	13.0%	0.0	0.1%	1.2	1.3%
Asia	159	18916	71.8%	7.0	19.0%	37.7	41.1%
Oceania/Australia	13	57	0.2%	2.1	5.7%	3.0	3.3%
Seas/ space	15	319	1.2%	0.9	2.4%	1.1	1.2%
World	353	26 359	100.0%	37	100.0%	92	100.0%

Source: Swiss Re Economic Research & Consulting and Cat Perils.

## North America

In the US, severe storms, a hard winter and floods caused most losses.

In North America, insured losses were USD 17 billion, the highest of all regions. Most of the losses came from winter storms, other severe storms, such as thunderstorms and tornadoes, and flood events in the US. There were relatively few catastrophes in Canada.

Losses from the harsh winter season were above average.

It was a harsh winter storm season in the US for the second year in a row. There were many winter storms with heavy snowfall and very low temperatures. In mid-February, a large storm and related ice accumulation caused widespread damage in 17 states, with Massachusetts hardest hit. The associated insured losses were estimated to be over USD 2 billion, mainly from burst frozen water pipes and ice weight/water damage to property. Insured losses from all the US winter storms together amounted to USD 3.2 billion, double the annual average of the previous 10 years.

Tornado activity was average while insured losses from severe storms were lower than average.

According to a preliminary count from the Storm Prediction Centre of the National Oceanic and Atmospheric Administration (NOAA), there were 1252 tornadoes in 2015, the most in one year since 2011 and in line with the annual average (1222) of the Doppler radar era from the early 1990s. Nevertheless, insured losses from tornado outbreaks and thunderstorms were estimated to have been around USD 10 billion, lower than in 2014 (USD 13 billion) and the previous 10-year annual average (USD 12 billion). Only one thunderstorm caused losses of USD 1 billion or more, while an outbreak of EF3 and EF4<sup>3</sup> tornadoes at the end of December in Texas and neighbouring states caused a high number of fatalities.

The North Atlantic hurricane season produced a below-average number of storms again.

The 2015 Atlantic hurricane season produced 11 named storms (eight in 2014), four of which became hurricanes (six in 2014) and, like in 2014, two (Danny and Joaquin) attained the status of major hurricanes (Category 3 or stronger on the Saffir-Simpson scale). Hurricane Joaquin was the strongest hurricane of the season and the strongest observed in the Atlantic since Hurricane Igor in 2010. Last year was the 10<sup>th</sup> year in succession that no major hurricane made US landfall,<sup>4</sup> the longest stretch since the 1860s. According to the NOAA's Climate Prediction Centre, El Niño curbed storm development given a combination of stable atmospheric conditions, drier air and high wind shear in large parts of the main hurricane generation region.<sup>5</sup>

<sup>3</sup> EF= Enhanced Fujita Scale

<sup>4</sup> When it made landfall, Hurricane Sandy in 2012 produced the third-biggest loss ever from a storm event. However, it does not register as a "major" hurricane on the Saffir-Simpson scale.

<sup>5</sup> "Below-normal Atlantic hurricane season ends; active eastern and central Pacific seasons shatter records", *noaaews.noaa.gov*, 1 December 2015, <http://www.noaaews.noaa.gov/stories2015/120115-below-normal-atlantic-hurricane-season-ends-active-eastern-and-central-pacific-seasons-shatter-records.html>

## Regional overview

Heavy rainfalls triggered many severe flood events during the year.

Even though no hurricane made US landfall in 2015, tropical storm activity affected several states in the form of intense precipitation, leading to severe flooding. In the spring, the remnants of tropical storm Bill brought heavy rain and flooding to Oklahoma and Texas. In October, downpours due to Hurricane Joaquin hit South Carolina and likewise led to heavy flooding.

Wildfires are an ever-present hazard in the US.

Other parts of the US were dry, and there were several wildfires during the year. Drought conditions fuelled wildfires in California, the most fire-prone state. The most destructive fire in terms of buildings destroyed (1307) and number of hectares burned (over 30 000) was the Valley Fire in Lake County, California. The insured losses from this event alone were just over USD 0.9 billion, ranking sixth as the most costly wildfire in the US ever. There were also wildfires in the western states of Washington, Oregon and Alaska, and in Canada. In terms of acres burnt (10.1 million)<sup>6</sup>, 2015 was the worst year for wildfires in the US since 1960. Yet while the fires spanned huge areas, only a few urban areas were impacted meaning that residential property-related losses were limited.

Insured losses were below average in Canada.

In Canada, there were few natural disasters in 2015 for a second year running. The biggest loss-inducing event was a series of thunderstorms in Calgary, Alberta, in mid-August, leading to insured losses of USD 0.23 billion.

### Europe

Flooding caused the heaviest losses, particularly in the UK.

In Europe, natural catastrophes and man-made disasters caused total losses of USD 13 billion in 2015. Of those, USD 6 billion were insured. The main losses came from heavy precipitation in western countries.

In December, severe flooding caused devastation across many parts of the north and north western UK.

During the first week of December, Storm Desmond brought very heavy rainfall to north and northwest England. More than 3500 houses were flooded, most in Cumbria, and several bridges were destroyed. Starting from 22 December, Storm Eva brought gusts of more than 75 miles per hour, and pushed the rains south into Yorkshire, Lancashire and Greater Manchester. Then, during the last days of the year, Storm Frank brought more heavy rain across northern England, Ireland, Northern Ireland and Scotland. It was the wettest calendar month and the warmest December in the UK since records began in 1910.<sup>7</sup> In total, about 16 000 homes were inundated as flood defences were breached. Preliminary estimates put the insured losses from all the December rains and flooding in the UK at around USD 2 billion.

However, 2015 was also a hot and dry year in Europe, leading to increased mortality and drought.

Earlier in the year, in October heavy rains and flooding hit southeastern France. However, overall 2015 was a hot and dry year in continental Europe. In June and July, temperatures remained above 30°C for long stretches in many countries. A prolonged rainfall shortage that began in April and the high summer temperatures caused severe drought, which affected soil moisture content and vegetation conditions. Countries in Eastern Europe, particularly Romania, were severely affected and drought conditions lingered through to the end of the year. The high summer temperatures also claimed a number of victims across Europe. Preliminary estimates from statistical offices indicate a death toll of at least 1200.

There were two terror attacks in Paris in 2015, the most deadly on 13 November.

Of man-made disasters, the most prominent event was a series of coordinated terrorist attacks in the French capital Paris on 13 November 2015. One hundred and thirty people lost their lives in simultaneous mass shootings, suicide bombings and hostage taking at various locations in the city, and 351 were injured. It was the biggest loss of life in one event in continental Europe last year. Also in Paris, in January the offices of satirical magazine Charlie Hebdo were attacked. Eleven people died.

<sup>6</sup> "Billion-Dollar Weather and Climate Disasters: Table of Events", *ncdc.noaa.gov*, accessed in January 2016, <http://www.ncdc.noaa.gov/billions/events>

<sup>7</sup> "Recording the weather across the UK", *blog.metoffice.gov.uk*, January 2016, <http://blog.metoffice.gov.uk/2016/01/08/reporting-the-weather-across-the-uk/> and "2015 weather summary – December", *metoffice.gov.uk*, 12 January 2016, <http://www.metoffice.gov.uk/climate/uk/summaries/2015/december>

## Asia

Asia has suffered the most loss of life from catastrophic events for four years running.

As in the previous three years, loss of life due to natural and man-made catastrophes was highest in Asia in 2015. In all, there were around 19 000 victims. The total cost of disaster events in the region was estimated to be around USD 38 billion, of which more than USD 7 billion were insured.

Around 9 000 people died in the earthquake that struck Nepal in April.

On 25 April 2015, an earthquake of magnitude  $M_w$  7.8 struck Nepal.<sup>8</sup> The epicentre was between the capital Kathmandu (home to 1.2 million people) and Pokhara, the nation's second largest city. The resulting destruction spanned large parts of central Nepal, affecting almost half of its districts including isolated mountainous areas. The earthquake was 8.2 km below the earth's surface and caused severe damage in Kathmandu. The city lies on a dry lake bed, the soil of which is soft and just 650 metres deep, which accentuated the destructive power of the quake. In all, close to 9 000 people were killed, making it the worst disaster in Nepal in over 80 years. The earthquake's impact went beyond Nepal, with casualties and damage reported in India, China and Bangladesh also. Total losses from the earthquake were estimated to be USD 6 billion, most of which were uninsured.

Typhoon Goni caused the highest insurance loss of all natural catastrophes in Asia.

With respect to insured losses, the biggest natural catastrophe event in Asia was Typhoon Goni, which made landfall in Japan on 25 August. The insured losses were estimated to be USD 1.2 billion. The typhoon claimed 89 lives, most in the Philippines and North Korea rather than in Japan.

Heavy monsoon rains hit southern India.

Elsewhere, India was hit by severe flooding. In mid-November, repeated heavy monsoon rains caused floods in the southern states of Tamil Nadu and Andhra Pradesh, and in the union territory of Puducherry. The cities of Chennai, Cuddalore and Kancheepuram and neighbouring districts were most affected. The total losses were estimated to be at least USD 2 billion. Insured losses were USD 0.8 billion, making the floods the second costliest insurance event in India on *sigma* records. A large part of the losses originated from commercial lines as Chennai is home to several manufacturing companies, particularly in the motor industry.

The city of Chennai was paralyzed by the resulting flash floods.

Chennai is a major urban and industrial centre in southern India, with a population of about 8.5 million. While heavy rains in the area are common, during the northeast monsoon (October–December) of last year, the accumulated rainfall in November alone was in excess of 500 mm. Some areas had more than 250 mm rainfall in just 24 hours. This extreme rainfall volume over a short duration paralyzed Chennai, with major disruption to critical infrastructure. The event highlights the vulnerability of rapidly growing urban areas to flash floods originating from heavy rains.

<sup>8</sup>  $M_w$  is the moment magnitude, based on the seismic moment, which "is a measure of the size of an earthquake based on the area of fault rupture, the average amount of slip, and the force that was required to overcome the friction sticking the rocks together that were offset by faulting." See <http://earthquake.usgs.gov/learn/glossary/?term=seismic%20moment>

## Regional overview

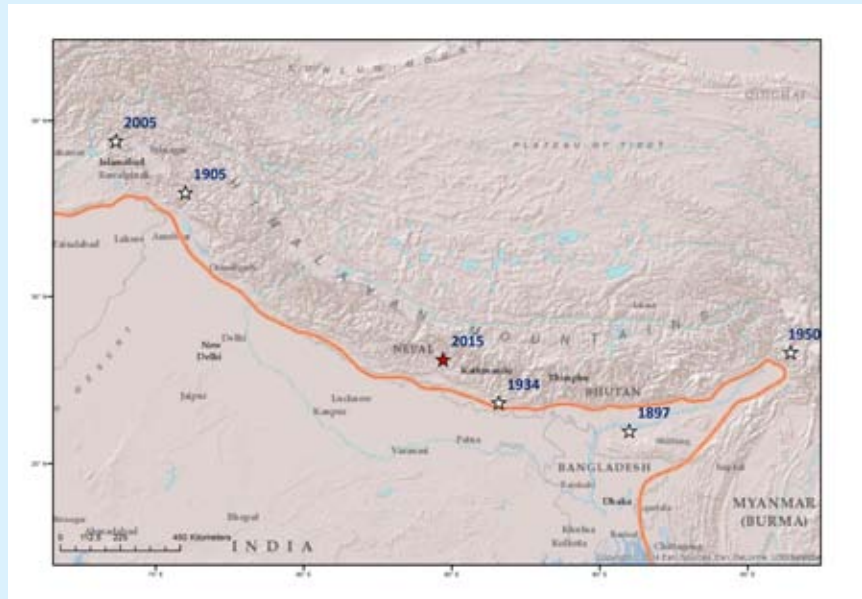
The Himalayas are one of the world's most seismically hazardous regions.

### Figure 5

The Himalayan plate boundary line and the dates of major earthquakes

### Living on the edge: earthquake hazard emanating from the Himalayan region

The Himalayas, formed by the continental collision of the Indian and Eurasian plates, have the highest mountain peaks in the world. The region is also one of the most seismically active globally. This is because the northbound under-thrusting of the India plate beneath the Eurasia plate continues today, at a rate of 3–4 centimeters per year. The map below shows the alignment of more recent earthquakes along the plate boundary line, running from Assam in the east (where there was an  $M_w$  8.6 quake in 1950) to Kashmir in the west (the site of an  $M_w$  7.6 earthquake in 2005).



Source: Swiss Re.

Though 750 km away from the epicentre, Delhi felt the tremors of the April quake in Nepal.

Tremors originating from the epicentre of the April 2015 earthquake in Nepal were also felt in Delhi, the capital of India, almost 750 km away. According to 2011 census data, around 90% of Delhi's building stock falls in the category of unreinforced masonry, which is not earthquake resistant. Moreover, Delhi is located on the banks of River Yamuna on a bed of very soft soil, which can amplify seismic waves and their damage-causing potential.

The presence of a seismic gap in central Himalayas is a risk for Delhi.

The Himalayan plate has a seismic gap, that is, an area where plate movement has already produced land deformation but – as of yet – no release of associated energy in the form of an earthquake. The gap extends from the region near the Kangra earthquake in 1905 (see Figure 5) to the epicentre of the 1934 Nepal earthquake (around 700 km). The likelihood of earthquakes in seismic gaps is very high, and the expected magnitude of such an earthquake in the Himalayas is  $M_w$  8.0–8.5. Delhi is much closer to certain areas of the seismic gap than to the epicentre of the April 2015 earthquake. In other words, the city is vulnerable to earthquake risk.

The economic loss from a major earthquake near Delhi could amount to as much as USD 4 billion.

To assess the loss potential of such an event in Delhi, Swiss Re simulated the impact of an earthquake of  $M_w$  8.0 magnitude just 190 km away from the city, with its epicentre in the Himalayan seismic gap, using the proprietary MultiSNAP tool. The simulation assumed an insurance penetration rate in Delhi of 1.34%.<sup>9</sup> The outcome was a total economic loss of at least INR 270 billion (USD 4 billion), with insured losses of around INR 25.2 billion (USD 400 million). And, Delhi is one of India's most populous city. A large earthquake there would likely also mean large loss of life.

<sup>9</sup> *Indian non-life insurance industry yearbook 2014–15*, General Insurance Council, 2015. <https://www.gicouncil.in/downloads.aspx>

Explosions in the port of Tianjin in China caused the largest insured loss of 2015.

With respect to man-made disasters, the largest insurance loss event of 2015 happened in Asia. On 12 August, two massive explosions at the Port of Tianjin in northeast China claimed 173 victims and injured many more. The explosions affected an area of 3 km radius, causing large-scale damage to surrounding property and infrastructure. The property insurance loss is estimated to be USD 2.5 billion to USD 3.5 billion. Read more in the special chapter on Tianjin in this *sigma*.

Insured losses in Latin America were over USD 3 billion in 2015.

### Latin America and the Caribbean

Natural catastrophes and man-made disasters caused total losses above USD 7 billion in Latin America and the Caribbean in 2015. Insured losses were over USD 3 billion. The main drivers were earthquakes, hurricanes and floods.

Floods hit northern Chile.

On March 25–26, there were very heavy rains in the Atacama Desert in northern Chile, one of the driest places on earth. The Copiapó River which, according to government sources, had been dry for 17 years, rapidly filled with rainwater and overflowed.<sup>10</sup> The ground's rock surface and lack of vegetation meant that the high volumes of rainwater were not absorbed. Instead, there were massive mudflows that hit the cities of Copiapó and Antofagasta in the Atacama and Antofagasta regions. According to government estimates, the total damage amounted to USD 1.5 billion. Insured losses were around USD 0.45 billion, the largest insured loss from a natural catastrophe in the region. El Niño/ENSO is associated with warm and wet weather along the coast of Peru and Chile.

Patricia was the strongest hurricane on record in the eastern North Pacific and Atlantic basins.

Similarly, in 2015 El Niño fuelled the tropical storm season in the eastern Pacific, according to the NOAA. The eastern Pacific saw 18 named storms, including 13 hurricanes, nine of which were major. It was the first year since 1971 that there were nine major hurricanes in the eastern Pacific. With wind speeds of 320 km/h, Hurricane Patricia was the strongest hurricane on record in both the Atlantic and the eastern North Pacific basins.<sup>11</sup> However, it did not hit heavily populated areas when it made landfall in Mexico, and the insured losses were moderate. The remnants of Patricia did bring rainfall to Texas, though. The combined Mexico/Texas insured losses are estimated to have been USD 0.3 billion.

There were some large man-made disasters in Latin America in 2015.

A fire and explosion on a drilling platform in the Bay of Campeche, Mexico, caused the biggest man-made loss of the region. In another disaster in November, a tailings dam at an iron ore mine in Minas Gerais, Brazil, burst causing significant damage and environmental pollution as mud travelled through waterways.

<sup>10</sup> "Flooding in Chile's Atacama Desert after years' worth of rain in one day", *climate.gov*, 16 April 2015, <https://www.climate.gov/news-features/event-tracker/flooding-chile%E2%80%99s-atacama-desert-after-years%E2%80%99-worth-rain-one-day>

<sup>11</sup> "Hurricane Patricia is strongest recorded in Eastern North Pacific", *World Meteorological Organization*, 12 October 2015, <https://www.wmo.int/media/content/hurricane-patricia-strongest-recorded-eastern-north-pacific>

## Regional overview

Many disasters caused insured losses for USD 2.1 billion in Oceania, mainly in Australia.

In Africa, over 3000 people died in disaster events in 2015.

### Oceania

Natural catastrophes and man-made disasters in 2015 caused insured losses of USD 2.1 billion in Oceania, primarily from thunderstorms and tropical cyclones. In April, a powerful storm system brought large hail and strong winds to New South Wales, causing insured losses of USD 0.7 billion, the costliest catastrophe event in Australia and the region last year. Other severe storms, tropical cyclone Marcia and bushfires added to the overall insured tally for the region. Marcia was the most intense cyclone to make landfall, and also the most intense recorded so far south on the eastern coast of Australia.<sup>12</sup> Several outbreaks of bushfires destroyed homes and vast areas of crop land in South Australia, Victoria and Western Australia last year.

### Africa

Natural catastrophes and man-made disasters in Africa claimed 3431 lives and caused total losses of USD 1.2 billion in 2015. The insured losses were minor. At the beginning of the year, 286 people died in floods in Malawi, and close to 250 000 people were left homeless. Losses from the thousands of houses destroyed or damaged were estimated to be USD 0.4 billion. Floods also hit Kenya, while Madagascar was affected by both floods and tropical storm Chedza. Yet again, terrorism contributed to large loss of life in the region. In a gun attack at a University in Garissa, Kenya, 148 students lost their lives.

<sup>12</sup> "Annual Climate Report 2015", *bom.gov.au*, 2016  
[http://www.bom.gov.au/climate/annual\\_sum/2015/Annual-Climate-Report-2015-LR.pdf](http://www.bom.gov.au/climate/annual_sum/2015/Annual-Climate-Report-2015-LR.pdf)

# Tianjin: a puzzle of risk accumulation and coverage terms

The explosions in Tianjin in 2015 generated accumulated losses across multiple lines of insurance business.

Tianjin's port is the gateway to Beijing and China's industrial northeast.

Two huge blasts ripped through a logistics park at the port in August.

According to the official report, auto-ignition of nitro-cotton sparked a fire that led to the explosions.

On 12 August 2015, two massive explosions at a warehouse in the Port of Tianjin in China claimed 173 victims, injured close to 800, and caused large-scale damage to surrounding property and infrastructure. The severity of the blasts and large asset exposures at the time mean that the Tianjin event is the biggest man-made insurance loss event ever recorded in Asia. The wide range of insurance policies impacted by the explosions, and the complexity of interpretation of coverage between policy classes, make for an interesting case study. The Tianjin experience also puts a spotlight on risk accumulation controls at major trading hubs and industrial parks.

## The event

Tianjin is in northeast China. It is the closest starting point to the Asia-Europe land bridge and gateway to the country's capital Beijing. In 2013, it ranked as the world's third largest port in terms of cargo volume and the 10th for container traffic.<sup>13</sup> It has an industrial and petrochemicals complex covering about 115 km<sup>2</sup>. The port is the main logistics hub for China's automotive industry, accounting for 40% of all car imports and exports, and serves the same function for components and materials for a number of other industries, including healthcare and electronics.

The two explosions at Tianjin on 12 August were triggered by a fire in a warehouse in one of the port's several logistics parks. The warehouse was storing hazardous and flammable materials, such as ammonium nitrate. Of the 173 victims<sup>14</sup>, 104 were firefighters called out to extinguish the initial fire. According to the China Earthquake Administration, the first blast registered a magnitude of  $M_w$  2.3 and the second  $M_w$  2.9.<sup>15</sup> The explosions generated a fireball and sent shockwaves across an area of several-kilometre radius, leaving a large crater in the ground. Properties adjacent to the site of the blasts, mostly container yards and automotive storage facilities, were destroyed, as were thousands of new vehicles in transit parked nearby. According to a recently issued official report from the Chinese authorities, 304 buildings, 12 428 vehicles and 7533 containers were destroyed.<sup>16</sup> In addition, due to the sheer intensity of the blasts, thousands of vehicles and properties within a 5 km radius sustained damage ranging from severe to non-structural (eg, shattered windows or just dust cover). Insurers estimate the total number of affected cars to be a multiple of the 12 428 mentioned in the official report. Ironically, the port's shipping terminals were largely unscathed. As the blasts happened in one of many storage and logistic operations areas, overall port activity was shut down for a few days only.

According to reports of official sources, the fire started in a warehouse after the wetting agent keeping a supply of nitro-cotton in a container damp, evaporated in the high temperatures and auto-ignited. The fire quickly spread to other chemicals stored at the site including ammonium nitrate, which triggered the devastating explosions.<sup>17</sup> There is an alternative and widely-held belief that attempts by firefighters to put out the initial fire could have triggered the blasts or magnified their intensity. The government, however, maintains that this was not the case. Either way, the event calls for a review of safety regulations for the storing of hazardous materials, and stronger enforcement of associated procedures.

<sup>13</sup> *World Port Ranking 2013*, American Association of Port Authorities <http://www.aapa-ports.org/Industry/content.cfm?ItemNumber=900#Statistics>

<sup>14</sup> 165 people were killed and eight are still missing. See A Duckett, "Tianjin blast blamed on mismanagement", *The Chemical Engineer*, 8 February 2016, [http://www.tcetoday.com/latest%20news/2016/february/tianjin-blast-blamed-on-mismanagement.aspx#.Vrn2c\\_72a71](http://www.tcetoday.com/latest%20news/2016/february/tianjin-blast-blamed-on-mismanagement.aspx#.Vrn2c_72a71)

<sup>15</sup> "Statement of Mr Pu Yun Qiao, member of the China Earthquake Administration", as reported in "国家地震台网记录天津两次爆炸", *Xinhua*, 13 August, 2015, [http://news.xinhuanet.com/science/2015-8/13/c\\_134511961.htm](http://news.xinhuanet.com/science/2015-8/13/c_134511961.htm)

<sup>16</sup> "Tianjin blast probe suggests action against 123 people", *Xinhua*, 5 February 2016, [http://news.xinhuanet.com/english/2016-02/05/c\\_135078930.htm](http://news.xinhuanet.com/english/2016-02/05/c_135078930.htm)

<sup>17</sup> A Duckett, op. cit.

## Tianjin: a puzzle of risk accumulation and coverage terms

The authorities enforced an exclusion zone to facilitate clean-up work.

In addition to flammable materials, large amounts of toxic sodium cyanide were being stored at the site. The risk of follow-up explosions prompted the authorities to impose a 3 km exclusion zone around the blast area until 25 August. Access within a 1.5 km radius remained restricted even thereafter due to ongoing clean-up operations.

The exclusion zone has delayed assessment of the full loss.

### The challenge of loss estimation and claims adjudication in Tianjin

The Tianjin explosions have presented insurers with a number of challenges, not least lack of access to the affected area to assess the full extent of damage and resulting insurance claims. The imposition of the exclusion zones meant that formal loss adjustment within those areas was not possible. The exclusion zones were lifted, but access remained restricted. As such, the level of insured losses in the zones (eg, to cars and cargo containers) have been estimated in total loss terms, or have been based on forensic accounting.<sup>18</sup>

Drones and satellite imagery enabled a first assessment of exposures.

Robots and pre- and post-event drone and satellite imagery have helped loss assessment. Drones were sent in to take pictures of the disaster site immediately after the explosions. These images were compared with satellite images of the site taken prior to the event. The comparison provided a view of the extent of destruction, and also of the high number of vehicles and containers on the site at the time of the explosion. Initial loss assessments have been based on this information.

Initial estimates indicate insured losses caused by the blasts will total USD 2.5 billion to USD 3.5 billion.

Based on Swiss Re's latest estimates, the total insured property loss of the Tianjin explosions is likely to be around USD 2.5 billion to USD 3.5 billion, making it the largest man-made insured loss event in Asia ever recorded. The estimate is based on, among other, the net loss estimates from re/insurers' third-quarter or full-year 2015 results, where available. Assumptions were made for those insurers which have not yet released claims estimates. The estimate is a working assumption and is subject to revision.

Destroyed and damaged vehicles account for most of the losses.

As first claims were filed, it became clear that damage to the thousands of new vehicles parked at and near the blast site would make up most of the insurance claims. The containers there at the time were mostly empty, and damage to containers, cargo, warehouses, infrastructure, machinery and equipment account for a much smaller proportion of the losses. Business/contingent business interruption, aviation, liability, personal accident and life claims likewise account for a small portion of the losses.

If the parked vehicles were in transit, claims would come under marine cargo insurance coverage.

Even though the main loss – to new cars – is known, uncertainties with respect to the types of policies involved remain. If the vehicles at the site at the time of the explosion were in transit, they would likely be covered by marine insurance policies. Standard marine cargo insurance usually covers onshore storage up to a certain number of days, depending on policy terms, once the cargo is loaded off the ships.

But if Tianjin was the final port of destination for the vehicles, claims could be under property insurance.

If Tianjin was the final port of destination for the vehicles, their next transfer being to a point-of-sales in China, claims could come under property insurance. However, this transfer is often done through a local wholesaler like China Automobile Trading Co (CATC), while other car manufacturers have their own distribution operations. If car imports are channeled through a local wholesaler or subsidiary, it is not quite so simple to determine whether the manufacturer's cargo policy or the local entity's property or domestic transport policy responds, or whether the two covers are overlapping. Further, it is sometimes difficult to ascertain which entity held title to the parked vehicles at the time of the explosions and, accordingly, whether the loss falls under the marine cargo or property insurance policies taken out.

<sup>18</sup> The branch of accounting used for engagements resulting from actual or anticipated disputes. See [https://en.wikipedia.org/wiki/Forensic\\_accounting](https://en.wikipedia.org/wiki/Forensic_accounting)

Tax treatment will affect the final valuation of vehicle claims.

In addition, if the vehicles had gone through customs and were deemed to be imported into China already, the declared goods (sale) price, including import levies, could apply for loss assessment purposes, depending on policy terms. That would be considerably higher than the manufacturing or replacement value: custom duties and taxes on imported cars in China can make up for up to 50% of the retail selling price, or even more depending on the size of the engine. The total number of cars in the affected area at the time may be known, but it is not possible to ascertain from the parking position alone whether customs duties and taxes have already been paid on these vehicles.

The extent of damage to vehicles further away from the centre of the blast is not clear, which further complicates valuation assessment.

Vehicles outside the 1.5 km exclusion zone but within the 3 km and even further out were also damaged, and it is not clear how badly. In these cases, the question for loss assessment purposes is whether the vehicles should be “written-off” as unsaleable, or whether they have resale value post cleaning and repair. If the latter, an actual sale price or negotiated depreciation rate for repaired vehicles could be applied to determine the residual value of a car. However, until a sufficient number of such sales have taken place, it will be difficult to assess the amount of depreciation. Further, so-called brand clauses could increase loss estimates, depending on policy terms. Some brand clauses give wide discretion to the insured to claim total loss for a car with just limited damage, because selling a repaired vehicle could harm brand reputation. This would be particularly relevant for cars with no physical damage, but where customers could have concerns about buying a vehicle that was in the port of Tianjin when the explosions occurred.

“Open policies” for cargo insurance add another unknown factor in final valuation.

For cargo and containers, there is an added complexity. The widely-used system of open policies for cargo insurance (with a rate based on turnover for a storage facility rather than declarations of the precise shipment) means that an insurer does not know what insured cargo is in a specific container or the exact value of its contents.

Indications are that most of the vehicle claims will ultimately fall under property insurance.

Information already published by re/insurers suggests that the majority of vehicle claims in Tianjin fall under the property insurance category, mostly arising from high-value imported cars at the onshore storage stage of their journey to market. However, the sheer volume of the destroyed and damaged cars and the numerous loss adjustment and adjudication challenges as described above leaves the total insurance loss in a state of flux. The very high number of cars on the site suggests some may have been there for an extended period. This could indicate that car manufacturers or importers use ports as intermediate storage facilities, something insurers may not have been aware of previously. The high number of parked vehicles could also be indicative of the recent downturn in the Chinese economy.

### Putting the pieces of the puzzle together

Property and cargo present major risk accumulation factors in ports, especially in big centres like Tianjin.

The size of the insured loss of any disaster event is largely driven by the accumulation of risks simultaneously exposed to the same event. Ports, warehouses, cargo storage facilities and industrial parks are among the locations with most risk accumulation potential. The concentration of stored, loaded and unloaded cargo, infrastructure and other industrial and commercial activities mean industrial accidents in, and severe weather events at, these locations can generate major accumulated losses across multiple lines of business. Such was the case in Tianjin. The explosions happened in a property close to large storage and transit spaces, where many high-value new cars were parked, and also close to other industrial and commercial buildings typical of a major trading hub. The explosions impacted many risks simultaneously, and there were large losses across many lines of business.

Tracking cargo exposure is challenging.

The shipping industry and marine and property insurers are well aware of the potential for large losses from accumulation of risks. However, quantifying losses in cargo aggregation points such as very large container vessels or ports at any given time is difficult. Some re/insurers have developed formal models to better understand these risks, and so improve the insurability of potential accumulated losses. However, Tianjin also shows that there needs to be more risk mapping in aggregation points to better understand exposure accumulations.

## Tianjin: a puzzle of risk accumulation and coverage terms

Capturing the spatial distribution of cargo is critical to an understanding of port accumulation.

The shipping industry and insurers can use the Tianjin experience to better understand risk accumulation in ports, and on vessels too.

The complexities presented by the explosions have challenged the insurance industry.

The Tianjin experience also highlights the new potential risks facing developing countries with rapidly-developing economies.

Catastrophe modelling has traditionally focused on static risks, such as buildings and infrastructures, including those within ports. Modelling mobile risks such as ships and cargo, and how the risks accumulate in distribution centres, has always been a challenge.<sup>19</sup> Accumulation management for cargo usually involves coding the exposure as warehouse content using fixed location data, such as the central point of the port. However, ports are large and fragmented, often consisting of separate areas spanning kilometers, as is the case of Tianjin. Proper cargo modeling must correctly account for the geographic distribution of exposure. Advanced methods are required to address the complexity of these distributions.

Equipping expensive goods and cargo containers with active sensors could help track exposure. Big Data and smart analytics could make marine data more accessible, enabling better assessment of cargo risk accumulations and creating greater scope for modelling. The shipping industry and insurers should use the Tianjin experience as an opportunity to promote more robust understanding of how exposures accumulate. It is not only fires and explosions that pose a risk. Ports and ships can also be struck by natural catastrophes, as in the case of Hurricane Sandy in 2012.<sup>20</sup> In all cases, a complex puzzle of marine and property cumulative loss scenarios can result.

The Tianjin explosions are a reminder that large-scale man-made industrial catastrophe events do happen. The disaster also throws light on some new considerations. In particular, the sheer volume of motor vehicles involved turned some simple coverage issues into one of the biggest challenges that the insurance industry has ever faced. Tianjin also shows that man-made disasters can have a major impact on a global and complex scale, given the large number of stakeholders spread across different jurisdictions, each with their own regulatory framework.

Tianjin could ultimately become one of the largest man-made insurance loss events worldwide ever recorded (see Table 4). The event shows the large loss potential in a country like China, with a fast-growing economy. If further evidence is needed, in 2013 a fire at a major high-tech semiconductor plant in Wuxi, also in China, caused insured losses of USD 0.9 billion. 2015 was the third year in a row that the biggest man-made loss globally originated from an emerging market, a reminder of the importance of insurance for developing countries. Financial protection through insurance is key to restoring business operations and recouping losses. Accurate assessment of exposures, appropriate coverage terms and adequate pricing are likewise crucial. For re/insurers, they need to actively identify, monitor and manage exposures in hazard zones and in areas with high asset-value concentrations.

**Table 4**

Largest man-made insured losses globally, in USD billion at 2015 prices

Year	Country	Event	Insured loss	Victims
2001	US	Terror attack on WTC, Pentagon, other buildings	25.2	2 982
1988	UK	Explosion on platform Piper Alpha	3.0	167
2015	China	Explosions at a warehouse storing hazardous chemicals at Tianjin Port	2.5 to 3.5*	173
1989	US	Vapour cloud explosion at petrochemical plant	2.4	23
1979	US	Damage at nuclear power station	1.4	
2001	France	Explosion destroys fertilizer plant	1.3	30

\*provisional

Source: Swiss Re.

<sup>19</sup> *Safe havens: Measuring natural catastrophe exposure to cargo traded through ports*. Swiss Re, 2010.

<sup>20</sup> Hurricane Sandy destroyed thousands of recreational boats along the eastern coast of US and caused significant damage on many of the facilities of the Port of New York and New Jersey.

# Leveraging technology in disaster management

Technology can be used to better understand the risks posed by different perils ...

... and also inform post-disaster response and logistics.

**Figure 6**

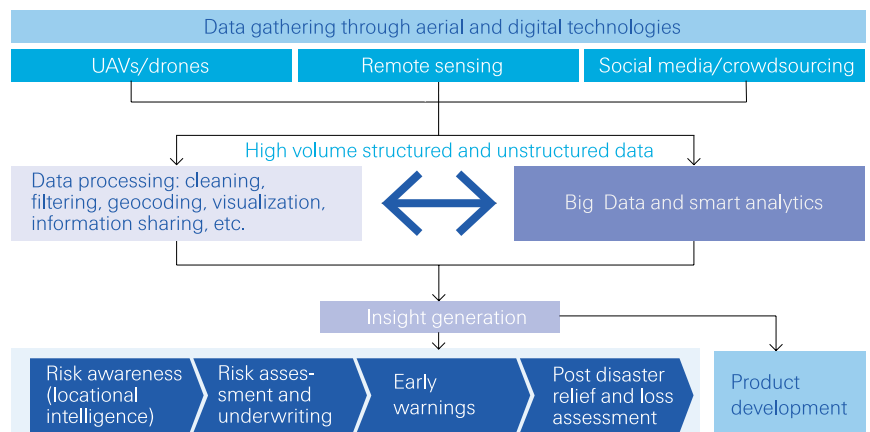
New technologies in disaster risk management

## Using technologies to build knowledge

The lessons of past disaster events can help build greater resilience by informing decisions with respect to putting in place mitigating infrastructure and financial resources (public and private sector). This chapter looks at how aerial and digital technologies are used to better understand the risks posed by perils, but is not a comprehensive review of all opportunities. The chapter specifically covers:

- Unmanned aerial vehicles (UAV), such as drones, and how these can help in post-disaster assessment and response;
- Remote sensing techniques, such as Interferometric synthetic aperture radar (InSAR – see box “Monitoring ground deformations from space”); and
- Improved location intelligence, early warning and relief response via social media and crowdsourcing.<sup>21</sup>

These technologies can be important tools in disaster risk management strategy. They can improve post-disaster assessment and response logistics, and can be used to build a knowledge profile of an area or specific property, including proximity to natural catastrophe risks. This is information that can also be used for insurance purposes – in risk modelling, underwriting, and real-time disaster tracking and loss assessment, and in the design of catastrophe insurance solutions.



Source: Swiss Re Economic Research & Consulting.

UAVs are increasingly being used as remote sensing and imaging devices in post-disaster reconnaissance.

## Post-disaster assessment and response mechanisms

The rapid development of UAV technology has enabled greater use of drones as imaging platforms to complement the visuals produced by satellites and manned aircraft. Drones have the advantage of being small, low-cost and able to closely survey and photograph large areas more efficiently. Damaged areas sometimes cannot be seen by satellites and manned aircraft, for example due to cloud cover, or may be inaccessible for first-hand human inspection due to contamination or transport outages after a disaster event. Drones can also survey objects from the side rather than just from above, and can facilitate 3D reconstruction of an environment using stereoscopic cameras. These are valuable inputs for improved damage assessment.

<sup>21</sup> Crowdsourcing is the practice of soliciting contributions from a large group of people. See <https://en.wikipedia.org/wiki/Crowdsourcing>

## Leveraging technology in disaster management

In 2015, the commercial deployment of drones in disaster situations became mainstream.

The first deployment of drones in a disaster event came after Hurricane Katrina in 2005. Ten years later, their use has become mainstream. For example:

- In the Port of Tianjin, drones were used to take pictures of the site hit by the devastating explosions of 12 August 2015 immediately after the event. These were compared with satellite images taken prior to the blasts which showed the number of vehicles, cargo and containers on site at the time of the explosion. The before and after comparison enabled initial loss assessment. This would not have been possible without drones because of the 3 km-radius exclusion zone enforced at the site. The alternative would have been to use manned aircraft to take pictures after the event from high altitude, which would have been more expensive and may not have produced the same quality images.
- In December 2015, drones were used to take pictures over Cumbria in the UK after large areas were flooded due to Storm Desmond. The images allowed for better response planning, and loss adjusters used them to identify the worst-affected areas and properties for which claims were reported, which in turn facilitated initial claims reserving.<sup>22</sup>
- Similarly, for the first time in Australia, insurers used drones to assess the damage caused by bushfires in Victoria on Christmas Day 2015.<sup>23</sup>
- In the US, the use of drones by insurers is a growing trend and, for the first time, in 2015 the Federal Aviation Administration granted regulatory approval to insurance firms to use drones for commercial purposes.<sup>24</sup>

Social media is becoming a valuable communications tool in disaster scenarios.

Social media can likewise be highly effective in disaster situations, for example to send early warning signals. When an  $M_w$  5.9 magnitude earthquake hit near Richmond, Virginia in the US in August 2011, Twitter users in New York read about the quake 30 seconds before they themselves felt the ground shaking.<sup>25</sup> In some situations, such as during Hurricane Sandy in 2012, social media platforms like Twitter and Facebook, and voice over internet protocol (VoIP)-based applications such as Skype, can be a primary source of communication. Sandy knocked out power to millions of people in New Jersey, who instead received updates from the authorities and the emergency services before and during the storm using their mobile devices.<sup>26</sup> Social media has infiltrated less-connected populations also. In an example of “technology leapfrogging”, in the aftermath of the devastating earthquake that hit Kathmandu in April 2015, the few people with connection to the likes of Facebook were able to use the networks to collect and share information.<sup>27</sup>

### Location intelligence

Location intelligence is crucial for disaster risk management and underwriting.

Knowledge of the location of insurable assets and their proximity to natural disaster risks, coupled with new analytical tools, can improve risk mitigation. Remote sensing tools such as InSAR can be used to support these efforts and help insurers improve risk models and pricing (see below).

<sup>22</sup> “Drones will transform loss adjusting”, *Insurance Day*, 2 January 2016.

<sup>23</sup> “Australia: IAG is first to use drones to assess Nat CAT damage”, *Asia Insurance Review*, 13 January 2016, <http://www.asiainsurancereview.com/News/View-NewsLetter-Article/id/34697/Type/eDaily>

<sup>24</sup> “How Insurers Are Racing To Adopt Drones In One Chart”, *CB Insights*, 4 January 2016, <https://www.cbinsights.com/blog/insurance-firm-drone-exemptions/>

<sup>25</sup> R. Ford, “East Coast residents read about D.C. earthquake before feeling it themselves”, *thehollywoodreporter.com*, 23 August 2011, <http://www.hollywoodreporter.com/news/earthquake-twitter-users-learned-tremors-226481>

<sup>26</sup> M. Mussoline, “Sandy Proves Social Media Can Be Powerful in a Hurricane”, *accuweather.com*, 13 August 2013, <http://www.accuweather.com/en/weather-news/social-media-and-hurricanes-disasters/9550752> And, according to a recent study by the University of San Francisco, in the US over 70% of people in disaster situations use social media to communicate with relatives. See S. Thomas, “Social Media Changing the Way FEMA Responds to Disaster”, *National Defense Magazine*, September 2013.

<sup>27</sup> “Social Media Becomes a Lifeline in the Nepal Earthquake Aftermath”, *globalvoices.org*, 26 April 2015, <https://globalvoices.org/2015/04/26/global-social-media-lifeline-in-nepal-earthquake-aftermath/>

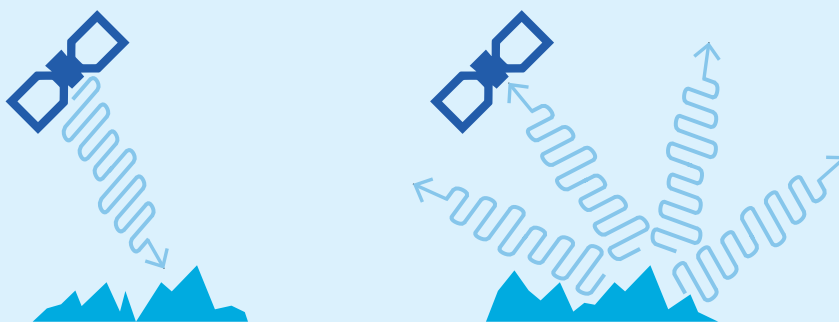
InSAR is a mapping tool of ground deformations using radar images.

### Figure 7

InSAR maps read ground deformation by measuring reflected echo of radar signals from an earth-orbiting satellite

### Monitoring ground deformations from space

Interferometric synthetic aperture radar (InSAR) is a technique for mapping ground deformations. To detect changes in the earth's surface, two or more radar images of a select area are taken from approximately the same position in space, but at different times. By bouncing signals from a radar satellite off the ground in successive orbits and comparing the images, InSAR can detect even subtle changes in the land surface – up, down or sideways (see Figure 7).<sup>28</sup>



Source: Jet Propulsion Laboratory, NASA.

Active, but previously thought dormant, volcanos have been discovered using InSAR.

InSAR has been used to monitor and analyse volcanos in Alaska and in the western US. A surprising discovery was that some volcanos long thought to be dormant, are actually deforming and could eventually erupt.<sup>29</sup> InSAR can also be used to estimate the overall damage after an earthquake by comparing built-up areas before- and after earthquake events.

The IoT can help develop location intelligence and be used for early warning communications.

The Internet of Things (IoT)<sup>30</sup> has a strong potential for risk mitigation. A central component of IoT are sensors, mostly inbuilt devices that can monitor various readings such as of temperature, ground movement and radiation. This information can provide early detection and ongoing monitoring of events like fires, earthquakes and radiation leaks. A recent study found that the GPS receivers in smartphones can detect earthquakes and can be used to build crowdsourced earthquake early warning systems.<sup>31</sup> The sensors can also help locate victims after a catastrophe.

Crowdsourcing platforms are increasingly being used in disaster situations.

Online crowdsourcing platforms can also be helpful during crises. For instance, the Ushahidi crisis map platform<sup>32</sup> was used in the response program after the  $M_w$  5.4 magnitude earthquake in Haiti in 2010. Information and reports were gathered through social media and text messages sent via mobile phones and plotted on the map in real time by an international group of volunteers. These reports, along with their specific locations, were available to anyone with internet connection. Emergency responders on the ground soon began to use them in determining where and how to direct resources. Another example is Safecast<sup>33</sup>, a crowdsourcing platform in Japan created to furnish more availability of public information about contamination after the March 2011 earthquake and tsunami, and subsequent meltdown of the Fukushima Daiichi nuclear power plant.

<sup>28</sup> "Monitoring Ground Deformation from Space", *US Department of the Interior/US Geological Survey*, July 2005, [http://volcanoes.usgs.gov/activity/methods/insar/public\\_files/InSAR\\_Fact\\_Sheet/2005-3025.pdf](http://volcanoes.usgs.gov/activity/methods/insar/public_files/InSAR_Fact_Sheet/2005-3025.pdf)

<sup>29</sup> Ibid

<sup>30</sup> The IoT is a massive network of heterogeneous devices, mostly battery-powered, and interconnected via wireless network interfaces.

<sup>31</sup> "Researchers Test Smartphones for Earthquake Warning", *US Geological Survey*, April 2015, <http://www.usgs.gov/newsroom/article.asp?ID=4189#.Vq0qeP5f2u4>

<sup>32</sup> Ushahidi is a crowdsourcing platform developed to map of reports of post-election violence in Kenya in 2008. The platform has since been used in a range of situations, including the Haiti earthquake of 2010. See [www.ushahidi.com](http://www.ushahidi.com)

<sup>33</sup> See <http://safecast.org/tilemap/>

## Leveraging technology in disaster management

Open source platforms can also improve catastrophe models.

The Global Earthquake Model (GEM) Foundation is a public-private initiative to promote advances in seismic hazard and risk assessment. GEM is developing a global standardized exposure database of property stock with detailed information on spatial, structural and occupancy rates. GEM has been working on exploring the possibility of using data, typically building inventory, crowdsourced through a social media platform called OpenStreetMap (OSM) to model earthquake risk.<sup>34</sup> OSM is a free global map of human settlements (transport networks, buildings, amenities etc.) and the natural environment. Similar to Wikipedia, the information is contributed by the general public, voluntarily and anywhere in the world. If platforms like OSM gain traction, there will be an accumulation of granular location-specific information available free of charge to the public at large. Insurers will be able to include these inputs into their models, turning what has-to-date been a labour-intensive data gathering process more automated. For governments, particularly in emerging markets where systematic documentation on the construction of new buildings in rapidly growing cities may be lacking, these data can be used to inform strategy on strengthening urban resilience.

Technology can also be used in insurance product design.

The aforementioned technologies can also be used in the design of new insurance solutions. Below is an example of how satellite technology can be used to trigger agriculture insurance pay-outs in regions prone to drought conditions.

Swiss Re has partnered with a local player in Mexico to develop a macro-level index-based insurance product for severe drought.

### Satellite pasture insurance pilot in Mexico

Swiss Re's Agro Reinsurance Product Center has joined forces with a local insurer in Mexico, Protección Agropecuaria Compañía de Seguros, SA (ProAgro) to develop an index-based insurance product to protect cattle producers in the event of severe drought losses to their pastures and grazing land. The product is designed to allow for quick and timely payouts to the insured so they can buy supplementary fodder to maintain their herds. Because it is parameter based<sup>35</sup>, the insurance is operationally more efficient than traditional livestock insurance, which requires a livestock and farm inspection to establish a claim.

The product is based on NDVI. Pay-outs are triggered if the measured NDVI value falls below a pre-defined threshold.

The product is based on the "Normalized Difference Vegetative Index" (NDVI), an indicator of vegetation growth conditions estimated from satellite imagery, and which augments drought-monitoring information. The underlying principle is to establish a historical NDVI database for each defined pixel area on a grid and to calculate the average NDVI value for that area over the growing season. Payouts are triggered if, during the insurance period, the actual measured NDVI value in a pixel of a satellite image of the area falls below a pre-defined threshold of the historical average NDVI value in that pixel. The threshold is set at a level to reflect the onset of pasture production losses due to drought. And, to calibrate the index and minimize the inherent basis risk<sup>36</sup>, measurements of biomass in random samples of ground soil in the pastures are taken to verify the findings observed in the satellite images.

It will be piloted in May 2016.

The product is due to be piloted in May 2016 in select states in Mexico.

Smart use of technology can make the world more resilient.

This example shows how, by using technology-driven innovation and working closely together, local stakeholders and re/insurers can play an important role in making the world more resilient.

<sup>34</sup> "End-to-end demonstration of the Inventory Data Capture Tools", *Globalquakemodel.org*, January 2014, <http://www.globalquakemodel.org/media/publication/DATA-CAPTURE-GEM-EndtoEnd-IDCT-Demo-201406-V01.pdf>

<sup>35</sup> Parametric insurance pay-outs are triggered based on the physical parameters of a catastrophic event, such as wind speed, location of a hurricane, or magnitude of an earthquake.

<sup>36</sup> Basis risk is the risk that actual losses borne by the buyer of protection will deviate from the payoffs received under the contract.

# Tables for reporting year 2015

**Table 5**

List of major losses in 2015 according to loss category

	Number	as %	Victims	as %	Insured loss (in USD m)	as %
<b>Man-made disasters</b>	<b>155</b>	<b>43.9%</b>	<b>6994</b>	<b>26.5%</b>	<b>8983</b>	<b>24.5%</b>
<b>Major fires, explosions</b>	<b>48</b>	<b>13.6%</b>	<b>1123</b>	<b>4.3%</b>	<b>5629</b>	<b>15.4%</b>
Hotels	1		0		100	
Other buildings	11		213		84	
Oil, gas	9		130		1553	
Other fires, explosions	10		331		0	
Industry, warehouses	17		449		3893	
<b>Miscellaneous</b>	<b>40</b>	<b>11.3%</b>	<b>2206</b>	<b>8.4%</b>	<b>24</b>	<b>0.1%</b>
Terrorism	27		1082		0	
Other miscellaneous losses	10		1102		0	
Social unrest	3		22		24	
<b>Mining accidents</b>	<b>8</b>	<b>2.3%</b>	<b>352</b>	<b>1.3%</b>	<b>450</b>	<b>1.2%</b>
<b>Maritime disasters</b>	<b>31</b>	<b>8.8%</b>	<b>2487</b>	<b>9.4%</b>	<b>1679</b>	<b>4.6%</b>
Passenger ships	20		2259		65	
Drilling platforms	5		45		1553	
Other maritime accidents	4		164		0	
Freighters	2		19		62	
<b>Aviation disasters</b>	<b>16</b>	<b>4.5%</b>	<b>685</b>	<b>2.6%</b>	<b>1001</b>	<b>2.7%</b>
Space	5		0		664	
Crashes	9		685		258	
Explosions, fires	1		0		39	
Damage on ground	1		0		40	
<b>Rail disasters (incl. cableways)</b>	<b>12</b>	<b>3.4%</b>	<b>141</b>	<b>0.5%</b>	<b>200</b>	<b>0.5%</b>
<b>Natural catastrophes</b>	<b>198</b>	<b>56.1%</b>	<b>19365</b>	<b>73.5%</b>	<b>27789</b>	<b>75.6%</b>
Storms	102		2011		20624	
Earthquakes	13		9500		510	
Drought, bush fires, heat waves	23		4955		2043	
Floods	55		2528		4306	
Other natural catastrophes	1		350		0	
Hail	3		0		306	
Cold, frost	1		21		0	
<b>Total</b>	<b>353</b>	<b>100.0%</b>	<b>26359</b>	<b>100.0%</b>	<b>36772</b>	<b>100.0%</b>

Source: Swiss Re Economic Research & Consulting and Cat Perils.

## Tables for reporting year 2015

**Table 6**

The 20 most costly insurance losses in 2015

Insured loss <sup>37</sup> (in USD m)	Victims <sup>38</sup>	Date (start)	Event	Country
2500 to 3500	173	12.08.2015	Port of Tianjin - explosions at a warehouse storing hazardous chemicals	China
2081	30	16.02.2015	Severe winter storm, strong winds, heavy snowfall and ice accumulations	US
1461	31	23.05.2015	Thunderstorms, tornadoes, hail, severe flooding in Texas and Oklahoma	US
1204	2	07.04.2015	Thunderstorms, large hail, tornadoes, flash floods	US
1150	89	18.08.2015	Typhoon Goni	Japan, Philippines, North Korea
1032	–	22.12.2015	Floods (Storms Eva and Frank)	UK, Ireland
1009	11	30.03.2015	Winter Storm Niklas <sup>39</sup>	Germany, Netherlands, et. al.
939	–	18.04.2015	Thunderstorms, large hail, tornadoes, flash floods	US
921	4	12.09.2015	Wildland fire "Valley Fire"	US
914	1	21.06.2015	Thunderstorms, large hail, tornadoes, flash floods	US
884	3	04.12.2015	Cumbria floods (Storm Desmond)	UK, Norway
850	4	06.05.2015	Tornado outbreak (122), hail, strong winds, flash floods	US
ns	4	01.04.2015	Fire and explosion on a drilling platform	Mexico
755	289	28.11.2015	Severe flash floods in Chennai	India
691	7	20.04.2015	Storm (East Coast Low), flash floods, storm surge, hail	Australia
687	4	24.04.2015	Thunderstorms, large hail, tornadoes, flash floods	US
659	–	02.08.2015	Thunderstorms, large hail, flash floods, tornadoes	US
652	20	03.10.2015	Torrential rains bring flash floods	France
636	43	26.12.2015	Thunderstorms, tornadoes (EF4 and EF3), blizzards, flash floods	US
ns	–	13.08.2015	Gas leak at a petrochemicals plant causes an explosion and ensuing fire	Czech Republic

Source: Swiss Re Economic Research & Consulting and Cat Perils.

<sup>37</sup> Property and business interruption, excluding liability and life insurance losses; US natural catastrophe figures based on Property Claim Services, including National Flood Insurance Program (NFIP) losses (see page 43, "Terms and selection criteria" section)

<sup>38</sup> Dead and missing.

<sup>39</sup> Loss numbers for Storm Niklas are Swiss Re estimates based on data from Perils AG.

**Table 7**

The 20 worst catastrophes in terms of victims 2015

Victims <sup>40</sup>	Insured losses (in USD m)	Date (start)	Event	Country/region
8960	160	25.04.2015	Earthquake (M <sub>w</sub> 7.8), avalanche on Mount Everest, aftershocks	Nepal, India, China, Bangladesh
2248	–	21.05.2015	Heatwave	India
1270	–	01.06.2015	Heatwave	Pakistan
1200	–	29.07.2015	Heatwave	Europe
822	–	19.04.2015	Boat carrying migrants capsizes	Libyan Arab Jamahiriya
769	–	23.09.2015	Stampede and crush at the annual Hajj pilgrimage	Saudi Arabia
451	–	12.01.2015	Severe floods	Malawi, Mozambique, Zimbabwe
442	–	01.06.2015	Cruise ship hit by strong winds and rains capsizes on Yangtze River	China
400	–	13.04.2015	Boat carrying migrants capsizes	Italy, Mediterranean Sea
399	–	26.10.2015	Earthquake (M <sub>w</sub> 7.5)	Afghanistan, Pakistan, India
350	–	01.10.2015	Landslide	Guatemala
300	–	08.02.2015	Boat carrying migrants capsizes	Italy, Mediterranean Sea
291	–	01.02.2015	Avalanches, landslides, floods, heavy snowfall	Afghanistan
289	755	28.11.2015	Severe flash floods in Chennai	India
224	ns	31.10.2015	Metrojet Airbus A321-231 plane crashes shortly after takeoff allegedly due to bomb explosion onboard	Egypt
206	–	15.07.2015	Monsoon floods exacerbated by tail end of Cyclone Komen	India
193	–	16.09.2015	Oil tanker overturns and explodes; local residents had gathered to siphon fuel	Sudan
190	–	04.06.2015	Explosion at a gas station	Ghana
173	2500 and 3500	12.08.2015	Explosions at a warehouse storing hazardous chemicals at Tianjin Port	China
166	–	15.07.2015	Monsoon floods	Pakistan

Source: Swiss Re Economic Research &amp; Consulting and Cat Perils.

<sup>40</sup> Dead and missing.

## Tables for reporting year 2015

**Table 8**

Chronological list of all natural catastrophes 2015



### Floods

Date	Country	Event	Number of victims/amount of damage (where data available), local currency and/or USD
5.1.–9.2.	Bolivia, Peru, La Paz, Chuquisaca, Potosí, Oruro, Cochabamba, Santa Cruz	Floods caused by heavy torrential rains	23 dead 1000 homeless
12.1.–31.1.	Malawi, Mozambique, Zimbabwe	Severe floods – 523 347 houses and 89 110 ha of crop land damaged or destroyed in Malawi, 21 780 houses destroyed and 14 361 houses damaged in Mozambique	279 dead, 172 missing 248 620 homeless USD 405m total damage
29.1.–12.2.	Greece, Bulgaria, Macedonia Albania	Floods, heavy snowfall, strong winds, landslides – severe damage to agriculture	4 dead, 1 missing 110 injured EUR 682m (USD 741m) total damage
8.2.–13.2.	Indonesia Java, Bali, West Nusa Tenggara	Floods	6 dead USD 235m total damage
13.2.–14.2.	Angola Luanda	Flash floods – 187 houses destroyed, more than 2000 houses damaged	5 dead More than 2000 homeless
27.2.–1.3.	Madagascar Antananarivo	Flash floods – 4800 houses destroyed	26 dead
9.3.–12.3.	Angola Lobito, Benguela	Severe flash floods	69 dead
10.3.	Iran Bandar Abbas	Flash floods – 900 houses destroyed	3 dead More than 2000 homeless USD 60m total damage
20.3.–31.3.	India Jammu and Kashmir	Floods – 12 565 houses damaged	44 dead 25 injured 2907 homeless INR 5bn (USD 76m) total damage
24.3.–26.3.	Chile Atacama, Antofagasta, Coquimbo	Flash floods, Copiapó River overflowed – 2071 houses destroyed, 6253 houses damaged, damage to copper mines	31 dead, 16 missing USD 450m insured loss USD 1.5bn total damage
29.3.	Burundi Muhuta, Bujumbura	Landslides caused by heavy rains	10 dead, 1 missing 2 870 homeless
4.4.–15.4.	China Hunan, Jiangxi	Remnants of Typhoon Maysak bring floods to 52 towns in Hunan and to 19 467 ha of cropland – more than 5000 houses destroyed, more than 10 000 houses damaged	6 dead USD 209m total damage
28.4.	Afghanistan Jerow-Bala, Khawahan, Badakhshan Province	Landslide caused by heavy rains and snow melt	52 dead
7.5.–21.6.	Tanzania Dar es Salaam, Arusha, Kilimanjaro, Tanga, Kagera	Floods	12 dead 5000 homeless
9.5.	Afghanistan Faryab	Flash floods – 1500 houses destroyed	7 dead 10 injured 3000 homeless
10.5.–18.5.	China Fujian, Jiangxi, Hunan, Guangdong, Guangxi, Guizhou	Floods – severe damage to agriculture	48 dead USD 800m total damage
18.5.	Colombia Salgar	Flash floods trigger large mudslide, debris flow	93 dead 48 injured
28.5.–1.6.	China Guizhou, Chongqing, Jiangsu, Fujian	Floods	17 dead USD 500m total damage

<b>Date</b>	<b>Country</b>	<b>Event</b>	<b>Number of victims/amount of damage</b> (where data available), local currency and/or USD
3.6.–5.6.	Ghana Accra	Flash floods	25 dead 5000 homeless >USD 12m total damage
10.6.	Nepal Taplejung District	Floods trigger landslide	36 dead
13.6.–14.6.	Georgia Tbilisi	Flash flood, landslide and ensuing mudflow caused Vere River to overflow – nearby properties flooded, partial collapse of the city's highway	19 dead, 3 missing 457 injured 300 homeless GEL 55m (USD 23m) total damage
16.6.–20.6.	China Guizhou, Hubei, Hunan, Jiangxi, Yunnan, Zhejiang	Floods	9 dead USD 200m total damage
19.6.–29.6.	India Western Gujarat	Monsoon floods – 200 000 ha of agriculture land flooded	81 dead INR 40bn (USD 604m) total damage
24.6.–28.6.	Bangladesh Cox's Bazar, Chittagong, Bandarban	Flash floods, landslides – 27 269 houses destroyed, 77 090 houses damaged	22 dead 20 651 injured USD 40m total damage
26.6.–2.7.	China Anhui, Jiangsu, Sichuan	Floods	16 dead USD 545m total damage
15.7.–19.8.	India West Bengal, Odisha, Rajasthan, Manipur	Monsoon floods exacerbated by tail end of Cyclone Komen	206 dead
15.7.–19.8.	Pakistan Chitral (Khyber Pakhtunkhwa), Punjab	Monsoon floods	166 dead
25.7.–19.8.	Niger, Burkina Faso Agadez, Dosso, Maradi, Niamey, Tillabéry, Tahoua, Zinder	River floods	12 dead 54 injured 5528 homeless USD 31m total damage
26.7.–11.8.	Myanmar (Burma) Chin, Rakhine	Severe monsoon floods exacerbated by tail end of Cyclone Komen – 21 221 houses destroyed, 468 676 houses damaged	125 dead MMK 155bn (USD 119m) total damage
1.8.–5.8.	North Korea North Hamgyong Province, South Hamgyong Province, South Hwanghae Province	Monsoon (Changma) floods – 714 houses destroyed	24 dead, 9 missing 3541 homeless
3.8.	Macedonia Tetovo	Flash floods, debris flow, landslides	6 dead 79 injured EUR 80m (USD 87m) total damage
10.8.–19.8.	Argentina Buenos Aires, Santa Fe	Floods	3 dead USD 146m total damage
11.8.–12.8.	Italy Corigliano Calabro, Rossano Calabro	Flash floods	EUR 102m (USD 111m) total damage
13.8.–11.9.	India Assam	Monsoon rains cause floods – Brahmaputra River burst its banks, 2000 villages flooded	50 dead USD 50m total damage
30.8.–11.9.	Nigeria Zamfara, Anambra, Sokoto, Kebbi, Kano	Floods caused by torrential rains	30 dead 2000 homeless
9.9.–11.9.	Japan Joso (Ibaraki), Tochigi, Miyagi	Flooding and 455 landslides due to tropical storm Etau – Kinugawa River burst its banks in the city of Joso, 16 houses destroyed, 102 houses seriously damaged, 18 882 houses flooded, more than 1000 people stranded	8 dead 46 injured JPY 40bn (USD 333m) insured loss USD 500m total damage
1.10.–27.10.	India Southern Tami Nadul	Monsoon floods – damage to agriculture	49 dead INR 1bn (USD 15m) total damage
3.10.–4.10.	France Alpes-Maritimes, Var, Côte d'Azur	Torrential rains bring flash floods	20 dead EUR 600m (USD 652m) insured loss EUR 850m (USD 924m) total damage

## Tables for reporting year 2015

<b>Date</b>	<b>Country</b>	<b>Event</b>	<b>Number of victims/amount of damage</b> (where data available), local currency and/or USD
13.10.–19.10.	Italy Benevento (Campania), Lazio, Abruzzo	Heavy rains, flash floods	4 dead EUR 150m (USD 163m) total damage
14.10.–17.10.	Oman Nizwa, Ras Al Hadd, Bahla	Flash floods	7 dead 50 injured
16.10.–23.10.	Algeria Tindouf	Heavy rains flood Sahrawi refugee camps and south-western Algeria – 1 200 homes and tents destroyed	35 000 homeless
28.10.–6.11.	Iraq Baghdad	Flash floods	58 dead 2650 homeless
2.11.–12.11.	Kenya Narok, Bungoma, Talek	Flash floods and landslides	23 dead
8.11.–20.11.	India Andhra Pradesh, Tamil Nadu, Puducherry	Monsoon rains exacerbated by remnants of a deep depression in the Bay of Bengal – flooding in Andhra Pradesh and Tamil Nadu	81 dead USD 110m total damage
10.11.–15.11.	China Hunan	Floods, landslides	38 dead USD 130m total damage
13.11.–4.12.	Sri Lanka Jaffna, Mullaitivu, Killinochchi, Trincomalee, Puttalam, Gampaha	Floods – 160 houses destroyed, 2656 houses damaged	3 dead 2600 homeless
19.11.–24.11.	Democratic Republic of Congo Kinshasa	River flood – N'djili River burst its banks	31 dead 8480 homeless
25.11.–4.12.	Qatar, Saudi Arabia Doha	Flash floods	1 dead USD 120m total damage
28.11.	Iran Ilam, Lorestan, Kurdistan, Kermanshah	Flash floods	6 dead IRR 7000bn (USD 234m) total damage
28.11.–4.12.	India Chennai (Tamil Nadu), Andhra Pradesh, Puducherry	Flash floods in Chennai – 55 175 ha flooded	289 dead 1000 injured INR 50bn (USD 755m) insured loss USD 2.2bn total damage
1.12.2015– 6.1.2016	Kenya Garissa, Migori, Busia and Homa Bay	Floods – several rivers burst their banks	89 dead 73 injured
4.12.–6.12.	UK, Norway Cumbria, Lancashire	Flooding as a result of Storm Desmond	3 dead GBP 600m (USD 884m) insured loss >GBP 800m (USD 1.2bn) total damage
5.12.–30.12.	Argentina, Paraguay, Uruguay, Brazil	Floods and landslides caused by torrential rains – Rivers Uruguay and Paraguay burst their banks	20 dead USD 200m total damage
22.12.–28.12.	UK, Ireland York, Yorkshire, Lancashire, Greater Manchester	Flooding as a result of storms Eva and Frank – Rivers Calder, Ribble, Nidd, Irwell, Ouse, Foss, and Aire burst their banks	GBP 700m (USD 1.0bn) insured loss >GBP 800m (USD 1.2bn) total damage
24.12.2015– 9.1.2016	United States MO (St. Louis), IL, AR, TN, MS, LA	Winter flood along Mississippi River in Midwest – major flooding in Missouri, Illinois	31 dead >USD 200m insured loss >USD 600m total damage



## Storms

Date	Country	Event	Number of victims/amount of damage (where data available), local currency and/or USD
8.1.–11.1.	Germany, Norway, UK, Sweden, Denmark	Windstorm Elon-Felix <sup>41</sup>	2 dead EUR 329m (USD 358m) insured loss EUR 500m (USD 543m) total damage
16.1.–17.1.	Madagascar Analamanga, Vatovavy, Fitovinany, Atsimo, Atsinanana, Menabe	Tropical storm Chedza – pump station responsible for disposal of rain and flood water collapsed exacerbating flooding, 1831 houses destroyed or damaged, 13 100 ha of paddy fields flooded	80 dead, 9 missing USD 36m total damage
19.1.	Oman Muscat	Storms and floods	USD 221m total damage
26.1.–28.1.	United States CT, ME, MA, NH, NY, RI	Winter storm (nor'easter) with winds up to 104 km/h, heavy snow fall, coastal flooding	2 dead USD 50m insured loss USD 80m total damage
1.2.–4.2.	United States MA, NY, CT, IL, MI, IN	Winter storm, high winds, heavy snowfall and freezing temperatures – 3000 flights cancelled	22 dead USD 100–300m insured loss USD 150m total damage
1.2.–15.2.	Afghanistan Panjshir	Avalanches, landslides, floods, heavy snowfall – 1454 houses destroyed, 7119 houses damaged	291 dead 96 injured USD 3m total damage
5.2.–8.2.	Spain, Italy	Blizzards, heavy snowfall, strong winds, flooding – frost damage to agriculture	3 dead EUR 68m (USD 73m) insured loss EUR 150m (USD 163m) total damage
7.2.–11.2.	United States MA, NY, CT, RI, NH	Winter storm, heavy snowfall – over 2000 flights cancelled	2 dead USD 100–300m insured loss USD 300m total damage
14.2.–15.2.	United States MA, NY, NJ, VA, MD, RI, CT, NH, PA, DE	Winter storm, heavy snowfall, strong winds – 1600 flights cancelled	8 dead USD 300–600m insured loss USD 700m total damage
16.2.–17.2.	United States VA, GA, TN, NC, SC	Winter storm, heavy snow, strong icy winds	10 dead USD 25–100m insured loss USD 100m total damage
16.2.–22.2.	United States MA, NY, TN, MD, VA, PA, KY, NC, MI, RI, NH, OH, SC, IL, DC, ME, VT	Severe winter storm, strong winds, heavy snowfall and ice accumulations – severe damage in Massachusetts	30 dead USD 1–3bn insured loss USD 3bn total damage
19.2.–20.2.	Australia Yeppoon, Rockhampton, Biloela, Yeppoon, Byfield, Jambin, Marmor, Monto, Queensland	Tropical Cyclone Marcia (Cat 5) with winds up to 208 km/h – up to 2000 houses destroyed	1 dead AUD 544m (USD 396m) insured loss AUD 750m (USD 546m) total damage
3.3.–4.3.	Tanzania Msalala, Shinyanga	Thunderstorms, large hail, flash floods – 634 houses destroyed	47 dead 112 injured, 3500 homeless
3.3.–5.3.	United States NY, PA, KY, WV, AR	Winter storm, sleet and snow fall	13 dead USD 100–300m insured loss USD 170m total damage
4.3.–9.3.	Italy Toscana, Liguria, Abruzzo, Umbria, Marche, Puglia, Campania	Winter storm Anton with winds up to 200 km/h, heavy snowfall, floods, landslides – severe disruption to transport, damage to agriculture, – explosion at gas pipeline in Abruzzo	3 dead EUR 254m (USD 276m) insured loss EUR 800m (USD 869m) total damage
6.3.–18.3.	India Gujarat, Punjab, Himachal Pradesh, Haryana, Maharashtra, Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan, Jammu & Kashmir, West Bengalwere	Severe hailstorms, flash floods – severe damage to agriculture	27 dead INR 7bn (USD 106m) insured loss INR 60bn (USD 906m) total damage

<sup>41</sup> Loss estimates for Windstorm Elon-Felix from Perils AG.

## Tables for reporting year 2015

<b>Date</b>	<b>Country</b>	<b>Event</b>	<b>Number of victims/amount of damage</b> (where data available), local currency and/or USD
9.3.–15.3.	Vanuatu, Tuvalu, Solomon Islands, New Zealand Tanna, Erromango, Efate	Cyclone Pam (Cat 5), winds up to 320 km/h – in Vanuatu, 20 000 houses destroyed or damaged, 95% of agriculture sector destroyed and 70% of water sources contaminated	11 dead 75 000 homeless >USD 287m total damage
12.3.–15.3.	Australia Pilbara, Gascoyne, Greenough, Irwin	Cyclone Olwyn	AUD 67m (USD 49m) insured loss AUD 78m (USD 57m) total damage
24.3.–25.3.	China Guizhou, Henan, Shanxi, Jiangxi, Chongqing, Sichuan, Shaanxi	Thunderstorms, flash floods	24 dead 148 injured USD 225m total damage
25.3.	Mexico Ciudad Acuna	Thunderstorms, tornadoes	14 dead 229 injured
25.3.–26.3.	United States OK, AR, MO, KS	Thunderstorms with winds up to 110 km/h, tornadoes, hail	1 dead 15 injured USD 300–600m insured loss USD 500m total damage
29.3.–31.3.	China Tibet, Xinjiang	Winter storm, heavy snowfall	USD 108m total damage
30.3.	Iran Esfarvarin, Qazvin	Thunderstorms, flash floods	77 injured
30.3.–1.4.	Germany, Netherlands, Austria, Belgium, UK, Switzerland	Winter Storm Niklas <sup>42</sup>	11 dead EUR 928m (USD 1.09bn) insured loss EUR 1.3bn (USD 1.4bn) total damage
31.3.–1.4.	Micronesia (Federated States of) Chuuk, Yap	Typhoon Maysak with winds up to 250 km/h – 600 houses destroyed or damaged, water sources contaminated, severe damage to agriculture	5 dead 3000 homeless USD 11m total damage
31.3.–1.4.	United States AR, TX, AL, OK, GA, TN, MS	Thunderstorms, hail, flash floods	USD 100–600m insured loss USD 200m total damage
1.4.–7.4.	Bangladesh Bogra, Rajshahi, Naogaon, Sirajganj, Pabna, Brahmanbaria, Dhaka	Multiple storms, tornadoes (Nor'wester) – over 50 000 houses damaged	53 dead 200 injured USD 4m total damage
2.4.–3.4.	United States KS, KY, MO	Thunderstorms, tornadoes, hail, flash floods	2 dead USD 100–300m insured loss USD 230m total damage
4.4.–5.4.	China Sichuan	Thunderstorms, hail	7 dead 37 injured 2500 homeless
6.4.–9.4.	China Yunnan, Sichuan, Guizhou, Guangxi	Thunderstorms, hail	USD 130m total damage
7.4.–10.4.	United States MO, IL, NC, IN, OH, KY, TX, IA, AR, MI, WV, WI, PA, OK, KS, TN	Thunderstorms, large hail, tornadoes (one EF4), flash floods	2 dead 22 injured USD 1–3bn insured loss USD 1.6bn total damage
11.4.	China Hebei, Shandong, Shanxi, Shaanxi	Winter storm	USD 174m total damage
16.4.–17.4.	United States TX, OK, KS	Thunderstorms, hail, tornadoes, flash floods	USD 100–300m insured loss USD 140m total damage
18.4.–21.4.	United States TX, AR, GA, PA, SC, AL, TN, KS, FL, OK, MS	Thunderstorms, large hail, tornadoes, flash floods	USD 600m–1bn insured loss USD 1.3bn total damage

<sup>42</sup> Loss numbers for Storm Niklas are Swiss Re estimates based on data from Perils AG.

<b>Date</b>	<b>Country</b>	<b>Event</b>	<b>Number of victims/amount of damage</b> (where data available), local currency and/or USD
18.4.–21.4.	China Guizhou, Shanxi, Shaanxi, Gansu	Thunderstorms, hail, flash floods	2 dead USD 250m total damage
20.4.	Brazil Xanxere, Santa Catarina	Tornado with winds up to 320 km/h	2 dead 120 injured
20.4.–23.4.	Australia Hunter, Sydney (New South Wales)	Winter storm (East Coast Low), gusty winds, flash floods, storm surge, hail	7 dead AUD 950m (USD 691m) insured loss >AUD 1.2bn (USD 873m) total damage
21.4.	India Purnia, Bihar	Thunderstorms, large hail – 25 000 houses damaged	100 dead USD 150m total damage
24.4.–28.4.	United States TX, LA, KY, AL, GA, FL, MS	Thunderstorms, large hail, tornadoes, flash floods	4 dead USD 600m–1bn insured loss USD 950m total damage
26.4.–27.4.	Pakistan Khyber Pakhtunkhwa	Thunderstorms, strong winds, flash floods, tornadoes	49 dead 267 injured PKR 150m (USD 1m) total damage
27.4.	India, Haryana	Thunderstorms	INR 6.92bn (USD 105m) total damage
30.4.–4.5.	Australia Brisbane, Gold Coast (Queensland), New South Wales	Winter storm (East Coast Low), flash floods	4 dead AUD 349m (USD 254m) insured loss AUD 420m (USD 306m) total damage
3.5.–4.5.	United States MN, NE, IA, WI, KS	Thunderstorms, hail, tornadoes, flash floods	1 dead 40 injured USD 100–300m insured loss USD 160m total damage
5.5.–8.5.	China Guangxi, Guangdong	Thunderstorms, hail	4 dead USD 300m total damage
6.5.–13.5.	United States OK, TX, CO, NE, SD, KS	Tornado outbreak (122), hail, strong winds, flash floods – severe damage in Oklahoma and Texas, – flash flood in Nebraska	4 dead USD 600m–1bn insured loss USD 1.4bn total damage
11.5.	Bangladesh Faridpur, Pabna	Thunderstorms, tornadoes (Nor'wester)	50 injured
13.5.	Germany Konstanz (Baden -Württemberg), Affing (Bavaria)	Tornado outbreak (EF3) with winds up to 250km/h	9 injured EUR 50m (USD 54m) insured loss EUR 55m (USD 60m) total damage
15.5.	Italy Piemonte, Lombardia	Thunderstorms (Storm Ferox), large hail, flash floods – damage to agriculture, damage to the Milan Malpensa airport	EUR 10m (USD 11m) insured loss EUR 100m (USD 109m) total damage
15.5.–17.5.	United States TX, OK, MO, CO, KS, NE	Thunderstorms, tornadoes, hail, flash floods	2 dead USD 100–300m insured loss USD 160m total damage
19.5.	India Andhra Pradesh	Thunderstorms	23 dead
23.5.	Bangladesh Dinajpur	Thunderstorms – 8 000 houses damaged, trees and electric poles uprooted	6 dead 50 injured USD 1m total damage
23.5.–28.5.	United States TX, OK, KS, LA, CO, AR, GA, OH, SC	Thunderstorms, tornadoes, hail – severe flooding in Texas and Oklahoma	31 dead USD 1.46bn insured loss USD 2.5bn total damage
25.5.	Mexico Acuña, Coahuila	Tornado EF3, with winds up to 200 km/h – 247 houses destroyed, 450 damaged	13 dead 229 injured
28.5.–30.5.	United States TX, OK, CO, KS	Thunderstorms, tornadoes, large hail, flash floods	USD 100–300m insured loss USD 180m total damage
29.5.–1.6.	China Shanxi, Shaanxi, Gansu, Jilin, Heilongjiang, Ningxia	Thunderstorms, hail	USD 325m total damage

## Tables for reporting year 2015

<b>Date</b>	<b>Country</b>	<b>Event</b>	<b>Number of victims/amount of damage</b> (where data available), local currency and/or USD
1.6.	China Jianli, Hubei	Cruise ship hit by strong winds and rains capsizes on Yangtze River	442 dead USD 15m total damage
3.6.–8.6.	United States CO, IL	Thunderstorms, tornadoes, large hail, flash floods	USD 300–600m insured loss USD 650m total damage
10.6.–11.6.	United States IL	Thunderstorms, large hail, 1 tornado, flash floods	1 dead USD 25–100m insured loss USD 80m total damage
16.6.–18.6.	United States TX, OK	Remnants of Tropical Storm Bill cause localised storm surge and major river flooding in Oklahoma, Texas and Louisiana (Red River Flood)	3 dead USD 25–100m insured loss USD 200m total damage
21.6.–23.6.	China Gansu, Heilongjiang, Inner Mongolia, Ningxia Hui, Qinghai, Shaanxi	Thunderstorms, hail	USD 145m total damage
21.6.–25.6.	United States CO, IL, NJ, MD, IA, PA, SD, MI, VA, WI, CT, NY, DE, ND	Thunderstorms, large hail, tornadoes, flash floods	1 dead USD 600m–1bn insured loss USD 1.4bn total damage
29.6.–30.6.	United States MN, PA	Thunderstorms, hail, flash floods, tornadoes	USD 100–300m insured loss USD 300m total damage
8.7.	Italy Dolo, Venice	EF4 tornado	3 dead 50 injured EUR 10m (USD 11m) insured loss EUR 25m (USD 27m) total damage
10.7.–21.7.	Brazil Paraná, Santa Catarina, Rio Grande do Sul	Thunderstorms, tornado with winds up to 115 km/h, flash floods – 3 900 houses damaged	3 dead 79 injured
11.7.–13.7.	China (Zhoushan, Zhejiang), Taiwan, Japan	Typhoon Chan-hom with winds up to 190 km/h – in China severe damage to agriculture	1 dead 24 injured USD 156m insured loss USD 1.426bn total damage
12.7.–14.7.	United States IL, MN, IN, KY, OH, TN, WI	Thunderstorms, large hail, tornadoes, landslides and flash floods	3 dead, 1 missing USD 300–600m insured loss USD 700m total damage
16.7.–17.7.	Japan, Marshall Islands	Typhoon Nangka	2 dead JPY 15.3bn (USD 127m) insured loss USD 207m total damage
17.7.–20.7.	United States MN, IN	Thunderstorms, hail, tornadoes, flash floods	USD 25–100m insured loss USD 80m total damage
18.7.–19.7.	Iran Alborz, Tehran	Thunderstorms, flash floods	17 dead, 6 missing 30 injured
21.7.–22.7.	Canada Alberta, Saskatchewan	Thunderstorms, hail, tornadoes, flash floods	USD 100–300m insured loss CAD 420m (USD 302m) total damage
29.7.–31.7.	Bangladesh Cox's Bazar, Chittagong, Bhola, Patuakhali, Barguna	Cyclone Komen brings heavy rains and flooding	7 dead, 38 missing USD 40m total damage
2.8.–4.8.	United States IL, MI, MA, WI, RI, ME, NY	Thunderstorms, large hail, flash floods, tornadoes	USD 600m–1bn insured loss USD 950m total damage
2.8.–8.8.	Taiwan, China (Fujian), United States, Philippines Northern Mariana Islands	Typhoon Soudelor	33 dead, 6 missing, 440 injured USD 100m insured loss USD 3.1bn total damage
4.8.–5.8.	Canada Alberta	Thunderstorms, large hail	USD 25–100m insured loss CAD 150m (USD 108m) total damage
18.8.–26.8.	Philippines, Japan, North Korea	Typhoon Goni brings flooding and landslides	82 dead, 7 missing, 94 injured USD 1.15bn insured loss USD 1.6bn total damage

<b>Date</b>	<b>Country</b>	<b>Event</b>	<b>Number of victims/amount of damage</b> (where data available), local currency and/or USD
27.8.–31.8.	Dominica, Haiti, United States	Tropical storm Erika	19 dead, 16 missing USD 15m insured loss USD 450m total damage
6.9.	India, Andhra Pradesh	Thunderstorms, lightning	32 dead
8.9.–9.9.	Lebanon, Syrian Arab Republic	Severe sandstorm	6 dead 4 330 injured
14.9.–19.9.	Vietnam, Cambodia, Thailand	Tropical storm Vamco brings floods	13 dead USD 150m total damage
25.9.–28.9.	Taiwan, China (Fujian, Zhejiang), Philippines	Typhoon Dujuan – 57 000ha of cropland flooded	3 dead, 2 missing 376 injured USD 78m insured loss USD 516m total damage
1.10.–4.10.	Bahamas Long Island, Ragged Island	Hurricane Joaquin – cargo ship goes missing	33 dead USD 61m insured loss USD 90m total damage
1.10.–13.10.	United States SC, NC	Heavy flooding in South Carolina due to Hurricane Joaquin	25 dead USD 300m insured loss USD 1.5bn total damage
2.10.–4.10.	China (Guangdong, Guangxi, Hainan), Philippines	Typhoon Mujigae – 562 300ha of cropland flooded	USD 400m insured loss USD 4.572bn total damage
2.10.–6.10.	United States SC, NC, VA, NJ, MD, DE	Thunderstorms, flash floods	USD 300–600m insured loss USD 500m total damage
3.10.–4.10.	United States NM	Thunderstorms, hail	USD 25–100m insured loss USD 110m total damage
3.10.–4.10.	India, Maharashtra	Thunderstorms	29 dead
5.10.–7.10.	United States El Paso, TX	Thunderstorms, large hail, torrential rain	USD 25–100m insured loss USD 100m total damage
18.10.–19.10.	Philippines Luzon	Typhoon Koppu (Cat 4) with winds up to 240km/h, heavy flooding, landslides – 18 795 houses destroyed, 118 885 houses damaged, 330 000ha of cropland destroyed	48 dead, 4 missing 83 injured PHP 14bn (USD 298m) total damage
20.10.–23.10.	United States TX, NM	Thunderstorms, hail, flash floods	USD 100–300m insured loss USD 230m total damage
22.10.–26.10.	Mexico, (Cuixmala, Jalisco), United States (TX)	Hurricane Patricia brings wind and flood damage to Mexico and Texas – freight train derails in US	14 dead USD 343m insured loss USD 823m total damage
24.10.–25.10.	Egypt Alexandria	Thunderstorms, hail, flash floods – damage to the city's sewage system	6 dead USD 100m total damage
29.10.–31.10.	United States TX, LA	Thunderstorms, hail, flash floods	USD 100–300m insured loss USD 270m total damage
1.11.–3.11.	Yemen Mukalla, Socotra	Cyclone Chapala	8 dead 65 injured
3.11.–4.11.	Egypt Beheira	Thunderstorms, flash floods	25 dead 35 injured
8.11.–10.11.	Yemen Socotra, Aden	Cyclone Megh – 800 houses, 1 power station damaged	24 dead 60 injured
16.11.–18.11.	United States WA, ID	Thunderstorms, flash floods	USD 100–300m insured loss USD 310m total damage
22.11.–23.11.	China Beijing, Tianjin	Winter storm	4 dead CNY 1.7bn (USD 262m) total damage
26.11.–30.11.	United States TX, OK, KS	Winter storm with freezing rains and flooding	18 dead USD 25–100m insured loss USD 140m total damage

## Tables for reporting year 2015

Date	Country	Event	Number of victims/amount of damage (where data available), local currency and/or USD
14.12.–16.12.	Philippines Mindoro, Romblon	Typhoon Melor brings flooding and landslides – 98 371 houses destroyed, 181 116 houses damaged	42 dead, 4 missing 24 injured 287 227 homeless PHP 10.543bn (USD 225m) total damage
16.12.	Australia Sydney, Kurnell	Thunderstorms, EF2 tornado with winds up to 200 km/h, flash floods – desalination plant in Kurnell damaged	6 injured AUD 202m (USD 147m) insured loss AUD 250m (USD 182m) total damage
23.12.–24.12.	United States GA, TN, IN, AL, MS, IL, AR	Thunderstorms, tornadoes, hail, flash floods	3 dead USD 100–300m insured loss USD 180m total damage
26.12.–28.12.	United States TX, MO, IL, OK, GA, IN	Thunderstorms, tornadoes (EF4 and EF3), blizzards, flash floods	43 dead USD 600m –1bn insured loss USD 900m total damage



### Earthquakes

Date	Country	Event	Number of victims/amount of damage (where data available), local currency and/or USD
1.3.	China Nansan, Cangyuan, Gengma	Earthquake (M <sub>w</sub> 5.2) – 220 houses destroyed, 15 800 houses severely damaged	32 injured 2000 homeless USD 15m total damage
15.4.	China Yangzhuang	Earthquake (M <sub>w</sub> 4.5)	1 dead, 1 injured 5000 homeless
25.4.	Nepal (Lamjung, Kathmandu), India, China, Bangladesh	Earthquake (M <sub>w</sub> 7.8), avalanche on Mount Everest, major aftershocks – in Nepal 498 852 houses destroyed, 256 697 houses damaged, severe damage to the country's cultural heritage	8957 dead, 3 missing 24 000 injured USD 160m insured loss USD 6bn total damage
12.5.	Nepal (Kodari), India, Bangladesh	Earthquake (M <sub>w</sub> 7.3)	117 dead 3628 injured
3.7.	China Yilkiqi, Xinjiang	Earthquake (M <sub>w</sub> 6.4)	3 dead 71 injured
16.9.	Chile Illapel	Earthquake (M <sub>w</sub> 8.3) triggers tsunami – 2 305 houses destroyed, 2 743 houses severely damaged, 7 301 houses slightly damaged, 191 boats destroyed	15 dead, 1 missing, 14 injured 600 homeless USD 350m insured loss USD 1bn total damage
24.9.	Indonesia, Sorong	Earthquake (M <sub>w</sub> 6.6) – 200 houses damaged	62 injured
26.10.	Afghanistan, Pakistan, India Badakshan, Hindu Kush	Earthquake (M <sub>w</sub> 7.5) – 32 681 houses destroyed, 79 312 houses damaged	399 dead 2 313 injured
4.11.	Indonesia Dili, Timor	Earthquake (M <sub>w</sub> 6.3) – 1 768 houses destroyed or damaged	3 injured More than 2000 homeless IDR 49.75bn (USD 4m) total damage
16.11.–23.11.	Indonesia West Halmahera District, North Maluku Province	Tremors – 237 houses heavily damaged, 193 medium damaged, 504 slightly damaged	2000 homeless
17.11.	Kyrgyzstan Osh	Earthquake (M <sub>w</sub> 5.7) – 222 houses destroyed, 836 houses severely damaged, 1 401 houses moderately damaged	2000 homeless USD 12m total damage
7.12.	Tajikistan Murghob, Gorno -Badakhshan	Earthquake (M <sub>w</sub> 7.2) – more than 500 houses destroyed, 793 houses damaged	2 dead, 13 injured More than 2000 homeless USD 5m total damage
25.12.	Afghanistan, Pakistan Ashkasham	Earthquake (M <sub>w</sub> 6.3)	2 dead 97 injured



## Cold, frost

Date	Country	Event	Number of victims/amount of damage (where data available), local currency and/or USD
6.7.–5.8.	Peru Puno, Apurimac, Ayacucho, Arequipa, Cusco, Huancavelica, Lima, Moquegua, Pasco, Tacna	Blizzards, cold spell with temperatures down to -20°C, severe frost – 529 houses damaged, 1894 ha of agricultural land damaged, 1162 ha of crops lost, 912 300 livestock perished	21 dead 100 homeless USD 94m total damage



## Drought, bush fires, heat waves

Date	Country/region	Event	Number of victims/amount of damage (where data available), local currency and/or USD
1.1.–31.12.	United States CA, NV, OR, WA, ID, MT, UT, AZ	Drought in western states	USD 1.8bn total damage
1.1.–31.12.	Guatemala, Honduras, Haiti, Dominican Republic, Jamaica, Saint Lucia, El Salvador	Severe drought in Central America and the Caribbean	<USD 600m total damage
1.1.–31.12.	South Africa, Botswana, Namibia	Severe drought in southern Africa	>USD 500m total damage
2.1.–8.1.	Australia Mount Lofty Ranges, Adelaide (South Australia)	Bushfires (Adelaide Hills) – 27 houses, sheds and farms destroyed, 12 500 ha of bush destroyed, 900 animals perished	134 injured AUD 62m (USD 45m) insured loss AUD 70m (USD 51m) total damage
12.4.–15.4.	Russia Khakassia	Wildfires – 1000 houses destroyed or damaged	34 dead RUB 9bn (USD 123m) total damage
16.4.–18.12.	Europe	Severe drought in Europe	<EUR 2.3bn (USD 2.499bn) total damage
1.5.–31.10.	China Inner Mongolia, Liaoning, Jilin	Severe drought in northeastern China	CNY 2.88bn (USD 444m) insured loss CNY 16bn (USD 2.464bn) total damage
11.5.–7.5.	Japan	Heatwave	2 dead 480 injured
21.5.–28.5.	India Andhra Pradesh, Telangana	Heatwave	2248 dead
1.6.–24.6.	Pakistan Karachi, Sindh	Heatwave	1270 dead
1.6.–31.12.	Papua New Guinea Highlands	Prolonged high temperatures, severe drought	23 dead
12.7.–15.7.	Japan	Heatwave	5 dead 3200 injured
29.7.–9.8.	Europe	Heatwave	1200 dead
3.8.–9.8.	Japan Osaka	Heatwave	32 dead 11 187 injured
5.8.–23.10.	India Odisha	Severe drought	USD 120m insured loss USD 1.5bn total damage
6.8.–18.8.	Egypt Cairo	Heatwave	110 dead 66 injured
1.9.–11.11.	Indonesia Jambi, Riau, South Sumatera (Sumatra), Kalimantan (Borneo)	Wildfires trigger dense smog haze	19 dead 500 000 injured USD 1bn total damage

## Tables for reporting year 2015

Date	Country	Event	Number of victims/amount of damage (where data available), local currency and/or USD
9.9.–14.9.	United States Amador, Calaveras (CA)	Wildland fire "Butte Fire" – 475 houses destroyed, 45 structures damaged, 28 679 ha of forest destroyed	2 dead, 1 injured USD 300–600m insured loss USD 400m total damage
12.9.–14.9.	United States Lake, Napa, Sonoma (CA)	Wildland fire "Valley Fire" – 1280 houses, 27 multi-family structures, 66 commercial properties, and 585 other minor structures destroyed. 41 houses, 7 commercial buildings damaged, 30 783 ha of forest destroyed	4 dead 4 injured USD 600m–1bn insured loss USD 1.4bn total damage
14.9.–17.9.	Colombia Boyacá, Cundinamarca	Severe wildfires	COP 476bn (USD 150m) total damage
15.11.–21.11.	Australia Esperance, Western Australia	Large bushfires destroy 145 000 ha of land including vast areas of cropping land	4 dead AUD 17m (USD 12m) insured loss AUD 150m (USD 109m) total damage
25.11.–28.11.	Australia Balaklava, Roseworthy, South Australia	Pinerey Bushfires – 85 000 ha of agricultural land burnt	2 dead, 13 injured AUD 170m (USD 124m) insured loss AUD 200m (USD 146m) total damage
25.12.–26.12.	Australia Victoria	Great Ocean Road bushfires – 116 houses destroyed	AUD 87m (USD 63m) insured loss AUD 100m (USD 73m) total damage



### Hail

Date	Country	Event	Number of victims/amount of damage (where data available), local currency and/or USD
7.4.	India Bareilly, Uttar Pradesh	Hailstorm	INR 8bn (USD 121m) total damage
25.4.	Australia Sydney	Anzac Day hailstorm – damage to commercial facilities and to agriculture	AUD 421m (USD 306m) insured loss AUD 500m (USD 364m) total damage
5.9.	Italy Pozzuoli (Campania), Emilia Romagna, Lombardia	Series of hailstorms cause damage to agriculture and vehicles	2 injured EUR 90m (USD 98m) total damage



### Other natural catastrophes

Date	Country	Event	Number of victims/amount of damage (where data available), local currency and/or USD
1.10.	Guatemala El Cambray II, Santa Catarina Pinula	Landslide – 73 houses severely damaged, 111 houses damaged	280 dead, 70 missing 27 injured 407 homeless USD 5m total damage

Note: Table 8 uses loss ranges for US natural catastrophes as defined by Property Claim Services.

Source: Swiss Re Economic Research & Consulting and Cat Perils.

**Table 9**

Chronological list of all man-made disasters 2015



### Aviation disasters

Date	Country	Event	Number of victims (where data available)
18.1.	Syrian Arab Republic Abu adh Dhuhur	Syrian Air Force Antonov 26 plane crashes on landing approach	30 dead
4.2.	Taiwan Taipei	TransAsia Airways ATR 72-600 plane crashes after take off	43 dead
24.3.	France Barcelonnette	Germanwings Airbus A320-211 crashes due to pilot suicide	150 dead
2.4.	Yemen Aden	Yemenia Boeing 747SP destroyed during a gun battle at Aden International Airport	
12.4.	Space	Loss of contact with Egypt-Sat 2, a remote sensing satellite	
14.4.	Japan Hiroshima	Asiana Airlines Airbus A320-232 plane written off after hard landing	27 injured
25.4.	Turkey Istanbul	A Turkish Airlines Airbus A320-232 catches fire on landing	
28.4.	Space	Russian ISS resupply craft lost due to early separation from rocket	
9.5.	Space	Airbus A400M plane crashes during a test flight	4 dead, 2 injured
16.5.	Space	Mexsat satellite crashes due to faulty launch	
28.6.	Space Cape Canaveral	NASA ISS resupply rocket explodes shortly after launch	
30.6.	Indonesia Medan	TNI-AU Lockheed C-130B Hercules plane crashes shortly after takeoff	139 dead
16.8.	Indonesia Oksibil	Trigana Air Service ATR 42-300 crashes before landing	54 dead
31.10.	Egypt Al-Arish, Sinai	Metrojet Airbus A321-231 plane crashes shortly after takeoff allegedly due to bomb onboard	224 dead
4.11.	Sudan Juba	Allied Services Ltd Antonov 12BK cargo plane crashes shortly after takeoff	41 dead
21.11.	Space	Loss of contact with Amos 5, a commercial satellite	



### Major fires, explosions

Date	Country	Event	Number of victims (where data available)
10.1.	United States, Ohio	Explosion and fire at an oil refinery	
10.1.	South Korea Uijeongbu	Fire at a multi-storey apartment block	5 dead 125 injured
11.1.	Bangladesh Dhaka	Fire in a shanty town	2 dead 2000 homeless
29.1.	Mexico Mexico City	Gas leak causes an explosion at a children's hospital	2 dead 72 injured
5.2.	UK Staverton	Fire at an electrical plant	
16.2.	Germany Rechterfeld	Fire at an animal feed factory	
3.3.	United States Duryea, PA	Fire at a glass-making facility	
11.3.	Russia Kazan	Fire at a shopping centre	17 dead 55 injured
12.3.	Bangladesh Mongla, Bagerhat	Under-construction roof at a cement factory collapses	5 dead 50 injured

## Tables for reporting year 2015

Date	Country	Event	Number of victims (where data available)
19.4.	Brazil Sao Paulo	Fire at a pharmaceuticals company	
29.4.	UK Guildford, Surrey	Fire at a heritage palace	
14.5.	Philippines Valenzuela, Manila	Fire at a footwear factory	72 dead
19.5.	Azerbaijan Baku	Fire at a residential building	15 dead 63 injured
19.5.	United States Santa Barbara	Oil spill into channel and on to beaches after onshore pipeline bursts	
25.5.	China Pingdingshan, Henan	Fire at a home for the elderly	38 dead
25.5.	South Korea Seoul	Fire at a clothing warehouse	1 dead
31.5.	Syrian Arab Republic Qamishli	Gas explosion in a hospital	40 dead
4.6.	Ghana Accra	Explosion at a gas station	190 dead 60 injured
10.6.	Israel Dimona	Fire at a chemical plant	
27.6.	Taiwan New Taipei City	Explosion at a recreational water park	9 dead 490 injured
5.7.	Qatar Al Shaheen	"Punch-through" incident at Al Shaheen oil rig	
28.7.	Egypt Qalioubiya	Explosion and fire at a furniture factory	25 dead 22 injured
12.8.	China Tianjin	Explosions at a warehouse storing hazardous chemicals at Tianjin Port – 304 buildings, 12 428 vehicles and 7533 containers destroyed	165 dead, 8 missing 798 injured
13.8.	Czech Republic Litvínov	Gas leak at a petrochemicals plant causes an explosion and ensuing fire	5 injured
25.8.	Germany Neuweiler	Fire at a hydraulics company	
29.8.	Canada Mildred Lake, Alberta	Fire and explosion at an oil sands facility	
30.8.	Saudi Arabia Khobar	Fire at a multi-storey residential complex	10 dead 259 injured
8.9.	Belgium Nieuwkerke	Fire at a food processing factory	11 injured
10.9.	UK Glasgow	Fire at a food processing factory	
11.9.	Saudi Arabia Mecca	Construction crane at a mosque collapses during a storm	111 dead 394 injured
13.9.	India Petlawad, Jhabua (Madhya Pradesh)	Explosions at a warehouse storing gelignite and at a restaurant located in the same building	104 dead
16.9.	China Ningde City, Fujian	Kindergarten children trapped by a fire in their building	104 injured
30.9.	Netherlands Geleen	Fire at a chemical plant	
19.10.	Ukraine Svatovo	Fire and explosion at an ammunition depot destroy or damage 1079 houses	4 dead 54 injured 3082 homeless
23.10.	United States Aliso Canyon	Large gas leak at a storage facility – state of emergency declared 2 months after incident, 7574 households temporarily relocated	660 injured
30.10.	Romania Bucharest	Fire at a nightclub, triggered by fireworks	56 dead 166 injured

<b>Date</b>	<b>Country</b>	<b>Event</b>	<b>Number of victims</b> (where data available)
4.11.	Pakistan Lahore	Shopping bags factory building collapses	45 dead 103 injured
15.11.	Malta Valletta	Glass banister in a nightclub collapses	71 injured
24.11.	Algeria Ouargla	Fire in a migrant camp	18 dead 50 injured
25.11.	Philippines Manila	Fire in a shanty town, destroys 800 houses	2500 homeless
29.11.	South Africa	Fire in a shanty town destroys 1000 homes	2 dead 4000 homeless
4.12.	Philippines Sta. Cruz, Manila	Fire in a shanty town	5000 homeless
5.12.	Azerbaijan Caspian Sea	Fire at an oil platform	7 dead, 23 missing
7.12.	India Kandivali, Mumbai	Fire and gas explosions in a shanty town	2 dead 11 injured 3000 homeless
13.12.	Russia Voronezh	Fire at a psychiatric hospital	23 dead
24.12.	Saudi Arabia Jazan, Jizan Region	Fire at a hospital	24 dead 123 injured
24.12.	Nigeria Nnewi	Explosion at a gas plant	100 dead
31.12.	United Arab Emirates Dubai	Fire at a hotel at time of New Year's Eve celebrations	14 injured



## Maritime disasters

<b>Date</b>	<b>Country</b>	<b>Event</b>	<b>Number of victims</b> (where data available)
2.1.	North Pacific Ocean Vung Tau	Bulk carrier sinks off the coast of Vietnam	2 dead, 16 missing 1 injured
13.1.	Central African Republic Ndimba, 42 km from Bangui	Boat catches fire and capsizes on River Oubangui	108 dead, 14 missing
16.1.	China Zhangjiagang, Jiangsu	Tugboat sinks during a trial voyage on the Yangtze River	22 dead
3.2.	Yemen Bab el-Mandeb	Boat carrying migrants capsizes in rough weather	35 missing
8.2.	Italy Lampedusa	Boat carrying migrants capsizes	300 dead
11.2.	Brazil Espírito Santo Basin	Explosion at a drilling platform	6 dead, 3 missing 10 injured
14.2.	Democratic Republic of Congo Lake Tanganyika	Boat capsizes on Lake Tanganyika	100 missing
22.2.	Bangladesh Manikganj district	Passenger ferry sinks in the River Padma after being hit by a cargo vessel	70 dead
13.3.	Myanmar, Indian Ocean Naung Daw Gyi Island	Passenger ferry capsizes in rough weather	34 dead, 12 missing
28.3.	Greece Drapetsona	Fire onboard a high-speed ferry while docked at shipyard	1 dead
1.4.	Mexico Bay of Campeche	Fire and explosion on a drilling platform	4 dead 16 injured

## Tables for reporting year 2015

Date	Country	Event	Number of victims (where data available)
1.4.	Russia, North Pacific Ocean, Kamchatka Peninsula, Sea of Okhotsk	Fishing vessel sinks after hitting ice	57 dead, 12 missing
13.4.	Mediterranean Sea Italy	Boat carrying migrants capsizes	400 missing
16.4.	Mediterranean Sea off Sicily	Boat carrying migrants capsizes	41 missing
19.4.	Libyan Arab Jamahiriya Zuwarah, Tripoli	Boat carrying migrants capsizes	24 dead, 798 missing
28.4.	Mediterranean Sea Spain, Majorca	Fire on board a passenger ferry	
5.5.	Mexico Bay of Campeche	Offshore oil rig tilts during maintenance operations	2 dead 10 injured
15.5.	Falkland Islands	Blowout at an oil rig	
11.6.	Indian Ocean Indonesia, Makassar Strait	Passenger ferry sinks in unknown circumstances	22 missing
27.6.	Turkey Dardanelles Strait	Passenger vessel collides with tanker; both damaged	
2.7.	Pacific Ocean Philippines, Ormoc City	Ferry capsizes in rough weather	61 dead
30.7.	Indian Ocean Bangladesh Sadar, Bhola	Three fishing boats capsize in rough weather	4 dead, 24 missing
3.9.	Indian Ocean, Malaysia Sabak Bernam, Selangor	Boat carrying migrant workers capsizes in rough weather	61 dead
13.9.	Mediterranean Sea Greece, Farmakonisi Island	Boat carrying migrants capsizes	34 dead
15.9.	Mediterranean Sea Greece, Kos	Boat carrying migrants capsizes	22 dead
20.9.	Indian Ocean Bangladesh, Patuakhali	Five fishing boats capsize in rough weather	47 missing
20.9.	Indian Ocean Bangladesh, Barguna	Five fishing boats capsize in rough weather	20 missing
25.10.	North Pacific Ocean Hong Kong	High-speed ferry hits floating object	124 injured
30.11.	Democratic Republic of Congo, Bukavu	Boat capsizes on Lake Kivu	1 dead, 22 missing
4.12.	Guneshli oil field, Caspian Sea, Azerbaijan	Fire on a drilling platform during a storm – 30 people die in a lifeboat during rescue operations, damage to gas pipeline	10 dead, 20 missing 9 injured
19.12.	Indian Ocean, Indonesia, Bone Bay, Siwa, Sulawesi	Ferry capsizes in rough weather	66 dead, 12 missing 37 injured



### Mining accidents

Date	Country	Event	Number of victims (where data available)
4.3.	Ukraine, Donetsk Oblast	Gas explosion at a coal mine	33 dead
19.4.	China, Datong City, Shanxi	Wall failure at a coal mine traps miners	21 dead
12.8.	China, Shanyang, Shaanxi	Landslide at a vanadium mine buries dormitories and three residential buildings	9 dead, 56 missing
10.10.	China, Shangrao, Jiangxi	Gas explosion at a coal mine	22 dead
5.11.	Brazil Bento Rodrigues (Mariana)	Two dams at an iron ore mine collapse – triggers mudflow at a nearby town and contaminates waterways	13 dead, 11 missing 637 homeless
20.11.	China, Jixi, Heilongjiang	Fire at a coal mine	22 dead
21.11.	Myanmar Hpakant, Kachin	Landslide at a jade mine buries workers and 80 residential buildings	115 dead
25.12.	Myanmar, Hpakant	Landslide at a gold and jade mine	50 missing



## Rail disasters, including cableways

Date	Country	Event	Number of victims (where data available)
6.1.	Brazil Mesquita, Rio de Janeiro	Train at a station hit from behind by another train	158 injured
12.1.	United States Washington	Smoke and electrical arcing accident at three metro stations	1 dead 84 injured
13.2.	India Anekal, Karnataka	Passenger train derailed due to faulty tracks	3 dead 60 injured
20.3.	India Raebareli, Uttar Pradesh	Passenger train derailed	39 dead 38 injured
25.3.	Thailand Phachi District	Two passenger trains collide	52 injured
28.4.	South Africa Johannesburg	Two passenger trains collide	1 dead 241 injured
12.5.	United States Philadelphia	Passenger train derailed	8 dead 200 injured
25.5.	India Kaushambi, Uttar Pradesh	Passenger train derailed	2 dead 100 injured
16.6.	Tunisia Tunis	Passenger train hits lorry at an unmarked crossing	18 dead 98 injured
2.7.	Pakistan, Jamkey Chattha, Gujranwala	Army train plunges into canal after bridge collapses	19 dead 100 injured
17.7.	South Africa Johannesburg	Two trains collide	300 injured
5.8.	India Harda, Madhya Pradesh	Two passenger trains derail due to flooded tracks	30 dead 60 injured
17.11.	Pakistan Bolan	Passenger train derailed after brakes fail	20 dead 96 injured



## Miscellaneous

Date	Country	Event	Number of victims (where data available)
30.1.	Pakistan Shikarpur	Bomb explosion in a mosque	60 dead
8.2.	Egypt Cairo	Clashes at a football stadium	22 dead
13.2.	Pakistan Peshawar	Gunmen attack and explosions at a mosque	22 dead 60 injured
17.2.	Haiti Port-au-Prince	High-voltage wire hits a carnival-parade float and electrocutes dancers	18 dead 78 injured
26.2.	Nigeria, Biu	Suicide bombing in a local market	22 dead
7.3.	Nigeria Maiduguri	Suicide bombings at a local market	58 dead
15.3.	Pakistan Lahore	Suicide bombing at a church	14 dead 70 injured
18.3.	Tunisia Tunis	Gunmen attacks at Bardo National Museum	22 dead 40 injured
26.3.	Somalia Mogadishu	Gunmen attacks at a hotel	24 dead
1.4.	Kenya Garissa	Gunmen attacks at University	148 dead
6.4.	Nigeria Kwajaffa	Mass shooting at a mosque	24 dead
11.4.	Pakistan Baluchistan	Mass shooting at a construction site	20 dead

## Tables for reporting year 2015

<b>Date</b>	<b>Country</b>	<b>Event</b>	<b>Number of victims</b> (where data available)
12.4.	Kenya Nairobi	Stampede following an electrical explosion at a university building	1 dead 141 injured
18.4.	Afghanistan Jalalabad	Suicide bombing outside a bank branch	33 dead 115 injured
27.4.–28.4.	United States Baltimore, Maryland	Protests, riots	130 injured
3.5.	Israel Tel Aviv	Clashes between ethnic groups and the police	53 injured
13.5.	Pakistan Karachi	Shooting attack on a bus carrying pilgrims	45 dead
22.5.	Saudi Arabia Al-Qadeeh	Suicide bombing at a mosque	21 dead 50 injured
14.6.	India Ludhiana	Gas leak from a tanker carrying liquefied ammonia	6 dead 213 injured
15.6.	Chad N'Djamena	Suicide bombing at the police headquarters	23 dead 100 injured
23.6.	Nigeria Maiduguri	Suicide bombings at a mosque	30 dead
26.6.	Tunisia Sousse	Mass shooting at a holiday resort	38 dead
26.6.	Kuwait Kuwait City	Suicide bombing at a mosque	24 dead 202 injured
7.7.	Nigeria Zaria	Suicide bombing outside a government building	25 dead 32 injured
14.7.	India Rajahmundry (Andhra Pradesh)	Stampede at a religious festival	27 dead 34 injured
20.7.	Turkey Suruç	Suicide bombing at a demonstration	33 dead 104 injured
10.8.	India Jharkhand	Stampede at a temple	11 dead 50 injured
17.8.	Thailand Bangkok	Bomb explosion at a religious shrine	20 dead 120 injured
16.9.	Sudan Maridi	Oil tanker overturns and explodes; local residents had gathered to siphon fuel	193 dead
23.9.	Saudi Arabia Mina, Mecca	Stampede and crush at the annual Hajj pilgrimage	769 dead 934 injured
10.10.	Turkey Ankara	Bomb explosions at peace demonstrations outside main train station	102 dead 400 injured
12.11.	Lebanon Beirut	Double suicide bombing, outside a mosque and a bakery, in crowded area of Beirut	43 dead 250 injured
13.11.	France Paris	Simultaneous terrorist attacks at various locations in Paris: mass shootings, suicide bombings and hostage siege	130 dead 351 injured
17.11.	Nigeria Yola	Bomb explosion at a farmer's market	32 dead 80 injured
19.11.	United Arab Emirates Sharjah	Gas leak at an industrial zone – workers hospitalised suffering from asphyxia	84 injured
20.11.	Mali, Bamako	Shooting and hostage siege at a hotel	22 dead
13.12.	Pakistan Parachinar	Bomb explosion at a bazaar	23 dead 30 injured
20.12.	China Shenzhen, Guangdong	Landslide from a construction waste dump at an industrial park buries 33 buildings and causes explosion at gas pipeline	73 dead, 4 missing
29.12.	Pakistan Mardan	Suicide bombing outside a government office	24 dead

Source: Swiss Re Economic Research & Consulting and Cat Perils.

**Table 10**

The 40 most costly insurance losses (1970–2015)

<b>Insured loss<sup>43</sup></b> (in USD m. indexed to 2015)	<b>Victims<sup>44</sup></b>	<b>Start date</b>	<b>Event</b>	<b>Country/region</b>
79663	1836	25.08.2005	Hurricane Katrina, storm surge, damage to oil rigs	US, Gulf of Mexico
36865	18520	11.03.2011	Earthquake (M <sub>w</sub> 9.0) triggers tsunami	Japan
36115	237	24.10.2012	Hurricane Sandy, storm surge	US, Caribbean, Canada
27017	65	23.08.1992	Hurricane Andrew, floods	US, Bahamas
25129	2982	11.09.2001	Terror attack on WTC, Pentagon, other buildings	US
24455	61	17.01.1994	Northridge earthquake (M <sub>w</sub> 6.7)	US
22343	193	06.09.2008	Hurricane Ike, floods, damage to oil rigs	US, Caribbean, Gulf of Mexico
16853	185	22.02.2011	Earthquake (M <sub>w</sub> 6.1), aftershocks	New Zealand
16180	119	02.09.2004	Hurricane Ivan; damage to oil rigs	US, Caribbean, Venezuela
15799	815	27.07.2011	Heavy monsoon rains, extreme flooding	Thailand
15248	53	19.10.2005	Hurricane Wilma, torrential rains, flooding	US, Mexico, Caribbean
12252	34	20.09.2005	Hurricane Rita, floods, damage to oil rigs	US, Gulf of Mexico
11351	123	15.07.2012	Drought in the Corn Belt	US
10097	36	11.08.2004	Hurricane Charley	US, Caribbean, Gulf of Mexico
9823	51	27.09.1991	Typhoon Mireille/No. 19	Japan
8738	71	15.09.1989	Hurricane Hugo	US, Caribbean
8691	562	27.02.2010	Earthquake (M <sub>w</sub> 8.8) triggers tsunami	Chile, the South Pacific ocean
8467	95	25.01.1990	Winter storm Daria	France, UK, Belgium, NL et. al.
8249	110	25.12.1999	Winter storm Lothar	Switzerland, UK, France, et. al.
7689	321	22.04.2011	Major tornado outbreak; 349 tornadoes, hail	US
7426	177	20.05.2011	Tornado outbreak, winds up to 405 km/h, hail	US
6966	54	18.01.2007	Winter storm Kyrill, floods	Germany, UK, NL, Belgium et. al.
6462	22	15.10.1987	Storm and floods in Europe	France, UK, NL, et. al.
6305	50	26.08.2004	Hurricane Frances	US, Bahamas
6118	53	22.08.2011	Hurricane Irene, floods	US, Canada, Caribbean
5975	600	20.09.1998	Hurricane Georges, floods	US, Caribbean
5785	64	25.02.1990	Winter storm Vivian	Switzerland, Germany
5746	26	22.09.1999	Typhoon Bart/No. 18	Japan
5432	–	04.09.2010	Earthquake (M <sub>w</sub> 7.0), over 300 aftershocks	New Zealand
4832	3034	13.09.2004	Hurricane Jeanne; floods, landslides	US, Caribbean
4823	43	05.06.2001	Tropical storm Allison; heavy rain, floods	US
4497	45	06.09.2004	Typhoon Songda/No. 18	Japan, South Korea
4205	25	27.05.2013	Floods	Germany, Czech Republic, et. al.
4127	51	02.05.2003	Thunderstorms, tornadoes, hail, flash floods	US
4014	78	10.09.1999	Hurricane Floyd, heavy rain, floods	US, Bahamas
3903	–	27.07.2013	Hailstorms	Germany, France
3895	77	01.10.1995	Hurricane Opal, floods	US, Mexico, Guatemala
3843	6425	17.01.1995	Great Hanshin earthquake in Kobe (M <sub>w</sub> 6.9)	Japan
3505	25	24.01.2009	Winter storm Klaus	France, Spain
3413	45	27.12.1999	Winter storm Martin	Spain, France, Switzerland, Italy

Note: M<sub>w</sub> = moment magnitude scale.

Source: Swiss Re Economic Research &amp; Consulting and Cat Perils.

<sup>43</sup> Property and business interruption, excluding liability and life insurance losses;

US natural catastrophe figures based on Property Claim Services (PCS)/incl. NFIP losses (see "Terms and selection criteria" on page 43).

<sup>44</sup> Dead and missing.

## Tables for reporting year 2015

**Table 11**

The 40 worst catastrophes in terms of victims (1970–2015)

Victims <sup>45</sup>	Insured loss <sup>46</sup> (USD m. indexed to 2015)	Start date	Event	Country/region
300 000	–	11.11.1970	Storm and flood catastrophe	Bangladesh
255 000	–	28.07.1976	Earthquake (M <sub>w</sub> 7.6)	China
222 570	109	12.01.2010	Earthquake (M <sub>w</sub> 7.0), aftershocks	Haiti
220 000	2508	26.12.2004	Earthquake (M <sub>w</sub> 9) triggers tsunami in Indian Ocean	Indonesia, Thailand, et. al.
138 300	–	02.05.2008	Tropical cyclone Nargis, Irrawaddy Delta flooded	Myanmar, Bay of Bengal
138 000	4	29.04.1991	Tropical cyclone Gorky	Bangladesh
87 449	403	12.05.2008	Earthquake (M <sub>w</sub> 7.9) in Sichuan, aftershocks	China
74 310	–	08.10.2005	Earthquake (M <sub>w</sub> 7.6); aftershocks, landslides	Pakistan, India, Afghanistan
66 000	–	31.05.1970	Earthquake (M <sub>w</sub> 7.9) triggers rock slide and floods	Peru
55 630	–	15.06.2010	Heatwave, temperatures of up to 40°C	Russia, Czech Republic
40 000	209	20.06.1990	Earthquake (M <sub>w</sub> 7.4), landslides	Iran
35 000	1624	01.06.2003	Heatwave and drought in Europe	France, Italy, Germany, et. al.
26 271	–	26.12.2003	Earthquake (M <sub>w</sub> 6.5) destroys 85% of Bam	Iran
25 000	–	07.12.1988	Earthquake (M <sub>w</sub> 6.8)	Armenia
25 000	–	16.09.1978	Earthquake (M <sub>w</sub> 7.7) in Tabas	Iran
23 086	–	13.11.1985	Volcanic eruption on Nevado del Ruiz triggers lahars	Colombia
22 300	313	04.02.1976	Earthquake (M <sub>w</sub> 7.5)	Guatemala
19 737	134	26.01.2001	Earthquake (M <sub>w</sub> 7.6) in Gujarat	India, Pakistan
19 118	1 422	17.08.1999	Earthquake (M <sub>w</sub> 7.6) in Izmit	Turkey
18 520	36 865	11.03.2011	Earthquake (M <sub>w</sub> 9.0) triggers tsunami	Japan
15 000	142	29.10.1999	Tropical cyclone 05B in Orissa	India
14 204	–	20.11.1977	Tropical cyclone in Andhra Pradesh	India
11 683	581	22.10.1998	Hurricane Mitch in Central America	Honduras, Nicaragua, et. al.
11 069	–	25.05.1985	Tropical cyclone in Bay of Bengal	Bangladesh
10 800	–	26.10.1971	Odisha cyclone, flooding in Bay of Bengal	India
10 000	313	12.12.1999	Floods, mudflows and landslides	Venezuela
9 500	1043	19.09.1985	Earthquake (M <sub>w</sub> 8.0)	Mexico
9 475	0.4	30.09.1993	Earthquake (M <sub>w</sub> 6.4)	India
8 960	160	25.04.2015	Earthquake (M <sub>w</sub> 7.8)	Nepal, India, China, Bangladesh
8 135	519	08.11.2013	Typhoon Haiyan, storm surge	Philippines, Vietnam, China, Palau
7 079	–	17.08.1976	Earthquake (M <sub>w</sub> 7.1) triggers tsunami in Moro Gulf	Philippines
6 425	3843	17.01.1995	Great Hanshin earthquake (M <sub>w</sub> 6.9) in Kobe	Japan
6 304	–	05.11.1991	Typhoon Thelma (Uring)	Philippines
6 000	–	02.12.1984	Accident in chemical plant - methyl isocyanates released	India
6 000	–	01.06.1976	Heatwave, drought	France
5 749	47	27.05.2006	Earthquake (M <sub>w</sub> 6.4); Bantul almost completely destroyed	Indonesia
5 748	509	14.06.2013	Floods caused by heavy monsoon rains	India
5 422	–	25.06.1976	Earthquake (M <sub>w</sub> 7.1)	Indonesia
5 374	–	10.04.1972	Earthquake (M <sub>w</sub> 6.6) in Fars	Iran
5 300	–	28.12.1974	Earthquake (M <sub>w</sub> 6.0)	Pakistan

Note: M<sub>w</sub> = moment magnitude scale.

Source: Swiss Re Economic Research & Consulting and Cat Perils.

<sup>45</sup> Dead and missing.

<sup>46</sup> Property and business interruption, excluding liability and life insurance losses.

# Terms and selection criteria

A natural catastrophe is caused by natural forces.

## Natural catastrophes

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

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

## Man-made disasters

This study categorises major events associated with human activities as “man-made” or “technical” disasters. Generally, a large object in a very limited space is affected, which is covered by a small number of insurance policies. War, civil war, and war-like events are excluded. *sigma* subdivides man-made disasters into the following categories: major fires and explosions, aviation and space disasters, shipping disasters, rail disasters, mining accidents, collapse of buildings/bridges, and miscellaneous (including terrorism). In Tables 8 and 9 (pages 41–42), all major natural catastrophes and man-made disasters and the associated losses are listed chronologically.

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

## Total losses

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

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

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

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

## Insured losses

“Losses” refer to all insured losses except liability. Leaving aside liability losses, on one hand, allows a relatively swift assessment of the insurance year; on the other hand, however, it tends to understate the cost of man-made disasters. Life insurance losses are also not included.

NFIP flood damage in the US is included.

## NFIP flood damage in the US

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

## Terms and selection criteria

### Selection criteria

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

#### Thresholds for insured losses and casualties in 2015

For the 2015 reporting year, the lower loss thresholds were set as follows:

Insured losses (claims):	
Maritime disasters	USD 19.7 million
Aviation	USD 39.3 million
Other losses	USD 48.8 million
<b>or Total losses:</b>	
	<b>USD 97.7 million</b>
<b>or Casualties:</b>	
Dead or missing	20
Injured	50
Homeless	2 000

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

### Adjustment for inflation, changes to published data, information

*sigma* converts all losses for the occurrence year not given in USD into USD using the end-of-year exchange rate. To adjust for inflation, these USD values are extrapolated using the US consumer price index to give current (2015) values.

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

Insured loss at 2000 prices: USD 1 045.7million

Insured loss at 2015 prices: USD 1 438.8 million

Alternatively, were one to adjust the losses in the original currency (GBP) for inflation and then convert them to USD using the current exchange rate, one would end up with an insured loss at 2015 prices of USD 1 427 million, 1% less than with the standard *sigma* method. The reason for the difference is that the value of the GBP declined by almost 1% against the USD in the period 2000–2015. The difference in inflation between the US (37.6%) and the UK (37.6%) over the same period was negligible.

### Figure 8

Alternative methods of adjusting for inflation, by comparison

Floods UK	Exchange rate		US inflation	
	GBPm	USD/GBP	USDm	USDm
29 October–10 November 2000				
Original loss	700.0	1.494	1045.7	1045.7
Level of consumer price index 2000	93.1			100.0
Level of consumer price index 2015	128.0			137.6
Inflation factor	1.376			1.376
Adjusted for inflation to 2015	963.2	1.482	1427.4	1438.8
Comparison			99%	100%

Source: Swiss Re Economic Research & Consulting.

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

Only public information used for man-made disasters

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

If changes to the loss amounts of previously published events become known, *sigma* takes these into account in its database. However, these changes only become evident when an event appears in the table of the 40 most costly insured losses or the 40 disasters with the most fatalities since 1970 (See Tables 10 and 11 on pages 41-42).

In the chronological lists of all man-made disasters, the insured losses are not shown for data protection reasons. However, the total of these insured losses is included in the list of major losses in 2015 according to loss category. *sigma* does not provide further information on individual insured losses or about updates made to published data.

### Sources

Information is collected from newspapers, direct insurance and reinsurance periodicals, specialist publications (in printed or electronic form) and reports from insurers and reinsurers. In no event shall Swiss Re be liable for any loss or damage arising in connection with the use of this information (see the copyright information on the back page).<sup>47</sup>

**Table 12**

Exchange rate used<sup>48</sup>, national currency per USD

Country	Currency	Exchange rate, end 2015
Australia	AUD	1.3745
Canada	CAD	1.3892
China	CNY	6.4937
Europe	EUR	0.9203
United Kingdom	GBP	0.6784
Georgia	GEL	2.3949
Indonesia	IDR	13 795.0000
India	INR	66.2200
Iran	IRR	29 855.0000
Japan	JPY	120.2750
Myanmar	MMK	1302.5000
Malawi	MWK	658.3500
New Zealand	NZD	1.4607
Philippines	PHP	46.9200
Pakistan	PKR	104.8700
Russia	RUB	73.0821
Saudi Arabia	SAR	3.7533
Thailand	THB	36.0350
Taiwan	TWD	32.9750
US	USD	1.0000

<sup>47</sup> The losses for 2015 were converted to USD using these exchange rates. No losses in any other currencies were reported.

<sup>48</sup> Natural catastrophes in the US: those *sigma* figures which are based on estimates of Property Claim Services (PCS), a unit of the Insurance Services Office, Inc (ISO), are given for each individual event in ranges defined by PCS. The estimates are the property of ISO and may not be printed or used for any purpose, including use as a component in any financial instruments, without the express consent of ISO.

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