Centre for Research on the Epidemiology of Disasters (CRED)

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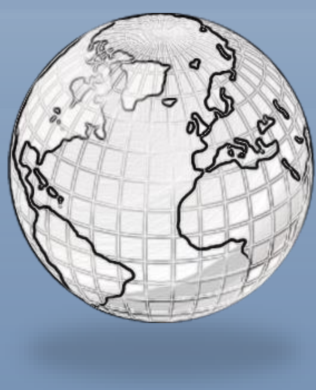
Annual Disaster Statistical Review 2016

The numbers and trends



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About CRED

The Centre for Research on the Epidemiology of Disasters (CRED) has been active for more than 40 years in the fields of international disaster and conflict health studies. CRED promotes research, training and technical expertise on humanitarian emergencies - with a particular focus on relief, rehabilitation and development. It was established in Brussels in 1973 at the School of Public Health of the Catholic University of Louvain (UCL) as a non-profit institution with international status under Belgian law. In 1980, CRED became a World Health Organization (WHO) collaborating centre as part of the WHO's Global Program for Emergency Preparedness and Response. Since then, CRED has increased its international network substantially and continues to collaborate closely with numerous UN agencies, inter-governmental and governmental institutions, non-governmental organizations, research institutes and universities.

Objective

The Centre promotes research and provides an evidence base for the international community, both on the burden of disease and health issues related to disasters and conflicts. CRED also provides training for field managers, students, relief personnel and health professionals in the management of short and long-term humanitarian emergencies. In doing so, CRED hopes to improve preparedness and responses to these humanitarian emergencies.

CRED's focus

CRED's research focuses on all humanitarian and emergency situations with a major impact on human health. These include all types of natural and human-made disasters - such as earthquakes, floods and storms -, as well as longer-term disasters - such as famines and droughts -, and situations creating a mass displacement of people – for example, civil strife and conflicts.

The Centre focuses on the health aspects and burden of disease arising from disasters and complex emergencies. CRED also promotes research on the broader aspects of humanitarian crises, such as human rights and humanitarian law, socio-economic and environmental issues, early warning systems, the special needs of women and children, and mental health care.

The Centre is actively involved in stimulating debate on the effectiveness of various humanitarian interventions. It encourages scientific and policy discussions on existing and potential interventions, as well as their impacts on acute and chronic malnutrition, human survival, morbidity, infectious diseases and mental health.

The CRED team works in four main areas:

- Natural disasters and their impacts
- Civil strife and conflict epidemiology
- Database and information support
- Capacity building and training

The CRED team

The Centre is composed of a multinational and multidisciplinary team including experts in medicine and public health, informatics and database management, psychology, nutritional sciences, sociology, economics and geography. The working languages are English and French.

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General Overview

In 2016, 342 disasters triggered by natural hazards were registered, below the 2006-2015 annual average (376.4). After a peak in disasters in 2015 (395), this decrease could be a sign of, either a return to a declining trend in the annual number of disasters since 2005, or a precursor of a possible stabilization in the annual number of disasters. Last year, the number of deaths caused by natural disasters (8,733) was the second lowest since 2006, largely below the 2006-2015 annual average (69,827). Inversely, the number of people reported affected by natural disasters (564.4 million) was the highest since 2006, amounting to 1.5 times its annual average (224 million). The estimates of natural disaster economic damages (US$ 154 billion) place last year as the fifth costliest since 2006, 12% above the 2006-2015 annual average.

The decrease in the number of reported natural disasters in 2016 was mostly due to the number of meteorological disasters (96), which was the lowest since 2006 at 21.4 % below the 2006-2015 annual average (122.1). The number of hydrological disasters (177) was 6.9% below its decadal average (190.1) and the number of geophysical disasters (31) was close to its 2006-2015 annual average (31.6). Inversely, the number of climatological disasters (38) was the fourth highest since 2006, 16.6% above its annual average (32.6).

Each year since 2006, the number of hydrological disasters still took the largest share in natural disaster occurrences in 2016 (51.8%, for an average proportion of 50.5% for the period 2006-2015), followed by meteorological disasters (28.1% versus a decadal mean proportion of 32.4%), while climatological disasters (11.1% versus an annual mean proportion of 8.7%) overpassed geophysical disasters (9.1% for a 2006-2015 mean proportion of 8.4%).

Over the last decade, China, the United States, India, Indonesia and the Philippines constitute the top five countries that are most frequently hit by natural disasters. In 2016, with 34 natural disasters reported, China experienced its fifth highest number of natural disasters of the last decade, 15.3% above its 2006-2015 annual average of 29.5. The country was affected by a variety of disasters types, including 16 floods and landslides, 13 storms, 3 earthquakes, 1 extreme temperature episode and 1 drought. The number of natural disasters in the United States (26) was the fourth highest since 2006, 22.5% above its decadal annual average (21.5). The number of disasters in India (17) and Indonesia (15), both, were close to their 2006-2015 annual average (respectively, 16.2 and 14.1). Inversely, with 11 natural disasters, the Philippines experienced their lowest number of disasters since 2006, 39.2% below their annual average of 18.1.

In 2016, the number of people killed by disasters (8,733) was the second lowest since 2006, far below the 2006-2015 annual average of 69,827 deaths. However, this takes into account two years with more than 200,000 people reported killed, mainly attributable to mega catastrophes: the cyclone, Nargis, in Myanmar in 2008 (138,366 deaths) and the earthquake in Haiti in 2010 (222,570 deaths). Yet, even after the exclusion of these disasters, the number of deaths in 2015 remains far below a recomputed 2006-2015 annual average of 33,733 deaths.

At a more detailed level, it appears that, in 2016, floods killed the most people (4,731), however 17% below a 2006-2015 annual average of 5,709. Storms accounted for 1,797 deaths, almost 10 times less than their annual average of 17,371, and earthquakes killed 1,315 people, a number equivalent to 4% of an annual average of 35,712. Deaths from wildfires (39), landslides (361) and extreme temperatures (490) were, respectively, 48%, 62% and 94% below their annual averages.

Amongst the top ten countries for disaster mortality in 2016, six are classified as low-income or lower-middle income economies (see World Bank income classification), and accounted for 23.9% of global reported disaster mortality. Three disasters killed more than 500 people in 2016: an earthquake in Ecuador (676 deaths), Hurricane Matthew in Haiti (546 deaths), and a flood in DPR Korea (538 deaths).

The total number of people affected by disasters in 2016 (569.4 million) was the highest since 2006, far above its 2006-2015 annual average (224.1 million). This increase is mainly explained by the human impact of drought in India, which affected 330 million people in both 2015 and 2016, the highest number affected by a natural disaster ever reported. This drought makes the number of people affected by climatological disasters in 2016 (393.3 million) the highest since 2006, representing more than 4.2 times its 2006-2015 annual average. Two other droughts in Ethiopia and China affected at least 10 million people, each. Meteorological disasters affected 95.8 million people in 2016, the highest number reported since 2006 for this disaster type, which represents 2.4 times the annual average. The greater part of this number is attributable to the storm Jonas or 'Snowzilla' which affected 85 million people in the USA in January 2016, a number which is the second largest ever reported for meteorological disasters after the 100 million people affected by a sand/dust storm in China in 2002. The 78.1 million people affected in 2016 by hydrological disasters are near the annual average of 82.6 million. One flood in China affected 60 million people. Since 2006, only three floods in China in 2007, 2010 and 2011 affected more people, with 105, 134 and 68 million affected, respectively. The number affected by geophysical disasters (2.2 million) was the third lowest since 2006, 75.2% below the 2006-2015 annual average. An earthquake in Ecuador affected the most people (1.23 million) in April, which is far from the 40 million reported for the Sichuan earthquake in China in 2008. Seven of the top ten countries, in terms of number of people affected by disasters, were low or lower-middle income countries, accounting for 63.8% of these people in 2016.

The estimated economic losses from natural disasters in 2016 (US$ 153.9 billion) was the fourth highest since 2006, almost 12% above the annual 2006-2015 damages average (US$ 137.6 billion). This increase in total costs is related, in part, to the US$ 59 billion damages reported for hydrological disasters, an amount representing 1.74 times the annual average. Of this amount, US$ 22 billion are attributable to a flood in China, while US$ 10 billion to another flood in the USA. Another part of this increase in disasters costs is attributable to the US$ 16 billion damages caused by climatological disasters, which corresponds to 1.69 times the annual average. One wild fire in Canada made US$ 4 billion damages, the third highest ever reported for such disasters, while one drought in China cost US$ 3 billion. The cost of meteorological disasters (US$ 46.6 billion) in 2016 remained close to the 2006-2015 annual average (US$ 48.4 billion). On the other hand, damages from geophysical disasters (US$ 32.8 billion) appeared significantly below their annual average (US$ 46.1 billion). However, this average is strongly influenced by the cost of the tsunami in Japan in 2011. When removed from the average, the 2016 costs from geophysical disasters is then 30.6% above the revalued average (US$ 25.1 billion). When looking at the top ten countries for economic damages, all countries were high or upper-middle income economies which accounted for 55.9% of the total economic losses.

The four costliest natural disasters in 2016 were a flood in China (US$ 22 billion), the Kumamoto earthquake in Japan (US$ 20 billion), a flood and Hurricane Matthew in the USA (US$ 10 billion, each). Thirty-two other disasters resulted in damages between US$ 1 and 5 billion, for a total of US$ 69.1 billion. Together, these disasters had a total cost of US$ 131.1 billion, a share of 85.1% of all reported damages in 2016.

Looking at the distribution of disaster occurrences across continents in 2016, it is similar to its average for years 2006 to 2015. Asia was most often hit (46.7%), followed by the Americas (24.3%), Africa (16.9%), Europe (8.2%), and Oceania (3.8%). However, the share of Asia is, in 2016, above its 2006-2015 annual average (41.3%), while the share of Europe in the distribution is below its annual average (13.1%). When considering UN regions, with 57 disasters reported, East Asia was the most hit, followed by Southeast Asia (54 disasters), and South Asia (40). East Africa suffered 29 disasters, while North and South America experienced 28 and 23 disasters, respectively. All other regions suffered less than 20 disasters. None of these numbers deviate significantly from their 2006-2015 annual average.

As during the previous decade, hydrological disasters were, in 2016, the most frequent in all continents, except Oceania where more meteorological disasters were reported. In all UN regions, floods were the most frequently reported disaster type, with the exception of the Caribbean, North America, East Asia, Western Europe and Polynesia, where storms predominate.

In Asia, Europe and Oceania, the share of people killed by disasters remained near their 2006-2015 annual average. However, in Africa it increased to 14.7% compared to an annual average of 4.4%. Inversely, the share of Asia in the 2016 total number of deaths (20%) was clearly below its annual average (34.2%). The UN regions with the highest numbers of deaths, East Asia (2,271), South Asia (2,210), South America (760), East Africa (716) and the Caribbean (614) were also those with the highest annual averages of people killed. However, the 676 deaths reported in Southeast Asia in 2016 are significantly below their annual average of 17,396 and remain significantly lower even when the number of deaths from cyclone Nargis in Myanmar in 2008 is removed from the average computation. The same phenomenon can be observed for the 66 deaths in Eastern Europe in 2016: their number remains significantly below the average, whether or not the more than 50,000 deaths from a heat wave in Russia in 2010 are considered for average calculation.

During the previous 2006-2015 decade, floods were the first cause of disaster deaths in all African UN regions, in Central and South America, as well as in Central, South and West Asia. Storms produced the highest numbers of deaths in North America, the Caribbean, Southeast Asia, Melanesia, and Micronesia. Extreme temperatures were the deadliest disasters in Eastern, Northern and Western Europe, and in Australia and New Zealand, while earthquakes caused the most deaths in East Asia, Southern Europe and Polynesia. In 2016, the regional deadly impacts of floods are slightly different. All African and Asian UN regions, and Western Europe saw floods killing the most people. Storms resulted in the most fatalities in North and Central America, the Caribbean, Australia and New Zealand, and Melanesia. Earthquakes caused the most deaths in South America and in Southern Europe. Finally, in Eastern Europe, extreme temperatures continued to kill the most people.

In 2016, 17.3% of people affected by disasters, worldwide, lived in the Americas, a share which is significantly above its 2006-2015 mean proportion (5.1%). Inversely, the shares of Asia (74.9%)

and Africa (7.7%) were below their annual average of 82.3% and 12.9%, respectively. The contributions of Europe and Oceania in the total number of people affected (0.02% and 0.09%, respectively) are marginal as well as their 2006-2015 average contribution (0.30% and 0.22%, respectively). The UN regions with the most people affected in 2016 were East Africa (31.8 million affected), North America (85.2 million), South Asia (337.9 million), Southern Europe (78,687), and Melanesia (364,770). The major impact of one storm in North America and one drought in South Asia propelled these two regions to first rank last year, while for years 2006-2015, South America and East Asia were the most affected regions. In seven regions, some disasters had a large impact and the number of people reported affected by disasters in 2016 was equal to its annual average multiplied by 56 in North America, by 27 in Micronesia, by nine in the Caribbean, by almost six in South Asia and South Africa, by almost three in North Africa, and by almost two in Eastern Africa.

In Africa, almost each year, droughts affect hundreds of thousands or millions people in every region. This was still the case in 2016, with a total of more than 41 million people affected, which is 1.74 times the annual average. In East, North, and South Africa, the impacts of drought were severe: the number of people affected last year represented 2, 3 and 7 times, respectively, the 2006-2015 annual averages. Inversely, in West Africa, the number of people affected by droughts was half the annual average, while no drought occurred in Central Africa. The number of people affected by floods, the second most prominent disaster on the continent, was below its annual average of 30% in North Africa, but increased to 85-90% of the annual average in Central, South, and West Africa. In East Africa, it remained close to the annual average.

In the Americas, 2016 was the worst year for people living in the Caribbean. In this region, 3.6 million people were affected by a single drought- more than three times the number affected by previous droughts; 2.5 million were affected by storms- or 10.2 times the annual average, and 1.9 million were affected by floods- or 37 times the annual average. In North America, one winter storm affected 85 million people, the second highest ever reported for a storm. Such an impact can dwarf the 96,452 people affected by wildfires, which was the second highest since 2006, and the 95,350 people affected by floods- the fourth highest since 2006. In Central America, 2 million people were affected by droughts- almost twice the annual average, and 500,000 people were affected by floods- which is 10% below the annual average. The number of people affected by other types of disasters were significantly below their annual average. In South America, more than 1.2 million people were affected by earthquakes, almost three times the annual average. The 130,000 people affected by volcanic activities was the third highest since 2006. On the other hand, the hundreds of thousands affected by droughts or floods were, respectively, 78% and 86% below their annual averages. Despite these grand figures, a total of almost 2.5 million people were affected by natural disasters in South America in 2016- 64% below the annual average.

In Asia, 345 million people were affected by droughts, with one long-lasting drought in India (South Asia), affecting, in both 2015 and 2016, 330 million people, which is the highest number ever reported of people affected by natural disasters. This number increases the total number of people affected in Southern Asia to almost six times its annual average, while the more than 6 million people affected by floods in this region represents only 33% of the annual average. In East Asia, more than 62 million people suffered from floods- 1.3 times the 2006-2015 annual average. Of these, one alone affected 60 million people in China. In Southeast Asia, more than 4.5 million people were affected by droughts, of which 2.5 million in Cambodia and 1.75 million in Vietnam amounted to 1.7 times the 2006-2015 annual average. In this region, the more than 5 million affected by floods was 30% below the annual average, and the 4 million affected by storms was 60% below the 2006-2015 average. In Central Asia, the 12,905 people affected by disasters, of which 12,750 were affected by one flood in Tajikistan, correspond to only 3% of the annual average. In West Asia, 91,634 people were affected by natural disasters, a number equivalent to 12% of the annual average. Among these people, 30,665, half of the annual average, were affected by a flash flood in Yemen, and 60,137- almost three times the annual average, by one wildfire in Israel.

In Europe, the total number of people reported affected by disasters (93,192) was equivalent to only 14% of its 2006-2015 annual average. People affected were unavailable for droughts, extreme temperatures, landslides, and storms. Among people affected by floods, the 14,481 living in Eastern Europe were equivalent to only 6.9% of the 2006-2015 annual average, while the 47,253 in Southern Europe amounted to 33.5% of the annual average, and the 24 reported affected in Western Europe resulted in a small 1.2% proportion of the annual average. The same equivalent of 1.2% of the annual average was found for the 1,161 people affected by wild fires in Southern Europe. Inversely, the 30,273 people affected by earthquakes in the same region in 2016 represented 1.48 times the annual average.

In Oceania, the total number of 487,332 people affected by disasters is almost equal to the 486,705, 2006-2015 annual average. Looking at UN region, the figure is more complex. Two droughts in Micronesia affected a total of 121,000 people, which is more than 18 times the number affected by a previous drought in this region. In Australia-New Zealand, 50 people affected by an earthquake amounted to 0.08% of the annual average, while the 580 people affected by to floods were equivalent to 1.4% of the annual average. In Melanesia, the 9,770 people affected by an earthquake represent 14.3 times the annual average, while the 355,000 affected by two storms are equal to 6.8 times the annual average. In Polynesia, the 392 people reported affected by storms were equivalent to only 14% of the annual average.

In 2016, the worldwide US$ 153.93 billion reported costs of natural disasters were distributed as follows among the continents: US$ 78.89 billion in Asia, US$ 57.26 billion in the Americas, US$ 10.79 billion in Europe, US$ 5.14 billion in Oceania, and US$ 1.66 billion in Africa. In proportion, this distribution does not differ significantly from its 2006-2015 annual average.

Due to the very poor reporting of damage costs in Africa, it is only possible to mention available information. In 2016, two disasters made almost 500 million US$ damages each: one long-lasting drought in Ethiopia with estimated costs of US$ 467 million in 2016, and one earthquake in Tanzania which resulted in US$ 458 million damages. In the whole African continent, only three disasters had higher costs since 2006: one flood in Algeria in 2011 (US$ 823 million damages), another flood in Nigeria in 2012 (US$ 517 million damages), and one wildfire in South Africa in 2008 (US$ 477 million damages). Still in 2016, five disasters cost between US$ 100 to 180 million for a total of US$ 672 million.

In the Caribbean, the US$ 4.6 billion total damages from Hurricane Matthew in Cuba and Haiti are, by far, the highest costs from storms reported in this region since 2006. They are also the second highest damages ever reported after the more than US$ 7 billion cost of Hurricane Georges in Cuba, the Dominican Republic, and Puerto Rico in 1998.

In Central America, costs from disasters (US$ 158 million) were notably low, amounting to only 5.7% of the 2006-2015 annual average (US$ 2.77 billion). The costliest disasters were one drought in El Salvador and one storm in Mexico which resulted in 50 million US$ damages in total.

In North America, the US$ 48.04 billion damages reported in 2016, are the fourth highest since 2006 and is equivalent to 1.4 times the 2006-2015 annual average. This increase in costs in 2016 was particularly obvious for floods (US$ 15.45 billion) and wildfires (US$ 5.5 billion), which had the highest cost since 2006, attaining, respectively, 4.3 and 4.4 times the annual average. The US$ 27.08 billion damages from storms represented 56.4% of all costs in North America, and were the fourth highest since 2006, but were still only 7% above the annual average.

In South America, the US$ 3.79 billion damages of 2016 were the fourth highest since 2006. The earthquake in Ecuador cost US$ 2 billion, or 52.8% of the total losses from damages reported for the region. Such an amount was the second highest since 2006, however, far below the more than US$ 32 billion in damages of the 2010 earthquake in Chile. Of the US$ 1.34 billion damages from floods, almost three quarter are attributable to one flood in Argentina, which cost US$ 1 billion. One drought, alone, cost US$ 450 million in Bolivia, the third highest amount since 2006, however, far below the US$ 5 billion in damages from a 2014 drought in Brazil.

In Asia, disasters resulted in a total of US$ 78.89 billion in damages, the third highest amount of losses since 2006- 20% above the 2006-2015 annual average. No damages were reported for the two disasters which occurred in Central Asia. In East Asia, the highest costs were reported for floods which resulted in a total of US$ 32.26 billion in damages and earthquakes, a total of US$ 21.02 billion. For floods, it was the highest amount of damages reported since 2006, representing 3.4 times the 2006-2015 annual average, with US$ 22 billion in damages from a flood in China being the highest amount of losses from floods since 2006. Damages from earthquakes were the third highest since 2006, but with the cost of the Kumamoto earthquake in Japan (US$ 20 billion) equaling less than a tenth of the cost of the tsunami in 2011 (US$ 221 billion). Storms resulted in US$ 8.03 billion in damages with the costliest storms occurring in China, from typhoons Ferdie/Meranti (US$ 2.3 billion) and Butchoy/ Nepartak (1.51 US$). These last two costs were far below the US$ 6.84 billion damages reported for the tropical storm Fitow, also in China, in 2013. Also in China, one drought cost 3 billion US$, the second highest amount reported for this disaster since 2006, after the 3.46 billion US$ from a previous drought in this country in 2006. A cold wave cost 1.6 billion US$ in China, however, this amount, also the second highest since 2006, is far below the 23.4 billion US$ in damages from severe winter conditions in China in 2008. One landslide cost 700 million US$ in China, which is the second highest cost since the 830 million US$ from another landslide in China in 2010.

In Southeast Asia, the 5.54 billion US$ damages were 42% below the annual average. The costliest disasters were two long-lasting droughts in Vietnam and Thailand - the second and third droughts with amounts of damages reported in this region - of which the last year damages were estimated at 2.25 and 1.1 billion US$, respectively . One flood made 500 million US$ damages in Vietnam, an uncommon amount in comparison with the 42.3 billion US$ losses from the flood in Thailand in 2011. The typhoon Aere resulted in 350 million US$ in losses in Vietnam- also far from the 10.21 billion US$ from Typhoon Haiyan/Yolanda in the Philippines in 2013. In Indonesia, an earthquake resulted in 100 million US$ in damages, far below the 3.68 or 2.46 billion US$ losses from two other earthquakes in the same country in 2006 and 2009, respectively.

In South Asia, natural disasters resulted in 6.04 billion US$ in 2016, an amount 22% below its 2006-2015 annual average. The costliest damages came from a long-lasting drought in 2016 with estimated damages of 1.5 billion US$, an amount ten times higher than the previous 150 million US$ reported for a drought in Afghanistan in 2011. The total damages from floods amounted to 2.86 billion US$- 47% below the annual average. The costliest flood resulted in 1.2 billion US$ damages in Sri Lanka, lower than the losses from a flood in Pakistan in 2010 (10.4 billion US$). Storm losses amounted to 1.6 billion US$, which is 8% above the 2006-2015 annual average, with the cyclone Vardah costing 1 billion US$ in India- far below the 7 billion US$ damages from the cyclone Hudhud, also in India, in 2014. The 75 million US$ damages from an earthquake in India was far below the 10.4 billion US$ losses of the 2010 earthquake in Nepal.

In Western Asia, the 520 million US$ damages from a wild fire in Israel, is equivalent to 1.76 times the 295 million US$ losses from a forest fire in the same country in 2010. The 50 million US$ in costs from a storm in Saudi Arabia is far below the 4.5 billion US$ in damages from tropical storm Gonu in Oman in 2007.

In Europe, natural disasters cost 10.98 billion US$, an amount 13 % below the 2006-2015 annual average. In Southern Europe damages of 5.72 billion US$ in losses were reported, corresponding to 2.6 times the annual average of this region. The greater part of these damages is attributable to the Central Italy earthquake which cost 5 billion US$, still far from the 16.35 billion US$ losses from Earthquake Emilia in Italy in 2012. Two other earthquakes in the same country cost, 100 million US$, each, and another earthquake in Macedonia cost 10 million US$. One forest fire cost 157 million US$ in Portugal, which is far from the 2.02 billion US$ in damages from a wildfire in Greece in 2007. Damages from floods (356 million US $) amounted to only 43% of the 2006-2015 annual average. Two floods resulted in 100 million US$ in damages in Serbia and Italy, far below the 2.1 billion US$ damages from a flood in Serbia in 2014.

In Western Europe, the 5.24 billion US$ in damages is 10% above the 2006-2015 annual average. The 4.4 billion US$ in damages from floods were 2.4% above the annual average. However, the combined cost of two floods in France (2.4 billion US$) and Germany (2 billion US$) remained far below those from a flood in Germany in 2013 (13.17 billion US$). One storm resulted in 844 million US$ in damages in the Netherlands, an amount much less than the 6.35 billion US$ in losses from the extra-tropical storm Kyrill in Germany in 2007.

Of ten disasters in Eastern Europe, damages were reported for only one: a flood which resulted in 10 million US$ losses. This is far below the 3.37 billion US$ in damages reported for a flood in Poland in 2007. No disasters were reported in Northern Europe in 2016.

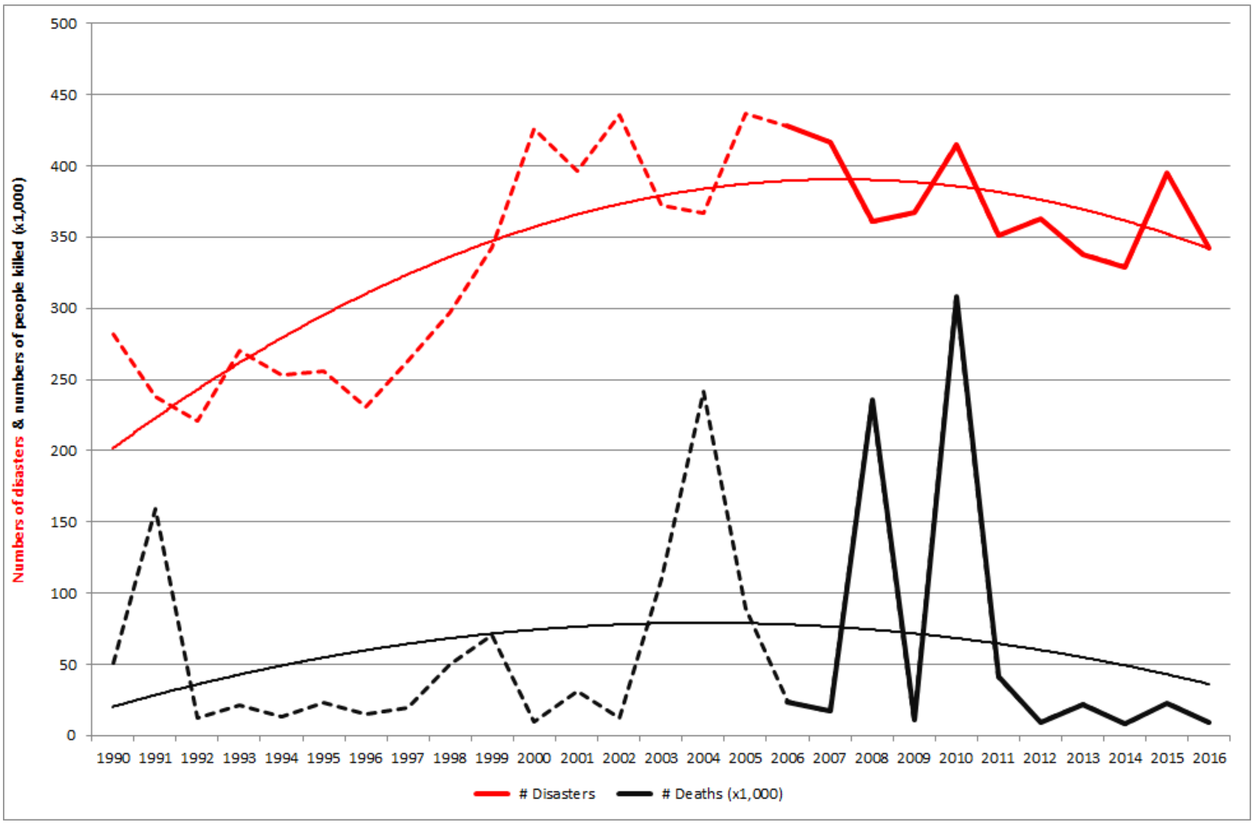
In Australia-New Zealand, disasters resulted in 5.14 billion US$ in damages, 9% below its 2006-2015 annual average. The costliest disaster was the Kaikoura earthquake and tsunami, which resulted in 3.9 billion US$ damages in New Zealand. Losses from this earthquake represented 1.5 times the annual average and is the third highest since 2006. However, this is far below the 15.8 and 7.1 billion US$ form the Christchurch earthquakes of 2011 and 2010, respectively. One winter storm in Australia produced 500 million US$ in damages, 60% below the storm damage annual average. This is incomparable to the 2.64 billion US$ in losses from the tropical storm Yasi in Australia in 2011. One wild fire costed 110 million US$ in Australia, an amount 55% below the annual average yet still below the 1.45 billion US$ from another wild fire in Australia in 2009.

Finally, one flash flood resulted in 25 million US$ losses in New Zealand, which represents 2% of the annual average and was far below the 7.7 billion US$ costs of one flood in Australia in 2010 or the 1.5 billion US$ in losses from another flash flood, also in Australia in 2007.

In Melanesia, among the three reported disasters, damages were only available for the cyclone Winston in Fiji, which resulted in 600 million US$ in losses. This amount is the highest reported for storms in this region since 2006. The second highest was the cyclone Pam, which cost the city of Vanuatu 454 million US$ in 2015. The third highest is from cyclone Tomas, which produced 43 million US$ in damages in Fiji in 2010. No damages were reported for disasters which occurred in Micronesia and Polynesia in 2016.

Detailed data are useful to understand local situations but, in cases when disaster occurrences are low or when data are poorly reported, it could make perception of trends difficult. On the other hand, aggregated data may produce phenomena which are less discernable, tangible, or proven at lower levels. With disaster data, we must continuously use both approaches, at different levels to try and understand in the most precise ways what happened and the possible explanatory factors which could inform action. The three figures below seek to illuminate developments at the global level. The 2006-2015 years, which are considered to compute annual averages used in this report, are highlighted. However, we accounted for data since 1990 to examine long-term trends[1] and the variability that could exist.

Figure 1: Numbers of disasters and people deaths (x1,000): 1990-2016



[1] All time trend curves are quadratic polynomials

Figure 2: Numbers of disasters and total people reported affected (x 1 million): 1990-2016

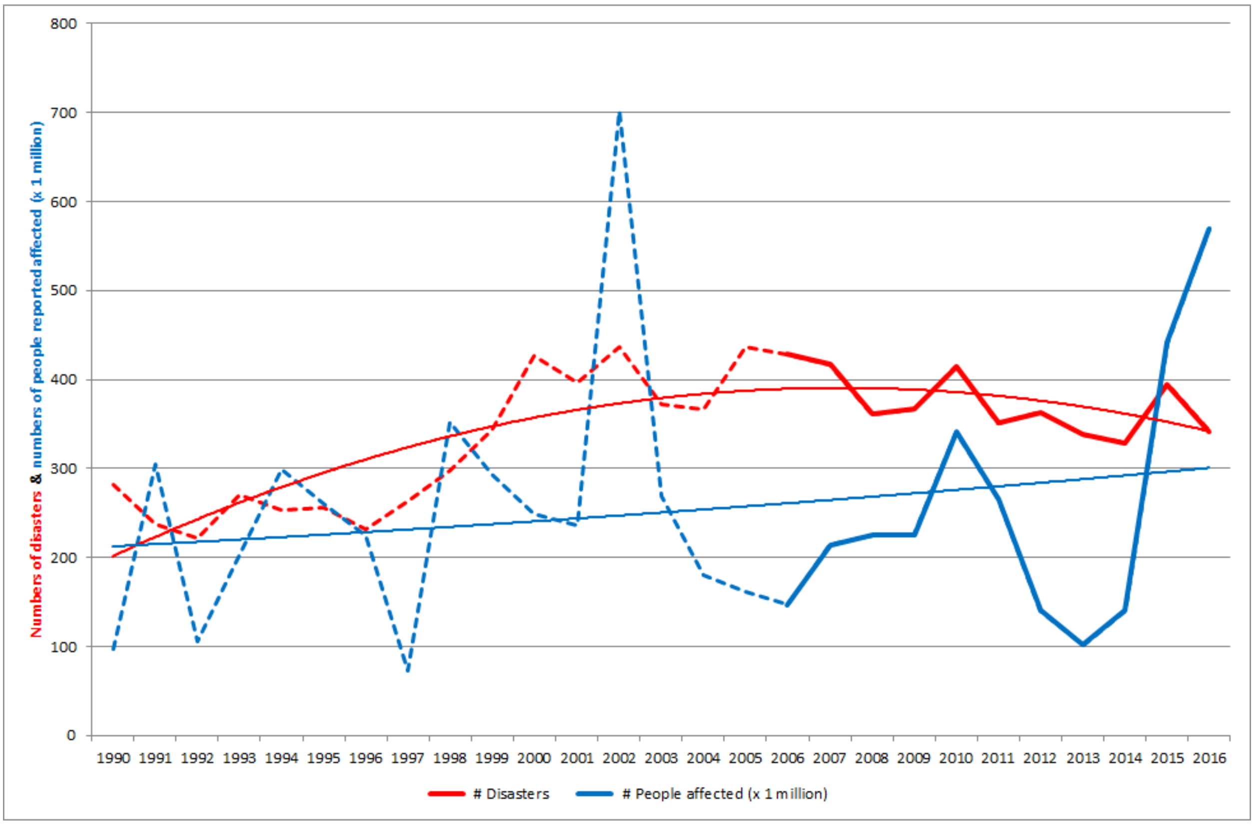
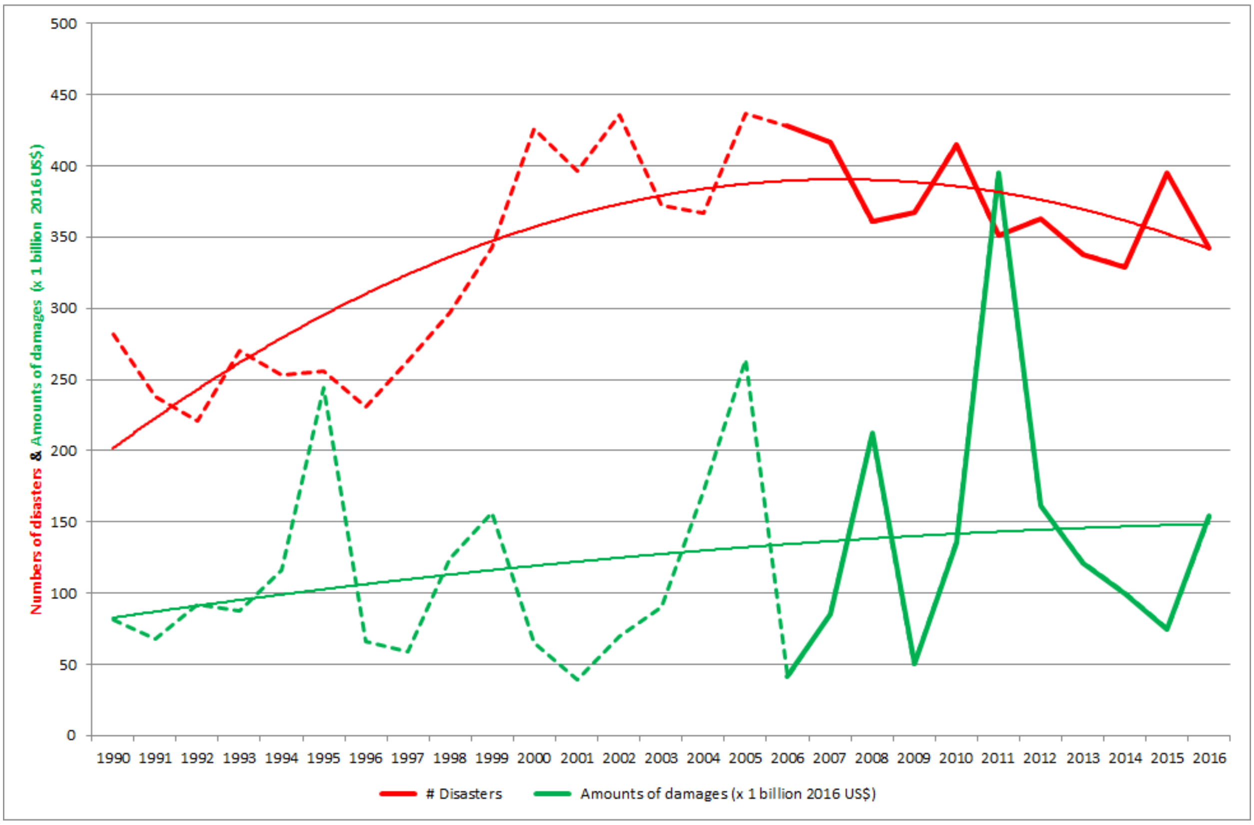


Figure 3: Number of disasters and amount of damages (x 1 billion 2016 US$): 1990-2016



Finally, EM-DAT's global approach to the compilation of disaster data continuously provides us with valuable information and trends on the occurrence of natural disasters and their impacts on society. However, the development of guidelines and tools for the creation of national and sub-national disaster databases for the compilation of standardized, interoperable disaster occurrence and impact data remains a priority for the strengthening of tools. These could help benchmark and orientate effective disaster risk reduction programs.

Chapter 1

About EM-DAT: The International Disaster Database

- What is EM-DAT?
- Database classification, definitions, criteria and content
- Methodology

1. About EM-DAT: the International Disaster Database

1.1 What is EM-DAT?

In 1988, with the sponsorship of the United States Agency for International Development's Office of Foreign Disaster Assistance (USAID/OFDA), CRED launched EM-DAT, a worldwide database on disasters. This database contains essential core data on the occurrence and impact of over 14,000 natural and 8,400 technological disasters across the globe, dating from 1900 to the present day. The data are compiled from various sources, including UN agencies, non-governmental organizations, insurance companies, research institutes and press agencies. Priority is given to data from UN agencies, followed by OFDA, governments and the International Federation of Red Cross and Red Crescent Societies. This prioritization reflects the quality and value of the data, while also acknowledging that most reporting sources do not cover all disasters, or have political limitations that can affect the figures. The entries are constantly reviewed for redundancy, inconsistencies and incompleteness. The database's main objectives are to assist humanitarian action at both the national and international level; to rationalize decision-making for disaster preparedness; and to provide an objective basis for vulnerability assessment and priority setting.

1.2 Database classification, definitions, criteria and content

CRED defines a disaster as "a situation or event that overwhelms local capacity, necessitating a request at the national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering". EM-DAT distinguishes between two generic categories for disasters - natural and technological. Technological disasters are not included in this publication. Figure 2 shows the classification of natural disaster subgroups and their main types. Disaster definitions can be found in Annex 1. For a disaster to be entered into the database, at least one of the following criteria must be fulfilled:

- 10 or more people reported killed;
- 100 or more people reported affected;
- declaration of a state of emergency;
- call for international assistance.

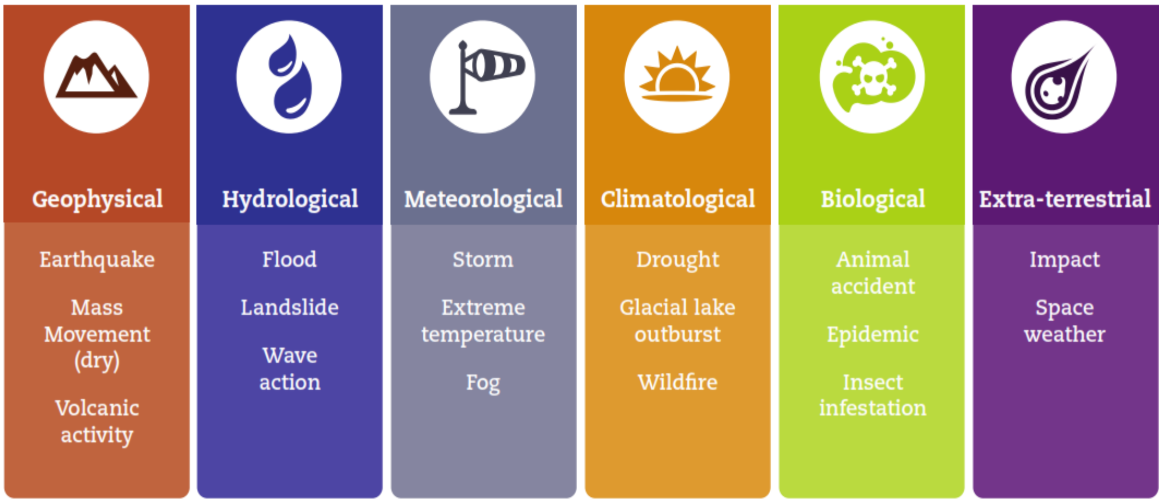


Figure 4 – Natural disaster subgroup classification

EM-DAT includes the following fields:

DISNO:	Unique disaster number for each disaster event (8 digits: 4 digits for the year and 4 digits for the disaster number; i.e. 1995-0324)
Country:	Country (ies) in which the disaster occurred
Disaster generic group:	Two groups are distinguished in EM-DAT – natural and technological disasters
Disaster sub-group:	Six sub-groups of natural disasters have been defined: geophysical, hydrological, meteorological, climatological, biological and extra-terrestrial
Disaster main type and sub-type:	Description of the disaster according to a pre-defined classification (for example, type: flood; sub-type: flash flood)
Date (start and end):	Date when the disaster occurred and ended (month/day/year)
Total Deaths :	Number of people who lost their life because the event happened (it includes also the missing people based on official figures)
Injured:	Number of people suffering from physical injuries, trauma or an illness requiring immediate medical treatment as a direct result of a disaster
Homeless:	Number of people whose house is destroyed or heavily damaged and therefore need shelter after an event
Affected:	Number of people requiring immediate assistance during a period of emergency; this may include displaced or evacuated people

Total affected:	Sum of injured, homeless and affected
Estimated damage:	Global figure of the economic impact of a disaster; it is given in current US dollars.
Additional fields:	Other geographical information (such as latitude and longitude, location), value and scale of the events (such as the Richter scale value for an earthquake), the international status (OFDA response, request for international assistance, disaster/emergency declaration), the aid contribution (in US dollars), and the different sectors affected.

1.3 Methodology

In EM-DAT and in this report, data are considered at the country level for two reasons: first, it is at this level that they are usually reported; and second, it allows the aggregation and disaggregation of data. Annex 2 shows the list of countries per continent and United Nations regions.

In EM-DAT, the number of total deaths includes those confirmed dead and those missing and presumed dead. People affected are those requiring immediate assistance during a period of emergency (e.g. requiring basic survival assistance such as food, water, shelter, sanitation and immediate medical help). People reported injured or homeless are aggregated with those affected to produce the total number of people affected.

The economic impact of a disaster usually consists of direct consequences on the local economy (e.g. damage to infrastructure, crops, housing) and indirect consequences (e.g. loss of revenues, unemployment, market destabilization). In EM-DAT, the registered figure corresponds to the estimated value of the direct damage caused by the event, expressed in current US dollars. In this report, damages were converted into 2016 US dollar values for easier comparison. Estimates of disaster damages must be treated with caution because of (a) the financial value of infrastructures, which is much higher in high-income countries than in middle- and low-income countries (World Bank classification of economies); and (b) the low reporting rates of direct losses, which is nonetheless better for large disasters.

In order to facilitate the comparison over time for the analyses of this report, the event start date has been used as the disaster reference date. However, droughts are often multi-year disasters, therefore, their impact over time has to be taken into account. Bearing in mind that data on deaths and economic damage from drought are infrequently reported, CRED has adopted the following rules regarding the data for multi-year droughts: (a) the total number of deaths reported for a drought is divided by the number of years for which the drought persists. The resulting number is registered for each year of the drought duration; (b) the same calculation is done for the reported economic damages; and (c) for the total number of people reported to be affected, CRED considers that the same number is affected each year that the disaster persists.
In the More, some disasters begin at the end of a year and may last some weeks or months into the following year has to be taken into account. In such cases, CRED has adopted the following new rules: (a) regarding the number of people reported affected, the total number is recorded for both the start year and the end year; (b) for the number of people reported as killed by sudden

onset disasters (earthquakes, flash floods, landslides, etc..) all those killed are registered according to “start year” of the disaster; (c) for the numbers of people reported as killed by slow-onset disasters (extreme temperature, some floods) the total of all those killed is divided and half is attributed to each year of persistence; (d) reported economic damages are always attributed to the end year of the disaster. This is because damage is related to both the strength of a disaster and its duration.

2006-2015 annual averages used in this report equal the sum of numbers (of disasters, of people killed, of people affected) or amounts (of damages) of each year of the decade divided by ten. The computation of the annual averages takes into account the rules defined above.

Disasters data analysis makes quickly appear the high variability of numbers of disasters, deaths, people affected and of amounts of damages over time and geographical space. Very large disasters, with often long return periods, were most of the time associated with exceptional values that far surpass those reported for disasters with shorter return periods. Annual averages allow to compare a year to a theoretic year of reference which is, in the case of disaster data, often very hypothetic. The use of past extreme high and low values is therefore useful, even essential to compare one year to the previous ones. But the comparison with one extreme may hide more subtle figures and the distributions of numbers over time has to be considered.

Analysis depends on the quality of data and the he CRED/EM-DAT team continuously strives to improve its data reporting methodologies and the EM-DAT database as a whole. The team also try endlessly to enhance the ways to explore and analyze this unique dataset and the outputs it can generate. We are therefore considering a reformulation of the indicators of comparison that we use to allow, in the near future, a better appreciation of the characteristics of the years, disasters and countries under review.

Chapter 2

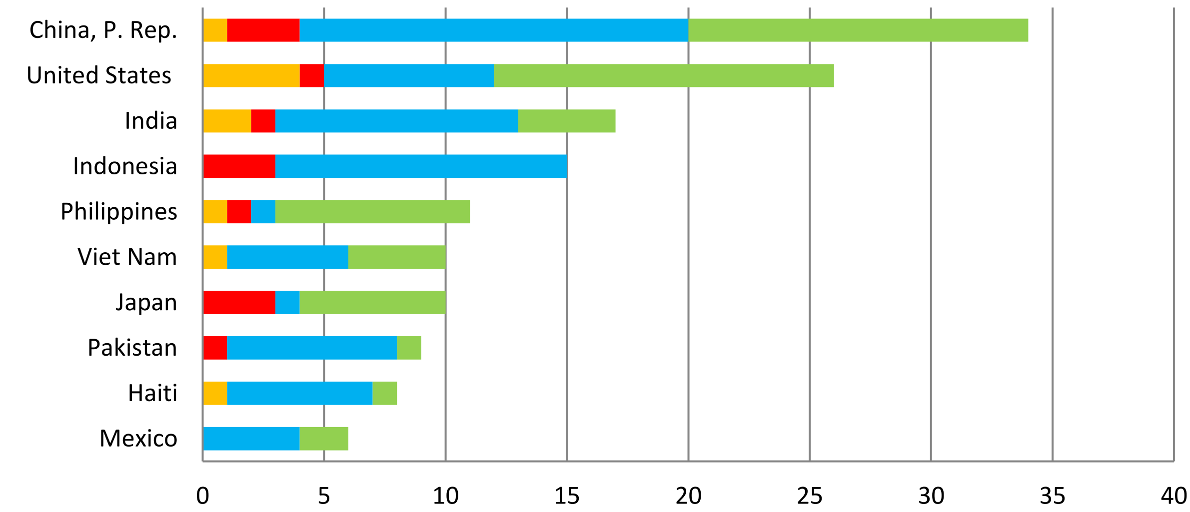
What did 2016 bring?

2. What did 2016 bring?

In 2016, worldwide, 342 reported natural disasters caused 8,733 deaths, affected 569.4 million people, and caused US$ 154 billion damages.

The number of disasters was the third lowest since 2006 and amounted to 90.1% of its 2006-2015 annual average (376.4). The number of deaths was the second lowest since 2006 and 87.5% below its annual average (69,827). Inversely, the number of people reported affected was the highest since 2006 and amounted to 1.5 times its annual average (224 million), while costs from natural disasters were the fifth highest since 2006, almost 12 % above their 2006-2015 annual average.

In 2016, 108 countries and territories were hit by disasters, which corresponds to 50.5% of all countries affected by disasters since 2006. All these countries experienced at least three disasters in the last 10 years (2006-2015). The five countries most often hit were China, the United States, India, Indonesia and the Philippines, which accounted for 30.1% of total disaster occurrences in 2016 (see Figure 5). Year after year, these countries appear prominently in the list of countries experiencing the highest number of disaster events.



	Mexico	Haiti	Pakistan	Japan	Viet Nam	Philippines	Indonesia	India	United States	China, P. Rep.
Climatological		1			1	1		2	4	1
Geophysical			1	3		1	3	1	1	3
Hydrological	4	6	7	1	5	1	12	10	7	16
Meteorological	2	1	1	6	4	8		4	14	14

Figure 5 – Top 10 countries by number of reported events in 2016

When considering the top ten countries for number of disasters, seven are located in Asia and suffered 31% of all 2016 disasters, while three countries located in the Americas accounted for 11.7% of all disasters. When looking at the level of income of these countries, two are high incomes countries (USA and Japan), two are upper-middle income countries (China and Mexico), five are lower-middle income countries (India, Indonesia, Pakistan, the Philippines and Vietnam) and one is a low income country (Haiti). For six countries, their number of disasters in 2016 was greater than its 2006-2015 annual average. In Haiti, the number of disasters (8) was the highest reported since 2006 and amounted to more than twice its annual average. The number of disasters in Vietnam and Pakistan was, respectively, 1.5 and 1.6 times their annual average, while the 2016 overproportions of disasters in China, USA and Japan represented, respectively, 15, 22 and 37% of the annual average. In India, Indonesia and Mexico, the 2016 number of disasters was very close to their respective annual averages. Inversely, the number of disasters reported for the Philippines (11) is the lowest reported since 2006, 40% below the 2006-2015 annual average.

As in previous years, the main burden of disaster impact was carried by a small number of countries in 2016. The countries that made up the top 10 ranking in terms of disaster mortality in 2016 represented 67.4% of total disaster mortality, while the top 10 countries for the number of people reported affected represented 93.5% of all people. Finally, the top 10 countries for damages accounted for 88.1% of all costs from natural disasters in 2016.

In 2016, the three deadliest disasters (Table 1), whose number represents less than 1% of all disasters, killed a total of 1,760 people, or 20.2 % of all people killed. These were one earthquake in Ecuador (676 deaths), one storm in Haiti (546 deaths) and one flood in Democratic People's Republic of Korea (538 deaths). These numbers are however, far below the extremes of 222,570 deaths from an earthquake in Haiti in 2010; the 138,366 from the cyclone Nargis in Myanmar in 2008 or even the 6,054 deaths from a flood in India in 2013. The seven remaining disasters of the top ten (or 2% of all 2016 disasters) totaled 1,877 deaths (or 21.5% of all 2016 deaths).

Table 1 – Top 10 natural disasters by number of deaths in 2016

Event	Country	No. of deaths
Earthquake, April	Ecuador	676
Hurricane Matthew, September	Haiti	546
Flood, August	Korea (the Democratic People\'s Republic of)	538
Heat wave, April	India	300
Earthquake, August	Italy	296
Flood, June	China	289
Flood, July	China	289
Flood, July	India	254
Flood, November	Zimbabwe	246
Flood, may	Sri Lanka	203

Four countries in 2016 had number of deaths above their 2006-2005 annual average: Ecuador, deaths are equivalent to 43.5 times their annual average, while deaths in Zimbabwe represented almost 16 times the annual average, 5.8 times in Italy and 5 times in the Democratic People's Republic of Korea. Compared to their annual average, 2016 deaths in Haiti were fewer. However, this annual average is biased by the 222,570 deaths from the earthquake of 2010. When deaths from this exceptional disaster are removed and the average recalculated, the 2016 deaths in Haiti appear then to represent almost 5 times the average. In the USA, the 255 deaths reported in 2016 are 13% below the 2006-2015 annual average, while in the four remaining countries the 2016 numbers of deaths are, at least, 50% below their annual averages. Among the top 10 countries in terms of disaster mortality in 2016 (Figure 5), five are located in Asia (China, Democratic People's Republic of Korea, Pakistan, India and Indonesia), three in the Americas (USA, Haiti, Ecuador), one in Europe (Italy), and one in Africa (Zimbabwe). The number of deaths reported for the five Asian countries of this top ten accounted for 43.2% of the total 2016 disaster mortality, while the three American countries of the top ten reported 17.6% of all disaster deaths (see Table 2).

In terms of their total population, five of the top ten countries had more than 100 million inhabitants in 2016, accounting for 51.2% of the world population and 39.1% of all deaths, while one had a population between 50 and 100 million inhabitants (0.9% of world population and 3.42% of all deaths) and the four others a population between 10 to 50 million inhabitants, accounting for 1% of the world population and 24.9% of all deaths. Economically, two are high income countries (USA and Italy), two are upper-middle income countries (China and Ecuador), three are lower-middle income countries (India, Indonesia and Pakistan) and three are low income countries (Zimbabwe, DPR Korea and Haiti). The six countries classified as low-income or lower-middle income countries accounted for 37.9% of the total reported disaster mortality, the four high-income or upper-middle income economies accounted for a share of 29.5%.

Table 2 - Top 10 countries in terms of disaster mortality in 2016

Country	Total deaths
China	1335
India	1142
Ecuador	686
Korea (the Democratic People\'s Republic of)	612
Haiti	599
Pakistan	409
Italy	299
Zimbabwe	277
Indonesia	270
United States of America (the)	255

When looking at disaster mortality relative to the number of inhabitants in a country, the figure is somewhat different (Table 3). Four countries (DPR Korea, Sri Lanka, Taiwan and Nepal) are located in Asia, two in Africa (Zimbabwe and Rwanda), two in the Americas (Haiti and Ecuador), one in Europe (Macedonia) and one in Oceania (Fiji). Eight countries had a population between 10 and 50 million inhabitants (Haiti, Ecuador, DPR Korea, Zimbabwe, Rwanda, Sri Lanka, Taiwan and Nepal) while two had populations of less than 10 million inhabitants (Fiji and Macedonia). According to the World Bank income classification, six of the top 10 countries are classified as low income (Haiti, DPR Korea, Zimbabwe, Rwanda and Nepal) or lower-middle income (Sri Lanka) economies and four are upper-middle (Fiji, Ecuador and Macedonia) or high income (Taiwan) countries.

In two cases, the high mortality rates reported for a country were attributable to only one disaster: floods, both, in Macedonia (1.06/100,000) and in Sri Lanka (0.98/100,000). In five other countries, 88 to 99% of all deaths are attributable to one disaster: one earthquake in Ecuador (4.13/100,000), storms in, both, Haiti (5.03/100,000) and Fiji (4.89/100,000) and floods in, both, DPR Korea (2.12/100,000) and Zimbabwe (1.52/100,000). In Nepal, one flood contributed to 79.3% of all deaths (0.48/100,000) while another flood in Rwanda caused 55% of all reported deaths (0.56/100,000) as one earthquake in Taiwan (0.50/100,000).

Table 3 - Top 10 countries in terms of disaster mortality in 2016 (per 100,000 inhabitants)

Country	Mortality (per 100,000 inhabitants)
Haiti	5.52
Fiji	5.12
Ecuador	4.19
Korea (the Democratic People\'s Republic of)	2.42
Zimbabwe	1.72
Macedonia (the former Yugoslav Republic of)	1.06
Rwanda	1.02
Sri Lanka	0.98
Taiwan (Province of China)	0.91
Nepal	0.60

In 2016, the ten most impacting disasters represented 2.9% of all disasters reported and affected a total of more than 518 million people or 91% of those affected worldwide. In India, one drought (0.3% of all 2016 disasters) affected, alone, more than 333 million people or almost 58% of all people reported affected by disasters last year, while the seven other droughts (2% of all 2016 disasters) which hit Ethiopia, China, Malawi, Somalia, Zimbabwe, Haiti and South Sudan affected a total of more than 43 million people or 7.6% of all people affected in 2016. One storm in the USA affected 85 million people, a share of almost 15% of all people affected worldwide, while, in China, 60 million people or 10.5% of the total affected in 2016, suffered from a flood. Seventeen other disasters (5% of all 2016 disasters) affected between 1 and 3 million people for a total of 30.5 million, a share of 5.4% of all people affected, while three affected between 950,000 and less than 1 million people for a total of 2.9 million or 0.5% of all people reported affected.

Table 4 - Top 10 natural disasters by number of people affected in 2016

Event	Country	Total affected
Drought, January-December	India	330,000,000
Winter storm Jonas, January	United States of America (the)	85,000,012
Flood, June	China	60,000,000
Drought, January-December	Ethiopia	10,200,000
Drought, June - August	China	10,000,000
Drought, January-December	Malawi	6,700,000
Drought, January-December	Somalia	4,700,000
Drought, January-December	Zimbabwe	4,300,000
Drought, January-December	Haiti	3,600,000
Drought, February-November	South Sudan	3,600,000

The top 10 list of countries with the most people affected by disasters is shared by four Asian countries India, China, Vietnam and the Philippines), four African countries (Ethiopia, Malawi, Somalia and Zimbabwe) and two American ones (USA and Haiti). In absolute numbers, the four Asian countries accounted for 72.9% of all people reported affected worldwide, with the drought in India representing, alone, 58.6% of these people. The two American countries contributed to almost 16% of all people affected by disasters in the world in 2016, while the contribution of the four African countries amounted to 4.6%. In terms of populations, the top ten countries, represent 49.9 % of world population but 93.5% of all people reported affected by disasters. When considering the total number of inhabitants, the five top ten countries which hosted more than 100 million inhabitants in 2016 (India, USA, China, Ethiopia and the Philippines), account for 47.6% of the world population and almost 89% of all people affected by disasters, while the country with a population of almost 100 million inhabitants (Vietnam) represents 1.4% of world population and 0.8% of all people affected. The four remaining countries with a population between 10 to 50 million inhabitants (Malawi, Haiti, Somalia and Zimbabwe) account for 1.12% of the world population and 29.9% of all victims.

Eight countries in the list are low-income (Ethiopia, Malawi, Haiti, Somalia and Zimbabwe) or lower-middle income (India, Vietnam and the Philippines) economies and dominate. However 86.3% of all people reported affected by disasters in 2016 lived in three countries: one lower-middle income economy, India (58.6% of all people affected by disasters in the world); one high income economy, the USA (15 %) and one upper-middle income economy, China (12.7%). In seven of the top ten countries, 95% to 100% of all people reported affected suffered from one single disaster. It was the case for six droughts in Somalia (100%), Zimbabwe, Malawi and South Sudan (both, 99.9%), India (98.5%) and Somalia (95.4%) and one winter storm in the USA (99.9%). In China, a share of 82.9% of people was affected by a flood, while 13.8% by a drought; in Haiti, a drought affected 62.1% of all people affected by disaster and a storm 36.3%; in Vietnam, the number of people affected by disasters was distributed between one drought (38.3 % of all people reported affected), two floods (14.4 and 12.3% of all people affected, respectively) and one storm (13% of people affected).

Table 5 - Top 10 countries by people affected by natural disasters in 2016

Country	Total affected
India	333,816,813
United States of America (the)	85,123,038
China	72,387,822
Ethiopia	10,693,080
Malawi	6,702,800
Haiti	5,794,943
Somalia	4,700,000
Viet Nam	4,567,721
Philippines (the)	4,416,499
Zimbabwe	4,302,128

The top ten list ranking countries according to the number of people affected by disasters as a percentage of their total population appears somewhat different from the one ranking the total numbers of people affected (Figure 6). The countries with the largest population disappear. Six countries have populations of 10 to 50 million inhabitants, while the four remaining host less than 10 million inhabitants. Five countries are located in Africa, three in Oceania, one in the Americas and one in Asia. According to the World Bank income classification, eight out of these top 10 countries are classified as lower-middle income (Micronesia, Lesotho, Mongolia and Swaziland) or low-income (Haiti, Malawi, Somalia and South Sudan) economies, while the two remaining (Marshall Islands and Fiji) are upper-middle economies. Four countries (Micronesia, Haiti, Marshall Islands and Fiji) are island states.

Table 6 - Top 10 countries by people affected by natural disasters in 2016 (%)

Country	Total affected (%)
Micronesia (Federated States of)	95.24
Haiti	53.42
Lesotho	44.42
Marshall Islands (the)	39.62
Fiji	39.49
Mongolia	37.07
Malawi	37.05
Swaziland	36.63
Somalia	32.83
South Sudan	29.61

Last year, the ten costliest disasters made damages for a total of US$ 86.3 billion, or, in proportion, 55% of all damages reported for disasters in 2016. With the exception of China, an upper-middle income economy, where two disasters had a total cost of US$ 26.5 billion, all these disasters occurred in high income countries and made a total of US$ 59.8 billion damages.

Twenty-six other disasters made damages between US$ 1 and 3 billion, for a total of US$ 44.8 billion, or 28.5% all damages. Thirteen disasters occurred in high-income countries and had a total cost of US$ 21.7 billion: in the USA, eight storms, two floods and one wildfire caused damages of, respectively US$ 11.8, 4.6 and 1.2 billion, while two floods, in France and Germany, cost, respectively, US$2.4 and 2 billion. Eight disasters created US$ 15.1 billion in upper-middle income countries: in China, one flood cost US$ 3 billion, while two storms resulted in damages of, respectively, US$ 2.3 and 1.5 billion and a cold wave cost US$ 1.6 billion. In lower-middle income countries four disasters caused a total of US$ 6 billion in damage: one drought in Vietnam cost US$ 2.3 billion while another in India US$ 1.5 billion; in India a storm created US$ 1 billion damages and in Sri Lanka a flood cost US$ 1.2 billion. Hurricane Matthew resulted in US$ 2 billion damages in Haiti, a low-income country.

Table 7 - Top 10 natural disasters by economic damages in 2016

Event	Country	Damages (in 2016 US$ bn)
Flood, June	China	22.00
Earthquake, April	Japan	20.00
Flood, August	United States of America (the)	10.00
Hurricane Matthew, October	United States of America (the)	10.00
Earthquake, August	Italy	5.00
Flood, July	China	4.50
Forest fire, May-July	Canada	4.00
Thunderstorms, April	United States of America (the)	3.90
Tsunami, November	New Zealand	3.90
Drought, June-August	China	3.00

Last year a total cost of US$ 135.6 billion is reported for the top ten countries with the highest damages, which represents 88.1% of all disasters cost reported in 2016.

In eight of the ten countries, damages were above their 2006-2015 annual average in 2016. In Cuba, 2016 damages represent 5.7 times their annual average, while 3.8 times in Vietnam, 3.5 times in Canada, 2.1 times in Italy, 2 times in France, 1.6 in China, 1.5 times in the USA and 1.4 times in New Zealand. In India, the 2016 costs are slightly below their annual average (US$ 4.4 billion), while in Japan, damages appear 30 % below their annual average.

Geographically, four Asian countries appear in this top ten with the US$ 73.3 billion total damages reported, representing 92.9% of all damages reported in this continent in 2016, and 47.6% of worldwide damages. The cost of damages in the three American countries figuring in this top ten (US$ 50.6 billion) represents 88.4% of all damages on the continent, and 32.9% of all damages reported in the world; the US$ 7.7 billion costs which occurred in the two European countries include 70.1% of all European damages and represents 5 % of world damages while the US$ 3.9 billion reported for New Zealand (Oceania) equates to 76.4% of costs reported in this region and 2.6 % of all damages, worldwide. No African country appears in this top ten. In terms of country wealth, the USA and China- the two largest economies of the world, representing, respectively, 22.4% and 13.5% of world GDP in 2016, reported the largest shares of damages of, respectively, 28.6% and 29.5% of all damages. The total disaster cost of the six high income countries (USA, Japan, Italy, Canada, New Zealand and France) represent 93.1% of damages reported for all high income countries in 2016 and 51.9 % of costs, worldwide. For the two upper-middle income countries (China and Cuba), their summed damages represent 89.1% of damages reported for this economic class of countries and 31.1% of world cost in 2016, while total damages for the two lower-middle income countries (India and Vietnam) represent 72.5% of all damages from this class of countries and 5% of all 2016 costs from disasters.

Table 8 - Top 10 countries by damages in 2016

Country	Damage (US$ billion)
China	45,328
United States of America (the)	44,035
Japan	20,200
Italy	5,300
India	4,074
Canada	4,000
France	2,400
Germany	2,000
Thailand	1,245
Argentina	1,000

When ranked according to the 2016 damages as a percentage of their GDP, the geographical distribution of the countries is completely different (See Figure 6). Five countries of the top ten are located in the Americas (Haiti, the Bahamas, Cuba, Ecuador and Bolivia), two in Oceania (Fiji and New Zealand), two in Asia (Vietnam and Sri Lanka) and one in Africa (Zimbabwe). Two countries are classified as high-income economies (the Bahamas and New Zealand), three as upper-middle income economies (Fiji, Cuba and Ecuador), three as lower-middle income economies (Vietnam, Sri Lanka and Bolivia) and two as low income economies (Haiti and Zimbabwe). The four countries with disasters having the highest impact on their GDP (Haiti, Fiji, the Bahamas and Cuba) are island states.

In eight out of ten countries, reported damages are attributable to only one single disaster which had a severe impact on the country's economy. However, it is not the case in Vietnam and Zimbabwe in which the costliest disaster, drought, accounted for only 62 % of all reported damages.

Table 9 - Top 10 countries by damages in 2016 (% GDP)

Country	Damage (US$ billion)
Tanzania, United Republic of	0.97
Ethiopia	0.65
Macedonia (the former Yugoslav Republic of)	0.55
Japan	0.41
China	0.40
Bangladesh	0.34
Thailand	0.31
Namibia	0.29
Italy	0.29
Serbia	0.26

Vulnerabilities of low and lower income economies and of small countries

When looking at country economies relating to vulnerability to disasters, five out of six in the top ten countries are defined as low and lower-middle income economies, and are the majority in both, absolute numbers and by their share in the world economy (38% of all countries and territories). They are less present in the ranking for total economic damages but this can easily be explained by the higher value associated with buildings and infrastructures in wealthier countries. Furthermore, they are represented, in this specific ranking, in proportion to their share in the world economy. With only one disaster causing the most deaths, affecting the most people or accounting for the most damages in many countries, the vulnerability to natural disasters of low and lower-middle income countries appears clearly from these tables. The number of deaths per 100,000 inhabitants; of victims as a percentage of the total population and of amounts of damages as a percentage of GDP also highlights that small countries, as well as island countries, are more likely to face disaster impacts which regularly overburden their response capabilities. It is essential to find ways to mitigate the shocks that natural hazards may have on populations and economies of these different countries. Such a challenge can only be considered in permanent and long-term strategies.

Chapter 3

How different was 2016?

3. How different was 2016?

3.1. General overview

3.1.1. Occurrence

The number of reported natural disasters in 2016 (342) is the third lowest since 2006, showing a decrease of 13.4% compared to the 2015 number (395), and also below the annual average disaster occurrence for 2006-2015 (376). After the peak of 2015, a year of break, the annual number of disasters comes closer to those of years 2011-2014. In 2016, the number of climatological disasters (38) was the fourth highest since 2006, after the maximum reached in 2015 (48), remaining 13.5% above its 2006-2015 annual average (32.6). The number of geophysical disasters (31) was almost equal to its annual average (31.6) while the number of hydrological disasters (177) showed a small decrease compared to the 2015 number (184) and its annual average (190.1). On the other hand, the number of meteorological disasters (96) showed a significant decrease in 2016 and was the lowest reported since 2006, decreasing by 21.4% from its annual average (122.1) and by 27.3% from the 2015 level (132).

3.1.2. Total Deaths

The number people killed by disasters in 2016 (8,733) was significantly below the value for 2015 (22,884) and much more below its 2006-2015 annual average (69,827), which is strongly influenced by the peaks of 2010 (307,778)- the year of Haiti's earthquake, and 2008 (235,338) when Cyclone Nargis hit Myanmar. When these two years were excluded from the computation, the annual average for the period falls to 15,515 people killed, a mean number of deaths that remains twice more than in 2016. For hydrological disasters the number of deaths in 2016 was 23.5% below its 2006-2015 annual average, while for each of the other disaster types the decrease exceeded 90 %.

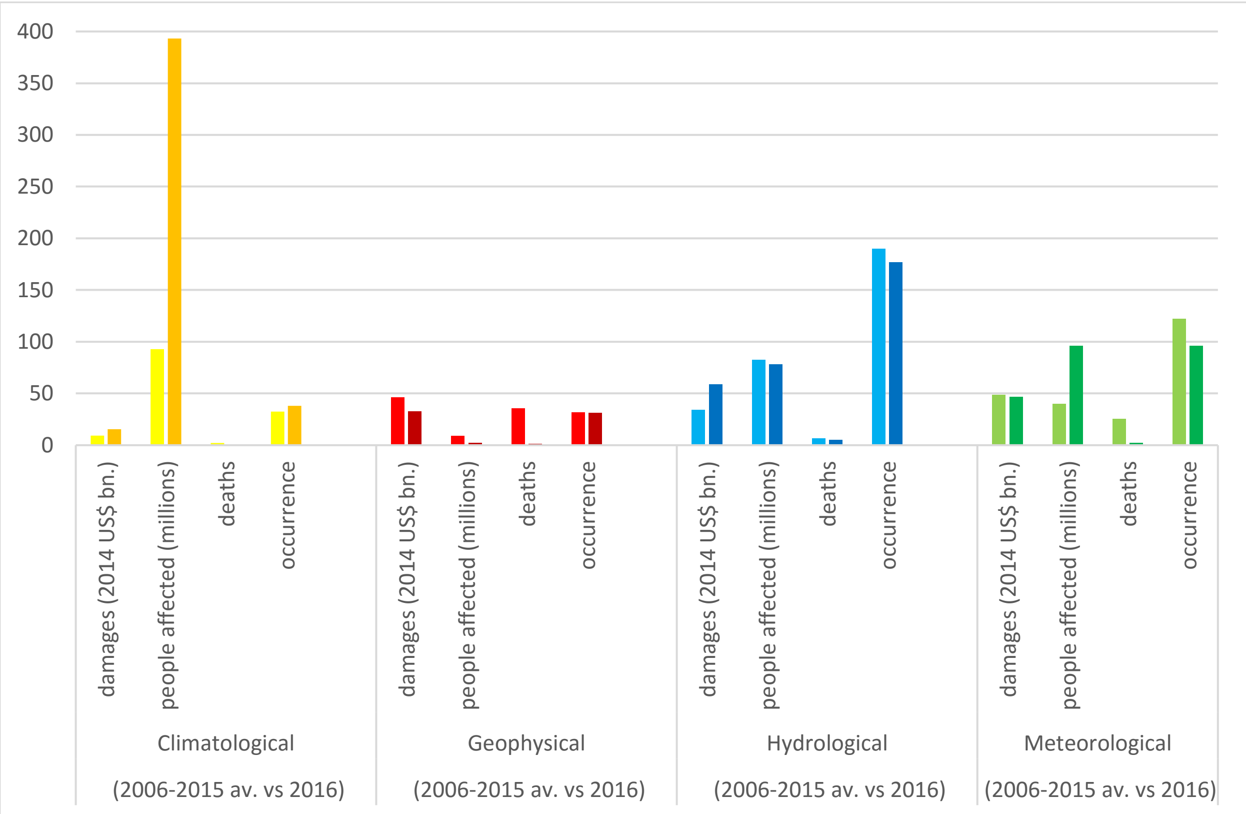
3.1.3. Total People affected

The number of people reported affected by natural disasters in 2016 (569 million) was the highest since 2006, after the last highest of 2015 (441 millions), reaching 2.5 times the level of the 2006-2015 annual average. This increase is directly attributable to climatological disasters which number reached 4 times the annual average and that of meteorological disasters which was twice its annual average. Numbers of people affected by these two disaster types were, both, the highest reported since 2006. The total of those who suffered from hydrological disasters (78 million) is slightly below the annual average (82.6 million) but far below the peaks of 2007 (almost 180 million) and 2010 (191 million), largely attributable to two floods in China which affected, 105 and 134 million people. In 2016, geophysical disasters affected 2.2 million people. This number, the third lowest since 2006, was four times smaller than the 2005-2016 annual average (8.7 million) and more than twenty times lower than in 2008 (48.6 million), during which an earthquake affected almost 46 million people in China.

3.1.4. Total Damages

The estimated economic losses from natural disasters in 2016 (US$ 154 billion) were the fourth highest since 2006, 11.2% above the damages annual average for years 2006-2015 (US$ 138 billion) but remained far below those reported in 2011 (US$ 395 billion), the year of the tsunami in Japan. Compared to the 2006-2015 annual average (US$ 46 billion), costs from geophysical disasters (US$ 33 billion) showed a decrease of 28%, which represents only 15 % of the amount of damages reported in 2011. Costs from meteorological (US$ 47 billion) disasters appeared only 3% below their annual average (US$ 48.4 billion) but half of the US$ 92 billion from 2008, the year of Hurricane Ike, which resulted in US$ 33 billion in damages in the USA, and with severe winter conditions in China which cost US$ 23.4 billion. To compare, Hurricane Sandy in the USA in 2012, caused more damages (almost US$ 52 billion) than all meteorological disasters, worldwide, in 2016. Inversely, damages from climatological (US$ 16 billion) and hydrological (US$ 59 billion) disasters were, both, the second highest since 2006, showing similar increases of around 74% above their annual average. However, one drought in the USA in 2012 caused more damages (US$ 21 billion) than the total for climatological disasters in 2016, and one flood in Thailand in 2011 had a cost of US$ 42 billion, an amount which represents more than two-thirds of all hydrological damages for 2016.

Figure 6 – Natural disasters impact by disaster sub-group: 2016 vs 2006-2015 annual average



3.2. Hydrological Disasters

3.2.1. Occurrence

Hydrological disasters (164 floods and 13 landslides) still took the largest share in natural disasters occurrence in 2016: 51.7%, however, to an average of 50.5% for the years 2006-2015. The two countries most hit by floods were China (13) and Indonesia (10) and these numbers of occurrence remained, for both countries, above their 2006-2015 annual average (10.7 and 7.7, respectively). In 2016, four countries experienced numbers of hydrological disasters unexpectedly high compared to their 2006-2015 annual average: the six floods in 2016 in Haiti represent 3 times their annual average and four floods reported, each, in Malaysia and Angola amounted to twice their annual average. Inversely, the only flood which occurred in the Philippines in 2016 represents a decrease of 88% compared to the 2006-2015 annual average and, in Brazil, the two floods of 2016 a decrease of 60%. The 13 landslides accounted for 7.3% of all 2016 hydrological disasters, while for 9.4%, on average, in the 2006-2015 decade. Three such disasters were reported in 2016 in China and two in Indonesia, close to their annual average.

3.2.2. Total Deaths

The number of deaths from hydrological disasters (5,092) was 23.5% below its 2006-2015 annual average (6,657). In total, deaths from floods (4,731) were 17 % below their annual average (5,709). Those from landslides (361), were fourth lowest since 2006, 64% lower than those reported in 2015 and 64% below their annual average (948). Deaths from floods in Rwanda (121) amounted to over 23 times their annual average, those in Zimbabwe (246) over 14 times. Inversely, the number of deaths from floods in Colombia (10), Bolivia (4), and Peru (2) were more than 90% lower than their annual average. In 2016, the number of deaths from landslides in Yemen (20) and Myanmar (42) were 18 and 3 times higher, respectively, than their 2006-2015 annual averages, while deaths reported in Guatemala (10) were 88 % lower.

3.2.3. Total People affected

The total number of people reported affected by hydrological disasters in 2016 (78.1 million) was slightly below its 2006-2015 annual average (82.6 million) and represented a share of 13.7% of all people affected in 2016, well below the 36.8% annual average share of 2006-2015. In 2016, 99.7% of people suffered from floods, a share similar to the 99.6% annual mean proportion for years 2006-2015. In 2016, one flood affected 60 million people in China which corresponds to 77% of the 78 million affected by such disasters worldwide. Only three floods, also in China, affected more people since 2006, with 134 million affected in 2010, 105 million in 2007 and 68 million in 2011. In the Dominican Republic, the number of people who suffered from floods (almost 1.8 million) was, in 2016, more than 153 times more than the 2006-2015 annual average; the 25,000 in Saint-Vincent and the Grenadines amounted to 14 times the annual average and the 450,500 in Honduras to 10.5 times. Inversely, the numbers of people affected by floods last year in Pakistan (10,762), Colombia (2,272), Australia (280), Ukraine (200) and Chile (100) represent less than 1 % of their 2006-2015 annual average.

Regarding landslides, the number of people affected by such disasters in 2016 in Rwanda (4,000) was more than 5 times its 2006-2015 annual average. In China, the number of 237,607 affected in 2016 is very close to its 215,860 annual average. Inversely, in 12 countries with averages of at least 1,000 people annually affected by landslides, few people suffered from such disasters.

3.2.4. Total Damages

In 2016, damages from hydrological disasters totaling almost US$ 59 billion were reported for 31 countries of the 79 having experienced such disasters. This total amount represents 38% of all reported damages in 2016, above the 24.6% mean proportion for the 2006-2015 decade. The share of damages attributable to floods (98.8%) was, in 2016, close to that of the previous decade (99.6). Costs from hydrological disasters were, in 2016, the second highest since 2006, being 74% above their 2006-2015 annual average, but remains highest in 2011 (US$ 83 billion), when a flood in Thailand cost more than US$ 42 billion and ten other floods, at least US$ 1 billion each, for a total of US$ 33.1 billion. The US$ 56 million in damages from floods, reported in Greece in 2016, represents 8.3 times the total damages reported from these disasters in the years 2006-2015, while the last year cost Zimbabwe US$ 100 million, 5 times the total costs from floods in this country during the previous decade, and the US$ 1.2 billion damages in Sri Lanka 1.8 times all those reported since 2006. Inversely, in 2016, damages from floods reported in Thailand (US$ 145 million), the Russian Federation (US$ 10 million) and the Philippines (US$ 9.3 million) represented less than 1% of all damages from floods occurring in these countries since 2006.

3.3. Meteorological disasters

3.3.1. Occurrence

Meteorological disasters (83 storms and 13 extreme temperatures) represented 28.1% of the total disaster occurrence in 2016, which is below their 2006-2015 annual average shares of 32.4 %. The total number of these disasters in 2016 (96) is the lowest since 2006, 21.4 % below its 2006-2015 annual average (122.1). When looking at the disaggregated data, numbers of storms (83) and extreme temperatures (13) were, both, the second lowest since 2006, 14.6 % and 47.8 % below their 97.2 and 24.9 2006-2015 annual averages, respectively. When looking at country level, the three storms which hit Tonga in 2016 represent 15 times their 2006-2015 annual average. Among countries suffering annually, on average, several calamitous storms in Taiwan, China and Vietnam experienced at least 30 % more storms in 2016. Inversely, in Mexico and Australia, the number of storms in 2016 was more than 40% below its annual average. Madagascar and France, two countries which, on average, suffer around two storm disasters each year, were spared from such calamities. The two disastrous extreme temperature episodes reported in 2016 for, both, Mongolia (two severe winter conditions episodes) and Japan (one cold wave and one heat wave), represent 6.7 and twice their 2006-2015 annual average, respectively.

3.3.2. Total Deaths

In 2016 meteorological disasters killed 2,287 people, representing 26.2 % of all deaths from natural disasters in the year. However, this global figure clouds great differences.
Last year, the number of deaths from storms (1,797) was the fourth lowest since 2006, far below

the 138,366 people killed by Cyclone Nargis in Myanmar in 2008. Deaths from storms in Fiji (46) and Zimbabwe (31) were more than 30 times their annual average, while those reported for Nigeria (28), Democratic Republic of Korea (60) and Haiti (546) were, respectively, 11, 7 and 6 times greater than their averages. The number of deaths from storms in China (346) in 2016 was 24 % above its annual average, while numbers of such deaths in India (128) and in the USA (185) were, respectively, 7 and 17 % below their annual average. The number of deaths from extreme temperatures (490) was, by far, the lowest since 2006, far below the almost 56,000 reported deaths from a heatwave in the Russian Federation in 2010. The number of deaths from extreme temperature episodes in South Africa (11) and Thailand (14) amounted to, respectively, 5 and 2.2 times their 2006-2015 annual averages. Inversely, the 300 deaths from a heat wave in India was 40% below the annual average for this country.

3.3.3. Total People affected

The 2016 number of people affected by meteorological disasters (95.8 million) is the highest since 2006, amounting to 2.4 times its annual average. But, here also, the disaggregation of the overall figure reveals a somewhat different landscape. The more than 93 million people affected by storms in 2016 is the highest since 2006 and represents 3 times its 2006-2015 annual average (31 million). However, one must account for the large impact of the winter storm “Snowzilla” which affected 85 million people in the USA last year. After a sand and dust storm which affected 100 million people in China in 2002, “Snowzilla” is the second most poignant storm ever reported. If the 85 million people it affected are removed from the 2016 total, the remaining number is, then, 70 % below the 2006-2015 annual average, a difference highlighting the impact of large disasters on global results. The number of 1.9 million affected by extreme temperatures is the second highest since 2006, remaining, however, 80 % below the annual average (9 million). Furthermore, this annual average of people affected by extreme temperatures is biased by the 77 million who suffered extreme winter conditions in China in 2008. When this number is not accounted for in the average, the 1.9 million people affected by extreme temperatures in 2016 become 46% above the annual average of 1.3 million.

People affected by storms represent 98% of all victims from meteorological disasters in 2016, compared to an annual mean proportion of 77.6% during the previous ten years. The 85 million people affected by “Snowzilla” represent 284 times the annual average of those affected by storms in the USA. While the 32,572 people reported affected in Egypt in 2016 has nothing to do with a 17.5 annual average, the number of people reported affected by storms in Fiji (355,000), Zimbabwe (2,000), Haiti (2.1 million) and Democratic Republic of Korea (103,865) accounted for, respectively, 69, 42, 31 and 11.2 times the countries annual averages. Inversely, the numbers of people having been affected by storms in 2016 in China (604,695), Honduras (151) and Mozambique (1,700) are 96% below their 2006-2015 annual average, while those reported for Iran (84), Taiwan (460), Pakistan (191) and Guatemala (55) represent less than 1% of their annual average. Three disasters accounted for 99.94% of all people affected by extreme temperatures in 2016. Two severe winter condition episodes in Mongolia affected 965,000 and 157,000 people, accounting for 4.5 times the 2006-2015 annual average, while one cold wave in Morocco affected 750,000 people, a number which represents 1,000 times this country’s annual average.

3.3.4. Total Damages

Damages from meteorological disasters (US$ 46.6 billion) were near their 2006-2015 average (US$ 48.4 billion) and were 96% attributable to storms (US$ 44.8 billion). The 2016 amount of storms damages is half that of 2012, the year of Hurricane Sandy, causing US$ 51.7 billion in damages. Hurricane Sandy was the costliest storm of 2016, making US$ 10 billion damages in the USA, US$ 2.6 billion in Cuba, US$ 2 billion in Haiti and US$ 600 million in the Bahamas, for a total which still remains far below the super-cost of Hurricane Katrina (US$ 156.3 billion) in the USA in 2005. In 2016, costs of extreme temperature disasters are reported for two cold waves in China and Southern Korea, which caused US$ 1.6 billion and 127 million in damages, respectively.

3.4. Climatological disasters

3.4.1. Occurrence

In 2016, the number of climatological disasters (38) was the fourth highest since 2006, taking a share of 11.1% in all natural disasters, above the share of 8.7% per year on average for years 2006-2015. The number of droughts (28) was 18.6% above the annual average of the previous decade (23.6). The number of wildfires (10) was close to its 2006-2015 annual average (9) but far from the peak of 18 in 2007. Among the 18 countries which experienced at least five droughts between 2006 and 2015, 11 experienced a new drought in 2016. In addition, 46.4% of droughts occurred in Africa and 28.6% in Asia, to be compared, respectively, to 50% and 17.8% for years 2006-2015. Half of all calamitous wildfires occurred in North America.

3.4.2. Total Deaths

In 2016, the total number of deaths from climatological disasters (39) represents less than 1% of all disaster deaths (8,733), compared to an annual mean proportion of 3% for the period 2006-2015. However, deaths from droughts are rarely reported and wildfires cause few deaths, compared to earthquakes, storms or floods. In 2016, no deaths from droughts were reported, to compare with the 20,000 deaths reported for a drought in Somalia in 2010-2011. The deadliest wildfire happened in the USA, killing 14 people, still far from the 180 deaths reported in Australia in 2009 or the 65 occurring in Greece in 2007.

3.4.3. Total People affected

In 2016, climatological disasters accounted for 69.1% of total people affected by disasters, to be compared to an annual average share of 41%. This can be clearly attributed to the 393 million people affected by droughts in 2016, making last year the one that ever affected the most people worldwide. Of this total, 330 million suffered from one drought in India, while in China and Ethiopia two droughts affected 10 million people, each. Thirteen other droughts affected at least one million people each, for a total of 38.4 million. The 3.6 million people affected by one drought in Haiti, the 665,000 in Bolivia and the 492,000 in Swaziland represent, respectively, 18, 13 and 12 times their 2006-2015 annual average. Inversely, the 1.25 million reported for Kenya and the 10 million reported in China, were 50 and 60% below their annual average, respectively.
The number of 158,290 people affected by wildfires in 2016 was the third highest since 2006 but is far from the 1 million who suffered from forest fires in Macedonia in 2007 or, that same year, the 640,000 affected by land fires in the USA, or even, the 409,664 people affected by forest fires

in Indonesia in 2015. The 88,000 people affected by wildfires in Canada in 2016 and the 60,137 reported for Israël, represent, respectively, 44 and 30 times their annual average. Inversely, the 8,452 people reported affected by wild fires in the USA was 88% below their annual average.

3.4.4. Total Damages

In 2016, the reported damages from climatological disasters (US$ 15.6 billion) were the second highest since 2006, representing 1.7 times their 2006-2015 annual average (US$ 9.2 billion). However, differences appear between damages from droughts and wildfires. The US$ 9.3 billion damages from droughts were the fifth highest since 2006 and amounted to 1.3 times their 2006-2015 annual average. On the other hand, damages from wildfires (US$ 6.3 billion) were, in 2016, the highest reported since 2006 and accounted for 2.8 times their annual average.
The share of climatological disasters in 2016 total damages grew from 6.7%, on average each year from 2006-2015 to 10.4% in 2016. Four droughts in China, Vietnam, India and Thailand made, respectively, US$ 3, 2.25, 1.5 and 1.1 billion damages; amounts far below the US$ 20.69 billion reported for one drought in the USA in 2012, but high enough to place them in the top twenty of the costliest droughts since 2006. The US$ 450 million damages from one drought in Bolivia in 2016 represents 41 times the annual average. The US$ 4 billion damages reported for one forest fire in Canada last year make it the costliest wildfire since 2006, accounting for 25 times the annual average, and the fourth costliest ever reported.

3.5. Geophysical disasters

3.5.1. Occurrence

In 2016, 31 geophysical disasters (earthquakes/tsunamis, volcanic activities and mass movements of geological origin) were registered, representing a share of 9.1% of total disaster occurrence, close to their decade's annual average of 8.4%. Of these disasters, 30 were caused by earthquakes. This number is the second highest since 2006, equal to the peak in 2011, and 20 % above the 2006-2015 annual average of 24.9. Inversely, only one volcanic activity-related disaster was reported in 2016, a number 83% below the 2006-2015 annual average of 5.9. No disasters from mass movement were reported in 2016, while the annual average for these disasters is 0.8.

3.5.2. Total Deaths

In 2016, 1,315 deaths from geophysical disasters were reported, representing 15% of all deaths for a 2006-2015 annual average of 51.2%. All these deaths were attributable to earthquakes with 90% caused by four in Ecuador (676 deaths), Italy (296), Taiwan (117) and Indonesia (104), the numbers of deaths still far below those from earthquakes in Haiti in 2011 (222,570 deaths) or in China in 2008 (87,476).

3.5.3. Total People affected

Geophysical disasters affected almost 2.2 million people, a share of 0.38% of all disaster victims, to be compared to the already low 3.9% average proportion for years 2006-2015. Earthquakes (2,025,717 people affected) accounted for almost 94% of all people reported affected by geophysical disasters in 2016, particularly the one which hit Ecuador in April, which affected 1.23

million people, alone. This number is far from the 45 million reported affected by the Sichuan earthquake in China in 2008 but made this disaster the tenth most disastrous since 2006. The number of 130,042 people affected by the activity of the Tungurahua Volcano in Ecuador in 2016, is the fourth highest since 2006, far below the 800,000 affected by the volcanic activity of the Mount Cotopaxi, also in Ecuador, in 2015.

3.5.4. Total Damages

Reported damages amounted to US$ 32.8 billion, 29% below the decennial annual average of US$ 46 billion. These disasters took a share of 21.4% of the total natural disasters damages of 2016, compared to a share of 33.5% on average from 2005 to 2016. The costliest 2016 earthquake occurred in Japan making US$ 20 billion damages. Such an amount is far from the US$ 222 billion damages from the tsunami in Japan in 2011, but is the ninth ever reported for earthquake damages. In 2016, two earthquakes produced damages of US$ 5 and 2 billion, respectively in Italy and Ecuador, while a tsunami cost US$ 3.9 billion in New Zealand. Such numbers are far below the US$ 93 billion damages of the Sichuan earthquake in China in 2008, whose costs do not compare with those of the tsunami in Japan in 2011 (US$ 221 billion). Year after year, the number of each disaster type in the total number of disasters occurring shows relative stability. Inversely, the contribution of each of the four disaster sub-groups to numbers of people killed, total reported affected, and economic losses vary considerably from one year to another, reflecting the high variability and diversity of disaster’s impacts over time.

Chapter 4

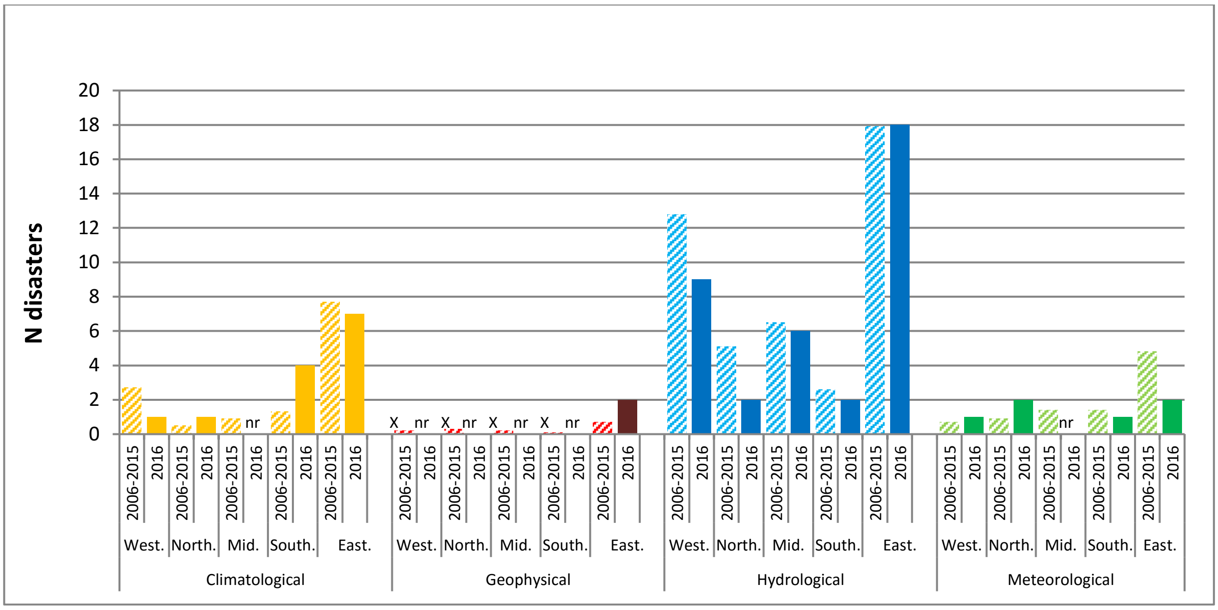
Regional analysis

- Africa
- Americas
- Asia
- Europe
- Oceania

4. Regional analysis

4.1. Africa

Figure 7 - Disaster occurrence by type. Mean 2006-2015 vs 2016



X: N <0.5;nr: no disaster reported

In 2016, the total number of disasters (58) was the third lowest since 2006, far below the heights of 2006-2011, varying between 72 to 87 disasters, annually.

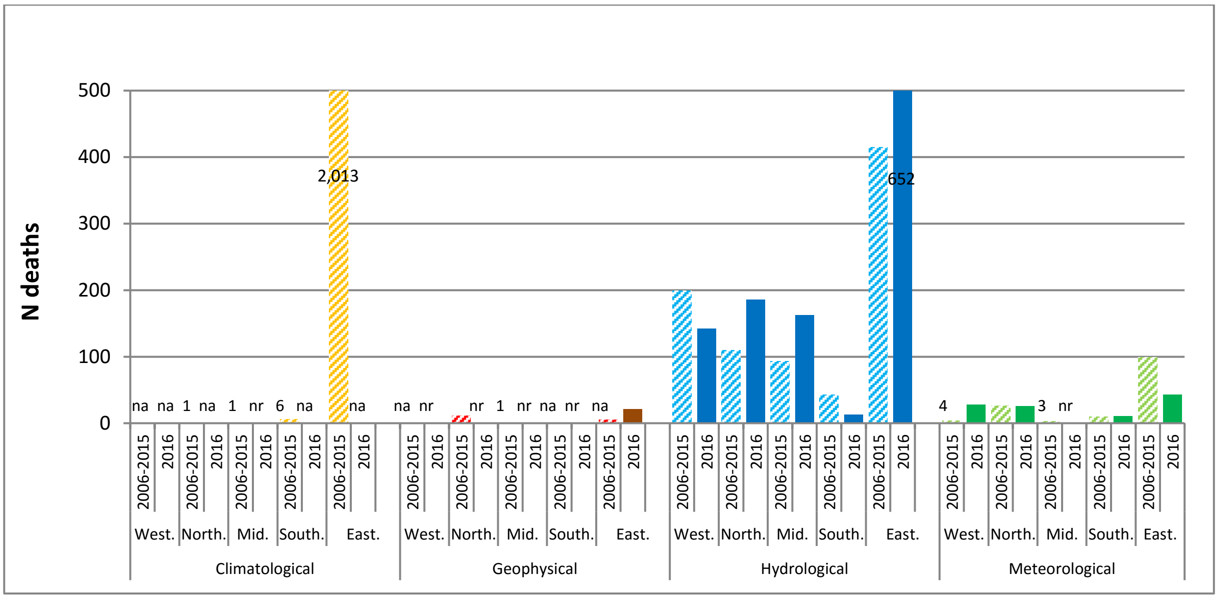
Hydrological disasters (primarily floods) were the most frequent in all regions but almost 50 % occurred in East Africa. In 2016, the number of floods in Central, South and East Africa remained at the same level as the previous decade, while in North and West Africa the numbers of floods were the third and fourth lowest since 2006.

More than 50 % of **climatological disasters** (primarily droughts) also occurred in East Africa, remaining very close to their 2006-2015 average. In 2016, South Africa suffered its second highest number of droughts since 2006. Inversely, with only one drought reported, West Africa experienced a fourth year of low occurrence of climatological disasters since 2006.

Meteorological disasters are rarely reported in Africa. East Africa is, again, the most prone region to suffer such disasters but, in 2016, the number of storms it suffered was the second lowest since 2006. It must be noted that, in this region in years 2006-2015, 48 % of storms resulting in disasters occurred in Madagascar, a country which, for the first time, none were reported in 2016.

Geophysical disasters are very rarely reported. East Africa remains the most at risk region for such events. In 2016, after several years with very low seismic activity, earthquakes in Tanzania and Uganda occurred, thus renewing the dangers associated with these hazards.

Figure 8 - Number of deaths by disaster type. Mean 2006-2015 vs 2016



na: not available; nr: no disaster reported

The number of deaths from disasters are very poorly reported for **droughts**, yet less so for geophysical and meteorological disasters, while deaths from hydrological disasters are better reported. The frequency of such events may explain this phenomenon, while to estimate the number of deaths from droughts is a difficult exercise.

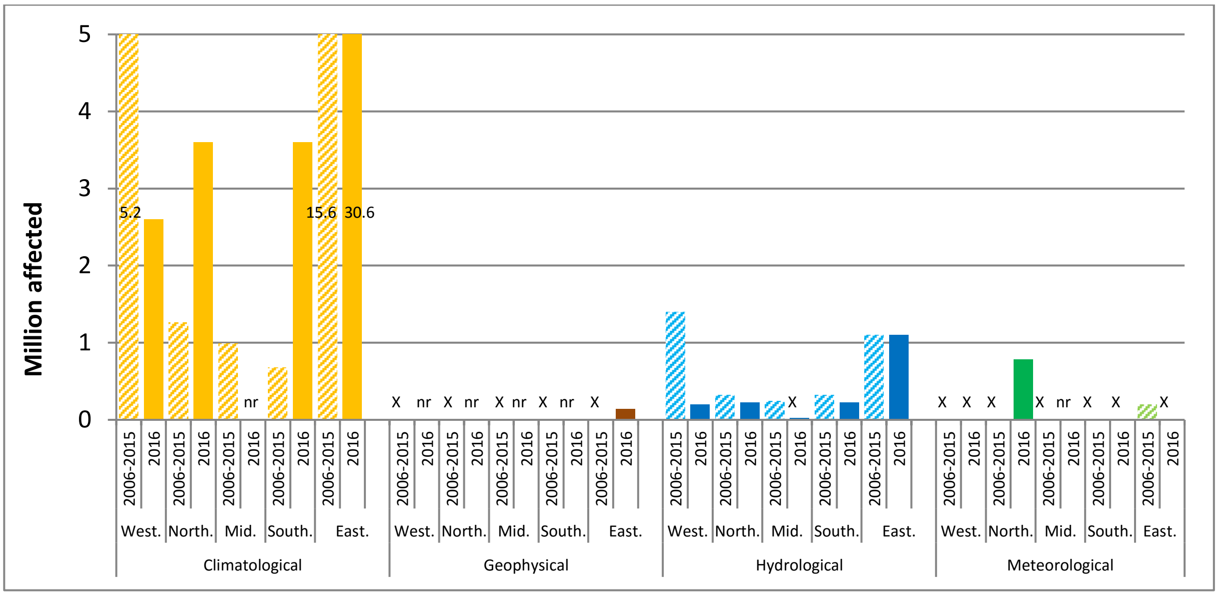
The total number of **hydrological disaster deaths** (1,156) accounts for 89 % of all 2016 deaths (1,285) and is significantly above its 2006-2015 average (860). Landslides accounted for only 6.3 % of deaths from hydrological disasters in 2016 and 7.2 % in the previous decade, most of them occurring in East Africa.

This region was the most hit, in 2016, as well as in 2006-2015. Its number of reported deaths in 2016 (652) was the fourth highest since 2006, the deadliest flood occuring in Zimbabwe (246 deaths) and the deadliest landslide in Rwanda (54 deaths). In the period 2006-2015, two floods resulted in 498 and 364 deaths, each, in Ethiopia in 2006 and one landslide resulted in 388 deaths in Uganda in 2010.

In 2016, there were two floods in Angola (54 deaths), one in DR Congo (50 deaths) and one flash flood in Algeria (171 deaths). Consequently, Central and North Africa experienced, respectively, their second and third deadliest years since 2006; compared to a flash flood which resulted in 154 deaths in DR Congo in 2014 and a flood causing 150 deaths in Sudan in 2007.

In 2016, West Africa's deadliest flood killed 50 people in Niger, a low death toll compared to a flood causing 363 deaths in Nigeria in 2012. In South Africa, a flood resulted in seven deaths in 2016, while the deadliest flood caused the death of 108 people in Namibia in 2011.

Figure 9 - Number of people reported affected (m) by disaster type. Mean 2006-2015 vs 2016



X: N <25,000;nr: no disaster reported

The number of people reported affected raises a question of scale. There is no common measure between the number of people affected by a drought or those who suffered from a landslide. Even when data are aggregated, the orders of magnitude may range from tens to the millions.

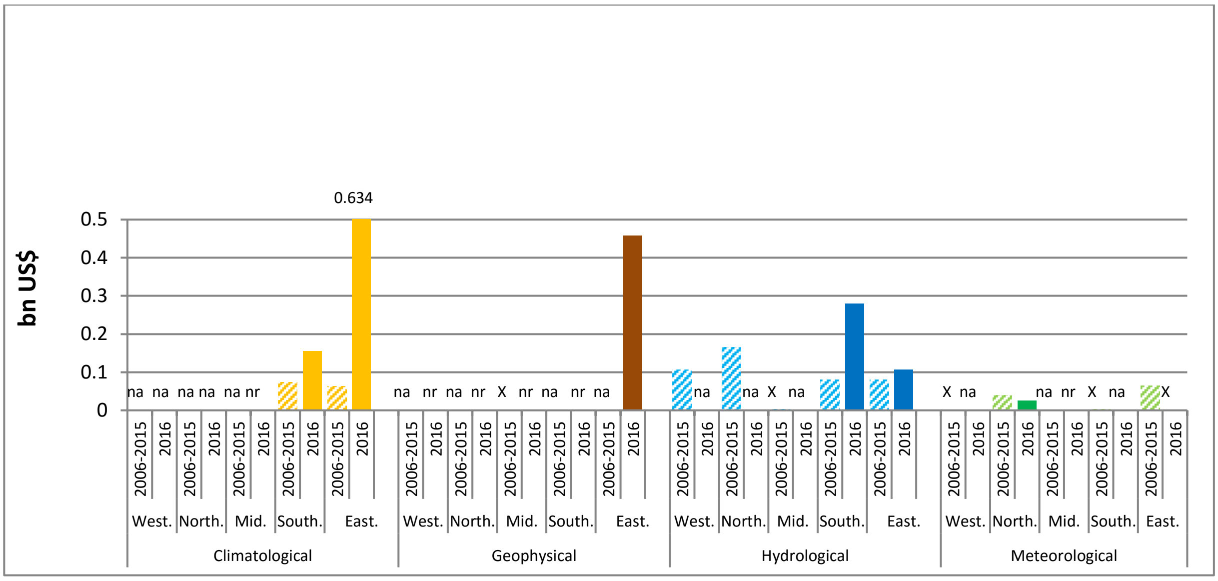
For all African regions, the annual number of people affected by **droughts** tends to exceed the threshold of one million (except in South Africa, which began at 0.3 million from 2006 to 2015). In East Africa, five out of the ten years reported over 20 million people affected by droughts (between 2006 and 2015). In 2016, almost 2.6 million people were reported affected by a drought in Niger (West Africa); 3.6 million in South Sudan (North Africa); 2.7 million in South Africa, 1 million in Lesotho, 600,000 in Namibia and 500,000 in Swaziland (all South African countries). In East Africa, one drought affected 10 million people in Ethiopia, while Kenya, Madagascar, Malawi, Mozambique, Somalia and Zimbabwe reported 1 to 7 million people affected for a total of almost 20.6 million people.

For geophysical disasters, mainly **earthquakes**, since 2006, the annual number of people reported affected varies from hundreds to a maximum of 20,000, except in East Africa in 2016, when an earthquake affected almost 140,000 people in Tanzania.

For hydrological disasters, primarily **floods**, from 2006 to 2015 in North, Central and South Africa, the annual number of people affected varied between thousands and one million. In 2016, this number was 222,000 (North), 22,000 (Central) and 7,500 (South) people for each African region. In 2006-2015, West and East Africa reported, each year, at least 100,000 to several million people affected by hydrological disasters. In 2016, the reported number of people affected was from 200,000 in West Africa and from 1 million in East Africa.

For meteorological disasters, **storms** primarily, the annual number of people reported affected varied from 10 to 100,000. The 2006-2015 annual average of people reported affected by disasters for each African region is as follows: 2,196 in West, 11,721 in North, 10,957 in Central and 4,015 in South Africa. Among these regions, only West and North Africa suffered from storms in 2016, with 1,000 and 32,570 people reported affected, respectively. Again, East Africa suffered more from storms than other African regions, with annual numbers of people affected varying from 8,000 to 753,000, for an average of 244,000 people. However, in 2016, only 3,700 people were reported as affected by storms. Extreme temperatures are very rarely reported for Africa. However, in 2016, in its Northern region, 750,000 people suffered from a **cold wave** in Morocco.

Figure 10 - Amount of damages reported (US$ bn) by disaster type. Mean 2006-2015 vs 2016



X: N <0,005; na: not available; nr: no disaster reported

In Africa, costs of damages are very poorly reported, where 10.2 % of all disasters were reported during the period 2006-2015 and 19 % in 2016. Though slightly better reporting can be observed in East, North and, mostly Southern Africa, **synthetic data must be cautiously interpreted here**.

Among climatological disasters, costs of **drought** can be distributed over several years, as with two which started in Ethiopia and Tanzania (East African countries) in 2015, lasting until 2017, and two which affected South Africa and Namibia in 2015 and 2016. If such costs are rarely reported, the annual average holds little use. In these four cases, the actual total estimated costs are of 934 million US$ in Ethiopia, of 334 million US$ in Zimbabwe, of 250 million US$ in South Africa and of 60 million US$ in Namibia.

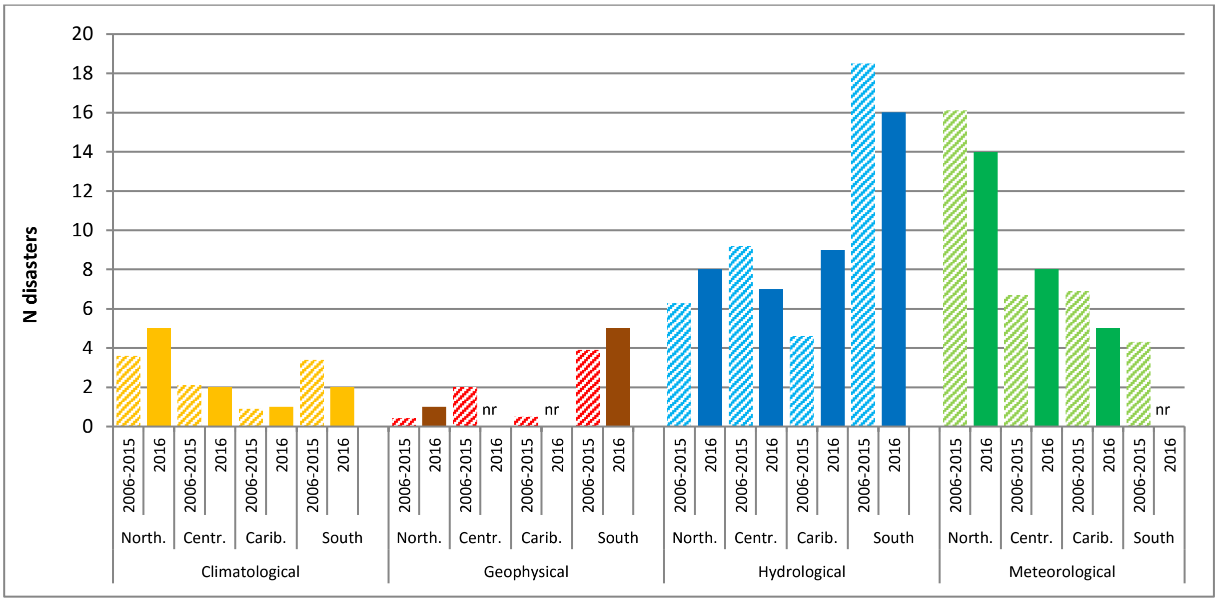
In 2008, the only **wildfire** with reported costs resulted in 477 million US$ in damages in South Africa. Costs of geophysical disasters were reported for only two **earthquakes**, one in Tanzania in 2016 (458 million US$) and one in DR Congo in 2008 (8 million US$).

Again, for hydrological disasters, the poor reporting of damage costs weakens the annual average. In 2016, a **flood** cost 180 million US$ and two others, 100 million in South Africa and Zimbabwe. In the 2006-2015 decade, the costliest floods struck Algeria (North Africa: 779 million US$) in 2011, Nigeria (West Africa: 500 million US$) in 2012, Malawi (East Africa: 390 million US$ in 2015) and South Africa (Southern Africa: 211 million US$). In Central Africa, the costliest flood (15 million US$) occurred in DR Congo in 2015.

In 2016, damages from two **storms** were reported in Egypt (25 million US$) and Mozambique (1.6 million US$). In the decade 2006-2015, the costliest storms occurred in Morocco (North Africa: 300 million US$) in 2014 and in Madagascar (East Africa: 240 million US$). In Southern Africa, the costliest storms resulted in 15 million US$ in damages in South Africa in 2009 and 1.1 million US$ in Cabo Verde in 2015.

4.2. Americas

Figure 11 - Disaster occurrence by type. Mean 2006-2015 vs 2016



nr: no disaster reported

In 2016, in North America, all **climatological** disasters were **wildfires**, which also accounted for 78 % of all climatological disasters that occurred in this region from 2006-2015. Inversely, **droughts** are the most frequent climatological disasters in Central America and the Caribbean, where their numbers (2 and 1, respectively) are near the annual 2006-2015 average (2.1 and 0.9, respectively). In South America, two droughts occurred in 2016 compared to an annual average of 2.4, while no wildfires occurred in this region, although they were regularly reported.

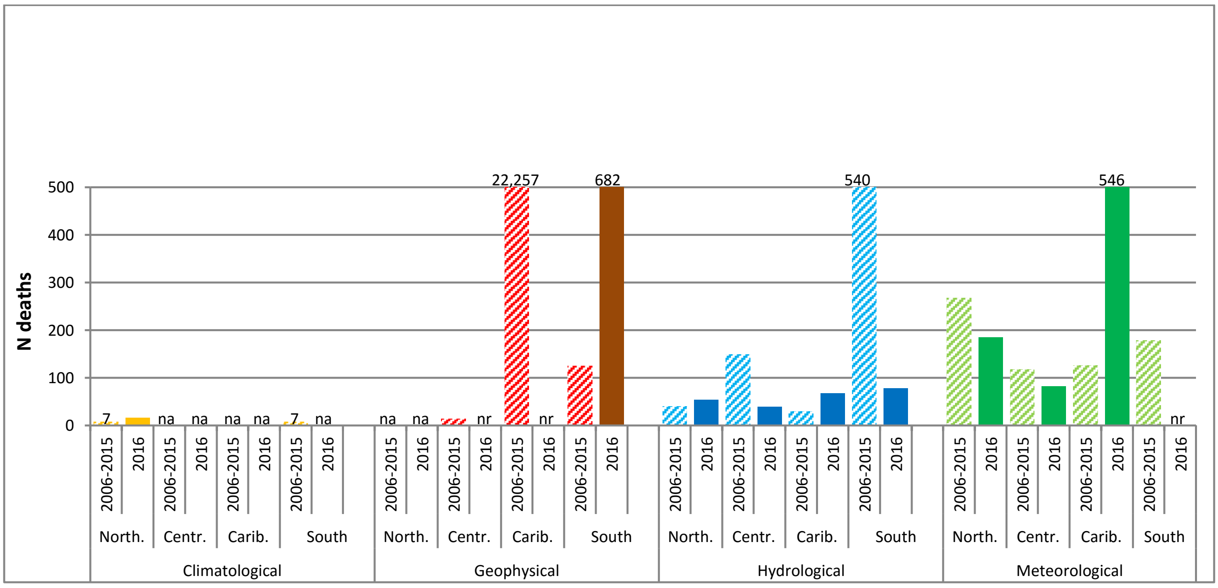
Geophysical disasters are rare in North America. However, one **earthquake** occurred last year in the USA. No earthquake disasters occurred in Central America and in the Caribbean, but such disasters, reported annually in Central America, remain relatively infrequent in the Caribbean. In these two regions, no disaster from volcanic activity was reported in 2016, although occurring periodically in Central America. In South America, four earthquakes were reported in 2016- the second highest rate since 2006. Only one volcanic disaster from volcanic activity occurred last year in South America, which is half the annual average for the years 2006-2015.

In the Americas, the most commonly reported natural disasters have a **hydrological** or **meteorological** origin, yet are unevenly distributed by region. Hydrological disasters are more frequent in Central and South America, while meteorological disasters are more frequent in North America.

In 2016, the number of disasters from **floods** in South America (16.2) was similar to its 2006-2015 annual average (16), but the absence of landslide disasters in this region in 2016 was unusual. Last year, the Caribbean experienced their highest number of floods since 2006 (9), twice the 2006-2015 annual average. Six of these nine floods occurred in Haiti in 2016 and 20 of 45 total during the years 2006-2015. In North America, the number of disasters from floods was the third highest since 2006 while no landslide – a very rare event in this region – was reported. In Central America, the number of floods was below its 2006-2015 average, while one landslide was reported, equal to the annual 2006-2015 average.

In 2016, the number of **storms** in North America (14) and Central America (8) was near its 2006-2015 annual average (15.1 and 6, respectively) and no extreme temperature episodes were reported, compared to an annual average of around 1 in both regions. The number of storms in the Caribbean (5) was also near its 2006-2015 average but far from the very high numbers of 2007 and 2008 (16 and 21), while disasters from extreme temperatures have never been reported for this region. Neither storms nor extreme temperatures were reported in 2016 in South America. While the 2006-2015 annual average for storms (2) in South America is low compared to the three other regions of the Americas, this is not the case for the annual average for **extreme temperature episodes** of 2,3, of which 95% were cold wave and extreme winter conditions.

Figure 12 - Number of deaths by disaster type. Mean 2006-2015 vs 2016



na: not available; nr: no disaster reported

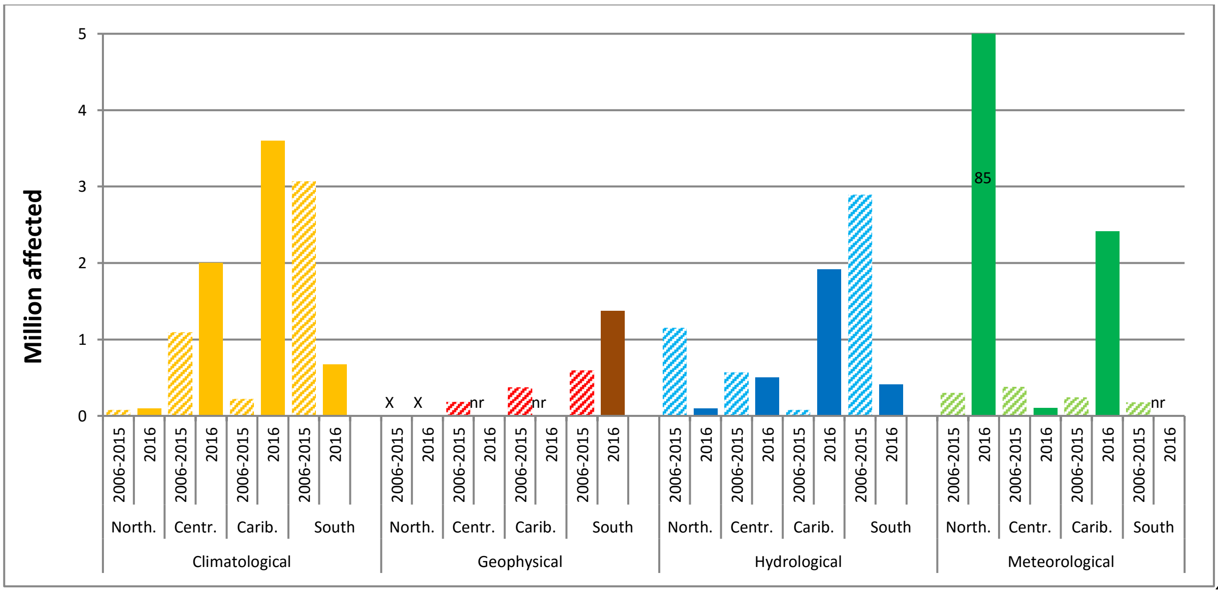
In North America, in 2016, 16 deaths occurred from **wildfires**, the only climatological disasters reported for this region. This number is the second highest since 2006 and is comparable to the 2006-2015 annual average of seven. In Central America and the Caribbean, the number of deaths from **climatological** disasters and 2006-2015 annual averages are, both, unavailable. In South America, this is also the case for droughts while wildfire disasters, unreported in 2016, have a 2006-2015 annual average of seven deaths.

No deaths were reported from the **geophysical** disaster that occurred in North America in 2016, as well as for such disasters in the previous decade. In Central America and in the Caribbean, no geophysical disasters occurred in 2016. In Central America, the 2006-2015 annual average for such disasters is 14 deaths, while in the Caribbean, the 222,570 deaths from the earthquake in Haiti in 2010 appears as an outlier. In South America, 676 of the 682 deaths reported in 2016 were caused by the Ecuador **earthquake** in April. This number of deaths is the highest reported since 2006, far above the 2006-2015 annual average of 122. Deaths caused by disasters from volcanic activities are rarely reported.

In North America, in 2016, the number of deaths from **floods** (54) was the third highest since 2006, above its 2006-2015 annual average (40). In Central America in 2016, deaths from floods (29) and landslides (10) were both far below their 2006-2015 annual average of, respectively, 91 and 58 deaths. In the Caribbean, the number of deaths from floods was the second highest since 2006, twice as high as the 2006-2015 average. Inversely, in South America, the number of deaths from floods (78) is the lowest since 2006, far below its annual average (463). No deadly **landslides** were reported in 2016 in this region, but the annual average of deaths from landslides remains high (77).

In North America, deaths from **storms** (185) were below their 2006-2015 average (224) as well as in Central America (82 deaths in 2016 versus an annual average of 116). Inversely, in the Caribbean, the 546 deaths caused by Hurricane Matthew in Haiti in 2016 was far above the 2006-2015 annual average of 126 for the region. No disasters from storms occurred in South America in 2016, while the 2006-2015 annual average is 168 deaths. There were no extreme temperature episodes reported in 2016 in the Americas but, according to the annual average of deaths, they were the most frequent, on average, in North America (44), far above the average numbers found in South (10) or Central America (2).

Figure 13 - Number of people reported affected (m) by disaster type. Mean 2006-2015 vs 2016



X:

N <25,000 ;nr: no disaster reported

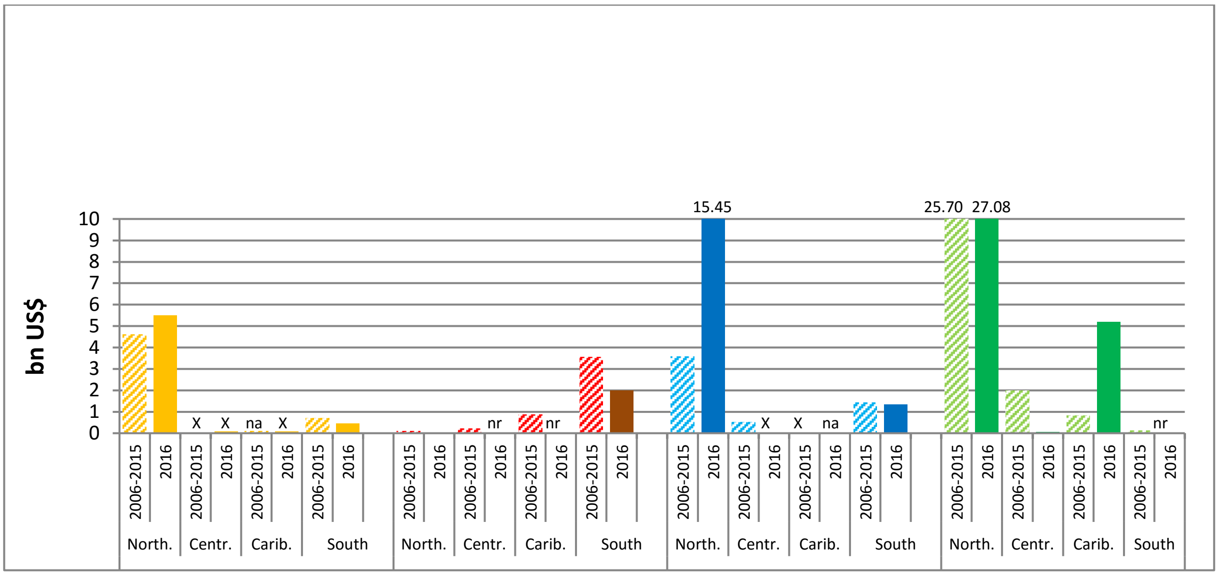
The number of people reported affected may sometimes reach very high or very low values, which must be taken into account when considering annual averages. In North America in 2016, 96,452 people were reported affected by **wildfires**, the second highest number since the 651,000 affected in 2007. No **drought** disaster was reported last year, and, for previous years, numbers of people reported affected were not available. In Central America, two million people were reported having been affected by droughts, a number higher than the 2006-2015 annual average (1.1 million) but still below the more than 2 million people affected by droughts in years 2009, 2011, 2014 and 2015. In the Caribbean, the 2016 drought in Haiti affected 3.6 million people, while in the same country, 1 million were affected by a long-lasting drought in 2014 and 2015. In South America, drought disasters affected 665,000 people in 2016, the fourth highest number since 2006, however, far below the 27 million affected in Brazil in 2014.

Very few people were reported having been affected by **geophysical** disasters in North America in 2016 (120), incomparable to those in South America (1.4 million). The phenomenon is the same when looking at the 2006-2015 annual averages, which are, respectively, 951 vs. 595,000 people affected (464,000 by earthquakes and 130,000 by volcanic activity). In comparison, in Central America between 2006 and 2015, an annual average of 173,000 people were affected by **earthquakes** and 9,300 by **volcanic activity**. In the Caribbean, where geophysical disasters are infrequent, the Haiti earthquake in 2010 affected 3.7 million people.

In 2016, **hydrological** disasters affected 95,000 people in North America, the fourth highest since 2006, but still below the 11 million reported for one **flood** in the USA in 2008. In Central America, 500,000 people were affected by floods in 2016, similar to the 567,000 annual average. In the Caribbean, floods affected almost 2 million people in 2016, with almost 1.8 million by one flood in the Dominican Republic. Such numbers are far from the almost 52,000 annual average for the years 2006-2015. In South American, 411,000 people were affected by floods last year, the lowest since 2006 and far below the 2.9 million annual average for years 2006-2015.

In 2016, the winter **storm** Jonas affected 85 million people, which is, by far, the highest number of people affected by one meteorological disaster in North America in decades. This far outweighs the 2006-2015 annual average of 300,000 people affected. In Central America, 105,000 people reported affected by storms in 2016 is the third lowest since 2006, far below the 360,000 average of people from the previous decade. In the Caribbean, in 2016, Hurricane Matthew accounted for 2.1 million people affected in Haiti, 190,000 in Cuba and 125,000 in Jamaica. This is far above the average of 237,000 people reported affected annually for years 2006-2015. In South America, there were no meteorological disasters reported in 2016, while the 2006-2015 annual average is 18,600 people affected by storms and 154,000 affected by **extreme temperatures**. In comparison, the annual average in Central America for the years 2006-2015 is just 14,000 people affected by extreme temperatures.

Figure 14 - Costs from damages reported (US$ bn) by disaster type. Mean 2006-2015 vs 2016



X: N <0.1;na: not available; nr: no disaster reported

Regarding disasters with reported costs from economic damages, North America is very different from the three other American regions. In North America, for the years 2006-2015, damages were reported for 71 % of all disasters and for 93 % in 2016. Inversely, Central America, the Caribbean and South America, each, reported damages for just 24 % of their 2006-2015 disasters; a proportion which remains stable in 2016 in Central America and in the Caribbean but has improved to 35 % in South America. Therefore, the 2006-2015 annual averages are fit for analysis in North America but not for the three other regions.

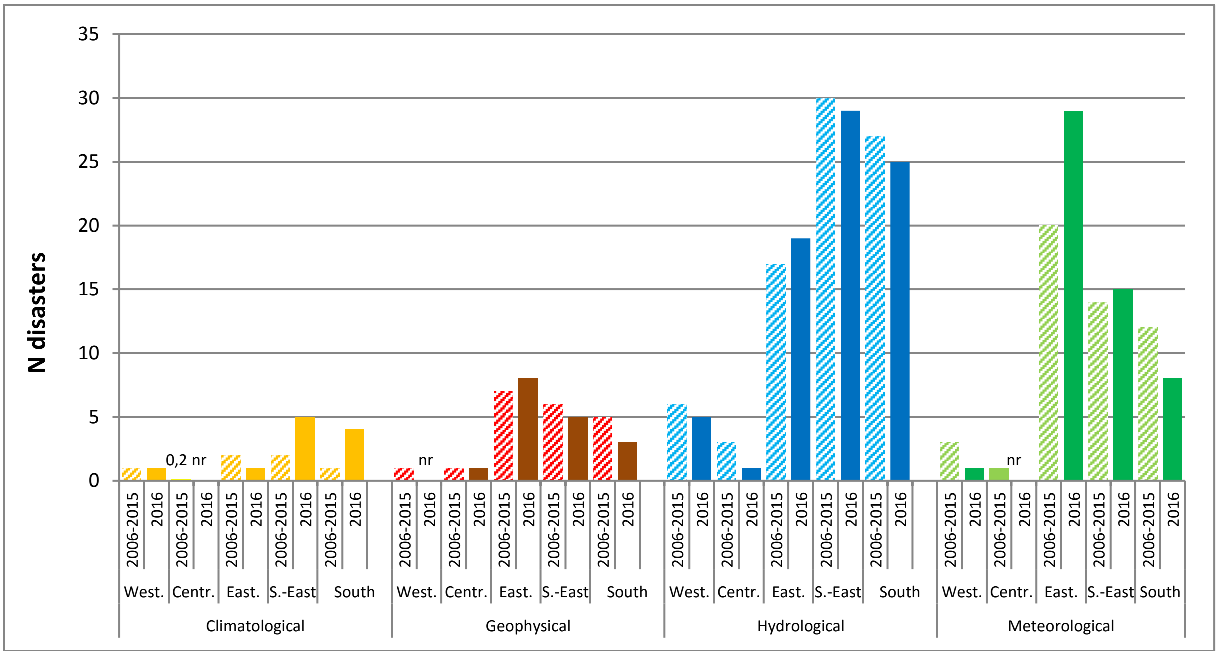
In North America, in 2016, **wildfires** caused damages of 5.5 billion US$, the highest amount since 2006, to be compared to a 2006-2015 annual average of 1.25 billion US$. No **droughts** were reported in 2016, yet the 2006-2015 annual average of 3.35 billion US$ is strongly influenced by the South- and Mid-Western drought which, in 2012, cost 20.7 billion US$. In South America, one drought in Bolivia cost 450 million US$ in 2016, while one drought in Brazil in 2014 cost 5 billion US$ and another in the same country, in 2013-2014, almost 1.5 billion US$. In Central America, the costs of two droughts, in El Salvador and Guatemala, could be estimated at 50 and 33 million US$, respectively, while a drought in Panama, in 2013, cost 200 million US$. In the Caribbean, Haiti suffered a 84 million US$ drought in 2016, contrastingly in 2014-2015, another drought cost a total of 1 billion US$.

In 2016, an **earthquake** cost 10 million US$ in North America, while another in 2014, resulted in damages of 700 million US$. No geophysical disaster occurred in Central America or in the Caribbean in 2016. The costliest earthquakes occurred in 2010 in Mexico and Haiti and cost 1.15 and 8 billion US$, respectively. Damages from volcanic activities in these two regions for the years 2006-2015 are not available. In South America in 2016, an earthquake in Ecuador cost 2 billion US$, while in 2010, another earthquake resulted in damages of 30 billion US$ in Chile in 2010. The highest amount of damages from volcanic activity (600 million US$) occurred in Chile in 2015. In North America, damages from **floods** (almost 15.5 billion US$) were the costliest in 2016, far above the 3.6 billion US$ 2006-2015 annual average. In 2016, one flash flood cost 25 million US$ in Mexico, while, in the same country, in 2007, another flood resulted in damages of 3 billion US$. In the Caribbean, no hydrological disasters were reported in 2016, while the costliest disaster in the previous decade cost 108 million US$ and occurred in Saint Vincent and the Grenadines in 2013. Last year, in Argentina, a flood resulted in 1.34 billion US$ in damages, still below the 2006-2015 average of 1.43 billion US$. In 2015, in Chile, one flood cost 1.5 billion US$, while in 2011, two floods in Colombia and one in Brazil cost, respectively, 1.3, 1.29 and 1 billion US$.

In 2016, **meteorological** disasters cost almost 27.1 billion US$ in North America, the fourth highest since 2006, yet still similar to the 25.7 billion US$ 2006-2015 annual average. Last year, Hurricane Matthew cost 10 billion US$ and nine other **storms** out of 13 made damages between 1 to almost 4 billion US$. In 2012, damages from Hurricane Sandy cost 50 billion US$ and, in 2008, those from Hurricane Ike cost 30 billion US$. In Central America, one storm resulted in 50 million US$ in damages in Mexico in 2016. Yet, in the same country, between 2010 and 2014, five hurricanes resulted in damage costs ranging from 1.5 to 4.2 billion US$. In the Caribbean, in 2006, hurricane Matthew resulted in damages of 2.6 billion US$ in Cuba, 2 billion US$ in Haiti and 600 million US$ in the Bahamas. Furthermore, in 2008 in Cuba, Hurricane Gustave and Ike resulted in 2.1 and 1.5 billion US$ damages, respectively. In South America, no meteorological disasters were reported in 2016. In the years 2006-2015, the most severe storm cost 90 million US$ in Brazil in 2013, and the same year, in Chile, extreme winter conditions cost 1 billion US$ in damages.

4.3. Asia

Figure 15 - Disaster occurrence by type. Mean 2006-2015 vs 2016



nr: no disaster reported

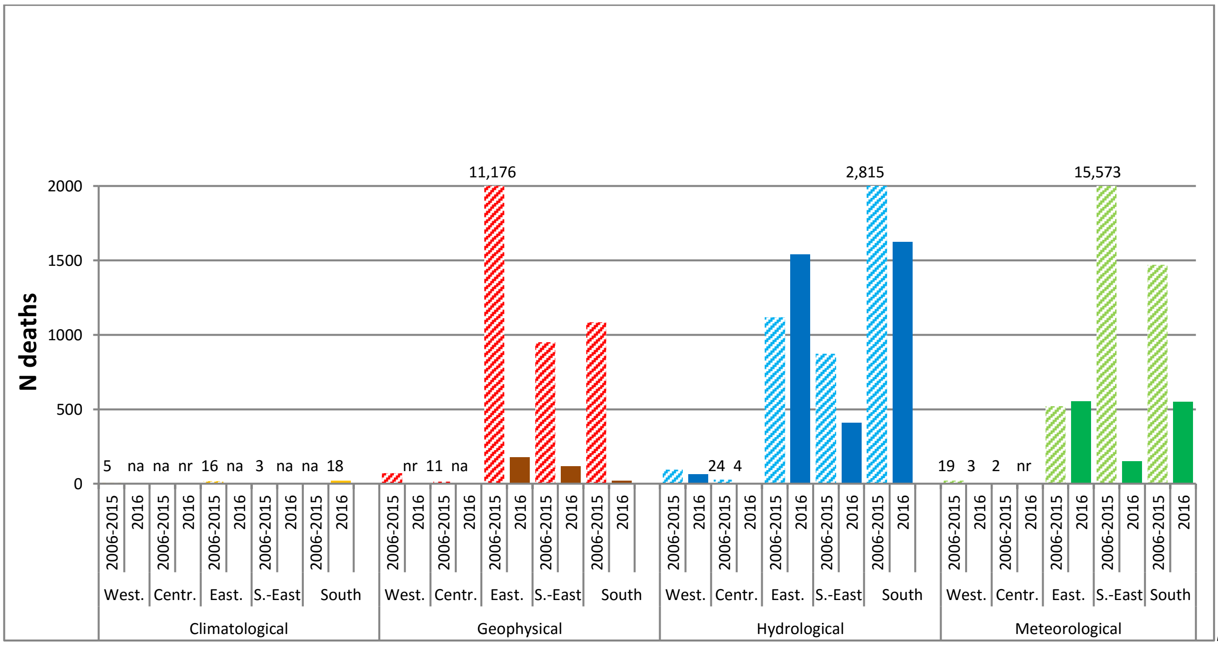
With the exception of Central Asia, all Asian regions had a 2006-2015 annual average of **climatological** disasters of 1 or 2. In 2016, **droughts** remained close to the annual average in Central and East Asia, while doubling, at least, in South-East and South Asia. In this last region, two **wildfires** were reported for the first time since 2006. This kind of disaster was very rarely reported in Asia in the last decade, with the exception of the Western region where one occurred in 2016.

In all the Asian regions, the numbers of **geophysical** disasters, mainly **earthquakes**, remained close to their 2006-2015 annual average, with the exception of South Asia where it was the fourth lowest since 2006. No disasters from volcanic activity were reported in 2016.

Hydrological disasters are the most frequently reported disasters in all Asian regions, with the exception of East Asia where meteorological disasters are more frequent. In all regions, numbers of hydrological disasters remained close to their 2006-2015 annual average.

In West and Central Asia, the numbers of **storms** and **extreme temperature episodes** decreased slightly, compared to their 2006-2015 annual average. In South Asia, in 2016, while the number of storms remained near its annual average, the number of extreme temperature episodes (1) was below its 2006-2015 annual average (4), which explains the overall decrease. In South-East Asia, in 2016, the number of storms was equal to its annual average, while an extreme temperature episode was reported for the first time since 2006. In East Asia, the number of storms was, in 2016, 20% above its annual average, while the number of extreme temperature episodes was the highest since 2006 at 3.5 times higher than the annual average.

Figure 16 – Number of deaths by disaster type. Mean 2006-2015 vs 2016



na: not available; nr: no disaster reported

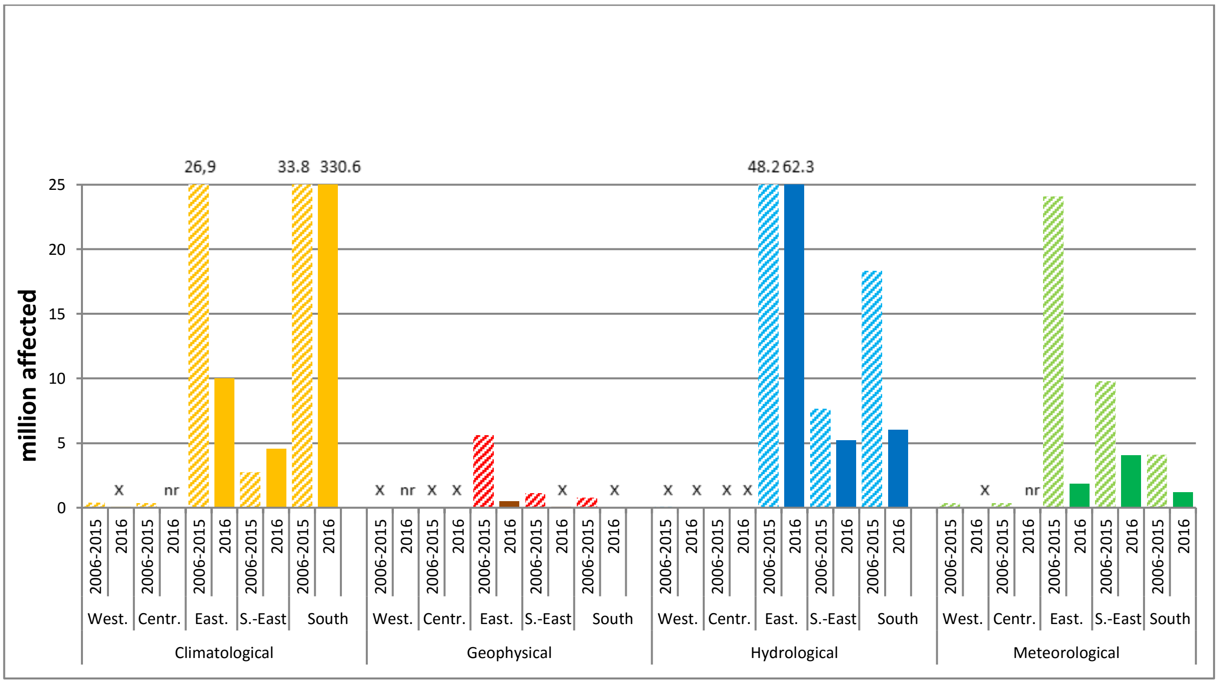
Number of deaths from **climatological** disasters are very low or unreported in all Asian regions. This partially reflects the difficulties in evaluating deaths from such disasters. For West and Central Asia, the number of deaths from geophysical, hydrological and meteorological disasters are also small. Looking at the data, compared to the three other regions, these two had lower levels of death from disasters; the deadliest in West Asia was an **earthquake** in Turkey in 2011 with 604 deaths and in Central Asia, an earthquake with 74 deaths.

In East, South-East and South Asia, in 2016, the number of deaths from **geophysical** disasters was very low, compared to their 2005-2016 annual averages. Each region was strongly influenced by the impact of earthquakes in China in 2008 (87,476 deaths), in Indonesia in 2006 (7,778 deaths) and in Nepal in 2015 (8,831 deaths).

In East Asia, the number of deaths by **floods** (1,417) was the third highest since 2006, high above the annual average (806). The number of deaths by **landslides** (123) was the fourth highest but still below its annual average (309). In South-East and South Asia, the number of deaths from floods (290 and 1,604, respectively) were far below their annual average (667 and 2,603, respectively) as well as deaths from landslides: 119 and 20, respectively, to be compared to annual averages of 204 and 211, respectively.

In East Asia, the number of deaths from **extreme temperature episodes** (107) and from **storms** (446), were near their 2006-2015 averages 93 and 427, respectively. In South-East Asia, extreme temperature deaths (14) were above their 2006-2015 average (6) while those from storms (137) were far from the 15,567 annual average which is strongly biased by the impact of Cyclone Nargis, which killed 138,366 people in Myanmar in 2008. In South Asia, deaths from extreme temperature (300) and from storms (249) were far below their 2006-2015 annual averages (770 and 700, respectively). This is incomparable to the high number of deaths reported for one heat wave in 2015 in India (2,248) and for Cyclone Sidr in Bangladesh in 2007 (4,234).

Figure 17 - Number of people reported affected (m) by disaster type. Mean 2006-2015 vs 2016



X: N <100,000 ;nr: no disaster reported

In West and Central Asia, as for number of deaths, the low number of disasters translates to low numbers of people reported affected, on average. However, a **drought** in Syria from 2008 to 2010 affected, annually, 1.3 million people and another, in Tajikistan in 2009, 2 million. In 2016 in Israel, one **wildfire** affected more than 60,000 people. In East Asia, between 2006 and 2015, nine droughts occurred in China, of which four affected between 18 and 60 million people. Also in China in 2016, another wildfire affected 10 million people. In South-East Asia, with more than 4.5 million people affected by droughts, 2016 was the fourth worst year since 2006. In South Asia, a drought that began in 2015 and lasted until 2017 was the worst since 150 years, affecting 330 million people, annually.

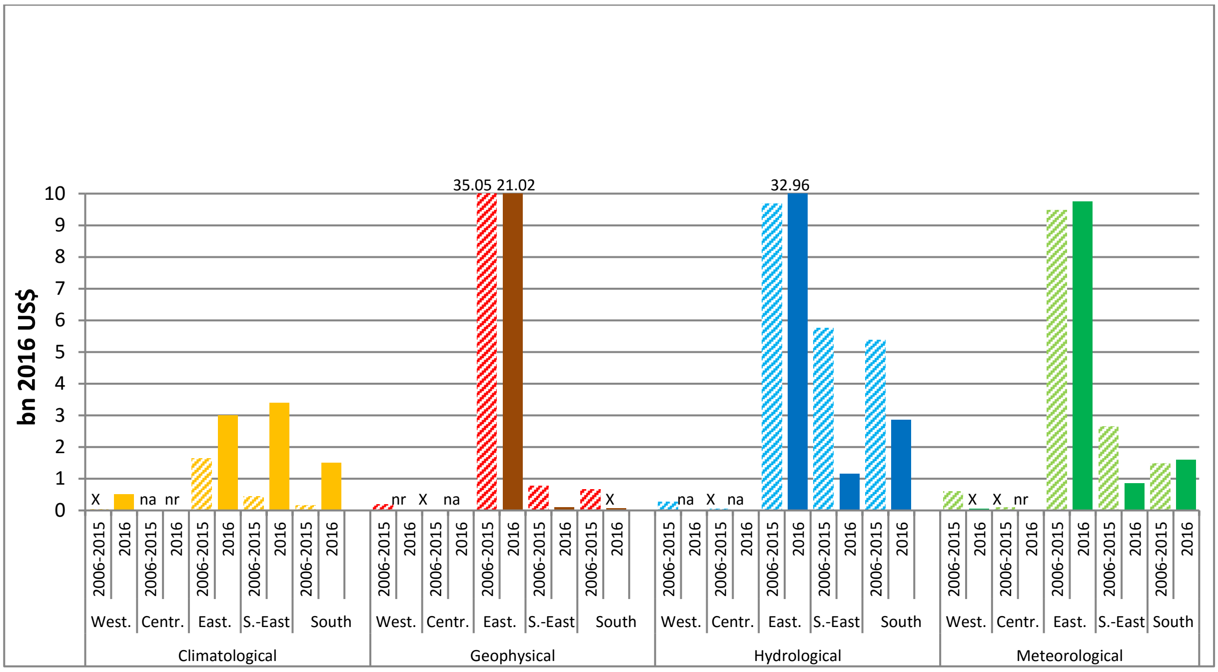
In West and Central Asia, the average numbers of people affected by **geophysical disasters** for the years 2006-2015 is low (7,691 and 7,389 people, respectively) compared to the 2006-2015 annual averages of 5.5 million in East Asia, 1.1 million in South-East Asia and almost 800,000 in South Asia. In these three Asian regions, in 2016, **earthquakes** affected 500,000 (East), 91,000 (South-East) and 11,000 (South) people. This is far below earthquakes that affected 46 million people in China in 2008, 3.2 million in the Philippines in 2006 and 5.6 million in Nepal in 2015.

The numbers of people affected by **hydrological disasters** in West and Central Asia (31,000 and 12,750 in 2016 compared to annual averages of 56,000 and 16,750, respectively) are small in comparison to those reported affected from the three other Asian regions where, each year, millions of people are affected by **floods**. In East Asia, one flood in China affected 60 million people, a number above the 2006-2015 annual average but lower than the over 100 million reported affected for two floods in 2007 and 2010. In South-East Asia, the number of people affected by floods in 2016 did not reach the annual average, far from the 9 and 9.5 million affected by two floods in Thailand in 2010 and 2011, respectively. In South Asia, the number of people affected by floods (6 million) is the second lowest since 2006, equivalent to one-third of the annual average. The 2 million people affected by one flood in India in 2016 is still far below the 20 million people affected by a single flood in Pakistan in 2010, the 30 million people affected in India in 2007 by two floods, or the 14 million affected by a flood in Bangladesh, also in 2007.

In West and Central Asia, **meteorological disasters** are less frequent than in the three other Asian regions, and their numbers of people affected much lower. Annual averages for **storms** is 330,000 people in West Asia and 1,000 in Central Asia, while inversely, there is an annual average of 2,500 affected for **extreme temperature episodes** in West Asia and a 200,000 annual average in Central Asia. However, a storm affected 2 million people in Israel (West Asia) in 2013, and severe winter conditions affected another 2 million in Tajikistan (Central Asia) in 2008. In East Asia, the number of people affected by storms (720,000) was the lowest since 2006, far below its 2006-2015 annual average of 15 million, as well as the 29 million who suffered from Cyclone Bilis in China in 2006.

Inversely, the number of people affected by extreme temperatures (1.1 million) was the third highest since 2006, but far below the 8.4 million annual average, which is strongly influenced by the 77 million affected by severe winter conditions in China in 2008. In South-East Asia in 2016, the number of people affected by storm disasters (4 million) was the fourth lowest since 2006, far below the 9.7 million 2006-2015 annual average. The cyclone Nina affected almost 1.9 million people in the Philippines far below the more than 16 million affected by the cyclone Haiyan in the same country in 2013. In South Asia, 1.2 million people were reported affected by storms in 2016, far below the 4 million annual average or 13 million affected by Cyclone Pailin in India in 2013.

Figure 18 – Costs of Damages reported (US$ bn) by disaster type. Mean 2006-2015 vs 2016.



X: N <0,1; na: not available; nr: no disaster reported

The proportion of reported damages varies strongly by region, disaster type, and time. In 2016, the proportion of disasters with reported damages is higher than for the period 2006-2015. This trend suggest an improvement over time in reporting, however the differences *between* regions are still significant. In 2016, damages were reported for 70% of disasters in East Asia (2006-2015: 60%); 50% in South-East Asia (2006-2015: 42%); 33 % in South Asia (2006-2015: 20%) and 29% in West Asia (2006-2015: 18%), while no damages were reported for two disasters which occurred in Central Asia in 2016 (2006-2015: 28%).

In 2016, the four regions suffered from **climatological** disasters resulting in reported damages above their 2006-2015 annual average. This trend may be due to better reporting, but also to the fact that damages reported in previous years were the first, second or third highest since 2006.
In East Asia in 2016, an **earthquake** in Japan resulted in 20 billion US$ in total costs, which accounted for almost all costs from geophysical disasters (21 billion US$) that year. This amount is the third highest since 2006, but remains below the 2006-2015 average which is strongly influenced by the tsunami in Japan in 2011 (222 billion US$). In South-East Asia, an earthquake in Indonesia cost 100 million US$, below the 2006-2015 average (768 million US$). Even more costly were two earthquakes in the same country in 2006 and 2009 which cost, respectively, 3.1 and 2.2 billion US$. In South Asia, an earthquake in India cost 75 million US$ in 2016, compared to the Gorka earthquake which caused 5.2 billion US$ in damages in Nepal in 2015.

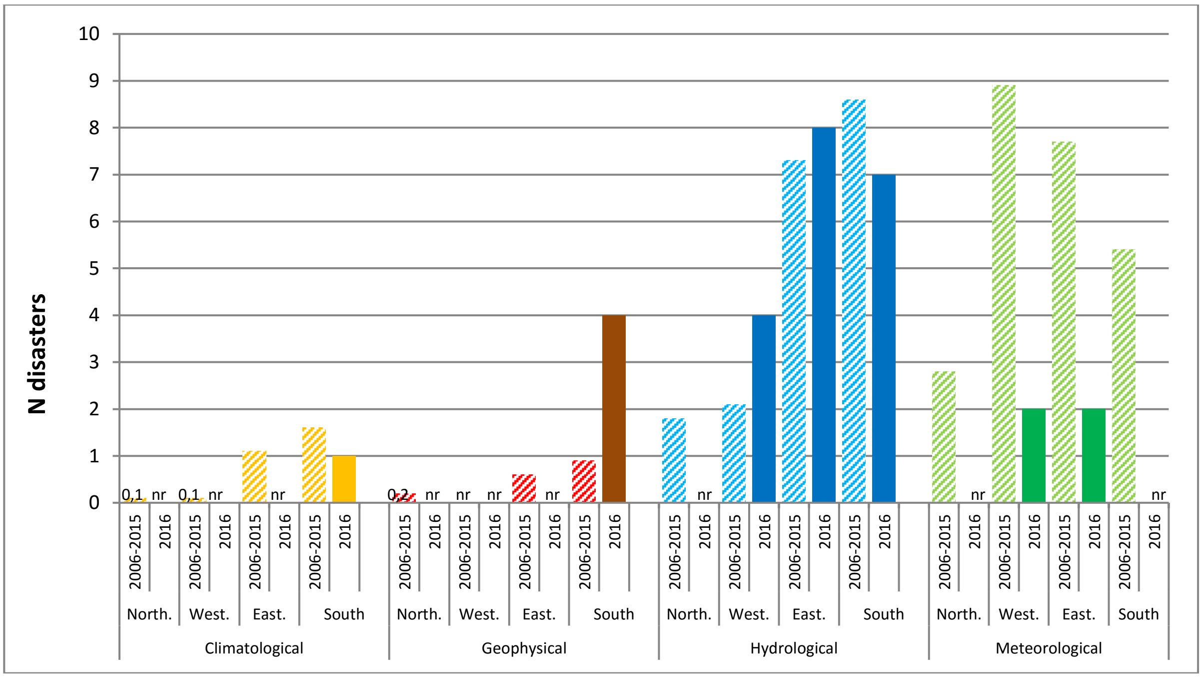
In 2016, damages from **hydrological** disasters in West and Central Asia were not reported. However, their 2006-2015 annual averages were lower (48 and 278 million, respectively) compared to the three other regions. In East Asia, **floods** resulted in almost 33 billion US$ in damages in 2016, the highest since 2006, with 10 floods in China: the costliest in 2006 (22 billion US$), two with damages of 3 and 4.5 billion US$, and seven with damages from 100 to 675 million US$. In South-East Asia, floods cost 1.13 billion US$ in 2016, an amount less than the 5.8 billion

US$ annual average. Last year, in the region, the costliest flood occurred in Vietnam with damages of 500 million US$, still lower than the 40 billion US$ in damages from a flood in Thailand in 2011. In South Asia, damages from floods accounted for 2.86 billion US$, far below the annual average of 5.4 billion US$. A flood costing 1.2 billion US$ occurred in Sri Lanka, making it the eleventh most costliest flood for this region, but not surpassing a flood costing 16 billion US$ damages in India in 2014.

In West Asia, a 2016 **storm** cost 50 million US$ in damages in Saudi Arabia, far below those reported in Oman in 2007 and 2010, where Cyclones Gonu and Phet cost 3.9 and 1 billion US$, respectively. In Central Asia, the only known cost from a meteorological disaster (932 million US$) was reported for severe winter conditions in Tajikistan in 2008. In East Asia in 2016, damages from **extreme temperatures** (1.7 billion US$) and from storms (8 billion US$) were the second and fifth highest since 2006. However, they remained relatively close to their 2006-2015 annual averages (2.4 and 7.1 billion US$, respectively). The costliest extreme temperature disaster in 2016 was a cold wave in China, with damages of 1.6 billion US$, still incomparable to the 23.4 billion US$ in damages from severe winter conditions, also in China, in 2008. The costliest storm in 2016 was Typhoon Ferdie (Meranti) which cost 2.3 billion US$ in China. The costliest storm since 2006 was Cyclone Fitow which cost China 6.8 billion US$ in damages in 2013. In South-East Asia, storms cost almost 900 million US$, the fourth lowest since 2006 and representing one third of the 2.7 billion annual average. Cyclone Aere cost 350 million in damages in Vietnam, far below the 10 billion US$ damages from Cyclone Haiyan in the Philippines in 2013. In South Asia, the 1.6 billion US$ in damages reported in 2016 was the third highest since 2006, but remained close to the annual average (1.5 billion US$). However, damages from Cyclone Vardah in India (1 billion US$) are still below those from Cyclone Hudhud, also in India, in 2014.

4.4. Europe

Figure 19 - Disaster occurrence by type. Mean 2006-2015 vs 2016



nr: no disaster reported

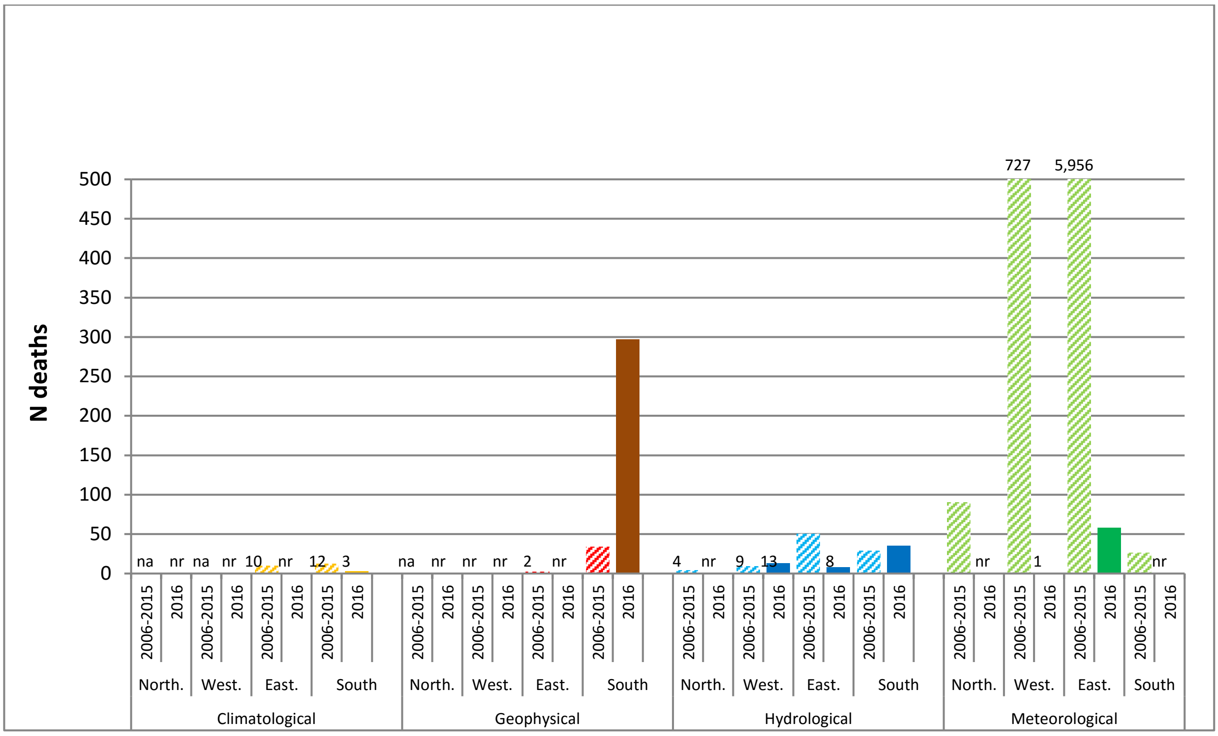
Climatological disasters occur infrequently in most European countries and in 2016, only one wildfire in Portugal was reported. In the years 2006-2015, two climatological disasters were reported in Northern and Western Europe: one calamitous drought in Lithuania in 2006 and a disastrous wildfire in France in 2009. Climatological disasters were more frequently reported in Eastern and Southern Europe during the last decade. In Eastern Europe, five droughts occurred in the Russian Federation or neighboring countries, in 2007, 2010 and 2012, while four wild fires were reported in the Russian federation in 2010, 2012 and 2015 and two in Bulgaria in 2007. In Southern Europe, only one drought was reported in Italy in 2012, while 15 wildfires were reported during the years 2006 to 2015, eight occurring in 2007 and four in 2009.

Geophysical disasters are also infrequent in Europe. The region most frequently hit is Southern Europe where nine earthquakes were reported during the years 2006-2015 (two in Italy, two in Greece, one in Albania, one in Serbia and one in Spain), and four in 2016 alone (three in Italy and one in Macedonia). No geophysical disasters occurred in the three other European regions in 2016. However, during the years 2006-2015, six were reported for Eastern Europe (three in the Russian Federation, two in Bulgaria and one in Hungary), two in Northern Europe (one earthquake in the UK and one volcanic event on an island), but none in Western Europe.

In 2016, **floods** were the most reported disaster in Europe with some significant differences between regions. The number of floods in Northern and Western Europe have a similar 2006-2015 annual average (1.8 and 2.1, respectively). However, in 2016, four calamitous floods occurred in Western Europe while none occurred in Northern Europe. In Eastern and Southern Europe, floods are much more common, their annual averages similar (7.3 and 8.6, respectively), as well as the number of floods suffered in 2016 (8 and 7, respectively). However, these numbers are low compared to the 19 reported in Eastern Europe in 2006 and the 16 that occurred in 2010 and 2014 in Southern Europe.

Since 2006, **meteorological** disasters were the most frequently reported in Europe, yet compared to hydrological disasters, have a different distribution between regions. In Northern Europe, meteorological disasters are slightly more frequent than hydrological ones. In Western Europe, the annual average of meteorological disasters is more than four times that of hydrological disasters. In Eastern Europe, the two averages are comparable, while in Southern Europe, meteorological disasters appear less frequent than hydrological ones. Neither Northern nor Southern Europe experienced meteorological disasters in 2016, while Western and Eastern Europe suffered two disasters, each. However, these very different in type, with storms in Western Europe but extreme temperatures in Eastern Europe. When examining this further, the annual averages for storms are similar in Northern (1.8), Eastern (1.9) and Southern Europe (1.8), but are three times higher in Western Europe (6.1). Extreme temperature episodes have a different distribution, with an annual average of one in Northern Europe, 2.8 in Western Europe, 3.6 in Southern Europe and 5.8 in Eastern Europe. Heat waves accounted for 10% of all extreme temperature episodes in Northern and Eastern Europe, while accounting for 25% in Western and Southern Europe. The largest numbers of heat waves were reported in 2006 in Western Europe and in 2007 in Eastern and Southern Europe, while cold waves or extreme winter conditions affected 39 European countries in 2012.

Figure 20 – Europe: Number of deaths by disaster type. Mean 2006-2015 vs 2016

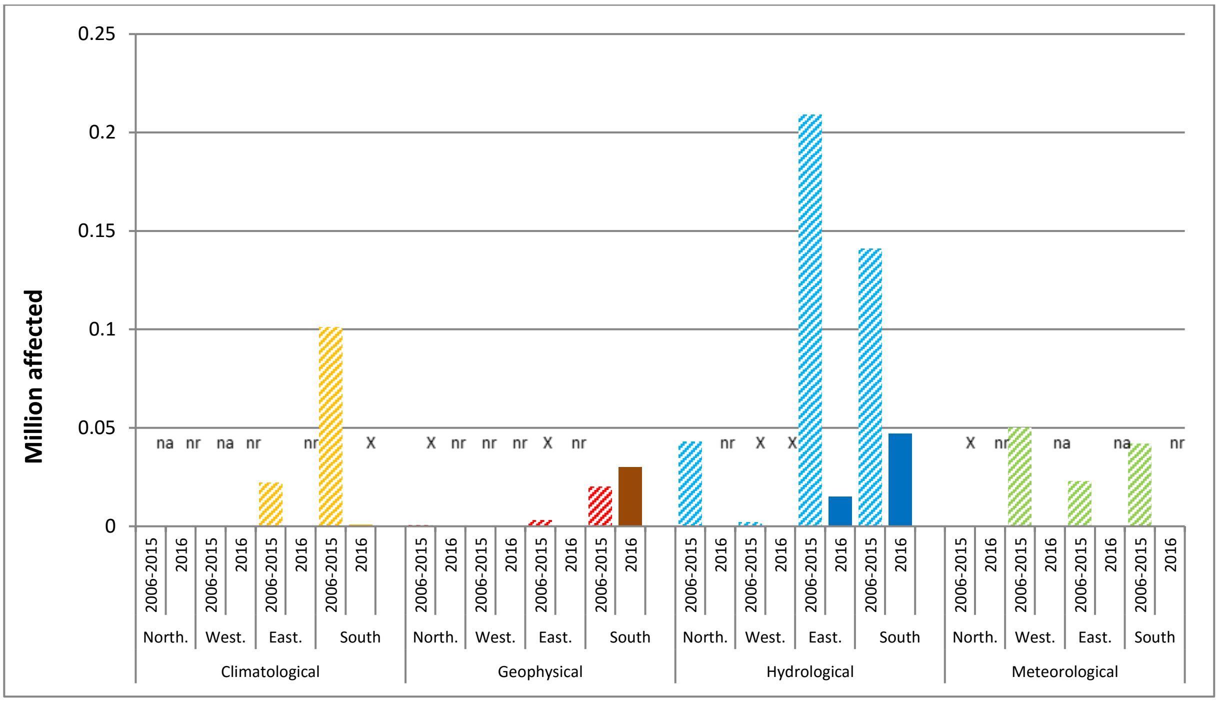


na: not available; nr: no disaster reported

High annual numbers of deaths are strongly associated with just a few deadly disasters. A **heat wave** killing 760 people in the United Kingdom in 2013, accounts for 86 % of the total number of deaths reported for Northern Europe for the years 2006 to 2015. The annual average of 727 deaths from **meteorological** disasters in Western Europe is explained by two heat waves in 2006 and 2015 which resulted in 3,340 and 3,685 deaths, respectively. The annual 5,956 deaths, on average, in Eastern Europe, follows the 55,736 people killed by a heat wave in the Russian Federation in 2010.

For **geophysical** disasters, the annual average of 34 deaths in Southern Europe comes from the L'Aquila earthquake, in Italy, in 2009 in which 295 people died. A similar number, 297 people, was reported in 2016 for the Amatrice earthquake, in the same region of Italy.

Figure 21 - Number of people reported affected (m) by disaster type. Mean 2006-2015 vs 2016



X:< 0,005; na: not available; nr: no disaster reported

Disasters affecting at least one million people are infrequent in Europe. Between 2006 and 2015, only three such large disasters occurred: one wild fire in Macedonia in 2007, one flood in the Czech Republic in 2013, and another flood in Bosnia-Herzegovina in 2014. Only six disasters affected more than 100,000 people.

Climatological disasters were rare in Northern and Western Europe and data on the numbers of people affected were not reported. In Eastern Europe, the annual average is strongly biased by the more than 200,000 people affected by a **drought** in Moldova in 2007. Otherwise, in this region, severe climatological disasters affected between 6,000-7,000 people, most often. In Southern Europe, the 1 million people affected by a **wildfire** in Macedonia in 2007 is much higher compared to the 1,161 who suffered from a wildfire in Portugal in 2016.

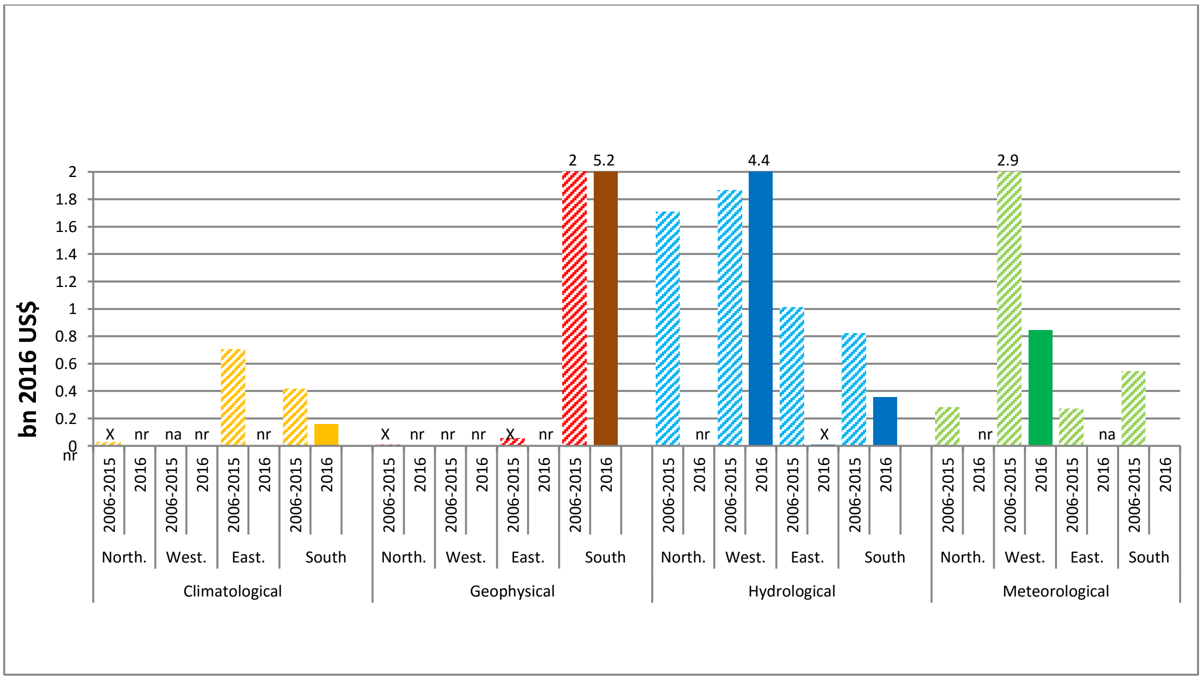
During the years 2006-2015, the number of people affected by **geophysical** disasters in Eastern Europe appears low, with 2,732 affected, on average. However, three **earthquakes** affected 12,567 (2006), 7,512 (2007) and 5,235 (2008) people in the Russian Federation alone. In Northern Europe, the only earthquake reported for years 2006 to 2015 affected 4,501 people in the UK in 2007. Comparatively, in Southern Europe, the 20,461 people affected, on average annually, is related to one earthquake in Greece which affected 75,000 people in 2014. A second earthquake affected 56,000 people in 2009 in Italy, and a third affected 27,000 in Serbia in 2010, while three of the remaining six earthquakes affected more than 10,000 people, each. In 2016, the Umbria earthquake in Italy affected more than 22,000 people, and the Amatrice earthquake, also in Italy, affected 4,854 people.

In Northern Europe, the 43,153 people affected, on average, by **floods** from the years 2006-2015 are mostly related to two floods in the UK that affected 340,000 and 48,000 people in 2007 and 2015, respectively. In Western Europe, the flood that affected the largest number of people

(6,350) occurred in Germany in 2013, while in 2016, a total of only 24 people were reported affected by floods occurring in France, Germany, Austria and Belgium. In Eastern Europe, the 2006-2015 annual average of 210,000 people affected by floods must be considered in relation to: 1.4 million people affected in the Czech Republic in 2013; and the more than 200,000 people affected in 2008 and 2010 in Ukraine and Poland. In 2016, the 14,481 people affected by floods in this region was the third lowest since 2006, with a flood in the Russian Federation accounting for 8,196 of these people. In Southern Europe, the annual average of more than 140,000 people affected by floods comes mostly from the one million people affected by a flood in Bosnia-Herzegovina in 2014, and the 100,000 affected by another flood in Macedonia in 2015. In 2016, the number of 47,253 people affected by floods in Southern Europe is the fourth highest since 2006, mostly related to a flash flood in Macedonia which affected 33,582 people.

In 2016, Northern and Southern Europe were not affected by **meteorological** disasters, while those affected in Western and Eastern Europe are not currently available. The 2006-2015 annual average of around 4,000 people affected by meteorological disasters in Northern Europe is mostly related to **storms** Ulla and Desmond which, in the UK in 2014 and 2015, affected 18,000 and 15,600 people, respectively. The 50,000 annual average of people affected by storms in Western Europe, is mostly accounted from the 500,000 affected by the extra-tropical storm Xynthia in France in 2010. Unlike Northern and Western Europe, people affected by meteorological disasters in Eastern and Southern Europe suffered mainly from **extreme temperatures,** not storms. In Eastern Europe, the 23,454 annual average is related primarily to a cold wave which struck six countries in 2012, totaling almost 105,000 people affected, with 87,500 of those from Ukraine; Severe winter conditions affected almost 60,000 people in Ukraine in 2006 and more than 10,000 and 30,000 in Belarus in 2013 and 2014, respectively. In Southern Europe, the 41,000 annual average comes mostly from the 340,000 people who suffered from severe winters conditions in six countries in 2012, with Albania accounting for 230,000 of these.

Figure 22 – Damages reported (US$ bn) by disaster type. Mean 2006-2015 vs 2016.



X: < 0,06; na: not available; nr: no disaster reported

The proportion of disasters with reported damages varies according to region, disaster type and time. Overall, for the period 2006-2015, the aggregated proportion of disasters with damages reported for the four regions is between 24 and 41 %. In 2016, it improves to 50 and 80% in Western and Southern Europe, respectively, but decreases to 10% in Eastern Europe. Moving forward, we examine the most damaging disasters shaping the annual average.

In Northern Europe, only one **drought** occurred in Lithuania in 2006, costing 268 million US$. In Western Europe, damages from a forest fire in France in 2009 remain unreported. In Eastern Europe, the 704 million US$ 2006-2015 annual average includes an average of 493 million US$ from droughts. This is reflected mostly by the costs of one drought in Ukraine in 2012 (1.75 billion$) and of two droughts in the Russian Federation in 2010 and 2012 (1.53 and 1.18 billion US$, respectively). The average of 211 million US$ for **wildfires**, is primarily based on one which occurred in the Russian Federation in 2010 (1.97 billion US$). In Southern Europe, one drought in Italy in 2012 cost 1.23 billion US$, while costs from wildfires are mainly derived from one occurring in Spain in 2006 (800 million US$) and another in Greece in 2007 (2.02 billion US$). In 2016, a wildfire in Portugal cost 157 million US$ in damages.

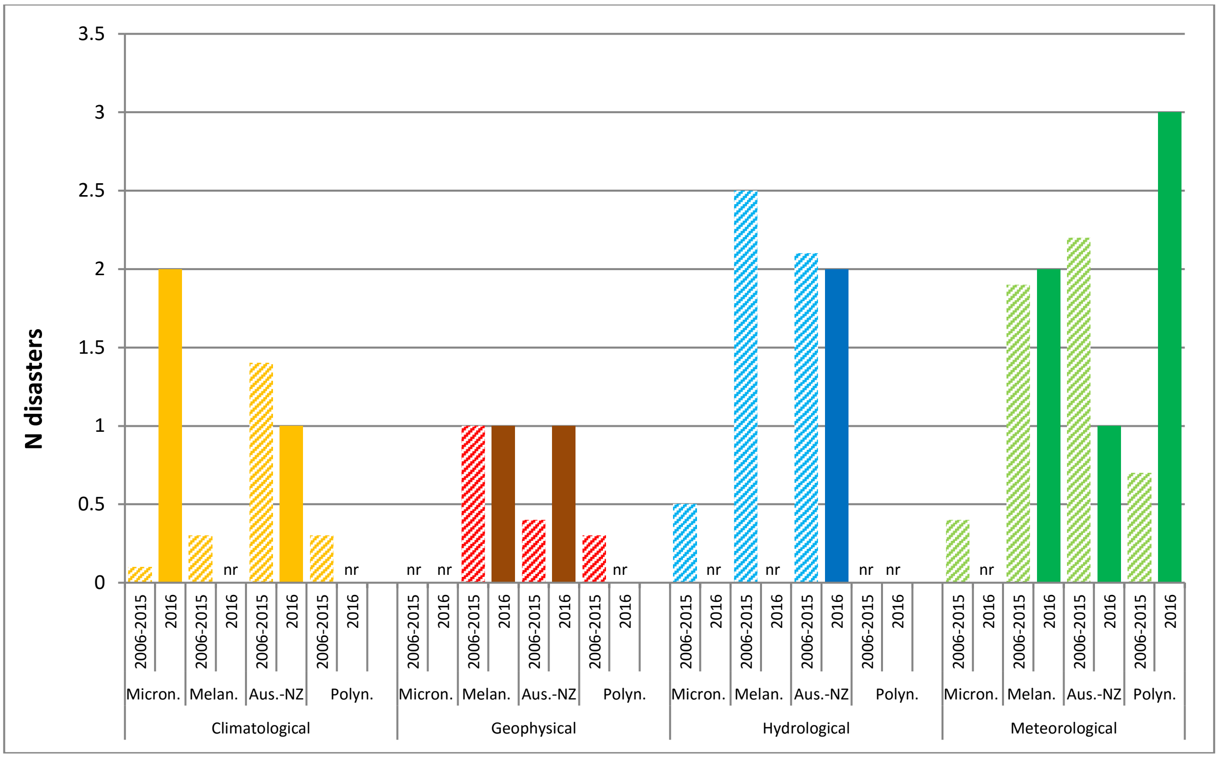
Damages from **earthquakes** were reported in two out of three cases. In Northern Europe, damages from the only earthquake reported since 2006 cost 70 million US$ in 2007. In Eastern Europe, damages were reported for two earthquakes in the Russian Federation in 2006 and 2007 with costs of 70 and 480 million US$, respectively. In Southern Europe, the 2006-2015 annual average (2 billion US$) can be mostly attributed to two earthquakes in Italy, which in 2009 and 2012 made 2.8 and 16.4 billion US$ damages, respectively.

In Northern Europe, five **floods** in the UK increased the annual average. Two floods in 2007 cost, both, 4.6 billion US$, while three in 2012, 2014 and 2015 made 4.7, 1.5 and 1.2 billion US$ in damages, respectively. In Western Europe, the 1.87 billion US$ annual average in costs comes mostly from four floods in France in 2010 (1.6 bn US$) and 2015 (0.9 bn US$), and in Germany (13.2 bn US$) and Austria (1 bn US$) in 2013. In 2016, one flood cost 2.4 billion US$ in Germany, meanwhile another cost 2 billion US$ in damages in France. In Eastern Europe the annual average of 1.01 billion US$ damages from floods is mostly attributed to four events: one in Ukraine in 2008 (1.1 billion US$), two in Poland and Romania in 2010 (3.4 and 1.2 billion US$, respectively) and one in the Russian Federation in 2013 (1 billion US$). In 2016, one flood cost 10 million US$ in the Russian Federation. In Southern Europe, the annual average of 823 million US$, is mainly due to two major floods in Portugal in 2010 and Serbia in 2014, costing 1.5 and 2.1 billion US$, respectively. However, it is also due to five floods in 2014: one in Bosnia-Herzegovina with 440 million US$ in damages and four in Italy, two costing around 300 million US$ each, and two 120 million US$ each.

In 2016, two floods in Italy and Serbia cost 100 million US$ each, one in Greece 56 million US$ and two flash floods In Macedonia and Spain 50 million US$, each. Between 2006 and 2015, **meteorological** disasters cost an annual average of 281 million US$ damages in Northern Europe. Most costs resulted from **storms** Kyrill and Desmond in 2007 and 2015, which cost 1.4 and 1.2 billion US$, respectively. In Western Europe, the storm Kyrill in Germany in 2007 cost 6.3 billion US$, Klaus and Xynthia in France in 2009 and 2010 cost 3.6 and 4.6 billion US$, respectively, and one convective storm in Germany in 2013 cost 4.9 billion US$ in damages. In 2016, one convective storm cost 844 million US$ in the Netherlands. In Eastern Europe, the 2006-2015 annual average includes damages from **extreme temperature episodes** and from storms. In Russia, one extreme winter episode cost 1.2 billion US$ in 2006, and one heat wave around 440 million US$ in 2010. Four storms strongly influenced the annual average for damages: 550 million US$ from a hail storm in Bulgaria in 2014, the 2007 extra-tropical storm Kyrill cost 170 million US$ damages in the Czech Republic, and 115 million US$ in Poland and Ukraine. In Southern Europe, also, meteorological disaster damages annual average combines extreme temperature episodes and storms. In Italy, a cold wave cost 140 million US$ in 2012, while storm Klaus cost 2.12 billion in damages in Spain in 2009, and two storms in Italy, in 2010 and 2015, caused 950 and 880 million US$ in damages, respectively.

4.5. Oceania

Figure 23 – Disaster occurrence by type. Mean 2006-2015 vs 2016



nr: no disaster reported

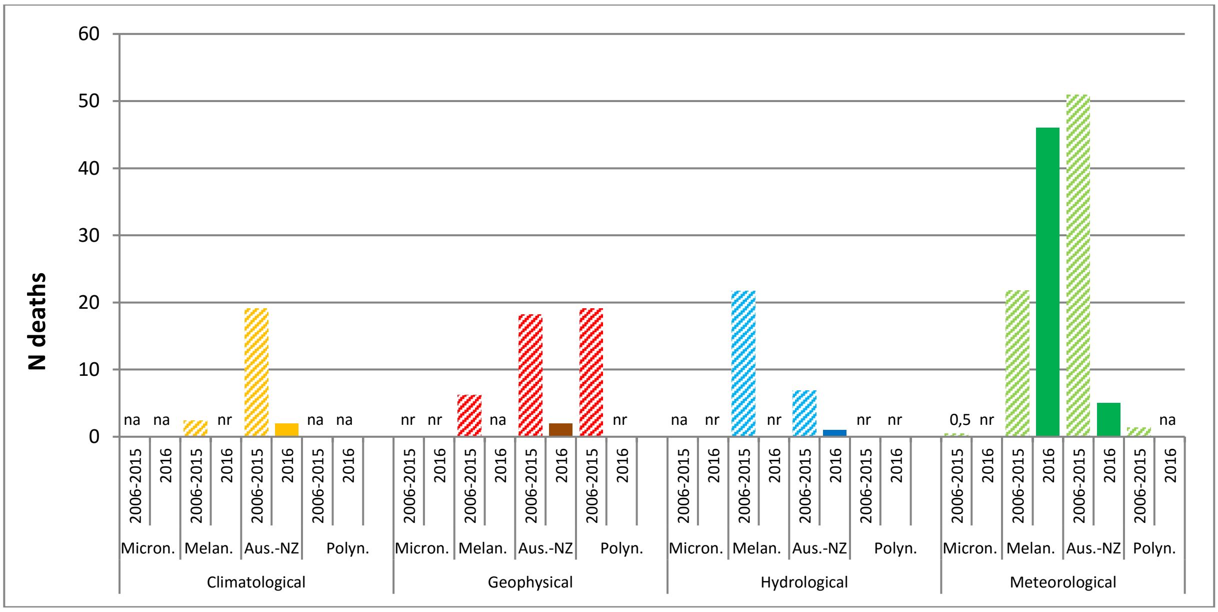
In Micronesia, the two **droughts** reported in 2016 were unusual as only one drought had been reported between 2006 and 2015. In Melanesia, three droughts were reported, all in 2015. In Australia and New Zealand, 1.4 climatological disasters occurred annually, on average. Unlike the three other regions, droughts were infrequent (2006-2015 annual average: 0.2) while **wildfires** were regularly reported (annual average: 1.2). Only one occurred in 2016, but four in 2006 and three in 2015. In Polynesia, droughts were also episodic: one was reported in 2011 and two in 2015. It should be noted that, in Oceania, only one drought was reported in 2006, for the five-year period 2006-2010. This is compared to one in 2011, two in 2013, five in 2015, and two in 2016- a total of 10 in the last six years. Although less obvious, a similar phenomenon can be observed for calamitous wild fires: four were reported for years 2006-2010, and nine for years 2011-2016.

In Micronesia, **geophysical disasters** are very rare: the only one listed in EM-DAT, an earthquake with an associated tsunami, occurred in 1993. In Melanesia, the annual average for **volcanic activity** is of 0.7 and for **earthquakes** is 0.3. Six disasters from volcanic activities are concentrated in the years 2006-2009. On the other hand, in the period 2006-2015, **earthquakes** happened regularly, every three years, with the last occurring in 2016. In Australia and New Zealand, four earthquakes occurred in 2010, two in 2011, one in 2013, and one again in 2016. In Polynesia, three earthquakes were reported in 2009, alone.

During the years 2006-2015, five **floods** were reported in Micronesia, with three in 2008 and two in 2014. On the other hand, floods were much more frequent in Melanesia, having an annual average of two, which was exceeded in 2006 and 2009 with three occurrences, and in 2012 with four. However, none occurred in 2016. Melanesia is also the only region of Oceania where **landslides** were occasionally reported (annual average: 0,4). Similar to Melanesia, disasters from floods were regularly reported in Australia and New Zealand (annual average: 2.1). This average was exceeded in 2008 (4 floods), 2010 (5 floods), and 2015 (3 floods). Two floods occurred in 2016, similar to the average. No floods have occurred in Polynesia since 2006.

Four calamitous **storms** were reported in Micronesia between 2006 and 2015, while three occurred in 2015 and none in 2016. Such disasters occur regularly in Melanesia (annual average: 1.9), with one or two being reported each year, though three occurred in 2007, and four in 2011 and 2015, each. The two storms occurring in 2016 follow the average. In Australia-New Zealand, the annual average (2) and the distribution of storms over time is similar to the Melanesian one. Three storms occurred in this region in 2006 and 2010, and four in 2015. With only one storm reported in 2016, Australia-New Zealand had a “quiet” year. In Polynesia, the annual average of storms is 0.7, although these are concentrated between the years 2010-2015. Finally, with three storms reported in 2016, Polynesia experienced a rough year.

Figure 24 – Number of deaths by disaster type. Mean 2006-2015 vs 2016

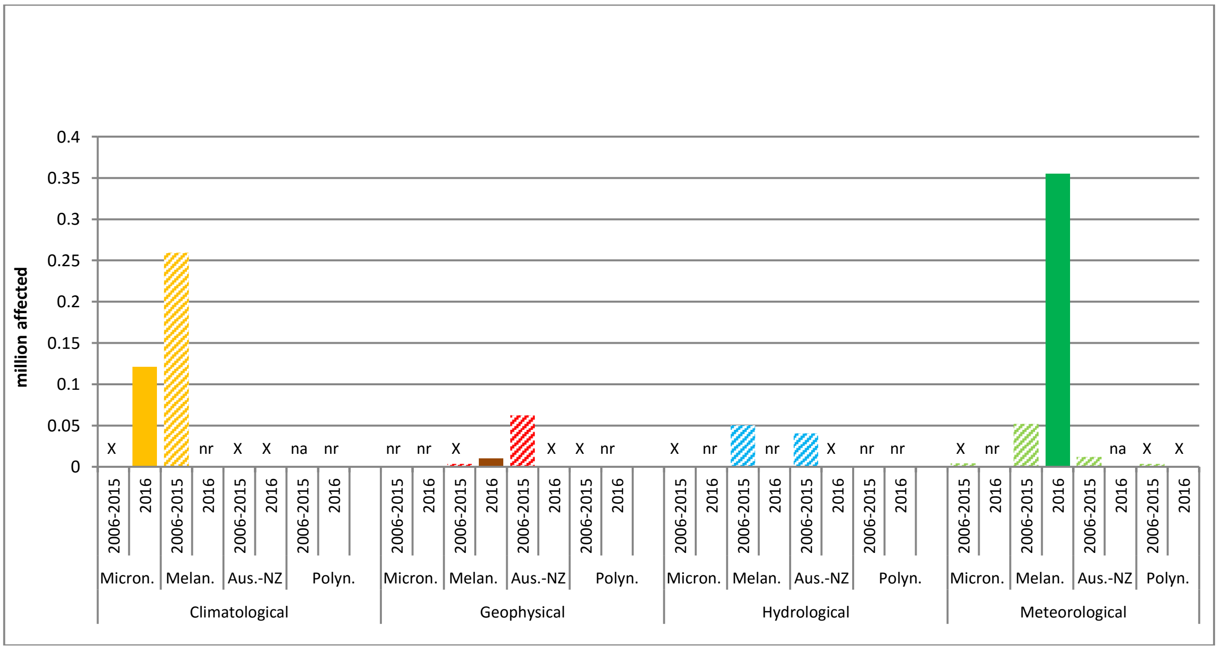


na: *not available; nr: no disaster reported*

Most of the time, the number of deaths from natural disasters is low in Oceania, and sometimes remains unreported. Among **climatological disasters**, 24 deaths from a **drought** were reported in 2015 in Melanesia. In Australia-New Zealand, the number of deaths reported is available for five out of six **wildfires**. Often, the number of deaths for these events was less than five, but in 2009 a wildfire killed 180 people in Australia, thus explaining the high annual average. In 2016, two people died of a fire. No deaths were reported from two droughts in 2006 in Australia, nor in 2013 in New Zealand. In Melanesia, no deaths were reported for an **earthquake** occurring in 2016. Furthermore, the number of deaths was rarely reported between the years 2006-2015 and data are only available for two **tsunamis**, the most severe killing 52 people on the Solomon Islands in 2007. In Australia and New Zealand, four earthquakes occurred between 2006 and 2015, yet the number of deaths is only available for one which hit Christchurch in New Zealand in 2011, killing 182 people. In Polynesia, the tsunami waves that struck Samoa, American Samoa and Tonga in 2009 killed respectively, 148, 34, and 9 people.

In Melanesia, the number of deaths from **floods** is low, rarely exceeding a few dozen, like on the Solomon Islands in 2009 (21 deaths) and in 2014 (47 deaths). In this region, **landslides** in Papua New Guinea killed 15 people in 2015, 19 in 2009 and 60 in 2012. In Australia-New Zealand, deaths from floods never exceeded ten, except once in Australia in 2010 when 35 people died.
In the Federated State of Micronesia, **Typhoon** Maysak killed five people in 2015, which is the only data available for this region. In Melanesia, deaths from tropical cyclones rarely exceed a dozen, with the exception of Cyclone Guba that killed 172 people in Papua New Guinea in 2007, and Cyclone Winston in 2016, which caused 44 deaths in Fiji. In Australia and New Zealand, deaths from storms were always less than ten from the years 2006 to 2016. On the other hand, two **heat waves** affecting Australia in 2009 and 2014 killed 347 and 139 people, respectively. In Polynesia, the number of deaths are known for just three out of seven cyclones which struck the region between 2006 and 2015: one killed 12 people in 2012 and two other cyclones in 2010 and 2014 each killed one person. No deaths were reported from the three cyclones that swept Tonga in 2016.

Figure 25 - Number of people reported affected (m) by disaster type. Mean 2006-2015 vs 2016



X: number of affected = or < 0,005 ; na: not available; nr: no disaster reported

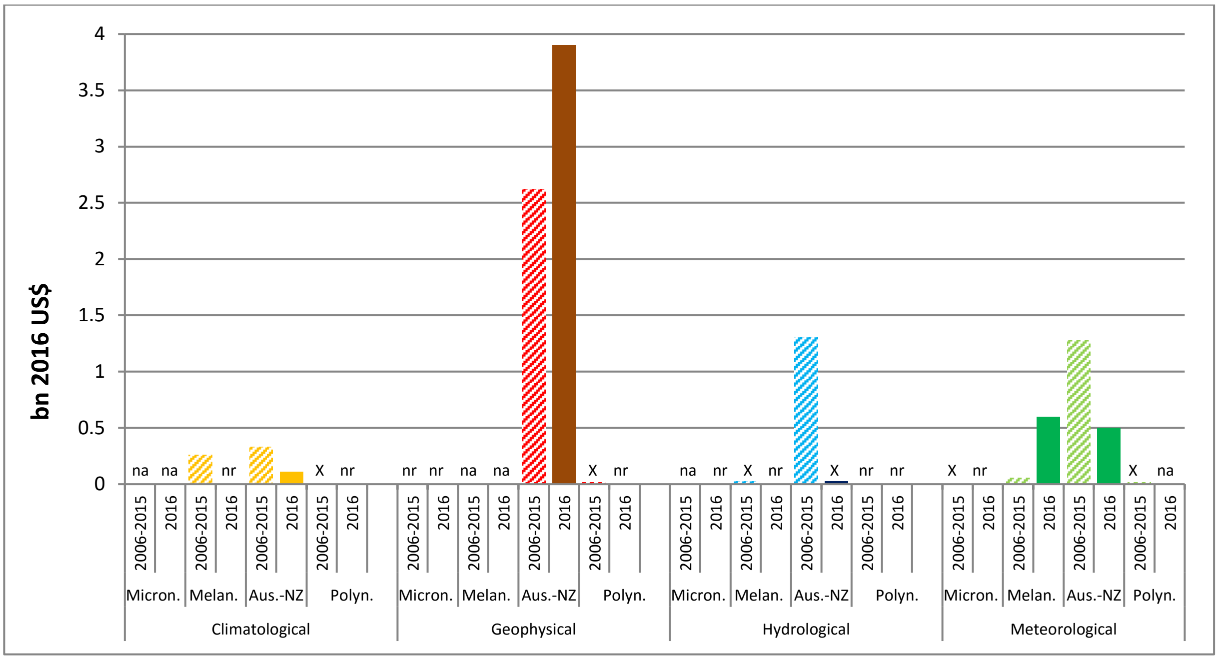
Before 2013, people reported affected by **climatological disasters** in Oceania were all from **wildfires** in Australia. Only once did this number exceed (several) thousand(s). In the second half of the last decade, with the increasing frequency of **droughts**, the number of people affected began to be reported, with several thousand appearing low compared to the tens of thousands then reported. In 2015, in the Melanesian region, a drought affected 2.52 million people in Papua New Guinea, the biggest number ever reported for this region. The same year in Fiji, 67,000 people suffered from drought. In the Micronesia region, a drought occurred on the Marshall Islands in 2013, affecting 6,384 people. In 2016, droughts affected 100,000 people in the Federated States of Micronesia and 21,000 on the Marshall Islands. The number of people affected by droughts in Polynesia has never been documented.

In the Solomon Islands (Melanesia), two **tsunamis** from 2007 and 2013 affected 2,384 and 3,329 people, respectively, while 1,126 suffered from an **earthquake** in 2010. A 2016 earthquake on the Solomon Islands affected 9,770 people, the most severe ever reported for this country. The seven disasters caused by **volcanic activity** influenced the 2006-2015 average of 2,308 people. However, in 2008 and 2009, in Vanuatu, the activity of Volcano Ambrym affected 9,000 people. In New Zealand, the two earthquakes of 2010 and 2011, in Christchurch, affected at least 300,000 people each, while two others, also in New Zealand in 2011 and 2013, affected only 345 and 13,840 people, respectively. For one earthquake occurring in 2016, an even smaller number of people were reported affected (50). In Polynesia, the tsunami waves that struck Samoa, American Samoa and Tonga in 2009 affected 5,584, 2,500 and 507 people, respectively.

Among the coastal **floods** which occurred in the Micronesia region in the years 2008 to 2014, the one that affected the highest number of people (600) occurred on the Marshall Islands in 2008. In Melanesia, the 20 floods reported for years 2006-2015 affected 49,196 people, on average. However, the one that occurred in Papua New Guinea in 2012 affected 200,000 people. In Australia-New Zealand, between 2006 and 2015, most floods affected between one and several thousand people. However, the one that occurred in Australia in 2010-2011 affected 175,000 people. In 2016, one flash flood affected 25,000 people in New Zealand, making it the second most severe in the region since 2006.

In 2015, three **cyclones** struck the Micronesia region, Maysak in the Federated States of Micronesia affected 35,000, Pam in Kiribati affected 1,500, and Soudelor in the Northern Mariana Islands affected 360 people. The number of people affected by Cyclone Haiyan in Palau in 2013 remains unavailable. The 2006-2015 average number of people affected by storms in Melanesia (52,000) is strongly influenced by the 188,000 people affected by Cyclone Pam in Vanuatu in 2015 and the 162,000 people affected by Cyclone Guba in Papua New Guinea in 2007. Nevertheless, the 350,000 people affected by Tropical cyclone Winston in Fiji in 2016, is, by far, the highest ever reported in this region. In Australia, the number of people affected by a convective storm in 2016 is unavailable. In Polynesia, the 392 people reported affected by Cyclone Ulla, is far below the 2,820 annual average or the 12,703 who suffered from Cyclone Evan in Samoa in 2012.

Figure 26 - Damages reported (US$ bn) by type. Mean 2006-2015 vs 2016



X:amount of damages = or < 0,025 ; na: not available; nr: no disaster reported

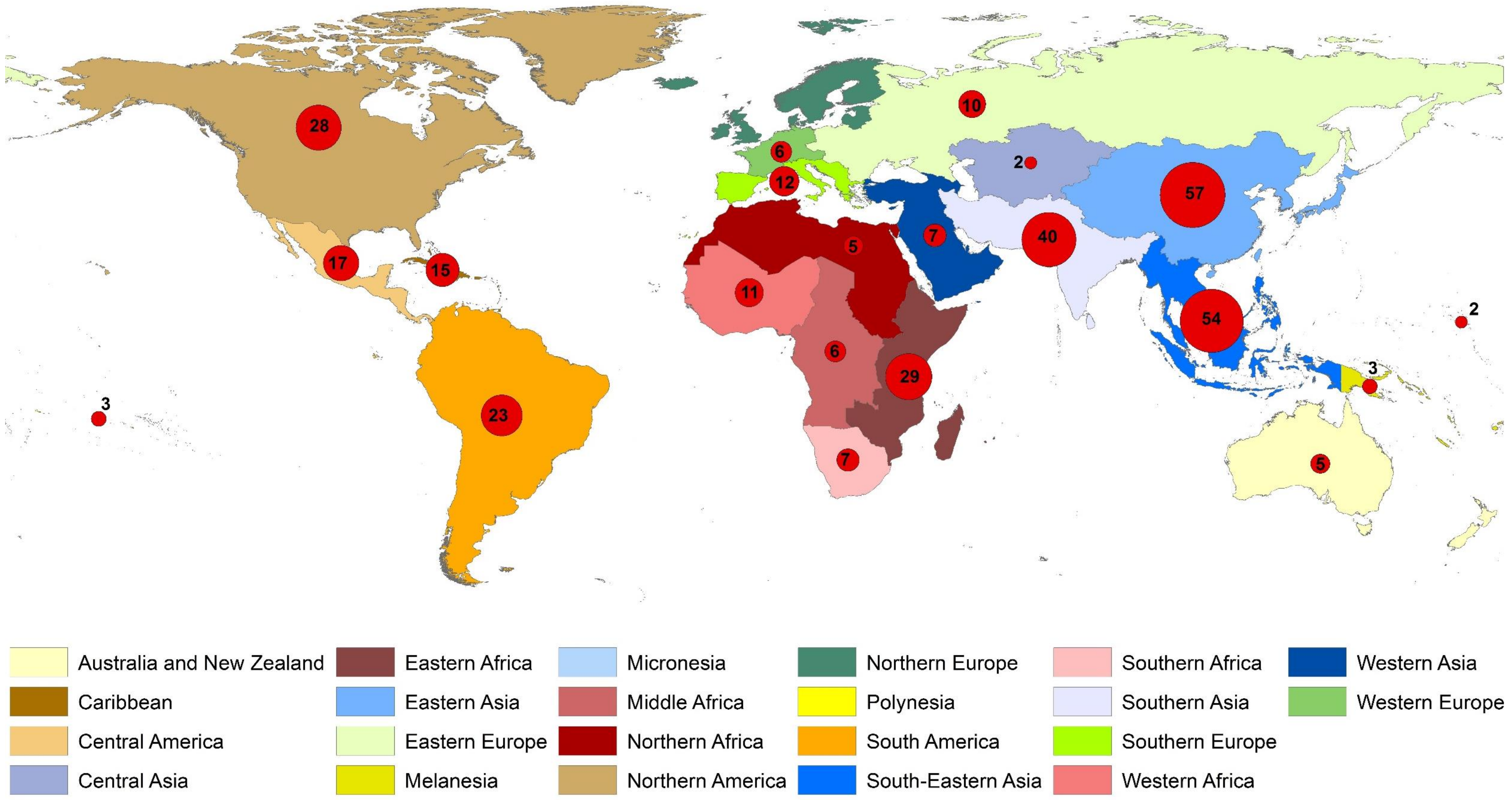
Among **climatological disasters**, the amount of damages are available for only two **droughts-** one in New Zealand in 2013 (US$ 840 million) and one in Papua New Guinea in 2015 (US$ 61 million). Inversely, damages are available for 11 of 12 **wildfires** for the years 2006-2015. The annual average, almost US$ 250 million, is, however, heightened by the US$ 1.45 billion damages from a land fire in Australia in 2009. Another fire affecting Australia in 2016 cost US$ 110 million in damages.

The four **earthquakes** that shook New Zealand between 2006 and 2015 resulted in a total of US$ 26.2 billion in damages, with the Christchurch earthquake of 2011 accounting for US$ 16 billion of this total. The three **tsunamis** that swept across the Polynesian coast in 2009 cost US$ 140 million in Samoa and US$ 11 million in Tonga. The tsunami that hit New Zealand in 2016 cost US$ 3.9 billion in damages.

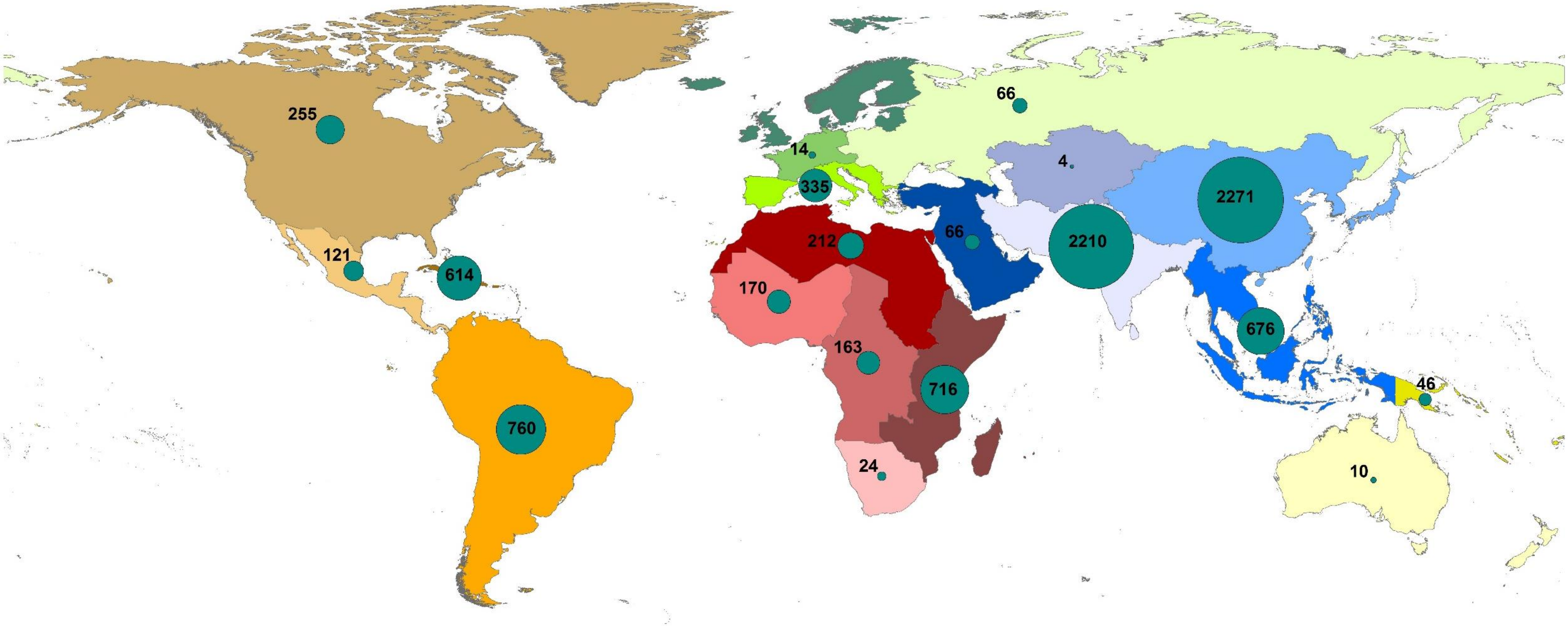
Damages from **hydrological disasters** are unavailable for the Micronesia region. In Melanesia, in the years 2006-2015, costs were reported for 40% of floods for an annual average of almost US$ 24 million. The most severe cost US$ 74 million in Fiji in 2012. In Australia-New Zealand, 2006-2015 damages are available for two-thirds of **floods**, with an annual average cost of US$ 1.31 billion. The costliest occurred in Australia in 2010-2011 and produced more than US$ 7.7 billion in damages. In 2016, one flash flood was reported to cause US$ 25 million in damages in New Zealand.

On the four **storms** reported for the Micronesia region between 2006 and 2015, costs from damage is available only for Cyclone Maysak which hit the Federated States of Micronesia in 2015 and cost US$ 11 million. In Melanesia, for the years 2006-2015, costs are available for 32% of storms, with an annual average of US$ 55 million. The costliest was Cyclone Raquel which produced US$ 454 million in damages in the Solomon Islands in 2015. However, in 2016, Cyclone Winston in Fiji caused even greater damages for a total of US$ 600 million, while those from Cyclone Zena, in the same country, are unavailable. In Australia-New Zealand, costs from storms in the years 2006-2015 are available for 80% of reported events, with an annual average amounting to US$ 1.28 billion. Of note, Tropical Cyclone Yasi, alone, cost US$ 2.64 billion in Australia in 2011, impacting this average. In 2016, a convective storm in Australia produced damages of US$ 500 million. In Polynesia, damage costs are available for four of seven storms, which occurred between 2006 and 2015, for a total of US$ 184 million. In 2012, Cyclone Evan alone, cost as much as US$ 138 million in Samoa. No data on cost of damages were available for the three storms which hit this region in 2016.

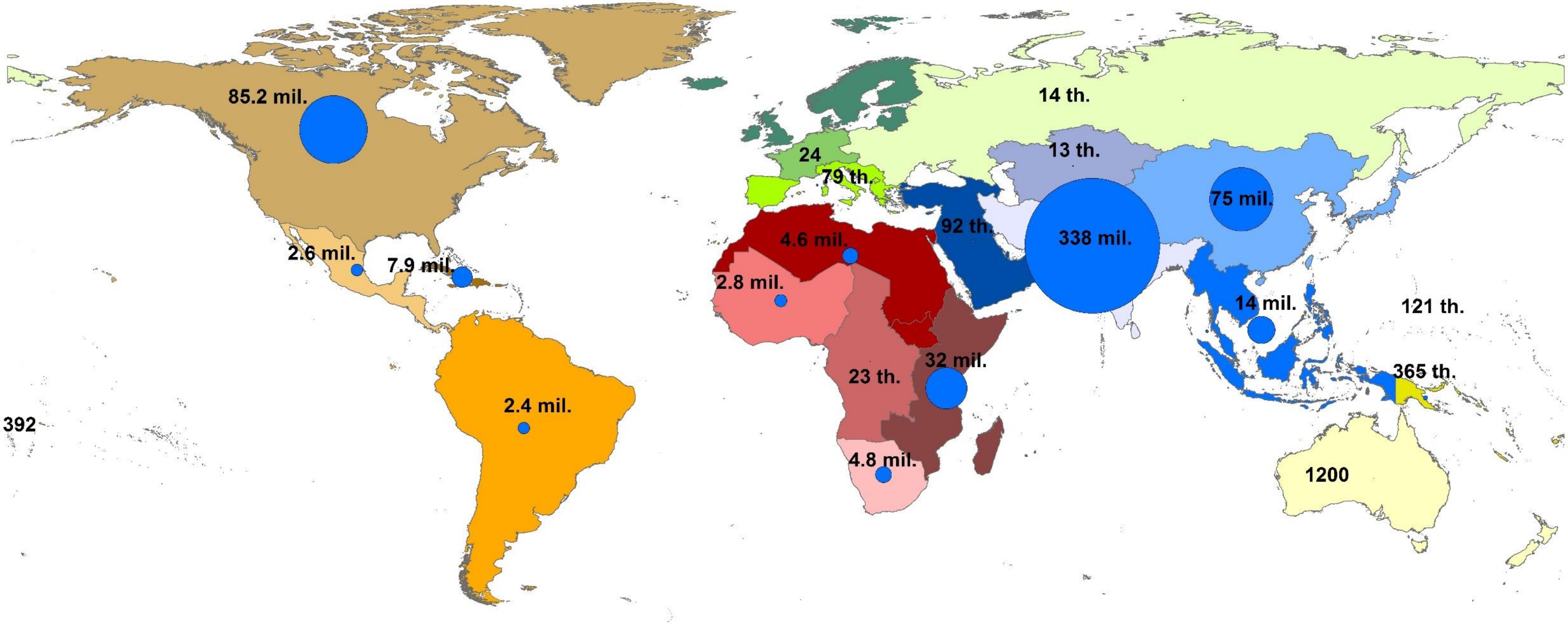
Map 1 - Occurrence of natural disasters per sub-continent in 2016



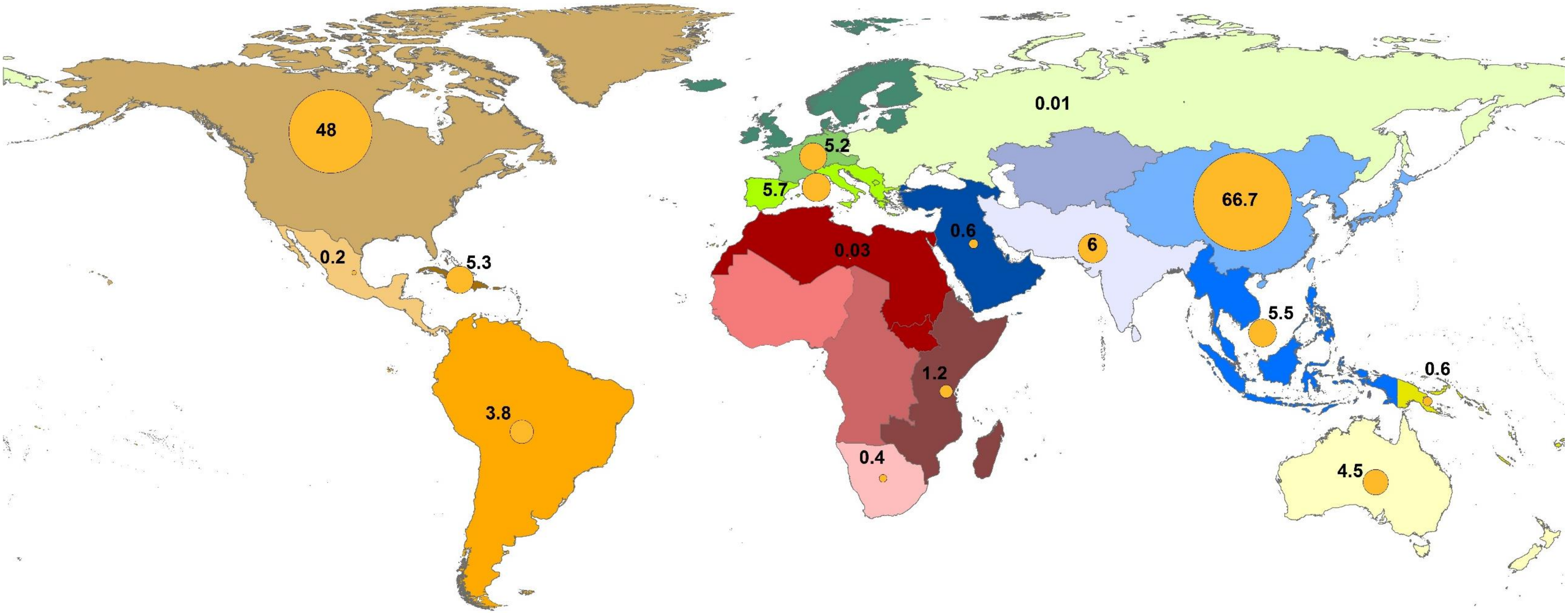
Map 2 - Total deaths per sub-continent in 2016



Map 3 - Total affected per sub-continent in 2016



Map 4 - Economic damages per sub-continent in 2016 (in US$ billions)



ANNEX 1: Definitions

These definitions have been established by IRDR Disaster Los Data (DATA group): "IRDR (2014) Peril classification and hzard glossary (IRDR DATA Publication n°1). Beijing: IRDR.

Term	*Definition*
Airburst	An explosion of a comet or meteoroid within the Earth's atmosphere without striking the ground.
Animal Incident	Human encounters with dangerous or exotic animals in both urban and rural environments.
Ash Fall	Fine (less than 4 mm in diameter) unconsolidated volcanic debris blown into the atmosphere during an eruption; can remain airborne for long periods of time and travel considerable distance from the source.
Avalanche	A large mass of loosened earth material, snow, or ice that slides, flows or falls rapidly down a mountainside under the force of gravity. Snow Avalanche: Rapid downslope movement of a mix of snow and ice. Debris Avalanche: The sudden and very rapid downslope movement of unsorted mass of rock and soil. There are two general types of debris avalanches - a cold debris avalanche usually results from an unstable slope suddenly collapsing whereas a hot debris avalanche results from volcanic activity leading to slope instability and collapse.
Bacterial Disease	An unusual increase in the number of incidents caused by the exposure to bacteria either through skin contact, ingestion or inhalation. Examples include salmonellae, MSRA (Staphylococcus aureaus), and vibrio cholerae, among others
Biological hazard	A hazard caused by the exposure to living organisms and their toxic substances (e.g. venom, mold) or vector-borne diseases that they may carry. Examples are venomous wildlife and insects, poisonous plants, and mosquitoes carrying disease-causing agents such as parasites, bacteria, or viruses (e.g. malaria).
Climatological hazard	A hazard caused by long-lived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multi-decadal climate variability
Coastal Erosion	The temporary or permanent loss of sediments or landmass in coastal margins due to the action of waves, winds, tides, or anthropogenic activities.
Coastal Flood	Higher-than-normal water levels along the coast caused by tidal changes or storms that result in flooding which can last from days to weeks.
Cold Wave	A period of abnormally cold weather. Typically a cold wave lasts two or more days and maybe aggravated by high winds. The exact temperature criteria for what constitutes a cold wave vary by location.
Convective Storm	A type of meteorological hazard generated by the heating of air and the availability of moist and unstable air masses. Convective storms range from localized thunderstorms (with heavy rain and/or hail, lightning, high winds, tornadoes) to meso-scale, multi-day events.
Debris Flow, Mud Flow, Rock Fall	Types of landslides that occur when heavy rain or rapid snow/ice melt and send large amounts of vegetation, mud, or rock downslope by gravitational forces.
Derecho	Widespread and usually fast-moving windstorms associated with convection/convective storm. Derechos include downburst and straight-line winds. The damage from derechos is often confused with the damage from tornadoes.
Disease	Either an unusual, often sudden, increase in the number of incidents of an infectious disease that already existed in the region (e.g., flu, E. coli) or the appearance of an infectious disease previously absent from the region (e.g., plague, polio).
Drought	An extended period of unusually low precipitation that produces a shortage of water for people, animals, and plants. Drought is different from most other hazards in that it

	develops slowly, sometimes even over years, and its onset is generally difficult to detect. Drought is not solely a physical phenomenon because its impacts can be exacerbated by human activities and water supply demands. Drought is therefore often defined both conceptually and operationally. Operational definitions of drought, meaning the degree of precipitation reduction that constitutes a drought, vary by locality, climate and environmental sector.
Earthquake	Sudden movement of a block of the Earth's crust along a geological fault and associated ground shaking.
Energetic Particles	Emissions from solar radiation storms consisting of pieces of matter (e.g., protons and other charged particles) moving at very high speed. The magnetosphere and atmosphere block (solar) energetic particles (SEP) from reaching humans on Earth but they are a danger to life in outer space and pose a radiation hazard to aircraft travelling at high altitudes.
Epidemic	Either an unusual, often sudden, increase in the number of incidents of an infectious disease that already existed in the region (e.g., flu, E. coli) or the appearance of an infectious disease previously absent from the region (e.g., plague, polio).
Expansive Soil	Earthen material, particularly clays that upon wetting, freezing, or drying will alternately expand or contract causing damage to foundations of buildings and other structures. Shrinkage is generally referred to as subsidence or desiccation.
Extraterrestrial hazard	A hazard caused by asteroids, meteoroids, and comets as they pass near-earth, enter the Earth's atmosphere, and/or strike the Earth, and by changes in interplanetary conditions that effect the Earth's magnetosphere, ionosphere, and thermosphere.
Extratropical Storm	A type of low-pressure cyclonic system in the middle and high latitudes (also called- mid-latitude cyclone) that primarily gets its energy from the horizontal temperature contrasts (fronts) that exist in the atmosphere. When associated with cold fronts, extratropical cyclones may be particularly damaging (e.g., European winter/windstorm).
Extreme Temperature	A general term for temperature variations above (extreme heat) or below (extreme cold) normal conditions.
Extreme winter conditions	Damage caused by snow and ice. Winter damage refers to damage to buidlings, infrastructure, traffic (especially navigation) inflicted by snow and ice in the form of snow pressure, freezing rain, frozen waterways, etc.
Fire following Earthquake	Urban fires triggered by earthquakes. Particularly susceptible areas include densely spaced , wooden buildings that dominate local architecture, and where the earthquake has damaged or ruptured water and gas pipelines. Small local fires have the potential to merge into conflagrations destroying many city blocks.
Flash Flood	Heavy or excessive rainfall in a short period of time that produce immediate runoff, creating flooding conditions within minutes or a few hours during or after the rainfall.
Flood	A general term for the overflow of water from a stream channel onto normally dry land in the floodplain (riverine flooding), higher-than-normal levels along the coast and in lakes or reservoirs (coastal flooding) as well as ponding of water at or near the point where the rain fell (flash floods).
Fog	Water droplets that are suspended in the air near the Earth's surface. Fog is simply a cloud that is in contact with the ground.
Forest Fire	A type of wildfire in a wooded area.
Frost, Freeze	Frost is the consequence of radiative cooling resulting in the formation of thin ice crystals on the ground or other surfaces in the form of needles, feathers, scales, or fans. Frost occurs when the temperature of surfaces is below freezing and water vapor from humid air forms solid deposits on the cold surface. Freeze occurs when the air temperature is at (32˚F/0˚C) or below over a widespread area for a climatologically significant period of time. Use of the term is usually restricted to advective situations or to occasions when wind or other conditions prevent frost. Frost and freeze are particularly damaging during the crop growing season.

Fungal disease	Exposure to fungi either through skin contact, ingestion or inhalation of spores resulting in an unusual increase in the number of incidents. Examples are fungal pneumonia, fungal meningitis, etc.
Geomagnetic Storm	A type of extraterrestrial hazard caused by solar wind shockwaves that temporarily disturb the Earth's magnetosphere. Geomagnetic storms can disrupt power grids, spacecraft operations, and satellite communications.
Geophysical hazard	A hazard originating from solid earth. This term is used interchangeably with the term geological hazard.
Glacial Lake Outburst	A flood that occurs when water dammed by a glacier or moraine is suddenly released. Glacial lakes can be at the front of the glacial (marginal lake) or below the ice sheet (sub-glacial lake).
Ground Movement	Surface displacement of earthen materials due to ground shaking triggered by earthquakes or volcanic eruptions
Hail	Solid precipitation in the form of irregular pellets or balls of ice more than 5 mm in diameter.
Heat Wave	A period of abnormally hot and/or unusually humid weather. Typically a heat wave lasts two or more days. The exact temperature criteria for what constitutes a heat wave vary by location.
Ice Jam Flood	The accumulation of floating ice restricting or blocking a river's flow and drainage. Ice jams tend to develop near river bends and obstructions (e.g., bridges).
Impact	A type of extraterrestrial hazard caused by the collision of the Earth with a meteorite.
Insect Infestation	The pervasive influx, swarming and/or hatching of insects affecting humans, animals, crops, and perishable goods. Examples are locusts and African Bees.
Lahar	Hot or cold mixture of earthen material flowing on the slope of a volcano either during or between volcanic eruptions.
Landslide following Earthquake	Independent of the presence of water, mass movement may also be triggered by earthquakes.
Lava Flow	The ejected magma that moves as a liquid mass downslope from a volcano during an eruption.
Lightning	A high-voltage, visible electrical discharge produced by a thunderstorm and followed by the sound of thunder.
Liquefaction	The transformation of (partially) water-saturated soil from a solid state to a liquid state caused by an earthquake. Liquefaction reduces the strength and stiffness of soil causing buildings to topple over.
Mass Movement	Any type of downslope movement of earth materials.
Meteorological hazard	A hazard caused by short-lived, micro- to meso-scale extreme weather and atmospheric conditions that last from minutes to days.
Parasitic Disease	Exposure to a parasite – an organism living on or in a host – causes an unusual increase in the number of incidents. Exposure to parasites occurs mostly through contaminated water, food or contact with insects, animals (zoonotic), pets, etc. Examples are malaria, chagas disease, giardiasis and trichinellosis.
Prion Disease	A type of biological hazard caused by prion proteins. Prion diseases or transmissible spongiform encephalopathies (TSEs) are a family of rare progressive neurodegenerative disorders that affect both humans and animals characterized by long incubation periods and neural loss. Examples are Bovine Spongiform Encephalophaty (BSE), Creutzfeld-Jakob-Disease (CJD), Kuru, etc.
Pyroclastic Flow	Extremely hot gases, ash, and other materials of more than 1,000 degrees Celsius that

	rapidly flow down the flank of a volcano (more than 700 km/h) during an eruption.
Radio Disturbance	Triggered by x-ray emissions from the Sun hitting the Earth's atmosphere and causing disturbances in the ionosphere such as jamming of high and/or low frequency radio signals. This affects satellite radio communication and Global Position Systems (GPS).
Rain	Water vapor condenses in the atmosphere to form water droplets that fall to the Earth.
Riverine Flood	A type of flooding resulting from the overflow of water from a stream or river channel onto normally dry land in the floodplain adjacent to the channel.
Rogue Wave	An unusual single crest of an ocean wave far out at sea that is much higher and/or steeper than other waves in the prevailing swell system.
Sandstorm, Dust Storm	Strong winds carry particles of sand aloft, but generally confined to less than 50 feet (15 m), especially common in arid and semi-arid environments. A dust storm is also characterized by strong winds but carries smaller particles of dust rather than sand over an extensive area.
Seiche	A standing wave of water in a large semi- or fully-enclosed body of water (lakes or bays) created by strong winds and/or a large barometric pressure gradient.
Shockwave	A type of extraterrestrial hazard caused by the explosion (airburst) or impact of meteorites that generate energy shockwaves capable of shattering glass, collapsing walls, etc. A shockwave carries energy from a disturbance through a medium (solid, liquid, gas) similar to a wave though it travels at much higher speed.
Sinkhole	Collapse of the land surface due to the dissolving of the subsurface rocks such as limestone or carbonate rock by water.
Snow, Ice	Precipitation in the form of ice crystals/snowflakes or ice pellets (sleet) formed directly from freezing water vapor in the air. Ice accumulates when rain hits the cold surface and freezes.
Space Weather	A general term for extraterrestrial weather conditions driven by solar eruptions such as geomagnetic storms, radio disturbances, and solar energetic particles.
Storm Surge	An abnormal rise in sea level generated by a tropical cyclone or other intense storms.
Subsidence	Subsidence refers to the sinking of the ground due to groundwater removal, mining, dissolution of limestone (e.g., karst, sinkholes), extraction of natural gas, and earthquakes.
Tornado	A violently rotating column of air that reaches the ground or open water (waterspout).
Tropical Cyclone	A tropical cyclone originates over tropical or subtropical waters. It is characterized by a warm-core, non-frontal synoptic-scale cyclone with a low pressure center, spiral rain bands and strong winds. Depending on their location, tropical cyclones are referred to as hurricanes (Atlantic, Northeast Pacific), typhoons (Northwest Pacific), or cyclones (South Pacific and Indian Ocean).
Tsunami	A series of waves (with long wavelengths when traveling across the deep ocean) that are generated by a displacement of massive amounts of water through underwater earthquakes, volcanic eruptions or landslides. Tsunami waves travel at very high speed across the ocean but as they begin to reach shallow water they slow down and the wave grows steeper.
Viral disease	A type of biological hazard where an unusual increase in the number of incidents is caused by the exposure to a virus either through skin contact, ingestion or inhalation. Examples are dengue fever, Hepatitis A, HIV/AIDS, avian influenza, and Ebola.
Volcanic Activity	A type of volcanic event near an opening/vent in the Earth's surface including volcanic eruptions of lava, ash, hot vapor, gas, and pyroclastic material.
Wave Action	Wind-generated surface waves that can occur on the surface of any open body of water such as oceans, rivers, and lakes, etc. The size of the wave depends on the strength of the wind and the traveled distance (fetch).
Wildfire	Any uncontrolled and non-prescribed combustion or burning of plants in a natural setting

	such as a forest, grassland, brush land, or tundra which consumes the natural fuels and spreads based on environmental conditions (e.g., wind, topography). Wildfires can be triggered by lightning or human actions.
Wind	Differences in air pressure resulting in the horizontal motion of air. The greater the difference in pressure, the stronger the wind. Wind moves from high pressure toward low pressure.
Winter Storm, Blizzard	A low pressure system in winter months with significant accumulations of snow, freezing rain, sleet, or ice.. A blizzard is a severe snow storm with winds exceeding 35 mph (56 km/h) for three or more hours producing reduced visibility (less than .25 mile (400 m).

ANNEX 2: List of countries per continent

AFRICA		
Algeria	Gambia (the)	Rwanda
Angola	Ghana	Saint Helena, Ascension and Tristan da Cunha
Benin	Guinea	Sao Tome and Principe
Botswana	Guinea-Bissau	Senegal
Burkina Faso	Kenya	Seychelles
Burundi	Lesotho	Sierra Leone
Cameroon	Liberia	Somalia
Cabo Verde	Libya	South Africa
Central African Republic	Madagascar	South Sudan
Chad	Malawi	Sudan (the)
Comoros (the)	Mali	Swaziland
Congo (the	Mauritania	Tanzania, United Republic of
Congo (the Democratic Republic of	Mauritius	Togo
Cote d'Ivoire	Mayotte	Tunisia
Djibouti	Morocco	Uganda
Egypt	Mozambique	Western Sahara
Equatorial Guinea	Namibia	Zambia
Eritrea	Niger (the)	Zimbabwe
Ethiopia	Nigeria	
Gabon	Reunion	

AMERICAS		
Anguilla	Ecuador	Peru
Antigua and Barbuda	El Salvador	Puerto Rico
Argentina	Falkland Islands (Malvinas)	Saint Barthélemy
Aruba	French Guiana	Saint Kitts and Nevis
Bahamas (the)	Greenland	Saint Lucia
Barbados	Grenada	Saint Martin (French part)
Belize	Guadeloupe	Saint Pierre and Miquelon
Bermuda	Guatemala	Saint Vincent and the Grenadines
Bolivia (Plurinational State of)	Guyana	Suriname
Brazil	Haiti	Trinidad and Tobago
British Virgin Islands	Honduras	Turks and Caicos Islands (the)
Canada	Jamaica	Uruguay
Cayman Islands (the)	Martinique	Venezuela (Bolivarian Republic of)
Chile	Mexico	United States of America
Colombia	Montserrat	Virgin Islands (British)
Costa Rica	Netherlands Antilles	Virgin Islands (U.S)
Cuba	Nicaragua	
Dominica	Panama	
Dominican Republic (the)	Paraguay	

ASIA

Afghanistan	Korea (the Democratic Republic of))	Sri Lanka
Armenia	Korea (the Republic of)	Syrian Arab Republic
Azerbaijan	Kuwait	Taiwan (Province of China)
Bahrain	Kyrgyzstan	Tajikistan
Bangladesh	Laos People's Democratic Republic	Thailand
Bhutan	(the)	Timor-Leste
Brunei Darussalam	Lebanon	Turkey
Cambodia	Macao	Turkmenistan
China	Malaysia	United Arab Emirates (the)
Cyprus	Maldives	Uzbekistan
Georgia	Mongolia	Viet Nam
Hong Kong	Myanmar	Yemen
India	Nepal	
Indonesia	Palestine, State of	
Iran (Islmaic Republic of)	Oman	
Iraq	Pakistan	
Israel	Philippines (the)	
Japan	Qatar	
Jordan	Saudi Arabia	
Kazakhstan	Singapore	

EUROPE

Aland Islands	Gibraltar	Montenegro
Albania	Greece	Netherlands (the)
Andorra	Guernsey	Norway
Austria	Holy See	Poland
Azores Islands	Hungary	Portugal
Belarus	Iceland	Romania
Belgium	Ireland	Russian Federation (the)
Bosnia and Herzegovina	Italy	San Marino
Bulgaria	Jersey	Serbia
Canary Islands	Latvia	Slovakia
Channel Islands	Liechtenstein	Slovenia
Croatia	Lithuania	Spain
Czech Republic (the)	Luxembourg	Svalbard & Jan Mayen Islands
Denmark	Macedonia (the Former	Sweden
Estonia	Yugoslav Republic)	Switzerland
Faroe Islands	Malta	Ukraine
Finland	Man, Isle of	United Kingdom of Great
France	Moldova (the Republic of)	Britain and Northern Ireland
Germany	Monaco	(the)

OCEANIA		
American Samoa	Nauru	Samoa
Australia	New Caledonia	Solomon Islands
Cook Islands (the)	New Zealand	Tokelau
Fiji	Niue	Tonga
French Polynesia	Norfolk Island	Tuvalu
Guam	Northern Mariana Islands (the)	Vanuatu
Kiribati	Palau	Wallis and Futuna
Marshall Islands (the)	Papua New Guinea	
Micronesia (Federated States of)	Pitcairn	

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