Aon Benfield

2015 Annual Global Climate and Catastrophe Report

Impact Forecasting

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Executive Summary

Global Catastrophe Losses Remain Below Average in 2015 Despite Uptick in Disaster Events

Global natural disasters in 2015 combined to cause economic losses of USD123 billion, an amount 30 percent below the 15-year average of USD175 billion. However, the losses were just eight percent lower on a median basis (USD134 billion). The economic losses were attributed to 300[1] separate events, compared to an average of 269. The disasters caused insured losses of USD35 billion, or 31 percent below the 15-year mean of USD51 billion and 14 percent lower than the median (USD40 billion). It comprised the lowest total since 2009. This was the fourth consecutive year with declining catastrophe losses since the record-setting year in 2011. Notable events during the year included winter storms in the United States; extensive flooding in parts of India, the US, UK, and China; a major earthquake in Nepal; record-setting tropical cyclones in the Pacific Ocean; European windstorms; and massive forest fires in Indonesia. The top three perils, flooding, severe thunderstorm, and wildfire, combined for 59 percent of all economic losses in 2015. Despite 32 percent of catastrophe losses occurring inside of the United States, it still accounted for 60 percent of global insured losses. This speaks to a higher rate of insurance penetration in the country.

The deadliest event of 2015 was the magnitude-7.8 earthquake and subsequent aftershock that struck Nepal in April and May and left more than 9,100 people dead. A total of 21 tropical cyclones (Category 1+) made landfall globally in 2015; above the 1980-2014 average of 15. Fourteen of the landfalls occurred in the Northern Hemisphere, including 13 in Asia. The United States extended its record to 10 consecutive years without a major hurricane landfall. 2015 was also documented as the warmest year since 1880 when global land and ocean temperature records began.

The Indonesian forest fires were the costliest single economic loss event of the year and were triggered by local slash-and-burn tactics that quickly spread out of control. The World Bank estimated that the fires had left an economic cost of USD16.1 billion. The costliest non-weather event was the Nepal earthquake that was expected to cost the nation and surrounding countries an estimated USD8.0 billion in damage and reconstruction. From an insurance industry perspective, the costliest event was a February winter storm that impacted much of the Eastern United States, affecting both public and private insurers which paid out more than USD2.1 billion.

No region of the world sustained aggregate insured losses above their 15-year averages in 2015; though EMEA, Asia Pacific and the Americas (non-US) were above their respective medians. The top 10 insured loss events in 2015 comprised of five United States severe thunderstorm outbreaks, one United States winter storm, one European windstorm, one Indonesian forest fires, and one United States drought.

The percentage of global economic losses that were covered by public or private insurance entities was 28 percent. This was equal to the 15-year average. However, if you remove the United States the percentage drops to 16 percent. This clearly highlights how the United States continues to annually drive insured natural disasters around the world.

Along with this report, refer to Impact Forecasting's Catastrophe Insight website to access current and historical natural catastrophe data and event analysis at: **www.aonbenfield.com/catastropheinsight**

[1] *An event must meet at least one of the following criteria to be classified as a natural disaster: economic loss of USD50M, insured loss of USD25M, 10 fatalities, 50 injured or 2,000 homes or structures damaged.*

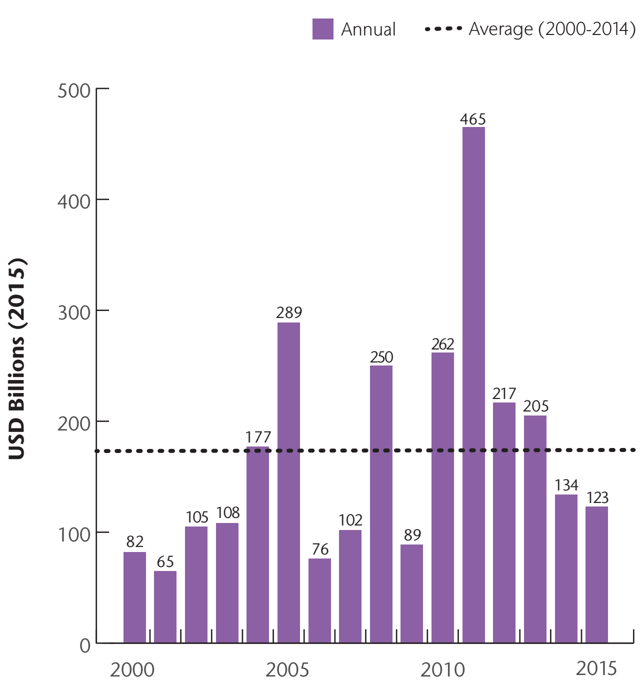
2015 Natural Disaster Events and Loss Trends

Global Economic Losses

Exhibit 1: Top 10 Global Economic Loss Events

Date(s)	Event	Location	Deaths	Economic Loss (USD)	Insured Loss (USD)
Yearlong	Forest Fire	Indonesia	19	16.1 billion	250 million
April 25 & May 12	Earthquake(s)	Nepal	9,120	8.0 billion	200 million
October 1 – 11	Flooding	United States	21	5.0 billion	700 million
October 2 – 4	Tropical Cyclone	China, Philippines	22	4.2 billion	100 million
Nov. – Dec.	Flooding	India, Sri Lanka	386	4.0 billion	650 million
May 23 – 28	Severe Weather	United States	32	3.8 billion	1.4 billion
February 16 – 22	Winter Weather	United States	30	3.3 billion	2.1 billion
August 2 – 9	Tropical Cyclone	China, Taiwan	34	3.2 billion	100 million
December 26 – 30	Severe Weather	United States	46	3.0 billion	1.4 billion
December 22 – 31	Flooding	United Kingdom	N/A	2.5 billion	1.3 billion
			All Other Events	70 billion	27 billion
			Totals	**123 billion[1]**	**35 billion[1,2]**

Exhibit 2: Global Economic Losses



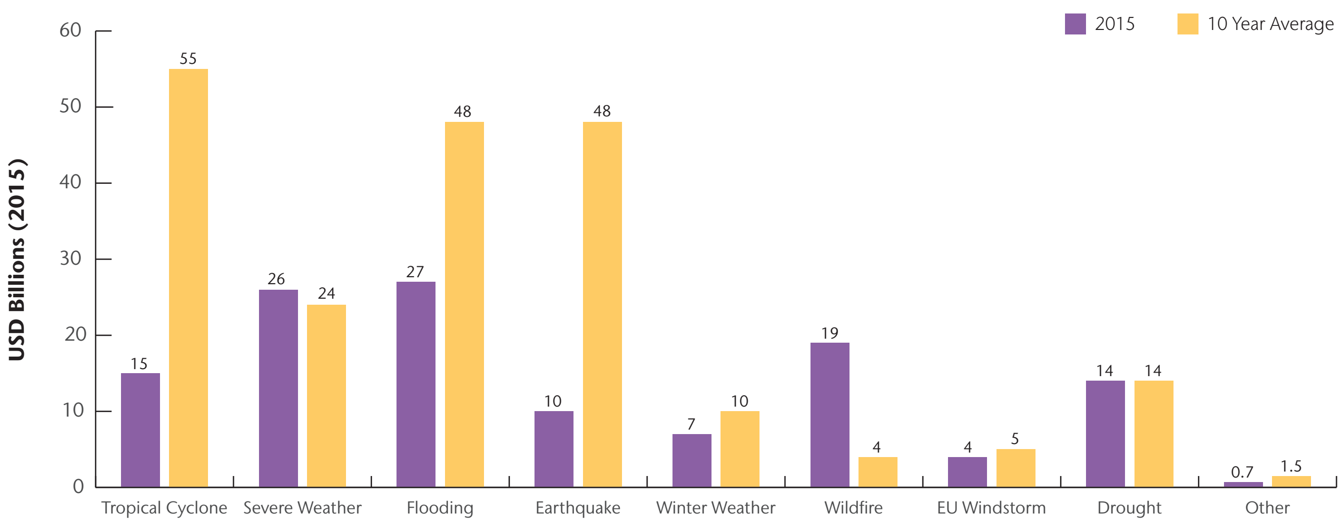
Economic losses in 2015 were driven by flood, severe weather (thunderstorm), tropical cyclone, and wildfire perils, which accounted for 70 percent of global natural disaster losses. Flooding was the costliest peril overall at USD27 billion, or 22 percent of the aggregated tally. See Exhibit 3 for more details. The most significant flood event was an early October event in the United States that left an estimated USD5.0 billion in damage, primarily in the state of South Carolina. Another multi-billion-dollar flood event occurred in southern India in November and December. The costliest singular event of 2015 was a nearly yearlong outbreak of forest fires across Indonesia's Sumatra and Kalimantan regions. The World Bank estimated the economic cost at USD16.1 billion, or 1.9 percent of the country's GDP. The majority of economic losses–82 percent—were registered in Asia Pacific with 50 percent and the United States with 32 percent.

Total economic losses were 30 percent below the 2000 to 2014 mean (175 billion) on an inflation-adjusted basis. On a median basis (134 billion), economic losses were only eight percent lower. The USD123 billion economic total in 2015 represents the lowest tally resulting from global natural disasters since 2009. Economic losses have trended upwards by 4.0 percent above inflation on an annual basis, or positively trended upwards by 7.0 percent nominally since 1980.

[1] Subject to change as loss estimates are further developed
[2] Includes losses sustained by private insurers and government-sponsored programs

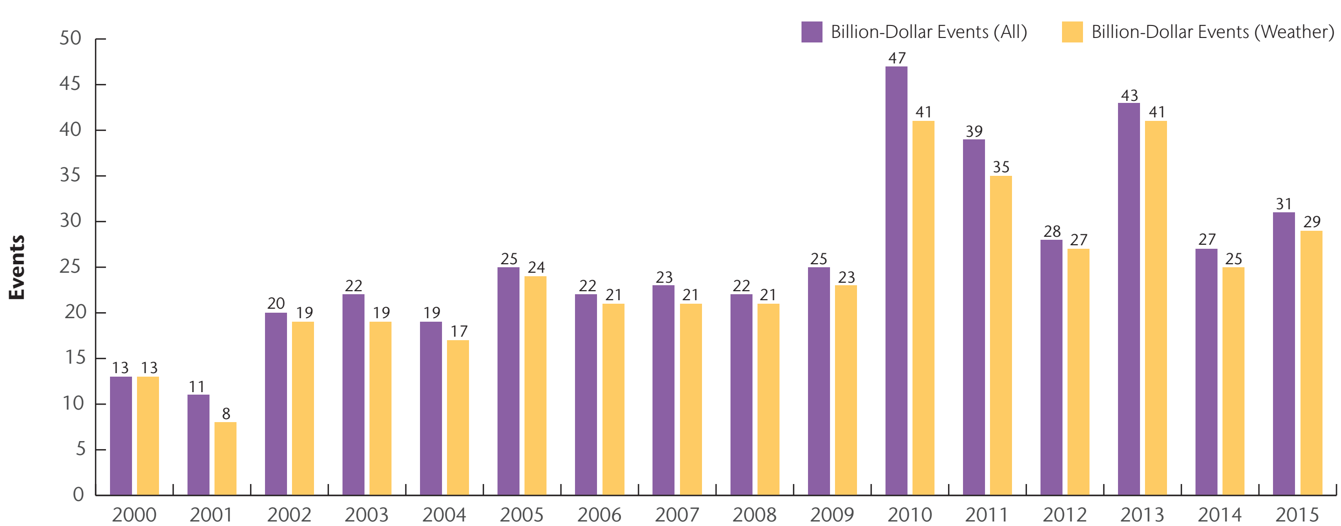
The costliest peril of 2015 was flood, which was closely followed by severe weather (thunderstorm), and wildfire. The year marked the first time since 2009 that no individual peril recorded economic losses beyond USD40 billion. The only perils to cross their recent 10-year averages were severe weather and wildfire. The wildfire peril at USD19 billion marked a significant increase over the recent mean of USD4 billion. These losses were driven by events in Indonesia and in the United States (California). Every other major peril incurred below normal levels of economic losses

Exhibit 3: Global Economic Losses by Peril



There were 31 individual billion-dollar natural disaster events in 2015, above the average of 26 since 2000. It was three above the total registered in 2014 (27). The United States led with 11 billion-dollar events with Asia Pacific close behind at 10. EMEA was third with seven and the Americas had three. For weather-only events, there were 29 billion-dollar disasters, which was above the 2000 to 2014 average of 24. The tally in 2015 was five above 2014 with 25. The United States led with 11 events, followed by Asia Pacific at nine, seven in EMEA, and two in the Americas.

Exhibit 4: Global Billion-Dollar Economic Loss Events (Inflated)



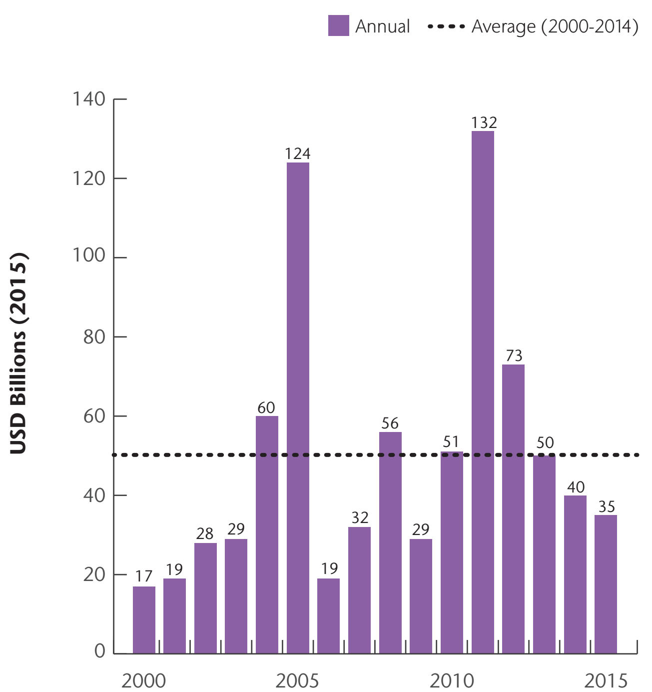
Note: Exhibit 4 includes events which reached the billion-dollar-plus (USD) threshold after being adjusted for inflation based on the 2015 US Consumer Price Index..

Global Insured Losses

Exhibit 5: Top 10 Global Insured Loss Events

Date(s)	Event	Location	Deaths	Economic Loss (USD)	Insured Loss (USD)
February 16 – 22	Winter Weather	United States	30	3.3 billion	2.1 billion
May 23 – 28	Severe Weather	United States	32	3.8 billion	1.4 billion
December 26 – 30	Severe Weather	United States	46	3.0 billion	1.4 billion
December 22 – 31	Flooding	United Kingdom	N/A	2.5 billion	1.3 billion
April 7 – 10	Severe Weather	United States	3	1.7 billion	1.2 billion
March 29 – April 1	WS Mike & Niklas	Western & Central Europe	9	1.4 billion	1.0 billion
Yearlong	Drought	United States	N/A	4.5 billion	1.0 billion
August 15 – 26	Typhoon Goni	Japan	70	1.8 billion	980 million
September 12 – 25	Wildfire (Valley)	United States	4	1.5 billion	975 million
April 18 – 21	Severe Weather	United States	N/A	1.4 billion	925 million
			All Other Events	100 billion	23 billion
			Totals	**123 billion[1]**	**35 billion[1,2]**

Exhibit 6: Global Insured Losses



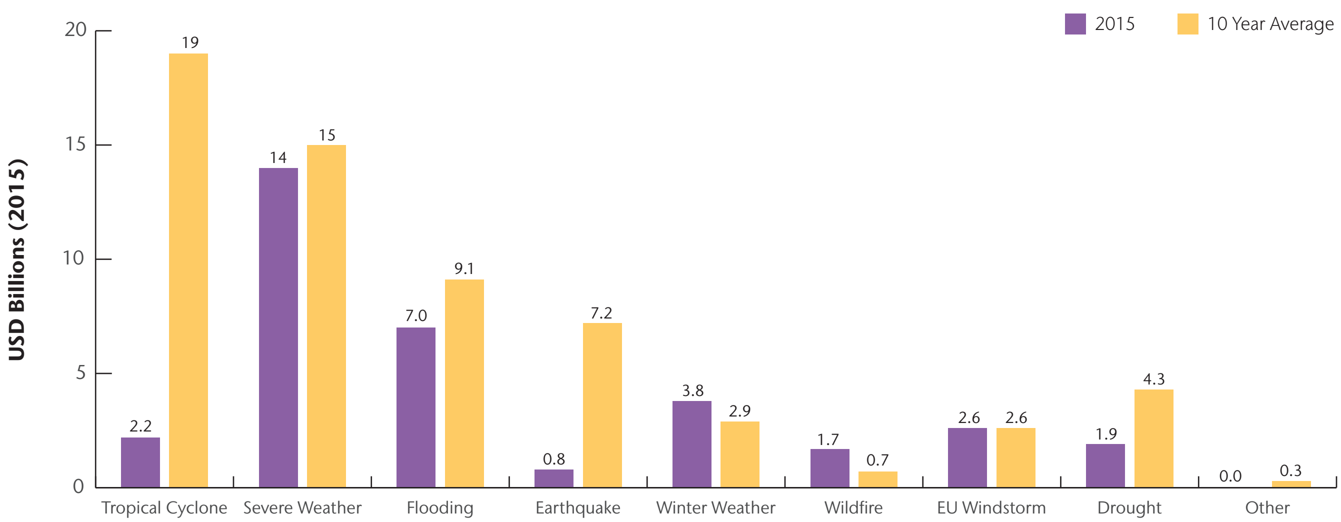
Severe weather (thunderstorm), flood, and winter weather perils accounted for 73 percent of 2015 global insured losses. Severe weather was the costliest peril overall at USD14 billion, or 41 percent of the aggregated tally. See Exhibit 5 for more details. The costliest individual insured loss event was a prolonged stretch of heavy snow, freezing rain, ice, and frigid cold that impacted much of the eastern United States in February. That event prompted an estimated USD2.1 billion insured loss. Additional notable insured loss events were December severe thunderstorms and flooding in the United States, windstorms Mike and Niklas that impacted Europe in March and April, December flooding in the UK, and August's Typhoon Goni that struck Japan. Seven of the top ten insured loss events occurred in the United States. The United States incurred 60 percent of all global insured losses.

Total insured losses were 31 percent below the 2000 to 2014 mean (USD51 billion) on an inflation-adjusted basis. On a median basis insured losses were 14 percent lower (USD40 billion). The USD32 billion insured total in 2015 represents the lowest tally resulting from global natural disasters since 2009. Insured losses have trended upwards by 7.2 percent above inflation on an annual basis, or positively trended upwards by 10 percent nominally since 1980.

[1] Subject to change as loss estimates are further developed
[2] Includes losses sustained by private insurers and government-sponsored programs

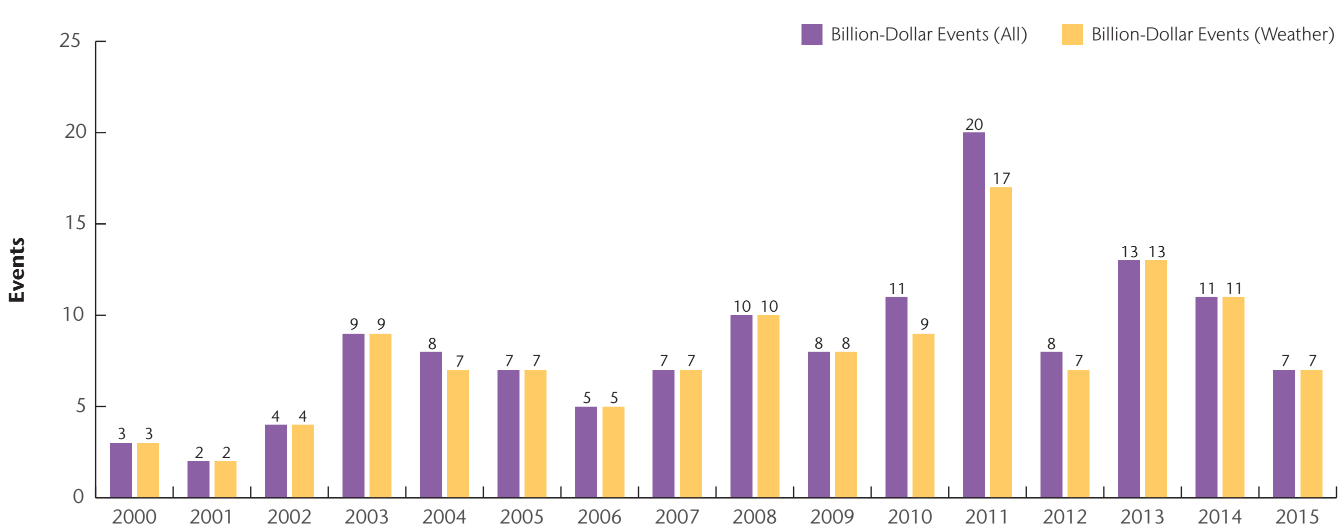
The costliest peril of 2015 was severe weather (thunderstorm) at USD14 billion, which far outpaced the next closest perils – flooding at USD7 billion and winter weather at USD4 billion. The year marked the first time since 2009 that no individual peril recorded insured losses beyond USD15 billion. The only two perils to cross their recent 10-year averages were winter weather and wildfire, though European Windstorm tied. Losses from those perils were driven by events in the United States and Asia Pacific. Every other major peril incurred below normal levels of insured losses by at least 15 percent.

Exhibit 7: Global Insured Losses by Peril



There were seven individual billion-dollar insured loss natural disaster events in 2015, which is below the average of eight since 2000. It marked the fewest number of such events since 2007. The United States recorded the greatest number with five events and EMEA incurred the other two. All of the events were weather-related and also lower than the average of eight. The last non-weather billion-dollar insured loss event came in 2012 with Italy's May earthquake events. The five events in the United States were equal to the 2000 to 2014 average. The all-time record of 17 billion-dollar weather events was set in 2011.

Exhibit 8: Global Billion-Dollar Insured Loss Events



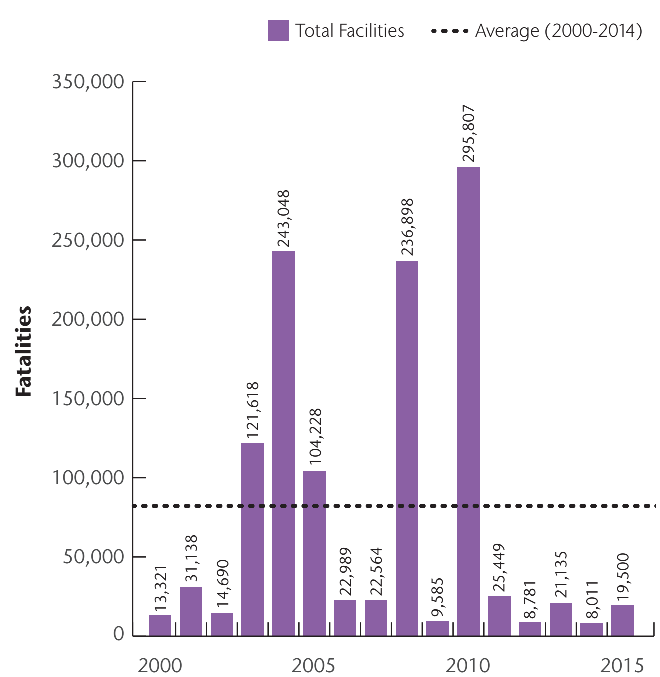
Note: Exhibit 8 includes events which reached the billion-dollar-plus (USD) threshold after being adjusted for inflation based on the 2015 US Consumer Price Index.

Global Fatalities

Exhibit 9: Top 10 Human Fatality Events

Date(s)	Event	Location	Deaths	Economic Loss (USD)
April 25 & May 12	Earthquake	Nepal	9,120	8.0 billion
April/May	Heatwave	India	2,500	N/A
June 20 – 30	Heatwave	Pakistan	1,233	N/A
June/August	Heatwave	Europe	1,000	N/A
October 1	Landslide	Guatemala	570	N/A
October 26	Earthquake	Afghanistan, Pakistan	403	100 million
Nov. – Dec.	Flooding	India	386	3.0 billion
January	Flooding	Malawi, Mozambique, Madagascar	307	550 million
July – August	Flooding	India, Bangladesh, Pakistan	303	500 million
February 15 – 28	Winter Weather	Afghanistan	247	Millions
		All Other Events	~3,450	110 billion
		Totals	**~19,500**	**123 billion**

Exhibit 10: Global Human Fatalities



The number of human fatalities caused by natural disasters in 2015 was approximately 19,500. Seven of the top ten events occurred in Asia, with the deadliest being a duo of earthquakes that struck Nepal in April and May, killing more than 9,100 people. The effects of the tremors also led to casualties in India, China, and Bangladesh. Unsurprisingly, earthquake was the deadliest peril of the year, comprising 53 percent of human fatalities. The second deadliest peril of 2015 was heatwave: more than 3,850 people died as the result of extremely hot weather conditions in India, Pakistan, Egypt, and Japan. Other events in the top 10 include a major summer European heatwave, a landslide in Guatemala, an earthquake that struck Afghanistan and Pakistan, flood events in southern Africa and South Asia, and a winter weather event in Afghanistan.

2015 saw an increase in natural disaster-related fatalities from those sustained in 2014 with roughly 8,000, but was still a substantial 75 percent lower than the average since 2000 with roughly 79,000. However, the tally was just 15 percent lower on a median basis with approximately 23,000.

Natural Disasters Defined and Total Events

An event must meet at least one of the following criteria to be classified as a natural disaster:

- Economic Loss: USD50 million
- Insured Loss: USD25 million
- Fatalities: 10
- Injured: 50
- Homes/Structures Damaged: 2,000

Based on these criteria, there were at least 300 separate natural disaster events in 2015, which was 12 percent above the 2000-2014 average of 269. The second and third quarters are typically the most active during the year, and 2015 was no exception with 79 and 84 events occurring, respectively. Asia Pacific sustained the highest number of events, which is to be expected given Asia's large size and susceptibility to natural disaster events. EMEA was the second-most active region of the globe.

Exhibit 11: Total Natural Disaster Events

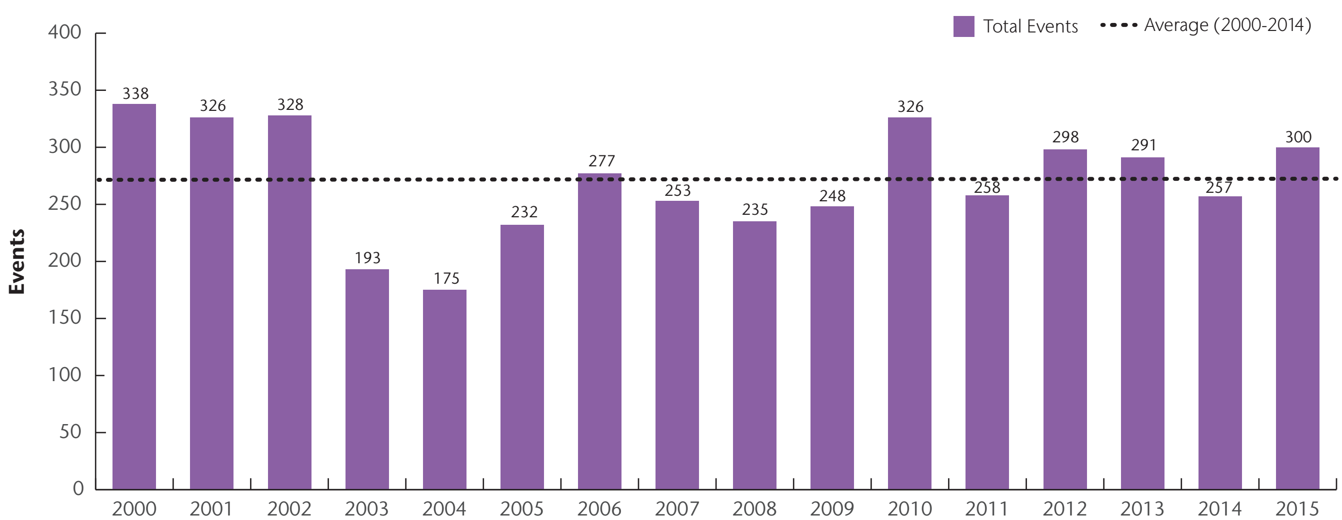
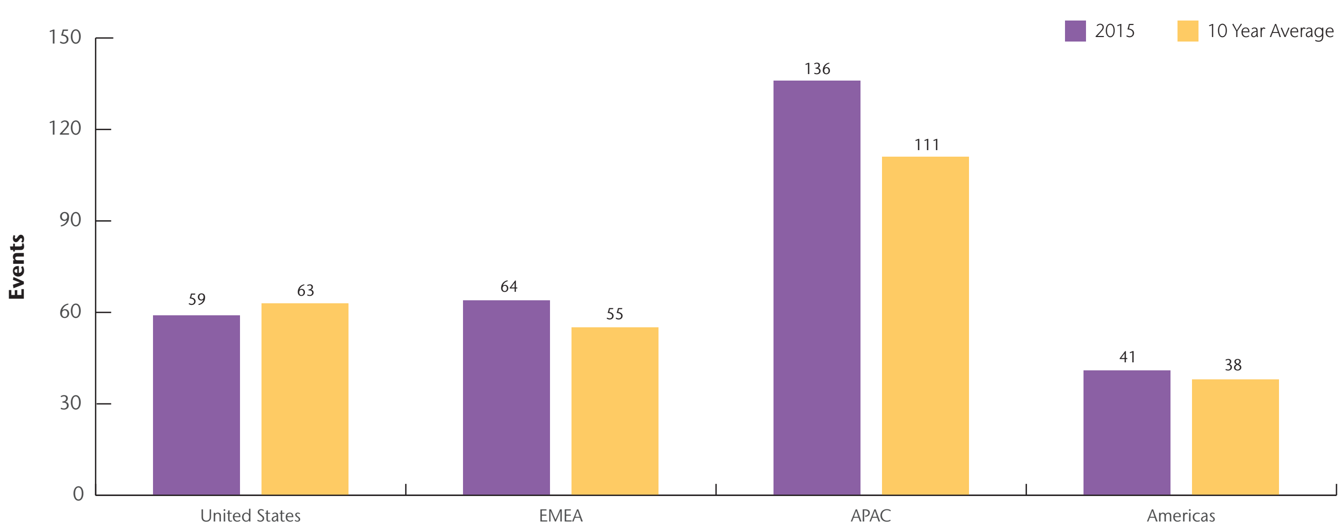


Exhibit 12: Total Natural Disaster Events by Region



An Analysis: Do ENSO Phases Lead to Differences in Weather Catastrophe Losses?

The El Niño-Southern Oscillation (ENSO) is an oceanic pattern that tracks anomalous warming or cooling of the waters in the central Pacific Ocean. A warm phase is known as El Niño, and a cool phase is known as La Niña. These phases typically occur every three to seven years, and often trigger significant weather disruptions that are felt around the globe. When these anomalously warm or cool sea surface temperatures do not exist, ENSO is considered to be in a neutral phase. In the 66 years since official ENSO records began in 1950, there has been a nearly uniform distribution of ENSO phase years: La Niña (21), El Niño (22), and Neutral (23). The question then becomes: Do the different phases of ENSO lead to weather catastrophe loss variability?

Overall Global Weather Catastrophe Losses

When breaking down historical weather catastrophe loss data from Aon Benfield's database, a distinct trend is recognized. La Niña years have clearly shown greater average annual losses on both an economic and insured basis in comparison to El Niño and Neutral phases. The results indicate that there is a 42 percent difference in annual economic losses alone between La Niña (USD77 billion) and El Niño (USD45 billion) years when using inflation-adjusted dollar values. Much of the increase in losses during a La Niña year surrounds the historical increased frequency of costly landfalling tropical cyclone events in the Atlantic Ocean basin and heightened flooding events across Asia Pacific. Similar percentage differences are found when analyzing from an insured loss perspective as well.

Global Weather Catastrophe Losses by Region

Significant distinctions between economic and insured losses by ENSO phases are found amongst the different regions of the globe. Asia Pacific shows a 121 percent increase during La Niña (USD47 billion) on average as opposed to El Niño (USD21 billion). The difference is less pronounced between Neutral (USD27 billion) and El Niño. The United States also shows greater rates of economic loss during La Niña (USD32 billion) and Neutral conditions (USD33 billion) in comparison to an average El Niño year (USD20 billion). Interestingly, the Americas have recorded more annual losses in La Niña years (USD11 billion) than El Niño (USD4.7 billion). This is surprising given warmer water temperatures off the west coast of South America and the southern half of North America typically leads to more tropical and non-tropical storm events that induce major flooding. EMEA, particularly Europe, does not typically sustain major weather variability during ENSO events. This is confirmed in the loss analysis. It is worth noting that data collection remains challenging in Latin America, which may be impacting this analysis.

Insured losses largely mirror the economic loss trend. The insured losses are primarily impacted by the location of the occurring event and the level of insurance penetration.

Exhibit 13: Global Weather Catastrophe Losses (Annual Average)

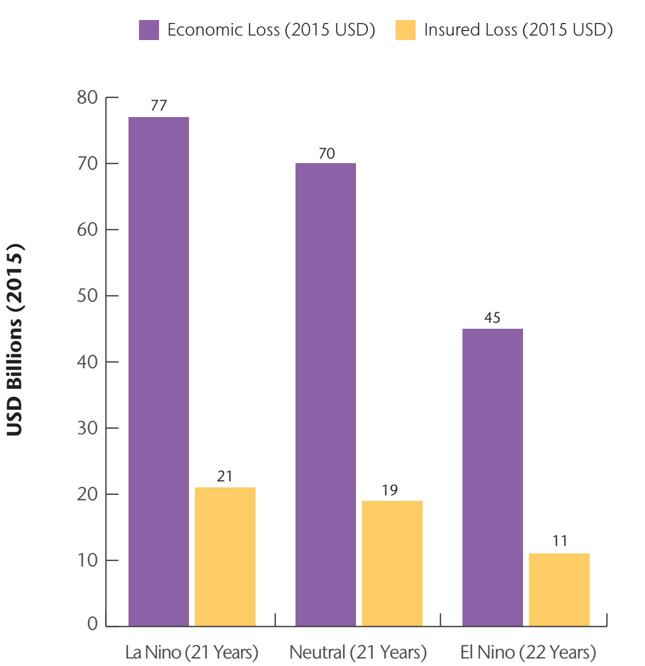
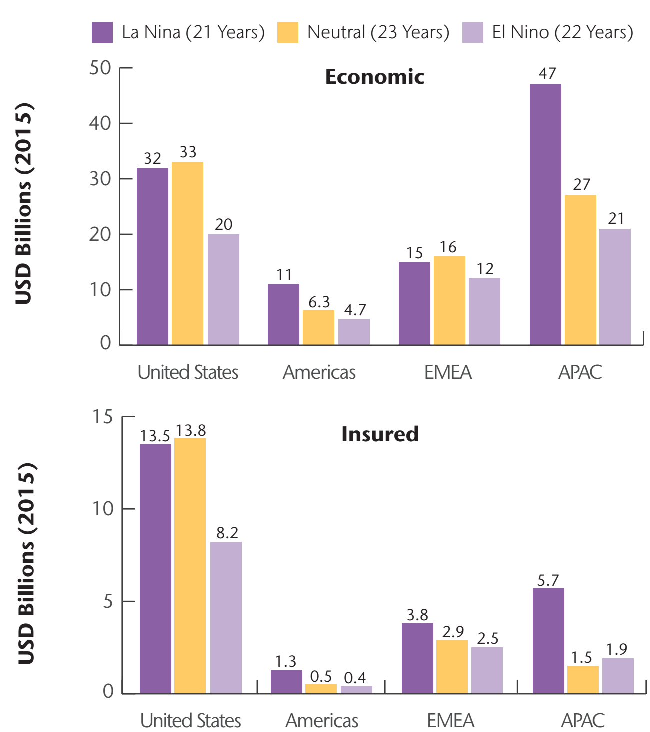


Exhibit 14: Global Weather Catastrophe Losses by Region



Global Weather Catastrophe Losses by Peril

When breaking down the economic loss data even further by perils, there are some expected yet slightly unexpected results. For this analysis, five major perils that are typically directly impacted by ENSO phases were selected: Tropical Cyclone, Flooding, Severe Thunderstorm, Winter Weather, and Drought.

The most striking find indicated that economic losses from the flood peril during La Niña (USD28 billion) were 94 percent higher than during El Niño (USD14 billion) and 51 percent higher than during ENSO-neutral conditions (USD19 billion). The two costliest flood events in modern history—Thailand in 2011 (USD47 billion) and China in 1998 (USD44 billion)—each occurred during La Niña phases. Of the nine non-tropical cyclone induced flood events that have caused more than USD20 billion in economic damage on an inflation-adjusted basis since 1950, five occurred during La Niña years. Three others were during El Niño and one was during Neutral conditions.

Similar ratios were attributed to the tropical cyclone peril, though not quite as dramatic. La Niña years have averaged USD22 billion annually, which is 79 percent higher than El Niño years (USD12 billion) and 15 percent higher than neutral years (USD19 billion). The breakdown of the top 10 costliest hurricane events with inflation-adjusted economic losses beyond USD15 billion by ENSO phase includes: Neutral (4), La Niña (3), and El Niño (3).

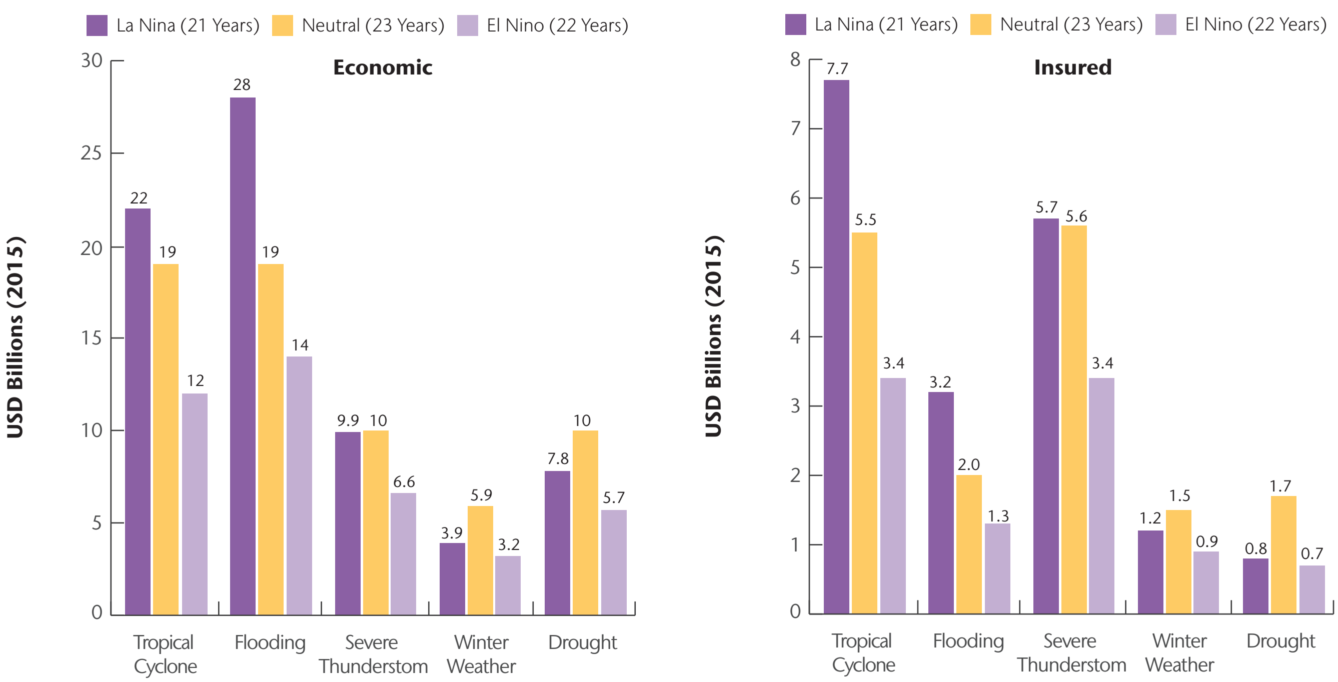
The rest of the major perils did not show distinctly greater differences. In each case, El Niño years were lower than La Niña and ENSO-neutral years. With the severe convective storm peril, thunderstorm activity produces slightly more tornadoes in the United States during La Niña or neutral years and the loss data on an economic and insured loss basis suggests this to be a contributing factor. Perhaps surprisingly it was determined that ENSO-neutral years are costlier for the winter weather and drought perils as opposed to warm or cool phases of ENSO.

Similar patterns were found when analyzing the insured loss data. An increased spike of insurance claims during La Niña was detected for the tropical cyclone and flooding perils around the world, though the majority of these claims were driven by "mega" events in the United States. If insurance penetration was greater in parts of Asia and Latin America, it is entirely likely that the percentage of insured losses for the flood peril would be much closer to—or perhaps even greater—than tropical cyclone.

Concluding Remarks

Regardless of the current phase of ENSO, extremely costly and catastrophic weather events can occur anywhere around the world. However, as this analysis concludes, the financial implications tend to be even greater during La Niña years on an economic and insured loss basis.

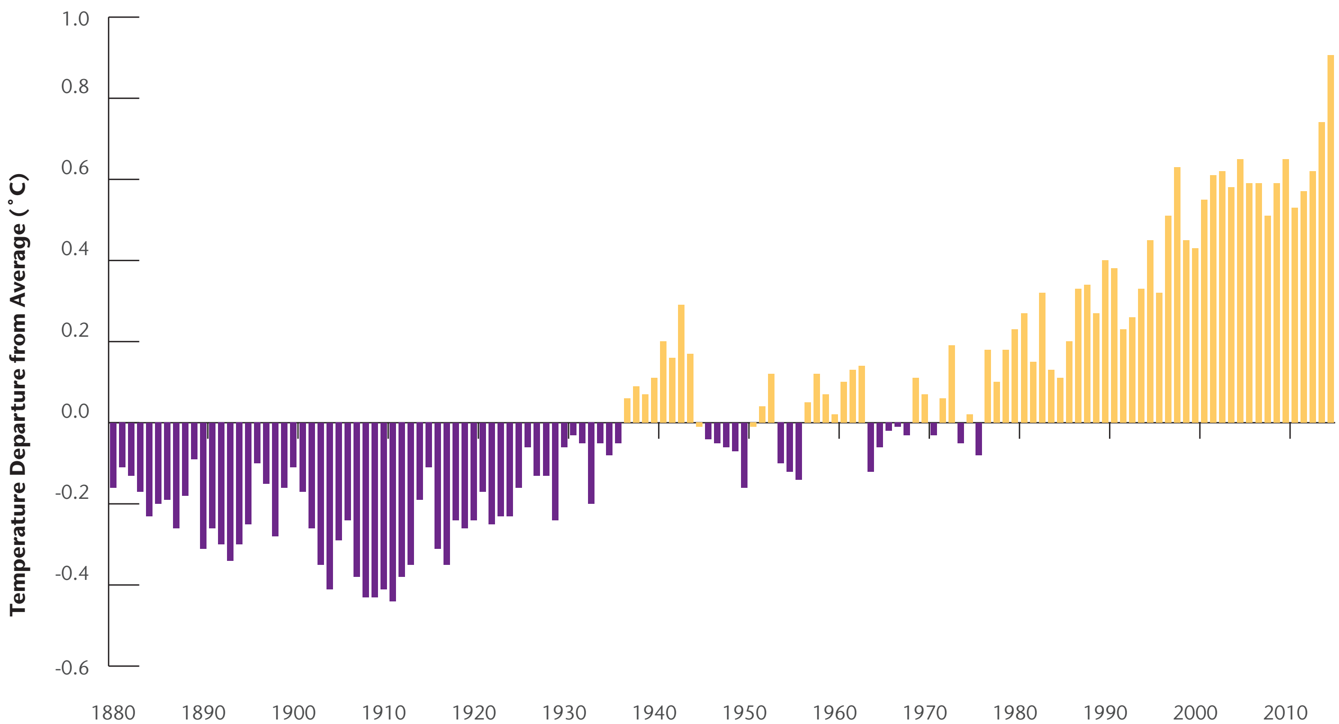
Exhibit 15: Global Weather Catastrophe Losses by Peril (Annual Average)



2015 Climate Review

2015 was the 39th consecutive year of above average global temperatures. Using official data provided by the National Centers for Environmental Information (NEIC)—formerly known as the National Climatic Data Center (NCDC)—combined land and ocean temperatures for the earth in 2015 averaged 0.90°C (1.62°F) above the long-term mean, making 2015 the warmest year ever recorded since official data on global temperatures began being collected in 1880. This well surpasses the previous record of 0.74°C (1.33°F) that was set in 2014. The anomaly data is used in conjunction with NEIC's 20th century average (1901-2000). The last below-average year for the globe occurred in 1976, when global temperatures registered 0.08°C (0.14°F) below the long-term average.

Exhibit 16: Global Land and Ocean Temperature Anomalies: 1880-2015



Various ocean oscillations influence the amount of warming or cooling that takes place in a given year. The El Niño/Southern Oscillation (ENSO) is a warming or cooling cycle of the waters across the central and eastern Pacific, leading to a drastic change in the orientation of the upper atmospheric storm track. Warming periods are noted as El Niño cycles, while cooling periods are known as La Niña cycles. The Niño-3.4 Index, which measures the temperature of the ocean waters in the central Pacific, is used to determine ENSO phases/cycles.

According to data from the National Oceanic and Atmospheric Administration's (NOAA) Climate Prediction Center (CPC), 2015 was a year marked by the strongest El Niño since at least 1997/98. El Niño conditions, which are defined by the CPC as five consecutive months with sea surface temperatures greater than the 0.5°C anomaly in the Nino-3.4 region in the Pacific Ocean (5°N-5°S & 120°-170°W), were first observed in March 2015 and intensified to above 2.0°C by the last quarter of the year. Long-range forecasts indicate that El Niño will persist through boreal winter 2015/16 and transition back to ENSO-neutral conditions by the end of the first half of 2016.

Overall global tropical cyclone activity in 2015 saw an uptick from last year, with 95 named storms having developed across all global ocean basins. This ties 2008 and 2013 as the highest number of named storms since 2005; and 10 percent above the long-term 35-year average of 86. There were 55 hurricanes, typhoons, and cyclones (storms with sustained winds of at least 74 mph (119 kph)), which was above the 35-year average of 47. The 55 storms represented the most in a season since 1997. The number of major storms (Saffir-Simpson Hurricane Wind Scale rating of Category 3, 4 or 5 with sustained winds of at least 111 mph (179 kph)) was also above average with 40 forming during the year. This is more than 72 percent above the long-term average of 23. This is the highest number of such storms since complete global data records began in 1980. The 31 major storms in the Northern Hemisphere far surpassed the previous record in 2004 with 23, and the 26 Category 4 and 5 storms in the Northern Hemisphere set an all-time record.

In terms of global landfalls, 21 storms came ashore in 2015 at Category 1 strength or above. Eleven of those made landfall at Category 3 strength or above. Landfall averages (1980-2014) include 15 Category 1+ and five Category 3+ events.

All official tropical cyclone data comes via the US National Hurricane Center (NHC) and the Joint Typhoon Warning Center (JTWC).

Exhibit 17: Global Tropical Cyclone Activity

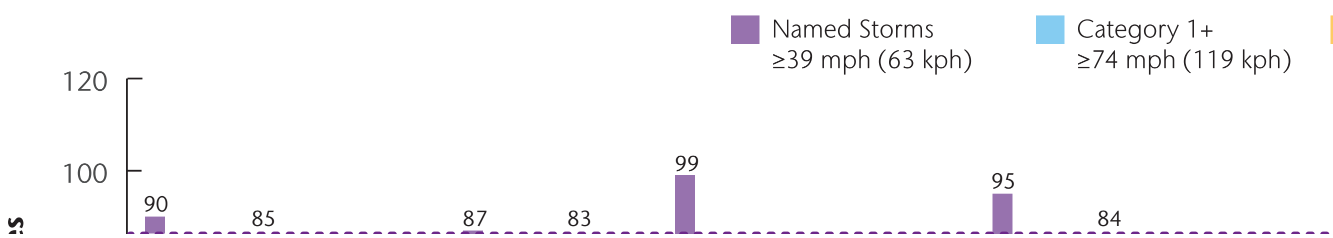
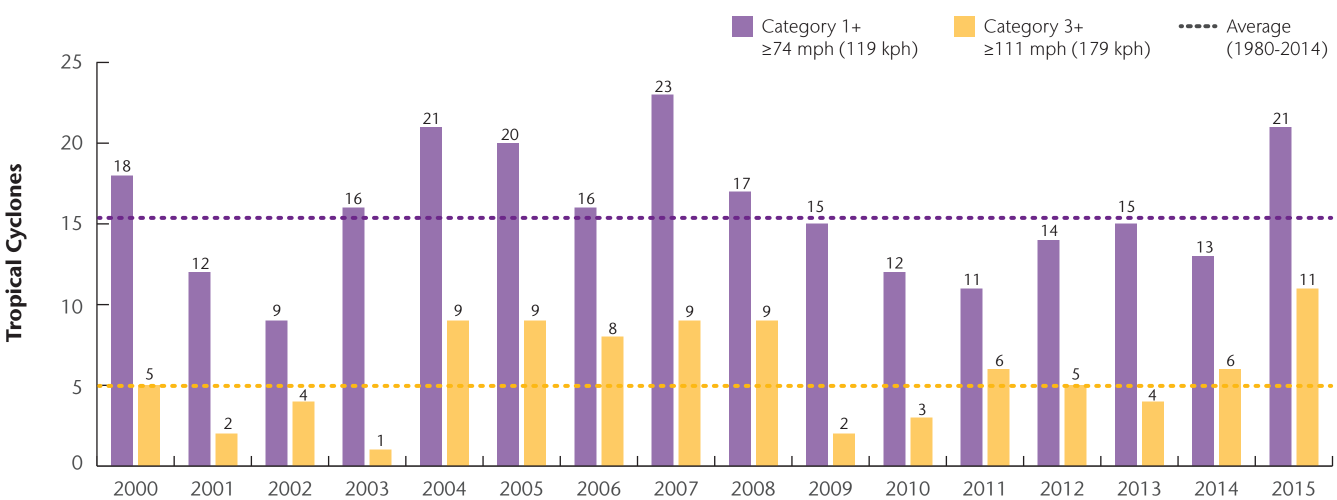


Exhibit 18: Global Tropical Cyclone Landfalls



2015 Atlantic Ocean Hurricane Season Review

The 2015 Atlantic Hurricane Season was another relatively quiet year, as it marked a record tenth consecutive season in which the United States did not sustain a major hurricane (Category 3+) landfall. In terms of overall basin activity, it was a slightly below average year as only 11 named storms developed. The average of 12. Four hurricanes (Category 1+) were recorded, of which two strengthened into major hurricanes (Category 3+). The 1980 to 2014 average number of hurricanes (Category 1+) is seven, and the long-term average for major hurricanes (Category 3+) is three. The 2005 season continues to hold the record for most hurricanes in a year when 15 formed.

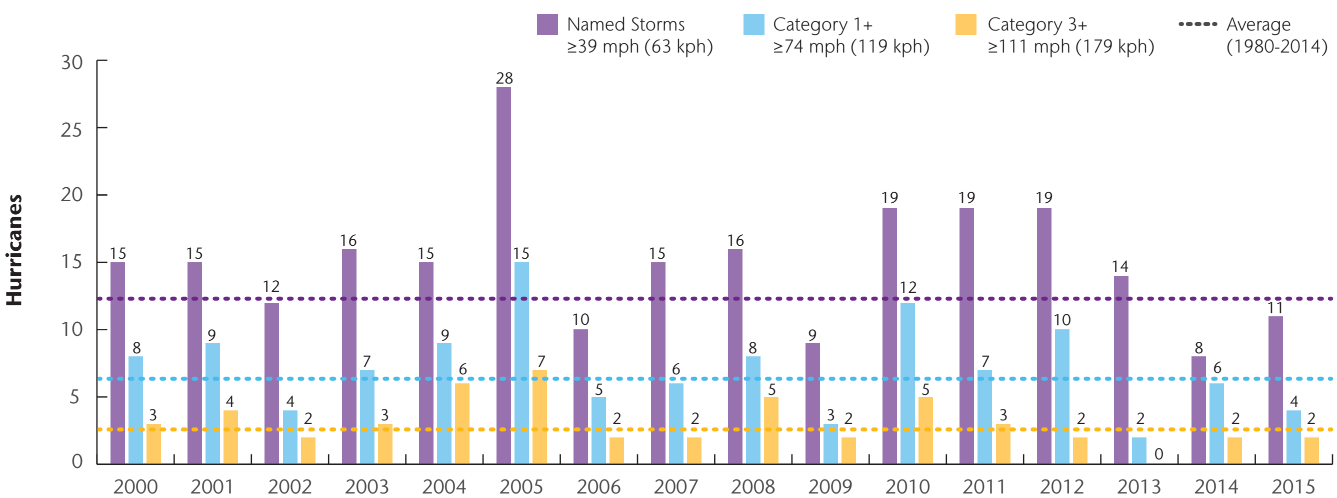
The lack of activity in the Atlantic Basin was heavily influenced by El Niño conditions in the Pacific Ocean. The El Niño conditions brought stronger than normal vertical wind shear to the Atlantic Ocean's main development region and the Caribbean Sea. Most of the season was also marked by below-average sea surface temperatures in the Atlantic Ocean.

The 2015 Atlantic Hurricane Season began with Tropical Storm Ana which developed nearly a month before the official start of the season in early May. Ana made landfall near the North Carolina-South Carolina border and became the earliest tropical system on record to make landfall in the United States. Tropical Storm Bill followed in mid-June, with the remnants bringing periods of heavy rain to the Midwest and Plains.

One of the most notable storms of the season was August's Tropical Storm Erika, which went down as the deadliest and costliest storm in the basin. Erika claimed 36 lives in Dominica and left an economic damage bill of USD512 million in the Caribbean. Major Hurricane Joaquin formed in September and was the strongest and longest-lived hurricane of the season. Joaquin caused major damage in the some of the lesser populated Bahamian Islands where it lingered for nearly 48 hours as a Category 4 storm. It claimed 35 lives and prompted an estimated USD50 million insured loss in the Bahamas and Bermuda. Of note, moisture from Joaquin would feed into South Carolina as part of a larger system that left historic flooding.

The Atlantic Hurricane Season officially runs from June 1 to November 30. For additional Atlantic Ocean Basin landfalling tropical cyclone data (including US-specific information), see Appendix D.

Exhibit 19: Atlantic Basin Tropical Cyclone Activity



2015 Eastern and Central Pacific Ocean Hurricane Season Review

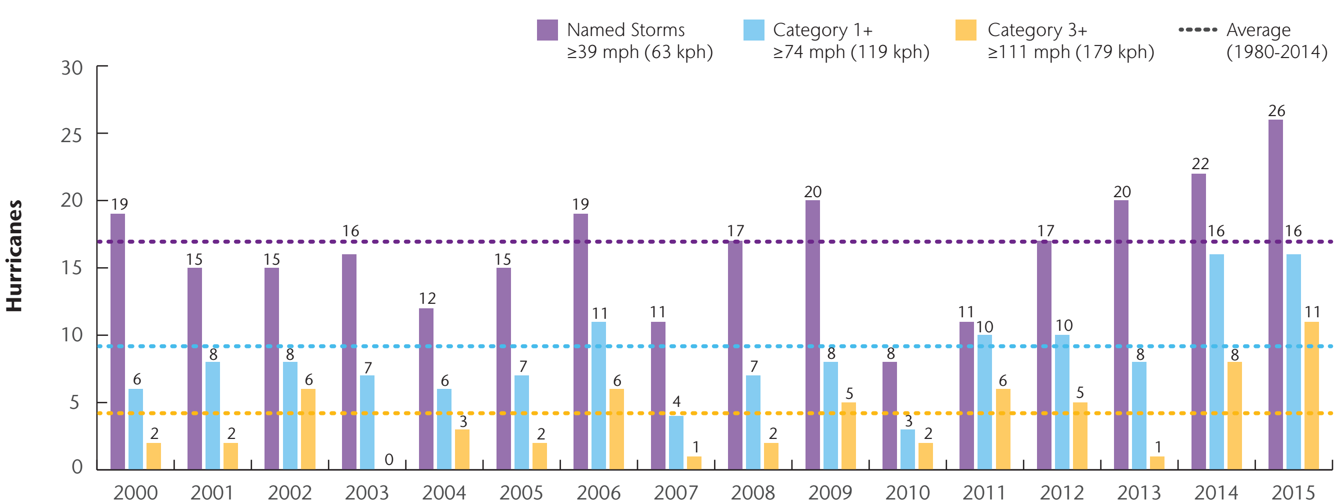
The 2015 Eastern and Central Pacific Hurricane Season was the most active year on record since 1992 with a combined total of 26 named storms forming, approximately 53 percent above the 1980 to 2014 average of 17 named storms. Of the 26 named storms, 16 became hurricanes, which was roughly 78 percent above the 35-year average of 9. This matched 2014's total of 16 hurricanes. Eleven hurricanes strengthened to major hurricane (Category 3+) status, or 175 percent above the 1980 to 2014 average of 4. The number of major hurricanes broke a modern record for the basin, which was previously set in 1992 with 10. Despite the enhanced hurricane activity, only one hurricane made a direct landfall: Major Hurricane Patricia came ashore in western Mexico in October as a Category 5 strength storm.

The increased activity in the Eastern and Central Pacific Ocean in 2015 was heavily influenced by the strongest El Niño conditions in the Pacific Ocean in decades. The El Niño conditions brought higher-than-average sea surface temperatures, reduced vertical wind shear and lower atmospheric pressure to the Eastern Pacific Ocean. Each of these factors combined to create favorable conditions for a very active year of cyclogenesis.

Despite just one hurricane officially making landfall, the Eastern and Central Pacific Hurricane Season was meteorologically very active. The season got off to an explosive start with two major hurricanes (Andres and Blanca) and a hurricane (Carlos) forming in May and June. Blanca and Carlos both made landfall in Mexico as tropical storms prompting damage in Baja California Sur and Jalisco states respectively. The most substantial cyclone event by far was October's Major Hurricane Patricia. The storm re-wrote the record book as it became the strongest, costliest, and deadliest hurricane of the Pacific season and only the second hurricane on record to make landfall on Mexico's Pacific coast as a Category 5 storm. It peaked with 200 mph (320 kph) winds, making it the strongest cyclone ever recorded in the Western Hemisphere. It made landfall in Jalisco state but remarkably only caused economic losses around USD410 million. Insured losses, primarily attributed to agriculture, were close to USD100 million.

The Eastern Pacific Hurricane Season officially runs from May 15 to November 30, while the Central Pacific season runs from June 1 to November 30. For additional Eastern Pacific Ocean Basin landfalling tropical cyclone data, please see Appendix D.

Exhibit 20: Eastern and Central Pacific Basin Tropical Cyclone Activity



2015 Western North Pacific Ocean Typhoon Season Review

Tropical cyclone activity in the Western North Pacific Ocean was close to average in 2015. A total of 26 named storms developed which equaled the long-term 35-year average. Of those storms, 18 became typhoons. This was slightly above the 35-year average of 16 typhoons. Sixteen of the 18 typhoons reached Category 3 (or higher) strength, or 122 percent above the 1980 to 2014 average of nine. The 18 typhoons were the most in the basin since 2004 and the 16 typhoons with Category 3+ intensity were one of the highest annual totals since 1950. Eleven typhoons made landfall, which was 34 percent above the long-term average. Seven of the typhoons were Category 3 or higher in intensity.

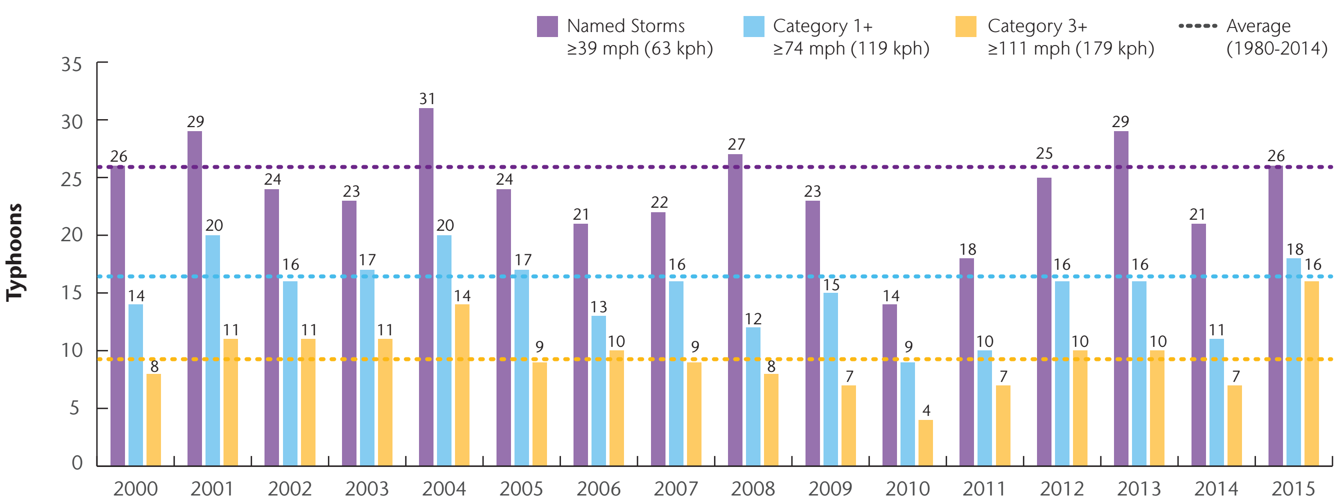
Multiple typhoons led to multi-billion dollar economic losses during the season, most notably Super Typhoon Soudelor and typhoons Mujigae and Chan-hom. Most of the damage from each listed storm occurred in China. The costliest insured storms were Typhoons Goni (USD980 million) and Chan-hom (USD325 million); while the deadliest storms were Typhoon Goni (70), Super Typhoon Koppu (58), Typhoon Melor (42) and Super Typhoon Soudelor (34).

The Philippines experienced another busy season, with three tropical storms, two typhoons, and two super typhoons making landfall in 2015. Super Typhoons Noul and Koppu made landfall in May and October respectively; while typhoons Mekkhala and Melor came ashore in January and December, respectively. Koppu was the most destructive of the storms to impact Philippines. This was primarily due to the storm lingering over northern Luzon for nearly four days and spawning torrential rains before dissipating. Koppu destroyed or damaged nearly 140,000 homes and caused economic losses of USD306 million to infrastructure and agriculture alone. Melor damaged nearly 280,000 homes.

The strongest typhoon of the season was August's Super Typhoon Soudelor which attained Category 5 strength with sustained wind speeds of 285 kph (180 mph). Soudelor was one of at least five typhoons to reach Category 5 intensity in the basin.

The Western Pacific Typhoon Season officially runs throughout the calendar year, though most activity occurs between the months of May and November. For additional Western Pacific Ocean Basin landfalling tropical cyclone data, please see Appendix D.

Exhibit 21: Western Pacific Basin Tropical Cyclone Activity



2015 North Indian Ocean Cyclone Season Review

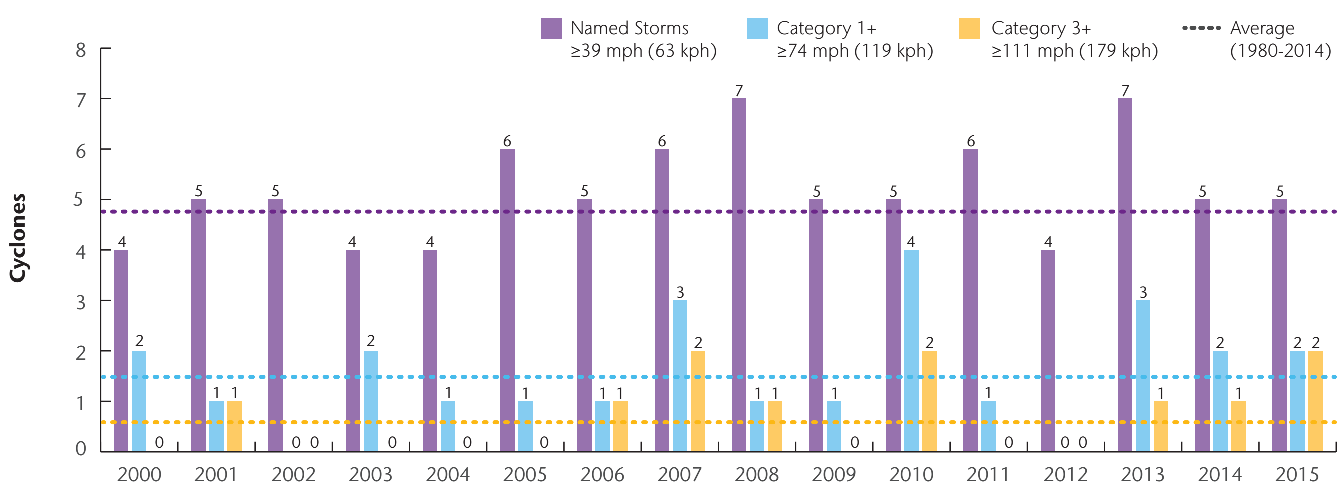
The North Indian Ocean Basin saw average tropical cyclone activity in 2015. Five named storms developed in the region which matches the 1980 to 2014 average. Of those storms, two cyclones formed, both of which strengthened to Category 3+ intensity. Based on the 35-year average, approximately two cyclones (Category 1+) develop per year and one cyclone strengthens to Category 3+ intensity. Two cyclones made landfall, which is one more than the longer-term average of one.

The season was highlighted by Cyclones Chapala and Megh which both made landfall in Yemen at the start of November. This was unprecedented in the modern era—never before have two tropical systems made landfall in the country in the same season. Chapala formed first, attaining Category 4 hurricane strength before weakening and coming ashore at Category 1 intensity. Megh followed one week later, becoming a Category 3 strength storm as it crossed Socotra Island. It weakened to tropical storm strength before striking mainland Yemen. The storms wrought havoc on Socotra and in Yemeni city of Mukalla, damaging a combined total of almost 15,000 homes and claiming dozens of lives.

Two more named storms formed during the season: Cyclone Ashobaa in June and Cyclone Komen in July. Both storms reached tropical storm strength along with an un-named system that formed in the Arabian Sea in October. Ashobaa triggered torrential rainfall and flooding in eastern Oman while Komen enhanced the southwest monsoonal system over portions of Myanmar and Bangladesh prompting widespread flooding and damage.

The North Indian Ocean Cyclone Season officially runs throughout the calendar year, though most activity occurs between the months of April and December. For additional North Indian Ocean Basin landfalling tropical cyclone data, please see Appendix D.

Exhibit 22: North Indian Basin Tropical Cyclone Activity



2015 Southern Hemisphere Cyclone Season Review

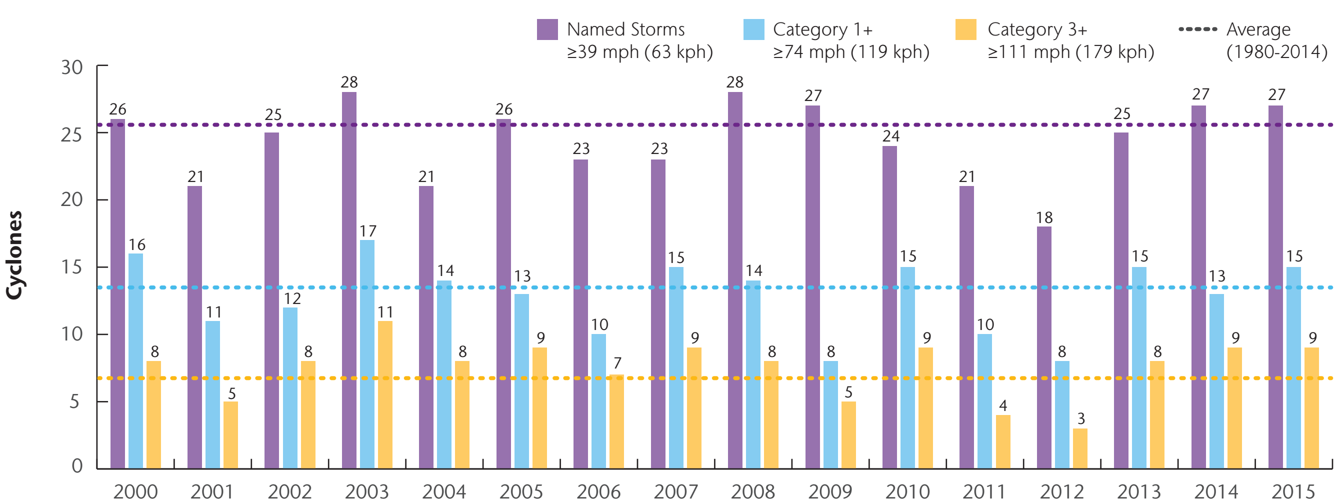
The Southern Hemisphere saw slightly above average tropical cyclone activity. A total of 27 named storms developed in the region, which is just above the average of 26 since 1980. Fifteen cyclones (Category 1+) formed which was also just above the 1980-2014 average of 14. Additionally, nine cyclones reached Category 3+ strength, which is approximately 29 percent above the 35-year average of seven, and three reached Category 5 strength. Out of the 15 Category 1+ cyclones, six made landfall: three of which came ashore at Category 3 strength or higher. Both of these figures were above the 1980-2014 averages of three and one respectively.

Five tropical cyclones (Category 1+) made landfall in Australia: Cyclone Lam was the strongest cyclone to make landfall in Northern Territory in nine years when it came ashore in February with 185 kph (115 mph) winds (Category 3); Cyclone Marcia intensified rapidly prior to making landfall over Queensland as a Category 4 storm, also in February. Cyclones Olwyn, Nathan, and Quang would all eventually make separate landfalls in the country at Category 1 intensity. Cyclone Marcia was the costliest of the Australian cyclones prompting economic losses of USD650 million and insured losses of USD402 million as it caused widespread wind and flood damage over parts of southeastern Queensland.

Outside of Australia, the most significant cyclonic activity occurred in Vanuatu where Cyclone Pam made landfall as a Category 5-strength system in March. Pam was the most intense Southern Hemisphere cyclone of the season and was one of the strongest ever to form in the South Pacific Ocean. Pam's wind speeds peaked at 270 kph (165 mph) as it made its way through the Vanuatu archipelago crippling the nation's infrastructure and damaging an estimated 90 percent of the properties. The USD450 million economic cost equaled 64 percent of Vanuatu's GDP. The damaging storm surge and torrential rainfall generated by the storm also impacted portions of Tuvalu, Solomon Islands, Fiji, New Caledonia, and New Zealand.

The Southern Hemisphere Cyclone Season officially runs from July 1 to June 30. (The 2015 season ran from July 1, 2014 to June 30, 2015.) For additional Southern Hemisphere landfalling tropical cyclone data, please see Appendix D

Exhibit 23: Southern Hemisphere Tropical Cyclone Activity



2015 United States Tornado Season Review

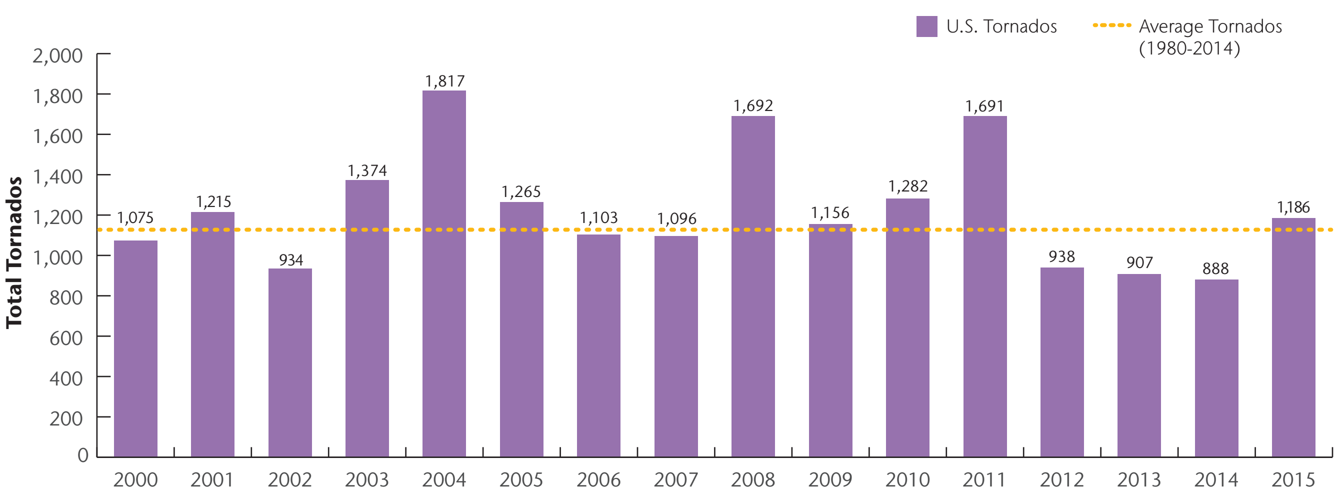
Tornado activity saw a slight uptick following three consecutive years of declining touchdowns as more than 1,000 tornadoes were recorded in the United States. The final tally in 2015 marked the first time since 2011 that tornadic activity surpassed the 1,000 threshold. However, the years 2012 to 2015 were markedly lower than 2011, which was one of the most active years in history. A preliminary count from the Storm Prediction Center (SPC) tallied 1,186 tornadoes in 2015, which was 34 percent above the 888 touchdowns in 2014 and a 31 percent increase from the 907 in 2013. 2015's tally was three percent below the Doppler Radar-era (1990-2014) average of 1,223. The use of Doppler radar, beginning in the early 1990s, has led to markedly improved tornado detection. Because of this improved detection, the observed annual average number of tornadoes has risen, particularly with weaker tornadoes (EF0). There were 21 tornadoes rated EF3 or greater in 2015, with no EF5 tornadoes touching down for the second consecutive year. This compares to the 27 EF3 or greater tornadoes (0 EF5) that struck the US in 2014.

A total of 13 killer tornadoes (tornadoes that caused fatalities) occurred across the United States in 2015. This is one below the 14 sustained in 2014. The killer tornadoes of 2015 left 34 people dead, which was 51 percent below the 35-year average of 69. This marked the fewest number of US tornado fatalities since 2009. Tornado-related fatalities tallied 47 in 2014. The vast majority of the tornado fatalities in 2015 occurred during the month of December with 24. Additional fatalities were recorded in May, March, and April.

The deadliest twister of the year occurred on December 23 as a powerful EF4 tornado ravaged portions of Mississippi and Tennessee and left nine people dead. Another deadly tornado on December 26 left eight people dead in the greater Dallas, TX metro region. The 2015 fatality by state breakdown includes: Texas (15), Mississippi (11), Tennessee (2), Arkansas (2), Oklahoma (2), Illinois (2).

For additional United States tornado data, including a look at a breakdown of tornado frequencies by month and during ENSO cycles, please see Appendix E.

Exhibit 24: United States Tornado Activity



2015 United States Wildfire Season Review

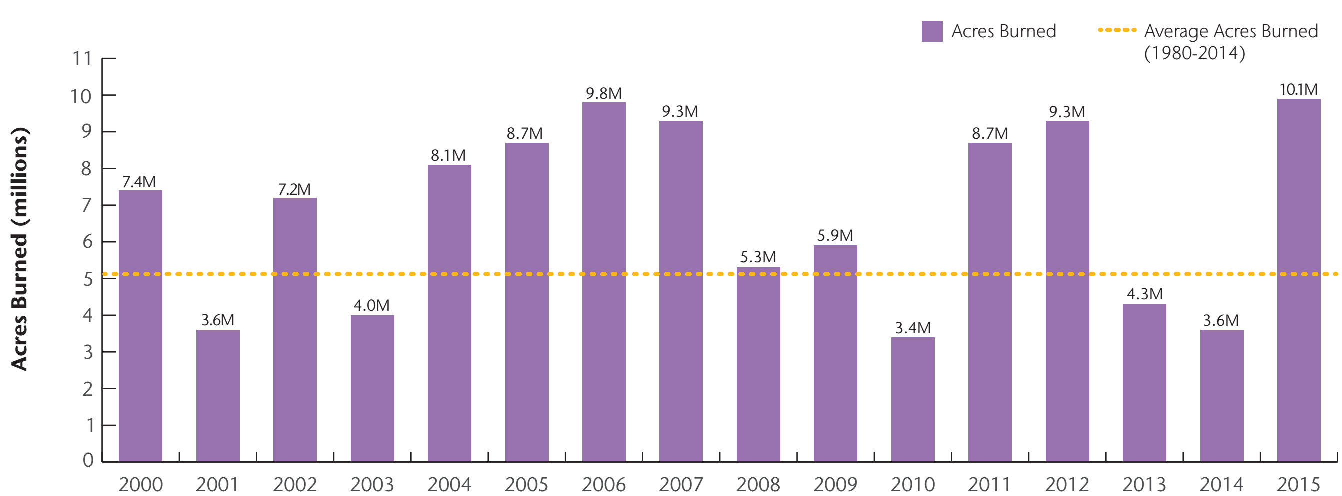
A record year for wildfires was established across the United States in 2015, as both the overall number of acres burned and the number of acres (hectares) burned per fire were each more than double the 1983-2014 average. The National Interagency Fire Center (NIFC) reported that an estimated 61,922 wildfires burned 10,125,149 acres (4,097,506 hectares) of land. Nearly half of this total was incurred in Alaska. This compares to 63,612 fires charring 3,595,613 acres (1,455,094 hectares) in 2014 and the 32-year average of 71,749 fires burning 4,665,347 acres (1,888,001 hectares). The average acres burned per fire during the year was 163.51 acres (66.17 hectares), which was substantially higher than the normal 65.53 acres (26.52 hectares). This set a record for the highest burn rate per fire. 2015 marked a 117 percent tally above the long-term average number of acres burned, and 150 percent above the normal acres burned per fire average.

The most significant wildfire activity occurred in California during the month of September as the Valley Fire and Butte Fire combined to cause an estimated USD2.0 billion in economic damage. The USD1.3 billion price tag to insurers made the 2015 season the costliest since 2007 in the state. The Valley Fire, which burned in Lake, Napa, and Sonoma counties, destroyed at least 1,958 structures and became the third-most damaging fire in state history. The Butte Fire, which destroyed at least 818 structures in Amador and Calaveras counties, became the seventh-most damaging fire in state history. Other notable fires burned in Washington and Oregon during the year.

El Niño very likely played a role in the dramatic increase in acres burned during 2015 – not just in the United States but in areas around the world. With some regions noting drought conditions due to a lack of rainfall and above normal temperatures, elevated wildfire activity was registered in parts of Europe and Asia. Indonesia endured record numbers of fires that burned uncontrollably and sent plumes of smoke across Southeast Asia for several months. The estimated USD16.1 billion economic impact made it the costliest natural disaster event of the year.

For additional United States wildfire data, please see Appendix F.

Exhibit 25: United States Wildfire Activity



2015 Global Earthquake Review

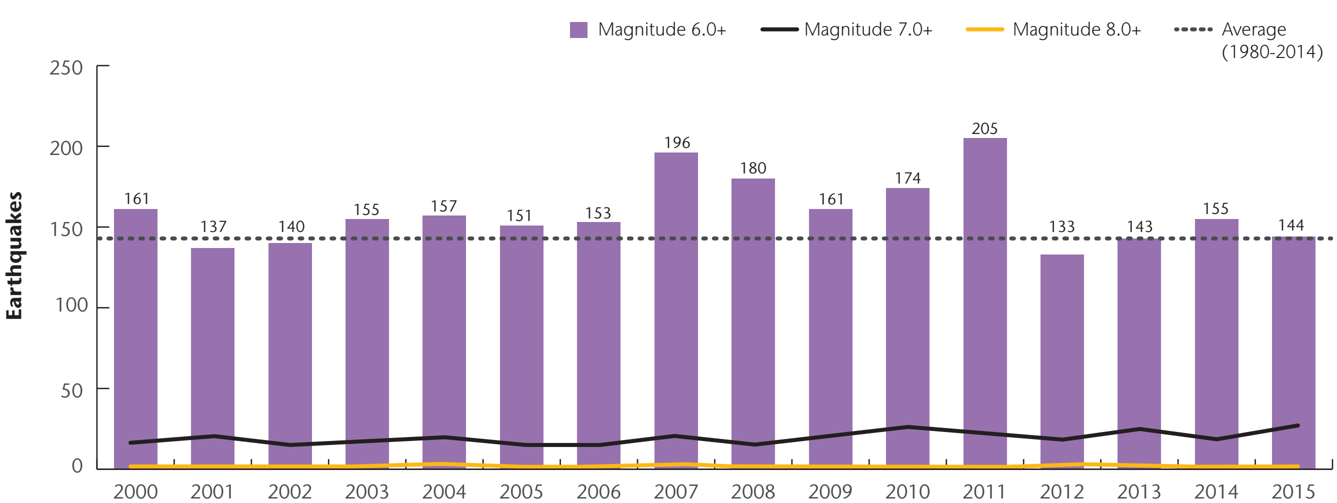
The number of recorded global earthquakes (≥M6.0) was slightly above average in 2015. Based on data from the United States Geological Survey's (USGS) National Earthquake Information Center (NEIC) and the Advanced National Seismic System (ANSS), there were 144 earthquakes with magnitudes greater than 6.0, 20 earthquakes with magnitudes greater than 7.0 and 1 earthquake with a magnitude greater than 8.0. This compares to the 155 (≥M6.0), 12 (≥M7.0) and one (≥M8.0) seen in 2014, and the 1980-2014 averages of 142 (≥M6.0), 14 (≥M7.0) and one (≥M8.0).

The strongest earthquake of the year was a magnitude-8.3 tremor that struck just offshore from Chile's Coquimbo Region on September 16. Despite the megathrust event being felt throughout numerous South American countries, damage was much less that initially anticipated given outstanding building codes and the structural integrity of homes and businesses in Chile. Small tsunami waves were observed along the coasts of Chile, Peru, Ecuador, and elsewhere across parts of the Pacific Ocean.

The deadliest earthquakes of the year struck Nepal on April 25 and May 12. The magnitude-7.8 and magnitude-7.3 temblors left a combined total of 9,120 individuals dead throughout Nepal, India, China, and Bangladesh. More than 850,000 residences and other buildings, including irreplaceable world heritage sites, were damaged or destroyed. This pair of earthquakes was also the year's economically costliest (USD8.0 billion) for the peril. The highest insured loss from an earthquake was the USD600 million tally accumulated following the magnitude-8.3 quake that struck Chile in September.

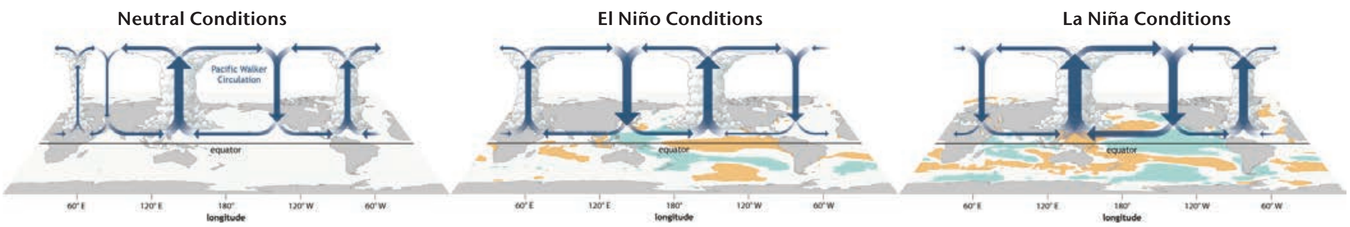
As shown during the past 10 years in Exhibit 26, overall earthquake activity does not tend to show large fluctuations on an annual basis. The USGS cites that a substantial increase in seismograph stations and continued improvements in global technology and communication has greatly strengthened the quality of earthquake data collection. It should also be noted that despite fluctuations in the number of total earthquakes since the early 1900s, the number of recorded major earthquakes (≥M7.0) have remained fairly consistent on a year-to-year basis.

Exhibit 26: Global Earthquake Activity ≥M6.0



El Niño/Southern Oscillation Background

Exhibit 27: Phases of the El Niño/Southern Oscillation (ENSO)



Source: NOAA

There are several atmospheric and oceanic dynamics that impact tropical cyclone development across the globe. One of the main driving climate factors for the globe's weather activity is the El Niño/Southern Oscillation (ENSO), which is an anomalous warming or cooling of the central Pacific Ocean waters that generally occurs every three to seven years, mainly between August and February.

During neutral conditions, surface trade winds blow from the east and force cooler waters that are upwelled from the deeper depths of the Pacific Ocean to the surface across the western coast of South America. Because of the displacement of water flowing to the west, the ocean is up to 60 centimeters (two feet) higher in the western Pacific Ocean as it is in the eastern Pacific Ocean. The warmer waters are forced into the western portions of the ocean, allowing thunderstorm activity to occur across the western half of the Pacific Ocean.

During El Niño conditions, the surface trade winds that normally blow from east to west weaken and sometimes even reverse direction. This allows the warmer waters to remain or even traverse eastward, bringing more frequent thunderstorm activity to the central and eastern portions of the Pacific Ocean. Warm and very wet conditions typically occur across Peru, Ecuador, Brazil and Argentina from December through April. Portions of Central America, Colombia and the Amazon River Basin are dry, as are southeastern Asia and most of Australia. In Africa, El Niño's effects range from wetter-than-average conditions across eastern portions to warmer and drier-than-average conditions across southern portions. In North America, the polar jet stream (the jet stream that is responsible for Arctic outbreaks) is usually pushed northward, keeping cold Arctic air across the northern portions of Canada. Warmer-than-average temperatures typically occur across the northern United States and southern Canada. The subtropical jet stream, which usually sinks southward during the winter months, will drift northward and bring a succession of storm systems across the southern tier of the US and northern Mexico.

During La Niña conditions, the surface trade winds will strengthen, promoting additional cooler water to be upwelled from the depths of the Pacific Ocean up to the surface and forced westward. This forces thunderstorm activity across the Pacific Ocean westward and often brings fewer tropical systems to the central and eastern Pacific regions. Because of the waters' influence on the upper atmospheric jet stream, La Niña's effects, like El Niño's effects, are experienced worldwide. The main effects are usually noted across the western Pacific regions, where wetter conditions are expected, especially during the beginning months of the year. Wet and cool conditions are typical across southern Africa and eastern South America between December and February. With the polar jet stream displaced further south, cool and wet conditions occur across the northern half of the North America West Coast, while dry and mild conditions are experienced for the southern half of the United States into northern Mexico. If La Niña's cycle continues into June, July and August, warm and wet conditions often occur across Indonesia and the southern half of Asia, while cool and wet conditions are found across the southern portions of the Caribbean Ocean.

See Appendix C for ENSO's effects on tropical system frequency for all of the global basins

Atlantic Hurricane Season Forecasts

Historical Predictions

Abundant media coverage is given to various organizations across the world that issue hurricane season predictions for the Atlantic Ocean Basin. These organizations utilize meteorological and climatic data obtained, in some instances, up to six months in advance to determine how active or inactive the Atlantic Hurricane Season will be in the upcoming year. Several different professional entities issue these forecasts, ranging from governmental agencies to universities to private companies. Three organizations which consistently make their forecasts available to the public are:

- Colorado State University (CSU), a forecast group sponsored by Colorado State University and private companies that is led by Dr. Philip Klotzbach and Dr. William Gray
- The National Oceanic and Atmospheric Administration (NOAA), the United States' official governmental climatological and meteorological office
- Tropical Storm Risk (TSR), an Aon Benfield-sponsored forecast group based in London, England led by Professor Mark Saunders and Dr. Adam Lea

Some of these entities disclose in detail the parameters being used to derive these forecasts, while others cite general factors for the reasoning of their predictions. CSU and TSR provide specific numbers for each year's forecasts, while NOAA provides a range of values.

The forecasts for the last five years made between the period of in late May and early June, along with the actual total number of named storms, hurricanes and major hurricanes are shown in the following tables. The May/June forecast was chosen due to the availability of forecasts from each organization. Additionally, a five-year cumulative forecast is shown to emphasize that long-term forecasting may yield more information on general frequency shifts than short-term forecasting

Exhibit 28: 2015 Forecasts

	May/June Atlantic Hurricane Season Forecast				
Forecast Parameter	1980-2015 Average	CSU	NOAA	TSR	2015 Season Total
Named Storms	12	8	6 – 10	10	11
Hurricanes	7	3	1 – 4	4	4
Major Hurricanes	3	1	0 – 1	1	2

Exhibit 29: Five-Year Average Forecasts

	May/June Atlantic Hurricane Season Forecast				
Forecast Parameter	1980-2015 Average	CSU	NOAA	TSR	5-Year Season Avg.
Named Storms	12	13	10 – 15	13	14
Hurricanes	7	6	4 – 8	6	6
Major Hurricanes	3	3	2 – 4	3	2

2016 Atlantic Hurricane Season Outlook

CSU and TSR release forecasts for the following year's Atlantic Hurricane Season in early December, and these forecasts are shown below. Beginning in 2011, CSU decided to suspend providing quantitative outlooks for specific numbers of named storms, hurricanes and major hurricanes (Category 3) in their December analysis. Instead, they now provide climatological probabilities of landfalls for tropical storms and hurricanes in the United States and the Caribbean Islands.

Exhibit 30: CSU 2016 United States & Caribbean Landfall Probabilities (issued December 11, 2015)

Region	Tropical Storm	Hurricanes (Category 1,2)	Hurricanes (Category 3,4,5)
Entire US Coastline	79%	68%	52%
Gulf Coast from the Florida Peninsula to Brownsville, Texas	59%	42%	30%
US East Coast including the Florida Peninsula	50%	44%	31%
Caribbean Islands	82%	57%	42%

The Accumulated Cyclone Energy Index is equal to the sum of the squares of six-hourly maximum sustained wind speeds (in knots) for all systems while they are at least tropical storm strength. The ACE Landfall Index is the sum of the squares of hourly maximum sustained wind speeds (in knots) for all systems while they are at least tropical storm strength and over the United States mainland (reduced by a factor of six).

Exhibit 31: TSR 2016 Atlantic Basin Hurricane Season Forecast (issued December 16, 2015)

Atlantic and Caribbean Overall Forecast	TSR Average year	TSR Forecast
Named Storms	11	13
Hurricanes	6	5
Intense Hurricanes	3	2
ACE Index	101	79

United States

Exhibit 32: Top 5 Most Significant Events In the United States

Date(s)	Event	Location	Deaths	Economic Loss (USD)	Insured Loss (USD)
February 22 – 26	Winter Weather	Eastern & Central US	30	3.3 billion	2.1 billion
Yearlong	Drought	Western US	N/A	4.5 billion	1.0 billion
October 1 – 11	Flooding	Eastern US	21	5.0 billion	700 million
May 23 – 28	Severe Weather	Plains, Midwest,Rockies, Southeast	32	3.8 billion	1.4 billion
September	Wildfires	California (Valley & Butte Fires)	6	2.0 billion	1.3 billion
		All Other Events	~200	16 billion	14 billion
		Totals	**~350**	**38 billion[1]**	**21 billion[1,2]**

Economic and insured losses derived from natural catastrophes in the United States were below the 2000-2014 norm and similar to incurred losses in 2014. For the third consecutive year, the country did not endure an individual disaster event that caused economic losses beyond the USD10 billion threshold. Both economic and insured losses (USD38 billion and USD21 billion, respectively) in 2015 were 35 and 34 percent, respectively, below the 2000-2014 average. However, on a median basis, economic losses were actually 17 percent higher. Insured losses were comparatively higher by 3.5 percent.

Despite a lack of a “mega” catastrophe, there were several notable events in the United States in 2015. The costliest was a historic flood event across parts of the Eastern US during the month of October, with particular emphasis in South Carolina. Areas around Columbia, SC recorded 1-in-1,000 year flooding following record rainfall that led to extensive damage to property, agriculture and infrastructure. Total economic losses are estimated around USD5.0 billion. Separate major flood events were also noted in parts of Texas and Oklahoma in May and October; and the Midwest and Mississippi Valley in December. Elsewhere, a record-setting winter season led to major impacts across the Northeast. The greater Boston, Massachusetts metro region set an all-time record for snowfall that had widespread economic impacts from both a physical damage and business interruption perspective. One particular bout of February heavy snow and cold in the Eastern US left insured losses exceeding USD2.1 billion.

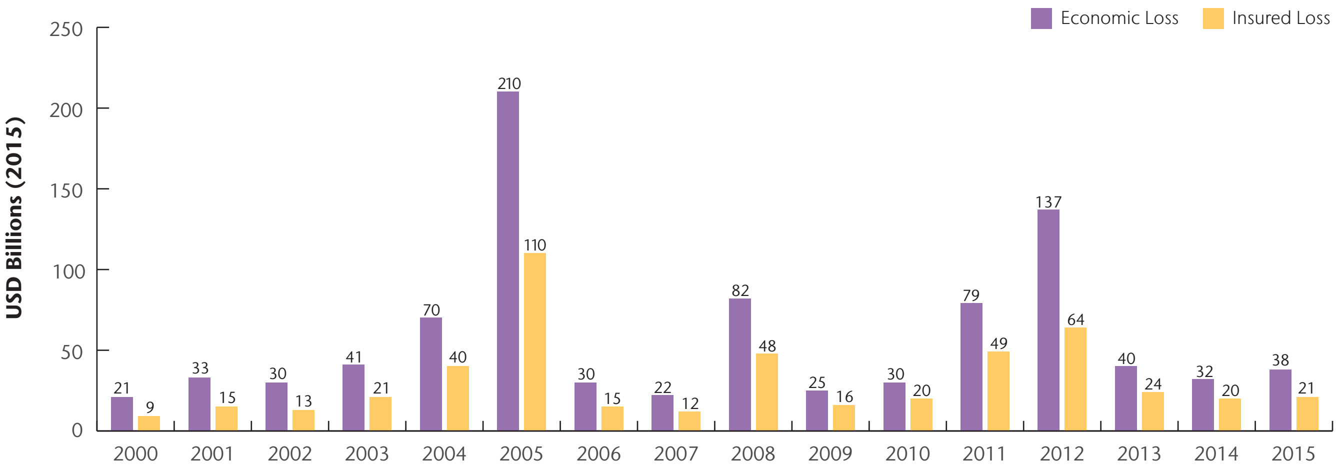
The historic drought across the Western US intensified during 2015, with the state of California declaring an emergency due to dangerously low levels of water availability. Record heat and a lack of precipitation left the state enduring nearly USD3.0 billion in additional drought damage. Drought impacts – particularly to agriculture – totaling an additional USD1.5 billion were noted in Washington and Oregon. The combination of drought, lack of rainfall and well-above normal temperatures also led to the costliest wildfire year in California since 2007. The Valley and Butte fires left an estimated USD2.0 billion price tag in September, with costs to public and private insurers near USD1.3 billion.

Several severe thunderstorm outbreaks, including two major outbreaks at the end of December, led to tornado, hail and wind damage across parts of the Plains, Midwest, Rockies, Southeast, and Mid-Atlantic.

For a detailed review of all events in 2015, please visit **www.aonbenfield.com/catastropheinsight** and click on “Thought Leadership” to download updated monthly Global Catastrophe Recaps

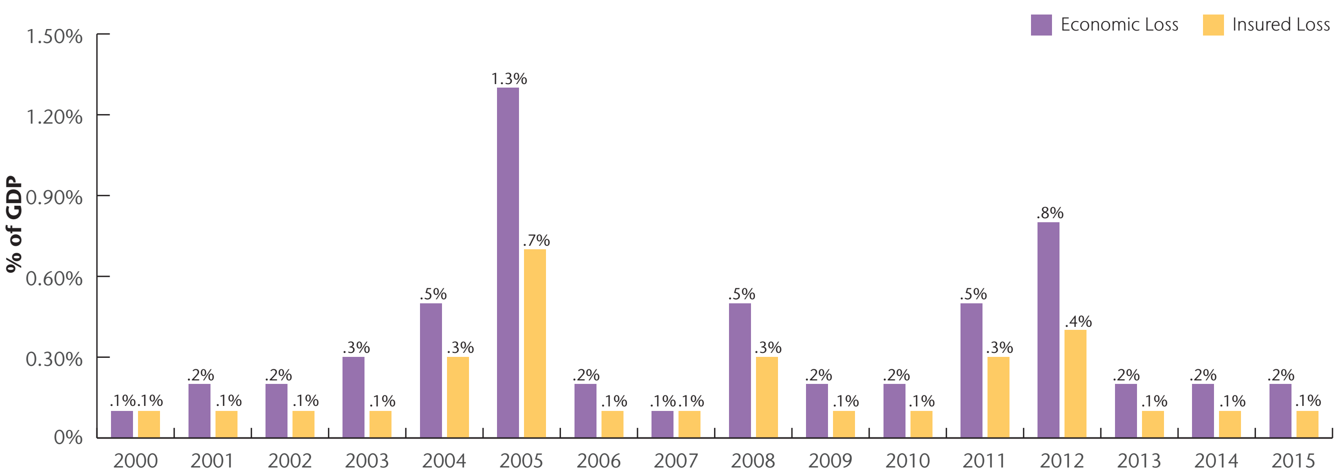
[1] Subject to change as loss estimates are further developed
[2] Includes losses sustained by private insurers and government-sponsored programs

Exhibit 33: United States Economic and Insured Losses



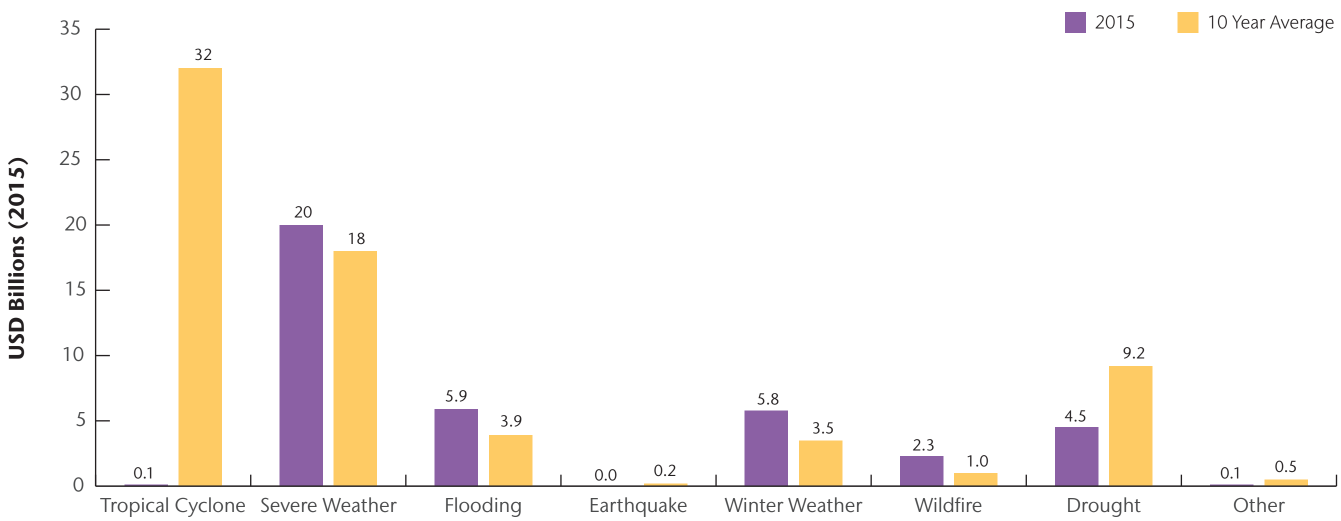
Since 1980, economic losses have increased 3.2 percent annually on an inflation-adjusted basis in the United States. Insured losses have increased at a slightly higher rate of 6.3 percent. These upward trending losses can be attributed to inflation, increasing population and risk exposure, and higher levels of insurance penetration. However, when analyzing loss data since 2000, US economic and insured losses from natural disasters still show a positive trend but at a less pronounced rate (2.2 and 4.0 percent, respectively). Much of the decrease can be attributed to the recent decline in hurricane landfalls and the lack of a significant earthquake event.

Exhibit 34: United States Economic and Insured Losses as Percentage of GDP



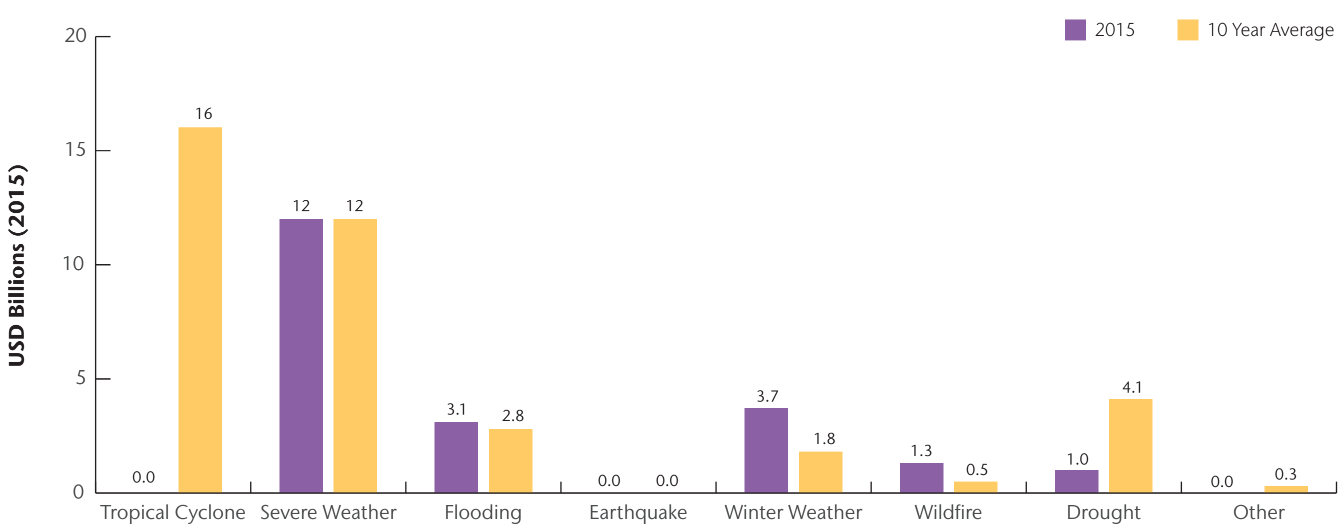
When analyzing natural disaster losses as a percentage of US GDP (World Bank), the rate of growth since 1980 has increased annually by 0.9 percent for economic losses and 3.9 percent for insured losses. However, during the past 15 years, there has been a slight positive trend on both an economic (0.7 percent) and insured (2.5 percent) basis.

Exhibit 35: United States Economic Losses by Peril



The severe weather peril dominated economic losses in the United States in 2015, and was slightly above the peril's 10-year average. It was by far the costliest peril of the year. The other perils to endure above recent average levels of losses were winter weather, flooding and wildfire. Tropical cyclone losses were largely minimal despite two tropical storm landfalls. During the past 10 years, losses associated with tropical cyclones have been the predominant driver of damage costs in the US (especially in 2005, 2008, and 2012).

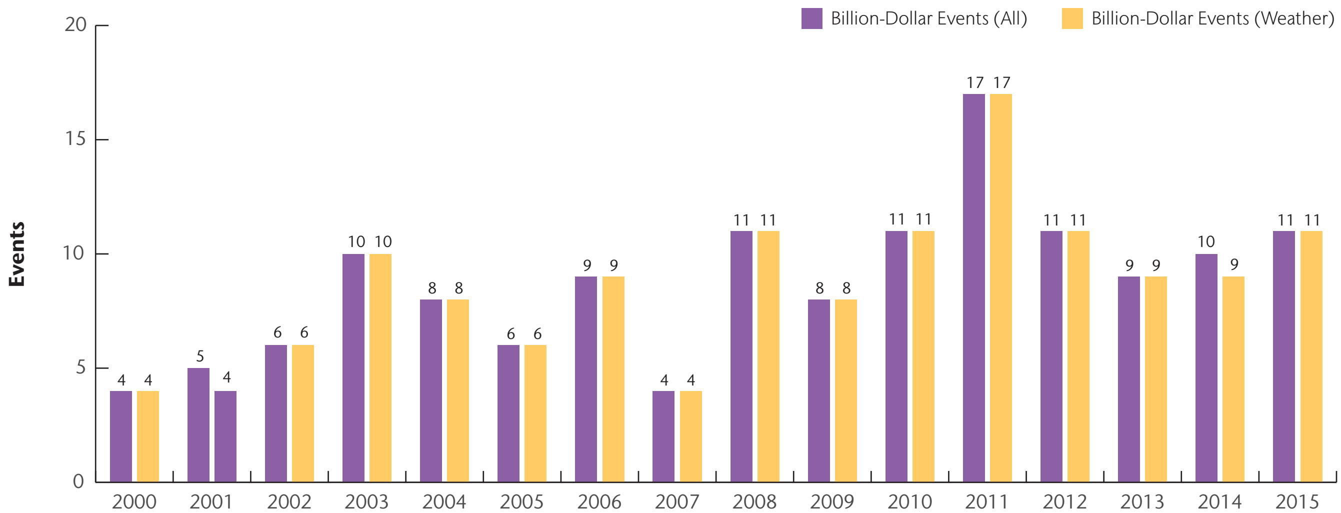
Exhibit 36: United States Insured Losses by Peril



Losses from severe weather again accounted for the majority of insured losses in the United States in 2015. The nearly USD12 billion in insured losses was easily the costliest peril, though it only equaled the peril's 10-year average. Insured winter weather losses were above their recent average and at their highest levels in more than a decade. Wildfire and flood were above average, but the rest of the major perils were below normal.

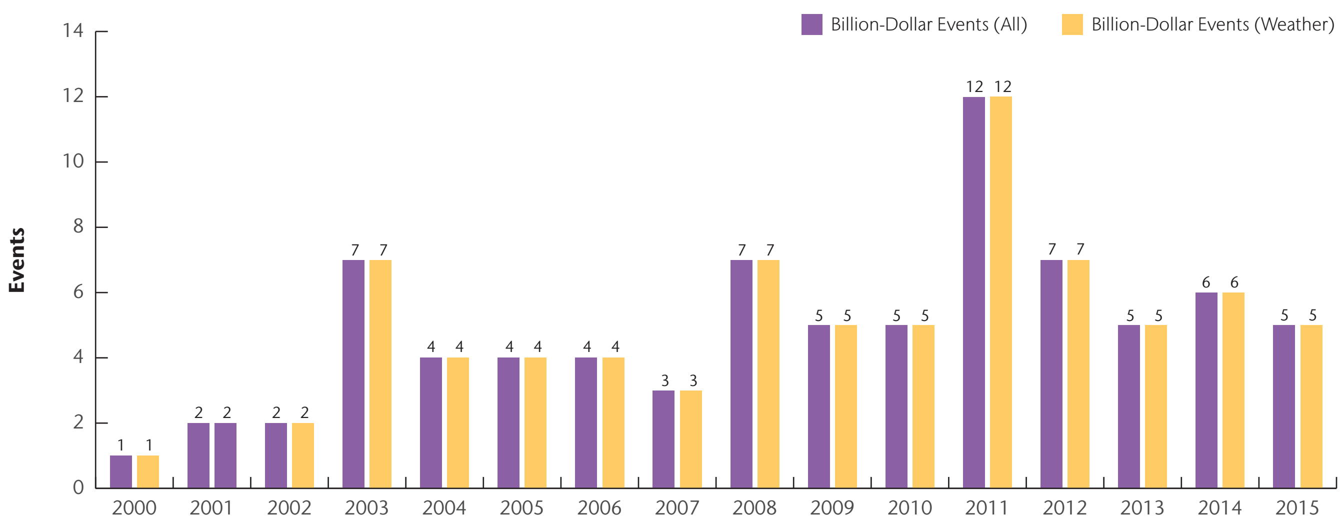
Please note that insured losses include those sustained by private insurers and government-sponsored programs such as the National Flood Insurance Program and the Federal Crop Insurance Corporation (run by the USDA's Risk Management Agency).

Exhibit 37: United States Billion-Dollar Economic Loss Events



There were 11 events that caused at least USD1.0 billion in economic losses in 2015, which was above the 15-year average (9). An equal number of weather-related billion-dollar events occurred as well, which was one above the longer-term average. The breakdown of billion-dollar events by peril included severe weather (7), winter weather (1), drought (1), wildfire (1), and flood (1).

Exhibit 38: United States Billion-Dollar Insured Loss Events



There were five events that triggered insured losses beyond USD1.0 billion in 2015, which was equal to the 2000-2014 average of five and one less than 2014. The same number of weather-related events was registered as well. The breakdown of billion-dollar events included severe weather (3), winter weather (1), and drought (1).

Americas (Non-U.S.)

Exhibit 39: Top 5 Most Significant Events in the Americas (Non-U.S.)

Date(s)	Event	Location	Deaths	Economic Loss (USD)	Insured Loss (USD)
March 25 – April 8	Flooding	Chile	25	1.5 billion	450 million
September 16	Earthquake	Chile	14	1.5 billion	600 million
Yearlong	Drought	Canada	N/A	1.0 billion	600 million
August 27 – 29	Tropical Storm Erika	Caribbean Islands	36	512 million	50 million
October 22 – 25	Hurricane Patricia	Mexico	14	410 million	100 million
		All Other Events	~1,300	2.5 billion	1.2 billion
		Totals	**~1,400**	**8.0 billion[1]**	**3.0 billion[1,2]**

Economic and insured losses derived from natural catastrophes in the Americas (Non-US) were below the 2000-2014 norm and even lower than the incurred losses in 2014. The region has only incurred economic losses beyond USD20 billion three times (2005, 2010, 2013) and insured losses beyond USD10 billion once (2010) in the last 15 years. Economic losses (USD8.0 billion) in 2015 were 45 percent below the 2000-2014 average, though on a median basis, were only 4.8 percent lower. Insured losses (USD3.0 billion) were actually 18 percent above the recent average, and an even greater 70 percent higher on a median basis.

Despite several high profile events that were recorded in the Americas, none ended up causing catastrophic level of losses. Three of the top four costliest events on an economic loss basis occurred in Chile. The most significant was a major flood event in the northern regions of Norte Grande and Norte Chico in late March and early April that damaged or destroyed more than 28,000 homes. On September 16, a magnitude-8.3 earthquake struck just offshore the Coquimbo Region and damaged thousands of structures. Most of the damage was due to tsunami and not from ground shaking since Chile has strict building codes that are among the best in the world. Each of these two events caused USD1.5 billion in damage. The third event, the April volcanic eruption of Mount Calbuco, left a USD600 million economic cost. Also in South America, torrential December rains and flooding aided by El Niño affected parts of Argentina, Paraguay, Uruguay, and Brazil.

Elsewhere, Canada endured several severe thunderstorm and winter weather events during the year, though the costliest event in the region was a billion-dollar drought that was most intense in the West.

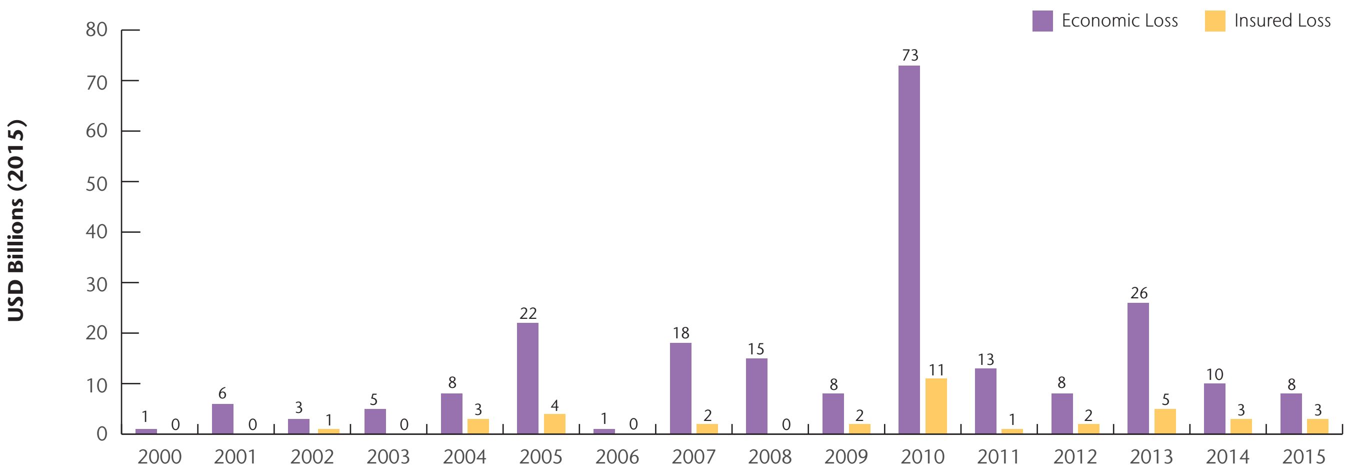
Multiple tropical cyclones impacted the Americas from both the Atlantic and Pacific Ocean basins. The most meteorologically significant event was Major Hurricane Patricia, which came ashore in rural Mexico as a Category 5 storm in October. Patricia, which made landfall between the cities of Manzanillo and Puerto Vallarta, narrowly avoided causing catastrophic damage in the country. The storm led to USD410 million in economic losses, most of which was incurred to the agricultural sector. In the Caribbean, Tropical Storm Erika caused damage on multiple islands, but most was incurred on the island of Dominica. At USD 483 million, it was the costliest event in the nation's history. Major Hurricane Joaquin caused heavy damage to sparsely populated Bahamian islands and Bermuda though the economic cost was only USD100 million.

From an insurance perspective, four events left more than USD200 million in claims payouts by the insurance industry: two each in Canada and Chile.

For a detailed review of all events in 2015, please visit **www.aonbenfield.com/catastropheinsight** and click on "Thought Leadership" to download updated monthly Global Catastrophe Recaps.

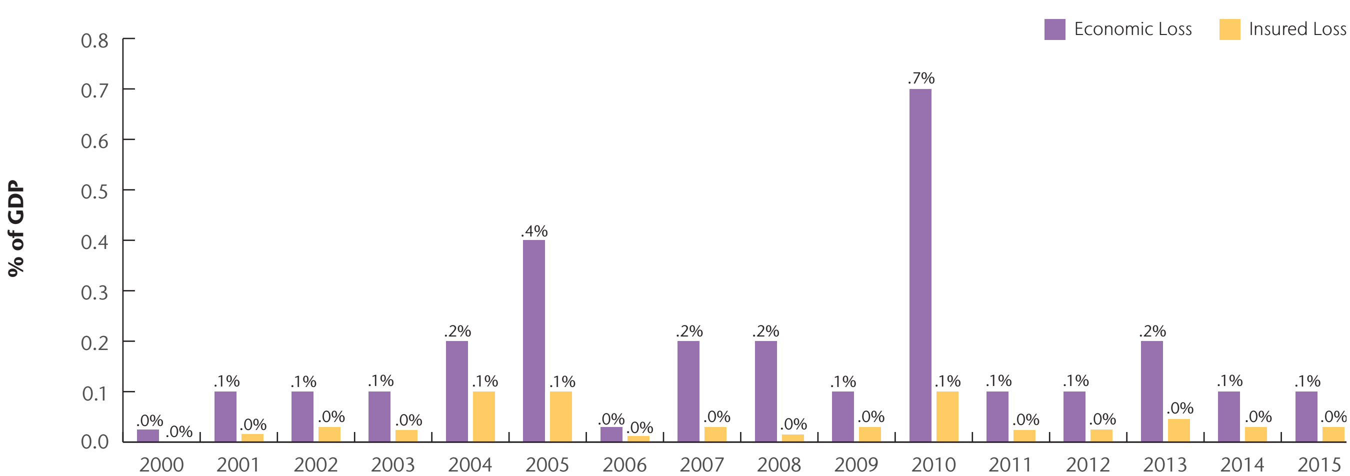
[1] Subject to change as loss estimates are further developed
[2] Includes losses sustained by private insurers and government-sponsored programs

Exhibit 40: Americas (Non-U.S.) Economic and Insured Losses



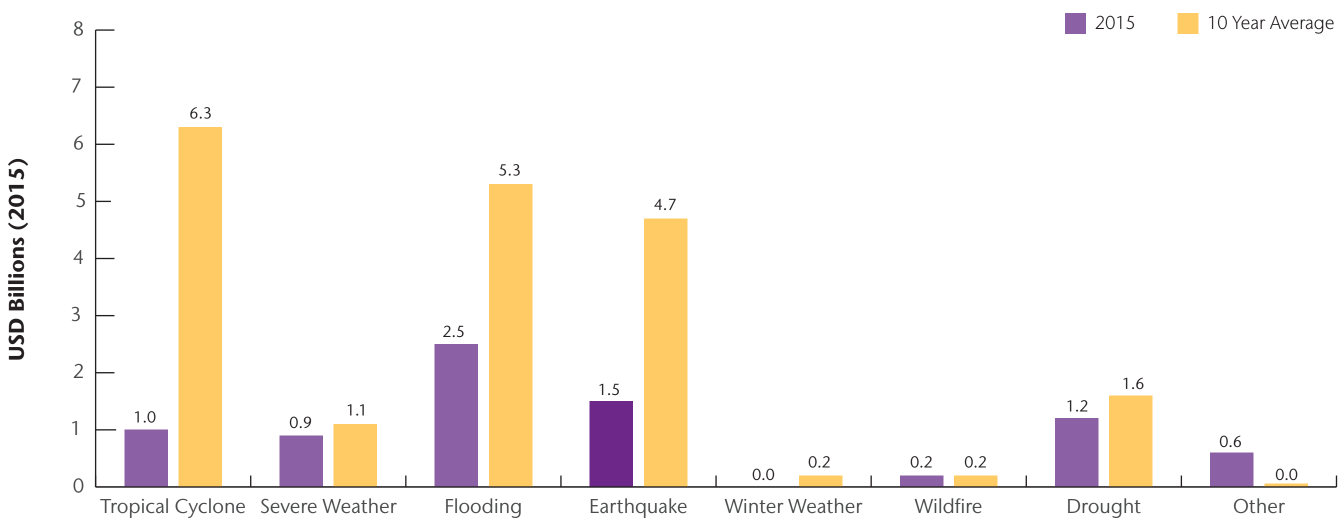
Since 1980, economic losses have increased about 4.2 percent and insured losses have increased at a more substantial 9.0 percent. Increases during the past 15 years have been accelerated (economic (12.7 percent); insured (23.4 percent)), though these totals have been skewed by the 2010 Chile earthquake. These upward trending losses can also be attributed to inflation, increasing population and risk exposure, higher levels of insurance penetration in developing markets in Latin America, and improved data availability. However, in spite of the growing trend of insured over overall economic losses, it is important to note that there remains a very low level of insurance penetration, particularly in Latin America.

Exhibit 41: Americas (Non-U.S.) Economic and Insured Losses as Percentage of GDP



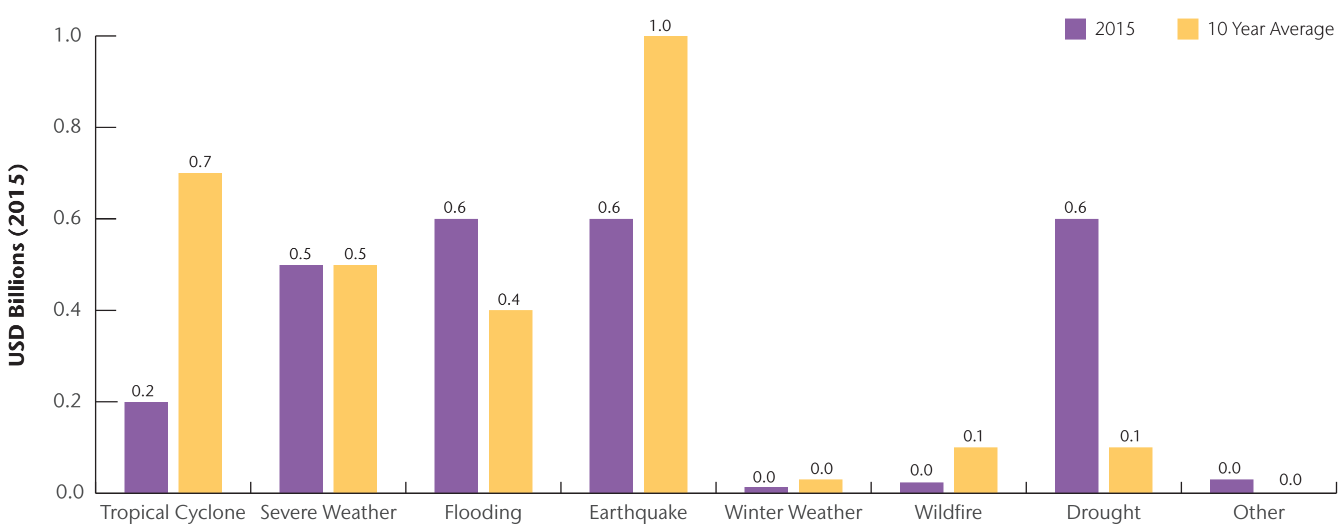
When analyzing natural disaster losses as a percentage of GDP (World Bank) for the Americas (Non-US), the rate of growth since 1980 has remained generally flat annually (0.4 percent) for economic losses, but has increased 4.3 percent for insured losses. The recent 15-year trend averages are much more pronounced at 5.0 percent (economic) and 19.7 percent (insured). It is critically important to note that despite these trend increases since 2000, the percent of GDP on an economic and insured loss basis are less than 1 percent—and often less than 0.1 percent.

Exhibit 42: Americas (Non-U.S.) Economic Losses by Peril



Every major peril recorded economic losses below its ten year average in the region. Only the miscellaneous perils—dominated by a volcanic eruption—were above normal. During the past ten years, the tropical cyclone, flood, and earthquake perils have been the costliest on an annual basis. In 2015, flood was the costliest at just less than USD2.0 billion.

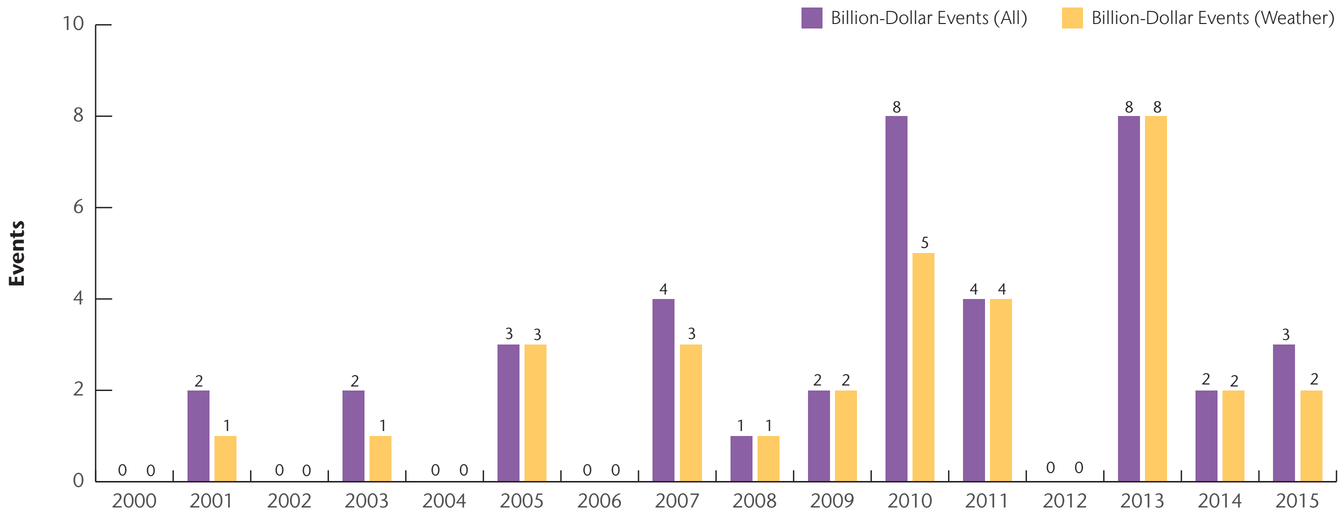
Exhibit 43: Americas (Non-U.S.) Insured Losses by Peril



Insured losses were above the 10-year normal for multiple perils in 2015. Losses from earthquake, drought, flood and severe thunderstorm accounted for the highest percentage of payouts, though none of the perils saw aggregate losses in excess of USD1.0 billion. The longer-term averages further underscore the lack of insurance penetration in the Americas as only earthquake has averaged at least USD1.0 billion on an annual basis.

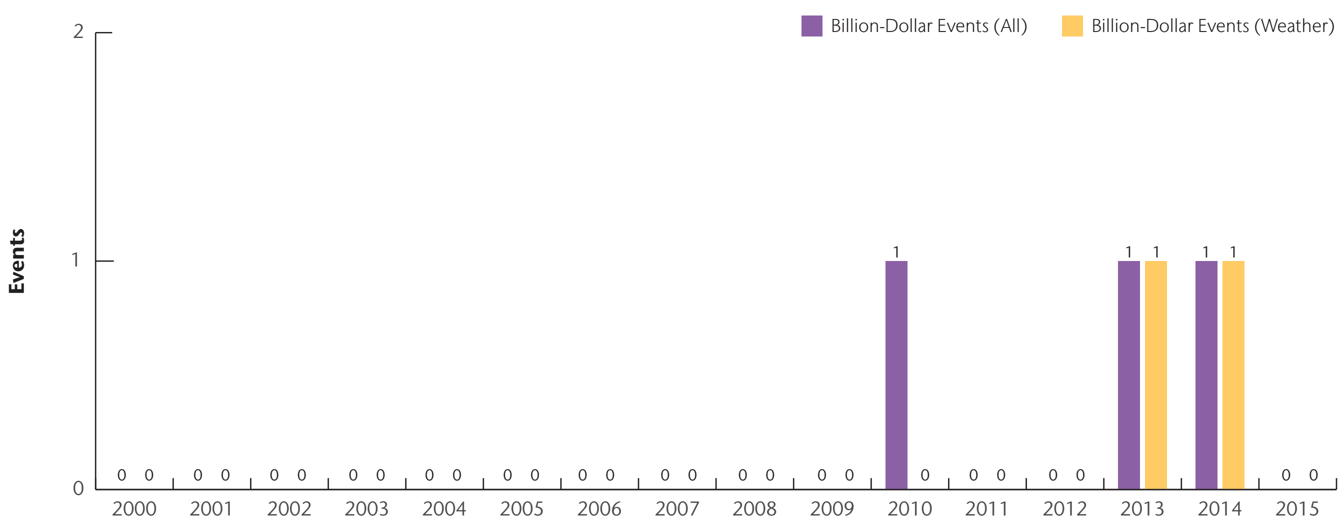
Please note that insured losses include those sustained by private insurers and government-sponsored programs.

Exhibit 44: Americas (Non-U.S.) Billion-Dollar Economic Loss Events



There were three natural disaster events in the Americas (Non-US) that caused at least USD1.0 billion in economic losses in 2015, which was one above 2014 (2) and also slightly higher than the 2000-2014 average (2). There were two weather-related billion-dollar events that was equal to the 15-year average. The breakdown by natural disaster peril included flooding (1), earthquake (1), and drought (1).

Exhibit 45: Americas (Non-U.S.) Billion-Dollar Insured Loss Events



There were no natural disaster or weather-related events that triggered insured losses beyond USD1.0 billion in 2015. Since 2000, billion-dollar insured loss events happen on average in the Americas (Non-US) once every five years. The combination of lower levels of insurance penetration and lack of available data in Latin America contribute to the lower frequency of such events occurring or being reported.

EMEA (Europe, Middle East & Africa)

Exhibit 46: Top 5 Most Significant Events in EMEA

Date(s)	Event	Location	Deaths	Economic Loss (USD)	Insured Loss (USD)
December 22 – 31	Flooding	United Kingdom	N/A	2.5 billion	1.3 billion
March 29 – April 1	Windstorms Mike & Niklas	Western and Central Europe	9	1.4 billion	1.0 billion
October 3 – 4	Flooding	France	19	1.3 billion	725 million
July-December	Drought	South Africa	N/A	2.0 billion	25 million
January 9 – 11	Windstorms Elon & Felix	Western and Northern Europe	N/A	650 million	400 million
		All Other Events	1,170	6.5 billion	1.1 billion
		Totals	**~1,250**	**16 billion[1]**	**5.0 billion[1,2]**

Economic and insured losses derived from natural catastrophes in EMEA were well below the 2000-2014 norm and the lowest since 2011. For the second consecutive year, the region did not endure an individual disaster event that caused economic losses beyond the USD5.0 billion threshold. Economic losses (USD16 billion) in 2015 were 35 percent below the 2000-2014 average and 28 percent below the median during the same timeframe. Insured losses (USD5.0 billion) were comparatively lower by a substantial 34 percent as compared to the 15-year average and a slightly less 13 percent on a median basis.

From a pure economic cost standpoint, the most significant events surrounded the drought peril as El Niño impacts led to a reduction in precipitation across broad sections of Europe and Africa. Three billion-dollar drought events were recorded in the region in 2015, including two alone in Africa (South Africa and Ethiopia) and one in Romania. The most considerable impacts to the droughts were to the agricultural sector, including concerns over food shortages in parts of Africa.

The most notable events in 2015, however, were primarily attributed to the European Windstorm peril. A fairly active year saw multiple storms impact western and northern portions of the European continent. The one-two punch of windstorms Mike and Niklas at the end of March and early April led to an estimated USD1.0 billion insured loss for the insurance industry. Windstorm Ted (also known locally as Desmond) led to extensive flooding in the northern UK as the Association of British Insurers noted insured losses up to USD775 million. Windstorms Elon, Felix, Heini, Nils, and Eckard also led to widespread damage. Please note that for consistency purposes, this report follows the naming convention by Free University of Berlin.

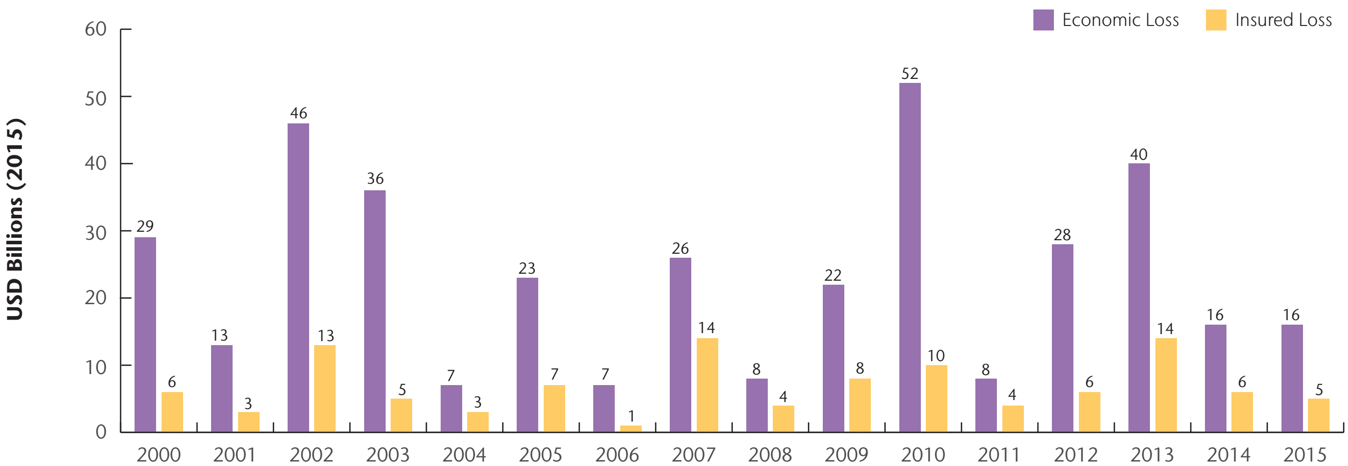
Extensive flooding impacted the United Kingdom in December as an active pattern brought substantial rainfall. Economic losses were in the billions (USD) and insured losses alone topped USD1.0 billion. In France, a catastrophic flash flood event in early October ravaged the French Riviera. Local insurers noted damages reaching USD725 million given extensive property damage to residential and commercial interests.

Perhaps the most unusual weather events during 2015 in EMEA came in Yemen. Two tropical cyclones (Chapala and Megh) made unprecedented November landfalls within one week's time that led to severe damage along coastal sections of the Yemeni mainland and Socotra Island. Economic damages were estimated into the hundreds of millions (USD), but relief and aid organizations struggled to reach the hardest-hit areas given geopolitical issues in the region.

For a detailed review of all events in 2015, please visit **www.aonbenfield.com/catastropheinsight** and click on "Thought Leadership" to download updated monthly Global Catastrophe Recaps.

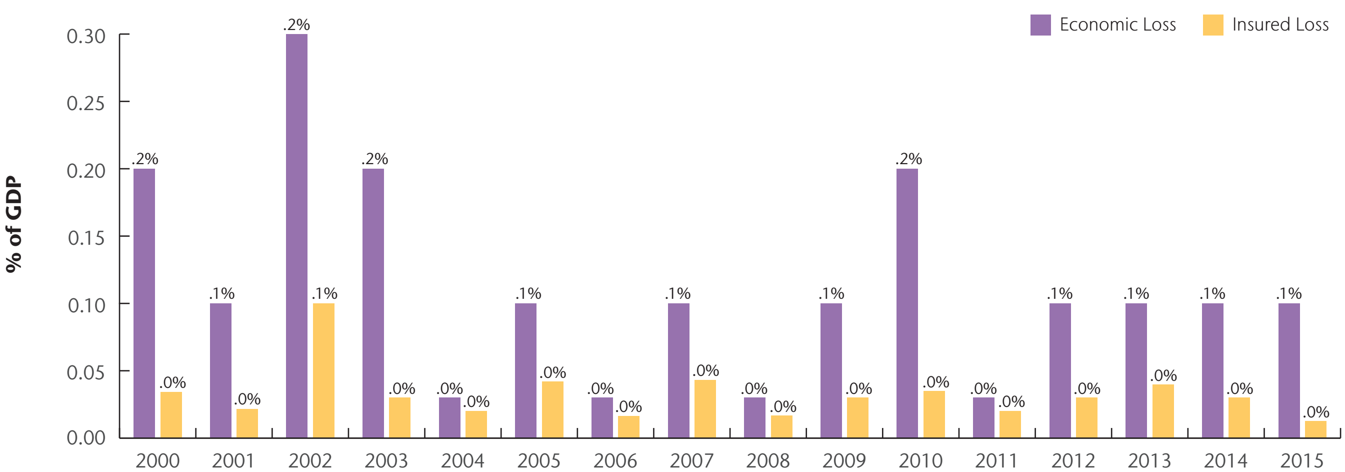
[1] Subject to change as loss estimates are further developed
[2] Includes losses sustained by private insurers and government-sponsored programs

Exhibit 47: EMEA Economic and Insured Losses



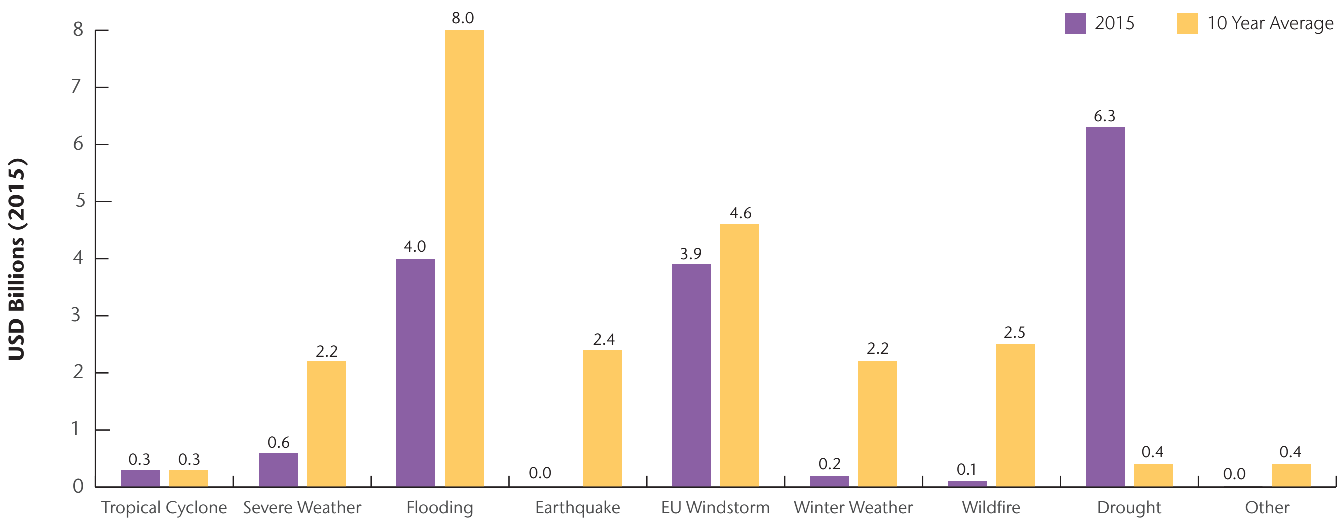
Since 1980, economic losses have increased by 1.4 percent annually on an inflation-adjusted basis in EMEA. Insured losses have increased at a higher rate of 7.7 percent. The rate of growth is greatly reduced when analyzing loss data during the past 15 years. On the economic loss side, losses have remained flat or slightly trended downward annually by 0.5 percent; while insured losses have shown a minor growth trend of 2.2 percent annually since 2000.

Exhibit 48: EMEA Economic and Insured Losses as Percentage of GDP



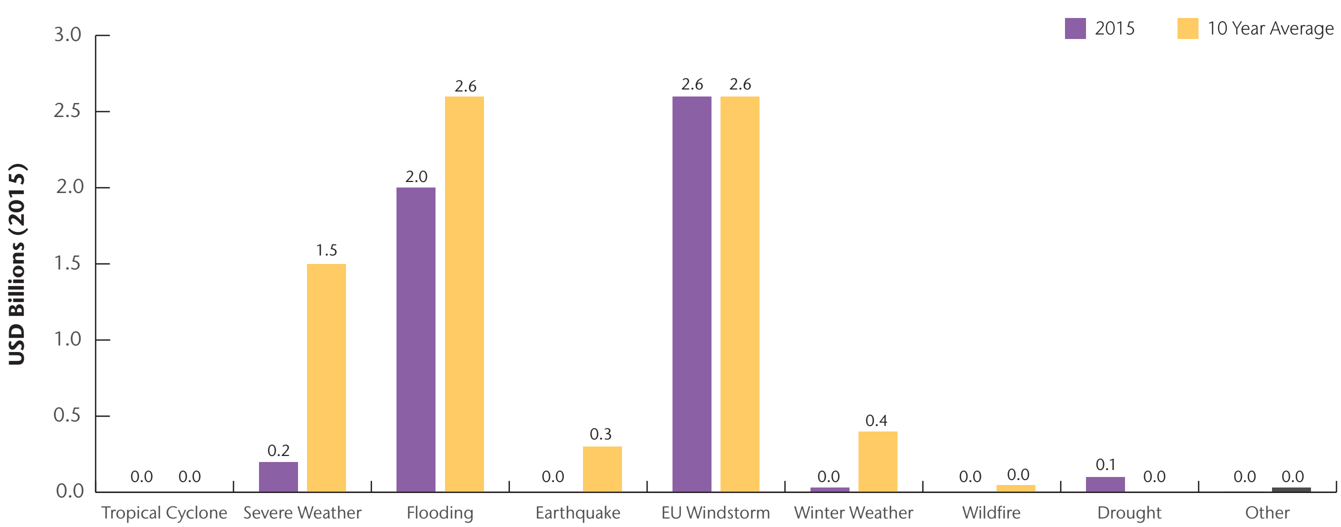
When analyzing natural disaster losses for EMEA as a percentage of GDP (World Bank), the rate of growth since 1980 has shown a slight downward trend in economic losses by 1.8 percent. Insured losses have annually shown a slight increase of 1.4 percent. However, the loss-to-GDP ratio growth has actually been negative on an economic and insured loss basis since 2000. Economic losses have trended down by 4.7 percent and insured losses have trended slightly less at 2.0 percent. It remains important to point out that overall losses as a percent of GDP remain low (having only approached 0.20 percent three times since 2000 (2000, 2002, 2003, 2010)). EMEA governments and the insurance industry have been well prepared to manage the associated losses.

Exhibit 49: EMEA Economic Losses by Peril



The drought peril (USD6.3 billion) was the costliest in EMEA, comprising 40 percent of all economic losses. Flood was the next costliest at 26 percent, with European Windstorm third at 25 percent. The only peril in the region to surpass its recent 10-year average was drought. The rest of the major perils were well lower than normal, with flood being particularly lower by 75 percent. Tropical Cyclone losses in Africa were on par with average.

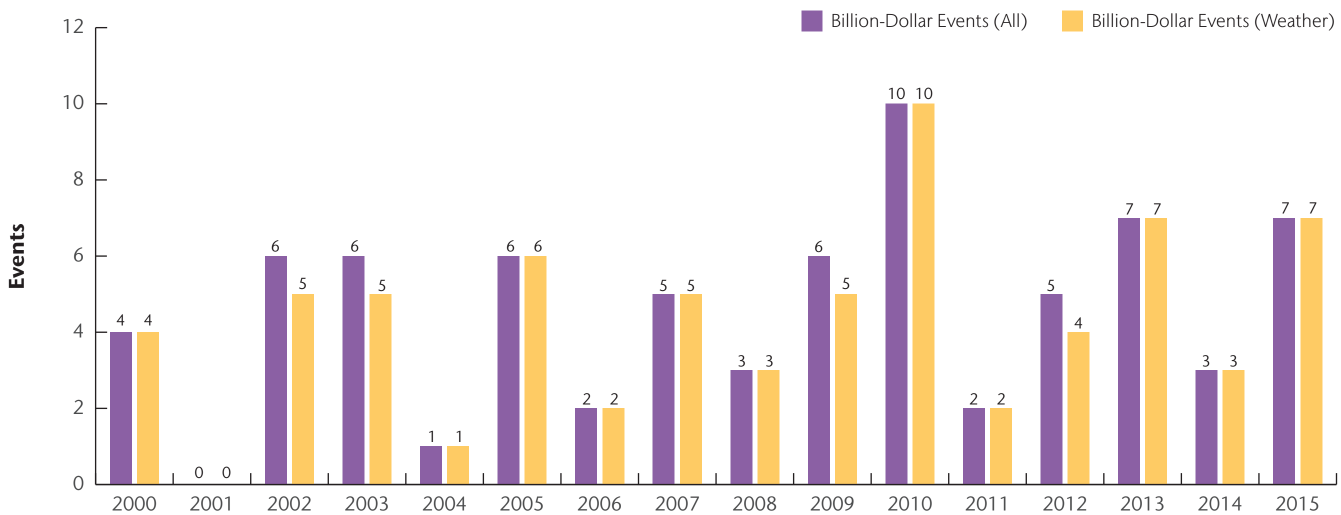
Exhibit 50: EMEA Insured Losses by Peril



Insured losses were below the 10-year normal for every major peril in EMEA with the exception of European Windstorm and drought. The closest peril nearest its recent average was flood, which at USD2.0 billion was within 20 percent. The rest of the perils were at least 70 percent lower then their averages since 2005.

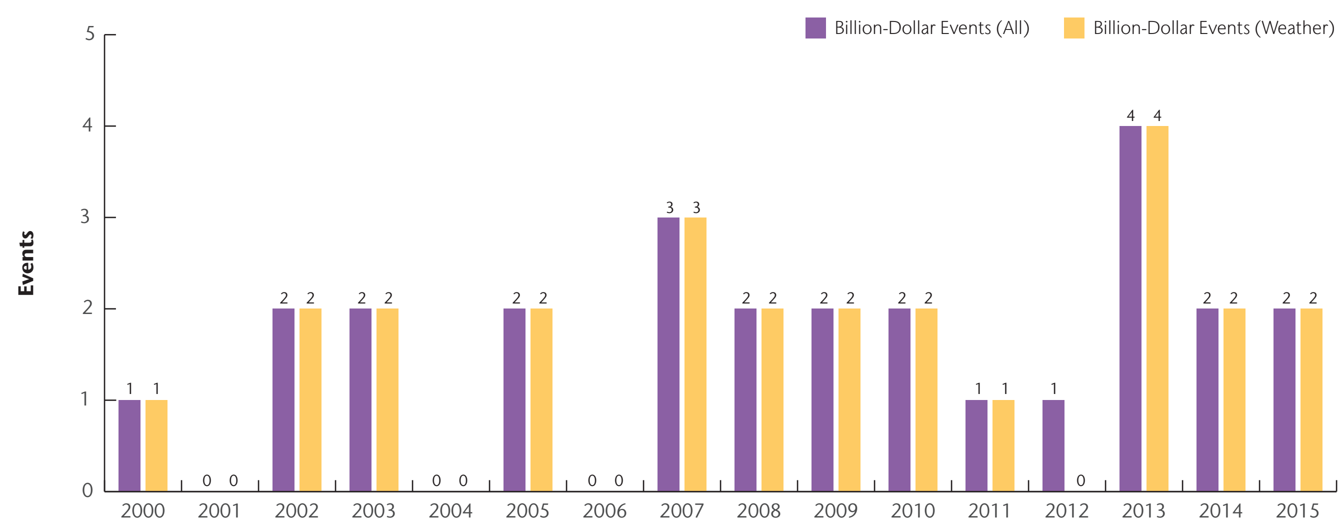
Please note that insured losses include those sustained by private insurers and government-sponsored programs.

Exhibit 51: EMEA Billion-Dollar Economic Loss Events by Peril



There were seven natural disaster events that caused at least USD1.0 billion in economic losses in 2015, which were three above the 15-year average of four. An equal number of weather-related billion-dollar events were recorded as well. The breakdown of peril types included drought (3), European Windstorm (2), and flood (2). Five of the seven events occurred in Europe and two were in Africa.

Exhibit 52: EMEA Billion-Dollar Insured Loss Events by Peril



There were two natural disaster events that triggered insured losses at or beyond USD1.0 billion in 2015, which was equal the 15-year average. This is equaled the number of events in 2014. The events that reached the threshold were December floods in the UK and the combination of windstorms Mike and Niklas. The two perils that historically average at least one billion-dollar insured event per year are European Windstorm and flooding.

APAC (Asia & Oceania)

Exhibit 53: Top 5 Most Significant Events in APAC

Date(s)	Event	Location	Deaths	Economic Loss (USD)	Insured Loss (USD)
Yearlong	Forest Fires	Indonesia	19	16.1 billion	250 million
April 25 & May 12	Earthquake	Nepal	9,120	8.0 billion	200 million
Nov. – Dec.	Flooding	India, Sri Lanka	386	4.0 billion	650 million
August 15 – 26	Typhoon Goni	Japan, Philippines, China	70	1.8 billion	980 million
April 20 – 24	Severe Weather	Australia	3	925 million	671 million
		All Other Events	~6,950	30 billion	3.5 billion
		Totals	**~16,500**	**61 billion[1]**	**6.0 billion[1,2]**

Economic and insured losses derived from natural catastrophes in Asia Pacific were each below the 2000-2014 norm and the lowest since 2012. Despite the reduced losses, the region incurred the highest economic cost resulting from natural disasters in the world. Economic losses (USD60 billion) in 2015 were 22 percent below the 2000-2014 average and insured losses (USD6.0 billion) were 41 percent lower. However, conducting the same analyses on a median basis produced strikingly different results. This plays into how the loss averages were heavily skewed given outlier years such as 2011. When analyzing economic losses on a median level since 2000, they were 57 percent higher. Insured losses were an even more substantial 70 percent higher than the median during the same timeframe.

The costliest singular event in Asia Pacific was a nearly yearlong outbreak of major forest fires across Indonesia. The fires that primarily burned on the island of Sumatra and in the Kalimantan region initially ignited by slash-and-burn tactics and spread out of control. A study by the World Bank concluded that the fires had an USD16.1 billion economic cost on the Indonesian economy. Elsewhere, deadly bushfires razed portions of South Australia and Victoria in December as the insurance industry incurred a USD122 million and USD45 million bill respectively.

The flood peril left a heavy financial toll in India, China, and Japan in 2015. The most notable event occurred in November and December as an El Niño enhanced monsoon pattern led to catastrophic flooding in southern India and Sri Lanka. The Indian state of Tamil Nadu was particularly impacted, with the greater Chennai metropolitan region sustaining historic flood damage. Total economic costs from the event were estimated beyond USD4.0 billion, though only USD650 million of the losses were insured.

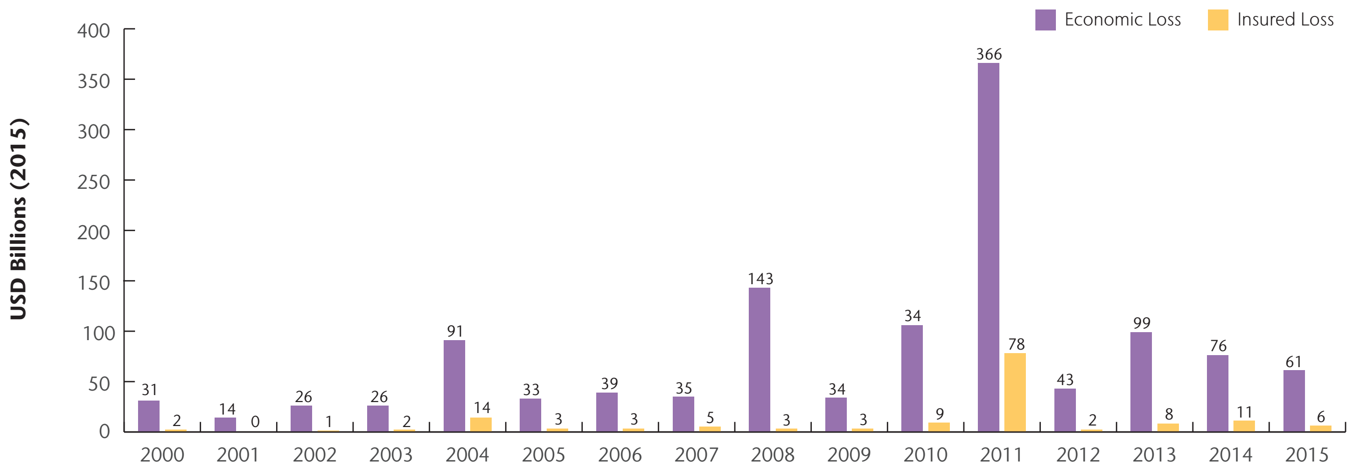
One of the strongest earthquakes of 2015 (M7.8) struck Nepal on April 25 and was followed by a powerful aftershock (M7.3) on May 12. The tremors led to more than 9,100 fatalities in Nepal, India, Bangladesh and China. Total combined economic damages and reconstruction costs in the affected countries were estimated at up to USD8.0 billion, with most of the damage occurring in Nepal's Kathmandu. Another strong earthquake struck near the Afghanistan and Pakistan border on October 25. Despite occurring 212 kilometers (132 miles) below the surface, the M7.5 temblor left more than 400 people dead.

Multiple typhoons and cyclones left billions in economic damage throughout Asia Pacific. Typhoons Goni, Mujigae, Soudelor, and Chan-hom were the costliest in China, Japan, the Philippines and Taiwan. Perhaps the most significant cyclonic event in the region was March's Cyclone Pam. The storm ravaged Vanuatu and caused USD450 million in damage. That equaled 64 percent of Vanuatu's GDP.

For a detailed review of all events in 2015, please visit **www.aonbenfield.com/catastropheinsight** and click on "Thought Leadership" to download updated monthly Global Catastrophe Recaps.

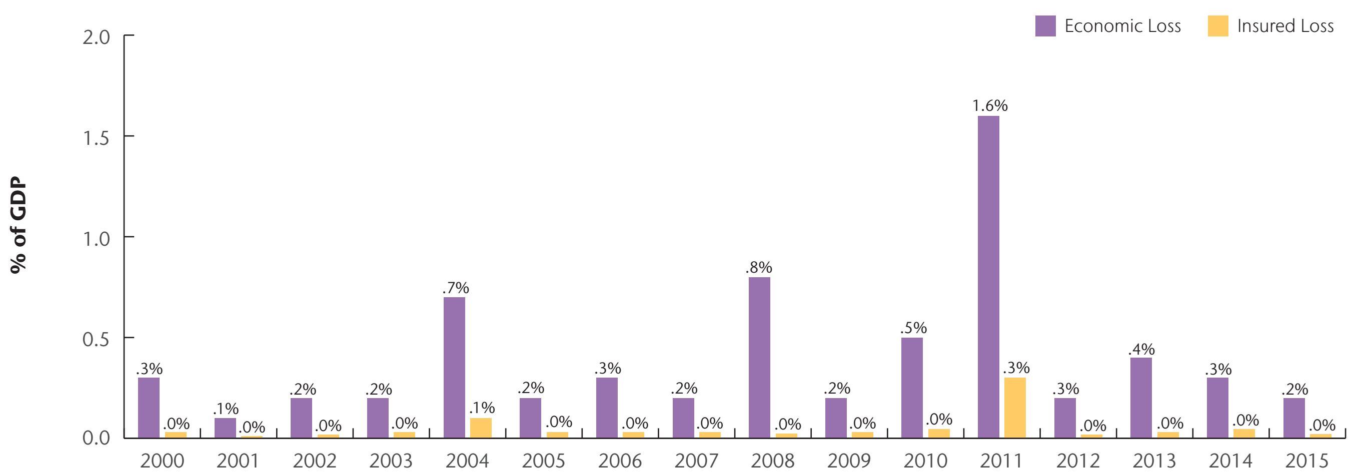
[1] Subject to change as loss estimates are further developed
[2] Includes losses sustained by private insurers and government-sponsored programs

Exhibit 54: APAC Economic and Insured Losses



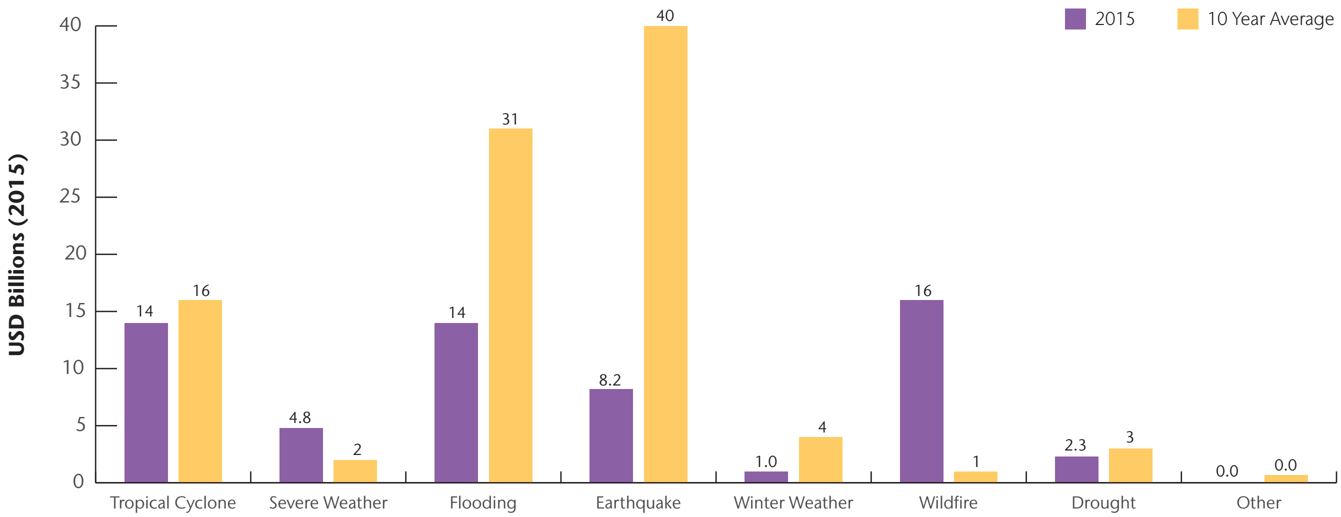
Since 1980, economic losses in Asia Pacific have shown an annual increase of 8.1 percent while insured losses have grown at a slightly faster 12.4 percent rate. Outside of the outlier years in 1995 and 2011, economic losses in the region have not shown exponential growth over time. With insurance penetration continuing to expand across emerging markets in Asia Pacific (most notably in parts of the Far East), it is unsurprising that insured losses have grown at a faster rate since 1980. When looking solely at the last 15 years, economic losses have trended higher at 10.6 percent annual rate. Insured losses have shown a 15.6 annual rate of growth.

Exhibit 55: APAC Economic and Insured Losses as Percentage of GDP



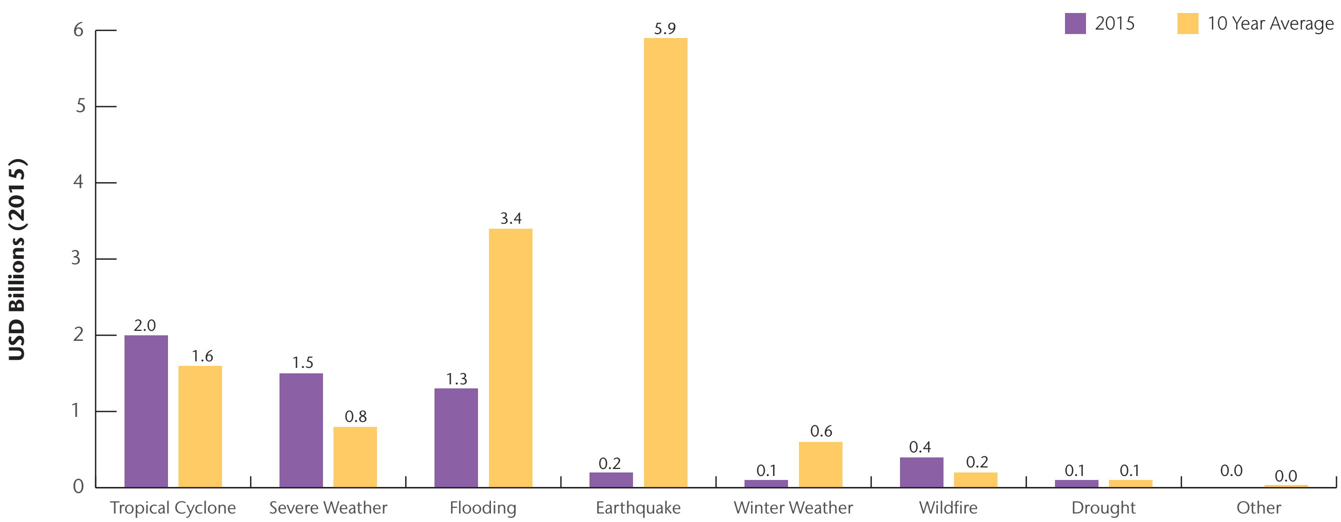
When analyzing natural disaster losses for Asia Pacific as a percentage of GDP (World Bank), the rate of growth since 1980 has increased annually by 3.8 percent for economic losses and 7.9 percent for insured losses. During the past 15 years, economic and insured losses have shown similar rates of annual growth at 3.5 and 8.2 percent, respectively. Asia Pacific economies include some of the fastest growing in the world and this has likely had an impact in recent years in regards to the smaller percentages of natural disaster loss to GDP growth. Despite the large loss values, only in 2011 did the economic loss-to-GDP ratio surpass 1.0 percent.

Exhibit 56: APAC Economic Losses by Peril



The three costliest perils (wildfire, flooding, and tropical cyclone) caused the vast majority of economic losses in Asia Pacific during 2015, combining to equal 72 percent of damages. However, only two perils surpassed their recent 10-year averages: wildfire and severe weather (thunderstorm). For the first time since 2008, the flood peril did not cause at least USD20 billion in damage across the region. Winter weather and earthquake losses were well below their 2005-2014 average.

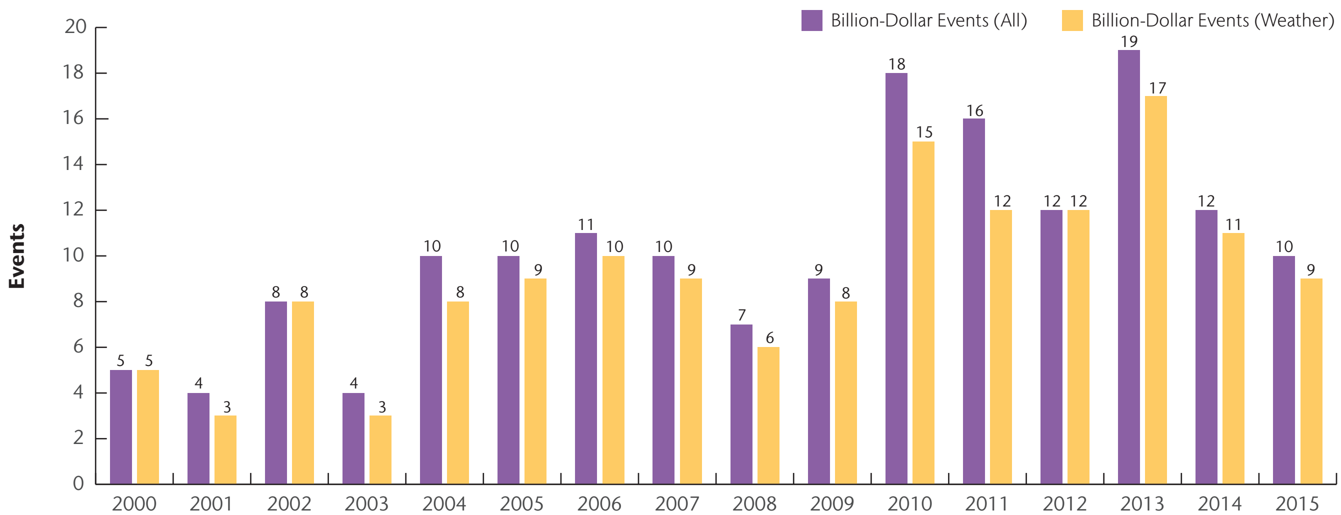
Exhibit 57: APAC Insured Losses by Peril



Multiple perils sustained above-average insured losses in 2015. The tropical cyclone, severe weather, wildfire, and drought perils were all higher than their 10-year norms. Tropical cyclone was the costliest with USD2.0 billion in payouts from the industry. Most of those losses were attributed to events in Japan. Severe thunderstorm losses were highest resulting from hail events in Australia. It remains worth noting that despite the very high economic cost of natural disaster events, only 10 percent of disaster losses in 2015 were covered by insurance.

Please note that insured losses include those sustained by private insurers and government-sponsored programs.

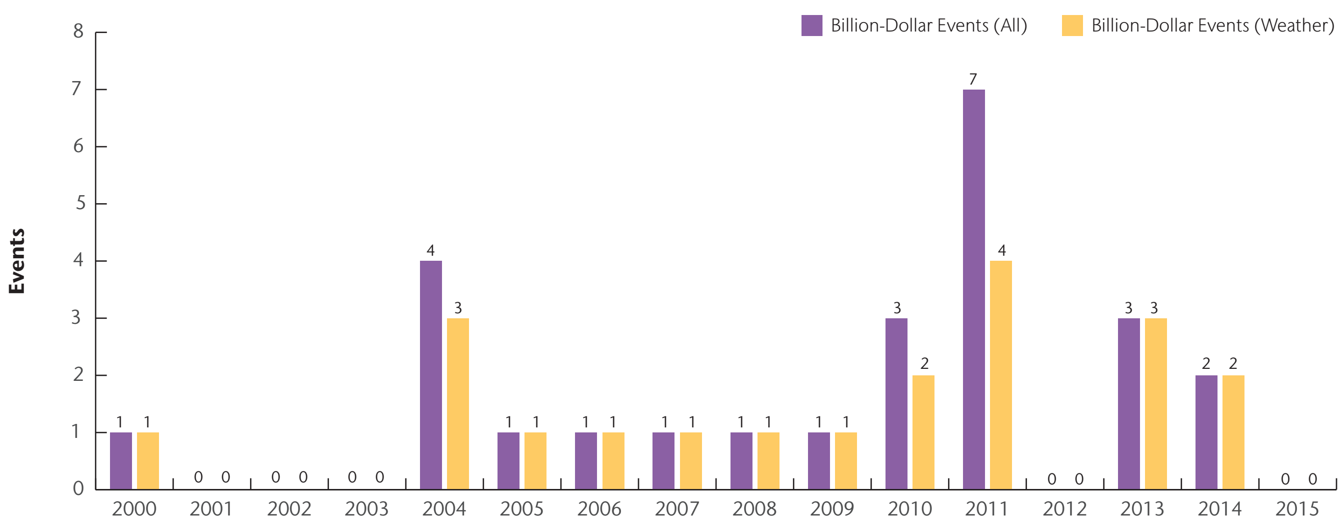
Exhibit 58: APAC Billion-Dollar Economic Loss Events



There were 10 separate natural disaster events that caused more than USD1.0 billion in 2015 economic losses in Asia Pacific, which was equal to the 2000-2014 average of 10. This follows the 12 that occurred in 2014. In terms of weather-only billion-dollar events, there were nine such instances. This was also equal to the 15-year average (9). The breakdown of billion-dollar event peril types included tropical cyclone (4), flooding (3), drought (1), earthquake (1), and wildfire (1).

Exhibit 59: APAC Billion-Dollar Insured Loss Events

Despite 10 events causing more than USD1.0 billion in economic losses, there were no events that had insured losses beyond the



same threshold. This was the first time that no billion-dollar insured loss events occurred in Asia Pacific since 2012. The closest event was Typhoon Goni, which cost the Japanese insurance industry an estimated USD980 million. The highest number of insured billion-dollar events occurred in 2011, when a record seven events were registered. Four of those were weather-related.

Appendix A: 2015 Global Disasters

Exhibit 60: United States

Date(s)	Event	Location	Deaths	Structures/ Claims	Economic Loss (USD)
1/01 – 9/30	Drought	Western US	0	Unknown	4.5+ billion
1/06 – 1/11	Winter Weather	Midwest, Northeast, Mid-Atlantic	15	Hundreds+	100+ million
1/26 – 1/28	Winter Weather	Northeast, Mid-Atlantic	2	5,000+	500+ million
1/31 – 2/04	Winter Weather	Midwest, Northeast, Southwest	22	10,000+	150+ million
2/06 – 2/08	Flooding	Northwest, Southwest	1	Hundreds	Millions+
2/07 – 2/11	Winter Weather	Northeast	2	25,000+	400+ million
2/13 – 2/15	Winter Weather	Midwest, Northeast, Mid-Atlantic	30	45,000+	650+ million
2/16 – 2/17	Winter Weather	Southeast	10	10,000+	100+ million
2/16 – 2/22	Winter Weather	Plains, Ohio Valley, Mid-Atlantic	8	215,000+	3.25+ billion
2/25 – 2/26	Winter Weather	Southeast, Mid-Atlantic	2	Thousands	Millions+
3/01 – 3/06	Winter Weather	Central & Eastern US	13	10,000+	175+ million
3/25 – 3/26	Severe Weather	Plains, Midwest, Southeast	1	35,000+	500+ million
3/31 – 4/01	Severe Weather	Plains, Midwest, Southeast	0	20,000+	175+ million
4/02 – 4/03	Severe Weather	Plains, Midwest, Southeast	0	25,000+	250+ million
4/07 – 4/10	Severe Weather	Plains, Midwest, Mississippi Valley	3	160,000+	1.65+ billion
4/16 – 4/17	Severe Weather	Plains	1	Thousands	100s of Millions
4/18 – 4/21	Severe Weather	Plains, Southeast, Northeast	0	135,000+	1.4+ billion
4/24 – 4/28	Severe Weather	Plains, Southeast	4	115,000+	950+ million
5/03 – 5/05	Severe Weather	Plains, Midwest	1	15,000+	175+ million
5/06 – 5/13	Severe Weather	Plains, Midwest, Rockies	6	90,000+	1.0+ billion
5/10	TS Ana	South Carolina	0	Hundreds	Millions
5/15 – 5/19	Severe Weather	Plains, Midwest, Rockies	2	15,000+	150+ million
5/23 – 5/28	Severe Weather	Plains, Midwest, Rockies, Southeast	32	150,000+	3.75+ billion
5/28 – 5/30	Severe Weather	Plains, Midwest, Rockies, Southeast	0	20,000+	170+ million
6/03 – 6/08	Severe Weather	Rockies, Plains	0	60,000+	600+ million
6/09 – 6/11	Severe Weather	Great Lakes	0	10,000+	100+ million
6/16 – 6/18	TS Bill	Texas, Oklahoma	1	10,000+	100+ million
6/19 – 6/26	Severe Weather	Rockies, Plains, Midwest, Mid-Atlantic	4	110,000+	1.3+ billion
6/28 – 6/30	Wildfires	Northwest	0	100+	150+ million
6/29 – 7/01	Severe Weather	Midwest, Northeast, Southeast	0	Thousands	Millions+
7/12 – 7/14	Severe Weather	Midwest, Ohio Valley, Southeast	4	65,000+	600+ million
7/16 – 7/18	Severe Weather	Plains, Midwest	4	7,500+	75+ million
7/20 – 8/05	Flooding	Florida	0	2,000+	100+ million
7/29 – 8/13	Wildfires	California	1	150+	Millions
8/02 – 8/04	Severe Weather	Midwest, Plains, Northeast, Mid-Atlantic	4	110,000+	925+ million
8/13 – 8/31	Wildfires	Northwest, Rockies	4	Thousands	150+ million

Date(s)	Event	Location	Deaths	Structures/ Claims	Economic Loss (USD)
8/29 – 8/30	Severe Weather	Pacific Northwest	2	1,000+	Millions+
9/09 – 10/30	Wildfires	California	7	10,000+	2.0+ billion
9/13 – 9/15	Flooding	Southwest	19	Thousands	Millions
9/24 – 9/28	Flooding	Northeast, Mid-Atlantic, Southeast	1	Thousands	Millions
10/01 – 10/11	Flooding	Southeast, Mid-Atlantic	21	70,000+	5.0+ billion
10/03 – 10/04	Severe Weather	New Mexico	0	10,000+	90+ million
10/05 – 10/07	Severe Weather	Texas	0	10,000+	80+ million
10/15 – 10/16	Flooding	California	1	Hundreds	Millions
10/20 – 10/23	Severe Weather	New Mexico, Texas	0	20,000+	250+ million
10/24 – 10/26	Flooding	Texas, Southeast	0	17,500+	250+ million
10/29 – 11/03	Severe Weather	Texas, Southeast	6	25,000+	400+ million
11/10 – 11/12	Severe Weather	Midwest, Southeast	0	Thousands	Millions
11/16 – 11/18	Severe Weather	Plains, Southeast	0	Thousands	Millions
11/16 – 11/18	Severe Weather	Pacific Northwest	3	30,000+	500+ million
11/20 – 11/22	Winter Weather	Plains, Midwest, Rockies	0	Hundreds	Millions
11/25 – 11/29	Winter Weather	Plains, Midwest, Rockies	18	Thousands	100+ million
12/07 – 12/11	Severe Weather	Pacific Northwest	2	Thousands	Millions+
12/16 – 12/18	Winter Weather	West, Rockies, Plains, Midwest	3	Thousands	Millions+
12/22 – 12/26	Severe Weather	Midwest, Southeast, Plains	18	Thousands	1.0+ billion
12/26 – 12/30	Severe Weather	Plains, Midwest, Southeast	46	Thousands	3.0+ billion

Exhibit 61: Remainder of North America (Canada, Mexico, Central America, Caribbean Islands)

Date(s)	Event	Location	Deaths	Structures/ Claims	Economic Loss (USD)
1/01 – 12/31	Drought	Canada	0	Unknown	1.0+ billion
2/20 – 2/21	Flooding	Dominican Republic	2	4,190+	Unknown
3/26 – 3/28	Severe Weather	Mexico	14	1,000+	Millions
4/04 – 4/05	Flooding	Haiti	6	8,832+	Unknown
5/26	Severe Weather	Mexico	14	1,000+	Unknown
6/01 – 7/31	Drought	El Salvador	0	Unknown	100+ million
6/08	HU Blanca	Mexico	0	Hundreds	Thousands
6/12	Severe Weather	Canada	0	5,000+	75+ million
6/22	Severe Weather	Canada	0	5,000+	40+ million
6/27 – 7/09	Flooding	Costa Rica	0	3,308+	Unknown
7/01 – 7/10	Wildfire	Canada	1	Hundreds	Unknown
7/21 – 7/22	Severe Weather	Canada	0	25,000+	375+ million
8/04 – 8/05	Severe Weather	Canada	0	17,700+	150+ million
8/13 – 8/21	Wildfires	Canada	0	Hundreds	193+ million
8/27 – 8/30	TS Erika	Caribbean Islands	36	5,000+	300+ million
8/29 – 8/30	Severe Weather	Canada	0	2,100+	50+ million
9/22 – 9/28	Flooding	Central America, Caribbean	5	1,700+	Millions
10/01	Landslide	Guatemala	304	125	Unknown
10/01 – 10/04	MHU Joaquin	Bahamas, Bermuda	35	Thousands	100+ million
10/11 – 10/12	Severe Weather	Canada	0	Thousands	Millions
10/22 – 10/25	MHU Patricia	Mexico	14	5,000+	410+ million
11/16 – 11/17	Severe Weather	Canada	0	Hundreds	Millions
12/27 – 12/30	Winter Weather	Canada	0	Hundreds	Millions

Exhibit 62: South America

Date(s)	Event	Location	Deaths	Structures/ Claims	Economic Loss (USD)
12/01 – 1/31	Drought	Brazil	0	Unknown	Unknown
1/15 – 1/31	Flooding	Bolivia, Peru	16	10,780+	Unknown
2/15	Flooding	Argentina	8	1,500	17.2+ million
3/01 – 3/06	Flooding	Argentina, Bolivia, Brazil, Ecuador, Peru	47	30,000+	Millions+
3/20 – 4/05	Severe Weather	Colombia, Ecuador, Peru	23	802+	Unknown
3/25 – 4/08	Flooding	Chile	25	14,000+	1.5+ billion
4/20	Severe Weather	Brazil	2	2,188+	2.0+ million
4/22 – 4/23	Volcano	Chile	0	Thousands	600+ million
4/27	Landslide	Brazil	15	Hundreds	Unknown
5/17	Flooding	Colombia	83	Hundreds	Unknown
8/06 – 8/10	Flooding	Argentina, Chile	9	Thousands	Unknown
9/16	Earthquake	Chile	14	10,000+	1.0+ billion
10/08 – 10/20	Flooding	Brazil	3	40,700+	Millions
12/01 – 12/31	Flooding	Peru, Paraguay, Uruguay, Brazil	16	10,000+	200+ million

Exhibit 63: Europe

Date(s)	Event	Location	Deaths	Structures/ Claims	Economic Loss (USD)
1/09 – 1/16	EU Windstorms	Northern/Central/Western Europe	2	Thousands	650+ million
1/29 – 2/01	Winter Weather	Western/Northern Europe	12	Hundreds	Millions+
1/30 – 2/02	Flooding	Balkans, Turkey	13	2,170+	13+ million
2/03 – 2/08	Winter Weather	Spain, France, Italy, Slovenia, Croatia	7	Thousands	Millions+
3/04 – 3/07	Winter Weather	Italy, Balkans	7	Thousands	Millions+
3/29 – 4/01	WS Mike & Niklas	Western & Central Europe	9	10,000+	1.0+ billion
4/12 – 4/13	Wildfire	Russia	33	1,476+	140+ million
5/05 – 5/06	Severe Weather	Germany, Belgium	1	Thousands	10s of millions
6/01 – 8/31	Drought	Romania, Poland, Czech Republic	0	100,000+	2.7+ billion
6/27 – 8/01	Heatwave	Western, Central & Eastern Europe	1,000+	Unknown	Unknown
7/24 – 7/25	Severe Weather	Netherlands, Germany, Poland, Slovakia	3	Thousands	25+ million
8/01 – 8/14	Heatwave/Wildfires	Central & Southern Europe, Middle East	109+	Unknown	9.0+ million
9/05	Severe Weather	Italy	0	Thousands	Millions
9/07	Flooding	Spain	4	1,000+	Millions
10/03 – 10/04	Flooding	France	19	60,000+	1.0+ billion
10/14 – 10/16	Flooding	Italy, Balkans	5	Hundreds	10s of Millions
11/01 – 11/03	Flooding	Portugal, Spain, Italy	7	Hundreds	Millions
11/17	WS Heini	UK, Western Europe	0	Thousands	225+ million
11/29 – 11/30	WS Nils	Ireland, U.K., Denmark, Sweden	0	Thousands	10s of Millions
12/04 – 12/06	WS Ted	United Kingdom, Ireland, Norway	3	30,500+	1.1+ billion
12/22 – 12/31	Flooding	United Kingdom	0	25,000+	2.5+ billion
12/30 – 12/31	WS Eckard	United Kingdom	1	10,000+	350+ million

Exhibit 64: Africa

Date(s)	Event	Location	Deaths	Structures/ Claims	Economic Loss (USD)
12/01 – 1/31	Flooding	Malawi, Mozambique, Zimbabwe	307	550,000+	550+ million
1/01 – 12/31	Drought	Ethiopia	N/A	N/A	1.4+ billion
1/02 – 1/04	Severe Weather	Malawi, Zimbabwe	15	Hundreds	Unknown
1/16 – 1/18	TS Chedza	Madagascar	89	5,000+	36+ million
2/07 – 2/08	TS Fundi	Madagascar	6	8,091	10+ million
2/13 – 2/14	Flooding	Angola	5	2,862+	Unknown
2/27 – 3/01	Flooding	Madagascar	24	642	Unknown
3/04	Flooding	Tanzania	47	634	Unknown
3/09 – 3/12	Flooding	Angola	69	2,500+	Unknown
3/28 – 3/29	Flooding	Burundi, Angola, Congo	24	500+	Unknown
4/04 – 4/10	Flooding	Kenya	13	Hundreds	Unknown
4/28	Flooding	Kenya	16	300+	Unknown
6/01 – 6/21	Flooding	Côte d'Ivoire	16	Unknown	Unknown
6/01 – 8/31	Drought	Botswana	0	Unknown	44+ million
8/08 – 8/09	Severe Weather	Sudan	20	Unknown	Unknown
8/13 – 8/15	Heatwave	Sudan	16	Unknown	Unknown
8/14	Flooding	Niger	4	2,170+	Unknown
7/15 – 9/10	Flooding	Burkina Faso	8	15,000+	31+ million
9/05 – 9/24	Flooding	Nigeria	53	53,000+	25+ million
10/16 – 10/25	Flooding	Algeria	0	Thousands	Unknown
7/01 – 11/30	Drought	South Africa	0	Unknown	2.0+ billion
11/16	Severe Weather	South Africa	0	20,000+	75+ million
11/19 – 12/17	Flooding	DR Congo	31	20,000+	Unknown

Exhibit 65: Asia

Date(s)	Event	Location	Deaths	Structures/ Claims	Economic Loss (USD)
1/01 – 12/31	Forest Fires	Indonesia	19	Unknown	16.1+ billion
1/01 – 12/31	Drought	China	0	Unknown	1.8+ billion
1/01 – 4/30	Drought	Thailand	0	Unknown	428+ million
1/01 – 1/23	Flooding	Indonesia	8	13,050+	6+ million
1/06 – 1/10	Winter Weather	Egypt, Israel, Jordan, Lebanon, Syria	9	Unknown	100+ million
1/09 – 1/12	Winter Weather	China	1	5,300+	226+ million
1/10 – 1/14	Earthquakes	China	0	17,500+	16+ million
1/14 – 1/20	Flooding	Malaysia	1	Thousands	Unknown
1/17 – 1/18	TY Mekkhala	Philippines	2	538+	1.0+ million
1/19	Severe Weather	Oman	0	5,000+	221+ million
1/23 – 1/25	Flooding	Indonesia	1	2,750+	Unknown
1/28 – 1/31	Winter Weather	China	0	1,000+	28+ million
1/31	Severe Weather	China	0	Unknown	80+ million
1/31 – 2/2	Flooding	Indonesia	2	5,050+	Unknown
2/08 – 2/13	Flooding	Indonesia	6	Thousands	235+ million
2/15 – 2/28	Winter Weather	Afghanistan, India	230	6,013	Unknown
2/22	Earthquake	China	0	3,000+	15+ million
2/24 – 3/3	Flooding	Pakistan	32	Unknown	Unknown
3/01	Earthquake	China	0	16,300+	19+ million
3/07 – 3/08	Winter Weather	Afghanistan, Pakistan	26	150+	Unknown
3/11 – 3/15	Severe Weather	India, Iran	20	1,140+	Unknown
3/14	Earthquake	China	2	11,234+	Millions+
3/16	Flooding	Indonesia	0	1,600+	Unknown
3/23 – 3/27	Flooding	Saudi Arabia	11	1,000+	Millions+
3/24 – 3/25	Severe Weather	China	0	1,000+	275+ million
3/25 – 4/5	STY Maysak	Micronesia, Philippines	9	2,000+	8+ million
3/28	Flooding	Indonesia	12	Unknown	Unknown
3/29 – 3/31	Winter Weather	China	0	1,000+	108+ million
3/29 – 3/31	Flooding	India	17	Thousands	38+ million
3/30	Earthquake	China	0	6,260+	20+ million
3/30 – 4/04	Severe Weather	China	6	19,300+	209+ million
4/01 – 4/03	Severe Weather	India, Pakistan, Tajikistan, Afghanistan	33	1,000+	Millions
4/04 – 4/05	Severe Weather	China	7	14,500+	20+ million
4/04 – 4/05	Severe Weather	Bangladesh, India, Myanmar	40	46,033+	4.3+ million
4/06 – 4/09	Severe Weather	China	1	5,000+	130+ million
4/08 – 4/12	Flooding	Kazakhstan	2	1,760+	5.3+ million
4/11 – 4/13	Winter Weather	China	0	Unknown	174+ million
4/19 – 4/21	Severe Weather	China	0	2,000+	350+ million

Date(s)	Event	Location	Deaths	Structures/ Claims	Economic Loss (USD)
4/21	Severe Weather	India	42	25,000+	158+ million
4/25 & 5/12	Earthquake	Nepal, India, Bangladesh, China	9,120	850,000+	8.0+ billion
4/27	Landslide	Afghanistan	52	100	Unknown
4/27 – 4/28	Severe Weather	Pakistan	49	Hundreds	Unknown
4/27 – 4/29	Severe Weather	China	2	36,500	485+ million
5/02 – 5/03	Severe Weather	Bangladesh	13	Unknown	Unknown
5/07 – 5/12	Severe Weather	China	4	26,600+	461+ million
5/10 – 5/12	STY Noul	Micronesia, Philippines, Japan	2	Unknown	24+ million
5/12	Flooding	China	0	2,000+	290+ million
5/13 – 5/17	Flooding	China	20	20,000+	254+ million
5/15	Severe Weather	Armenia	0	Hundreds+	10+ million
5/18 – 5/22	Flooding	China	48	87,000+	1.15+ billion
5/21 – 5/28	Heatwave	India	2,500+	Unknown	Unknown
5/23 – 5/27	Flooding	China, Taiwan, Hong Kong	7	2,500+	282+ million
5/28 – 6/01	Flooding	China	16	20,000+	500+ million
5/29 – 6/01	Severe Weather	China	0	10,000+	325+ million
6/01 – 6/04	Flooding	China	9	20,000+	625+ million
6/02 – 6/29	Volcano	Indonesia	0	Unknown	61+ million
6/05	Earthquake	Malaysia	19	Dozens	Thousands
6/06 – 6/11	Flooding	India, Nepal	21	1,000+	Unknown
6/07 – 6/11	Flooding	China	16	20,000+	2.0+ billion
6/12	CY Ashobaa	Oman	0	Dozens	Thousands
6/18 – 6/24	Heatwave	Pakistan	1,265+	Unknown	Unknown
6/19 – 6/25	Flooding	India	41	Thousands	100+ million
6/20 – 6/24	Flooding	China	9	8,700+	187+ million
6/21 – 6/23	Severe Weather	China	0	Hundreds	145+ million
6/22 – 6/24	TS Kujira	China, Vietnam	7	223+	11+ million
6/23 – 6/30	Flooding	Bangladesh, Myanmar, India	63	Thousands	Unknown
6/25 – 6/29	Flooding	China	0	6,200+	58+ million
6/26 – 7/02	Flooding	China	16	50,000+	645+ million
7/01 – 7/05	Flooding	China	6	23,300+	345+ million
7/03	Earthquake	China	4	12,000+	3.2+ million
7/03 – 7/07	Severe Weather	China	1	2,000+	169+ million
7/04 – 7/13	TY Chan-hom	China, Guam, Japan, Taiwan, Korea	0	4,700+	1.6+ billion
7/04 – 7/10	TY Linfa	Philippines, China	5	493+	214+ million
7/07 – 7/13	Flooding	India, Pakistan	35	Thousands	Unknown
7/08 – 7/13	Flooding	Philippines	16	10+	Unknown
7/13 – 7/14	Severe Weather	China	1	600+	85+ million
7/13 – 7/14	Flooding	China	3	8,500+	71+ million

Date(s)	Event	Location	Deaths	Structures/ Claims	Economic Loss (USD)
7/16	STY Nangka	Japan	2	288+	200+ million
7/17 – 7/25	Flooding	Pakistan	18	Thousands	Unknown
7/17 – 8/11	Heatwave	Japan	59	Unknown	Unknown
7/20 – 7/24	Flooding	China	28	42,900+	1.2+ billion
7/22 – 7/27	Flooding	Pakistan, Myanmar, Afghanistan, Bangladesh	162	39,000+	25+ million
7/24 – 8/06	Flooding	Vietnam	42	2,028+	204+ million
7/25 – 8/07	Flooding	Myanmar	121	50,000+	109+ million
7/26 – 8/06	Flooding	India, Pakistan, Bangladesh	303	350,000+	500+ million
8/01 – 8/05	Flooding	North Korea	21	968+	Unknown
8/01 – 8/07	Flooding	Nepal	90	1,000+	Unknown
8/01 – 8/15	Flooding	Laos	0	2,200+	10+ million
8/02 – 8/04	Flooding	China	15	15,000+	418+ million
8/02 – 8/08	STY Soudelor	China, Taiwan, Saipan	41	150,000+	3.2+ billion
8/07 – 8/12	Severe Weather	China	1	1,000+	59+ million
8/15 – 8/26	TY Goni	Japan, Philippines, Korea Peninsula	70	20,000+	900+ million
8/16 – 8/19	Flooding	China	23	25,800+	220+ million
8/19 – 8/26	Severe Weather	China	1	10,000+	281+ million
8/28 – 9/01	Flooding	India, Myanmar	47	50,000+	100+ million
9/06	Severe Weather	India	32	Unknown	Unknown
9/08 – 9/10	Sandstorm	Middle East	12	Thousands	Unknown
9/08 – 9/10	Flooding	Japan	8	25,000+	500+ million
9/15 – 9/23	Flooding	China	14	4,000+	473+ million
9/25	Earthquake	Indonesia	0	2,500	Unknown
9/25 – 9/28	TY Dujuan	Taiwan, China, Japan, Philippines	3	Thousands	687+ million
9/30 – 10/1	Winter Weather	China	1	Unknown	177+ million
10/02 – 10/04	TY Mujigae	China, Philippines	22	26,800	4.2+ billion
10/06 – 10/11	Severe Weather	China	14	5,200	43 million
10/08 – 10/12	Flooding	Myanmar	39	Hundreds	Unknown
10/18 – 10/22	STY Koppu	Philippines	62	150,000+	306+ million
10/26	Earthquake	Afghanistan, Pakistan	403+	95,000+	100+ million
10/28 – 10/30	Flooding	Iran, Iraq, Saudi Arabia	70	Unknown	Millions
11/03 – 11/04	CY Chapala	Yemen	8	Thousands	100s of Millions
11/08 – 11/09	CY Megh	Yemen, Somalia	18	3,000+	Unknown
11/09 – 12/08	Flooding	India, Sri Lanka	386+	100,000+	4.0+ billion
11/10 – 11/16	Flooding	China	0	Thousands	133+ million
11/13	Landslide	China	38	48	Unknown
11/17	Earthquake	Kyrgyzstan	0	4,371	Unknown
11/17	Flooding	Saudi Arabia	12	Hundreds	Unknown
11/22 – 11/25	Winter Weather	China	4	1,000	268+ million

Date(s)	Event	Location	Deaths	Structures/ Claims	Economic Loss (USD)
11/29 – 12/03	Landslides	Indonesia	20	550+	Unknown
12/04 – 12/05	Flooding	China	0	Hundreds	90+ million
12/14 – 12/17	TY Melor	Philippines	42	279,487+	140+ million
12/25	Earthquake	Pakistan, Afghanistan	2	Thousands	Unknown

Exhibit 66: Oceania (Australia, New Zealand, and the South Pacific Islands)

Date(s)	Event	Location	Deaths	Structures/ Claims	Economic Loss (USD)
1/02 – 1/08	Wildfires	Australia	0	996+	50+ million
2/20	Cyclone Lam	Australia	0	Hundreds	78+ million
2/20	Cyclone Marcia	Australia	0	36,483+	650+ million
3/11 – 3/15	CY Pam	Vanuatu, South Pacific Islands	16	30,000+	443+ million
3/13 – 3/15	CY Olwyn	Australia (WA)	0	500+	76+ million
3/20 – 3/24	CY Nathan	Australia (QLD, NT)	0	Hundreds	Millions
4/19 – 4/22	Severe Weather	Australia (NSW)	4	119,935+	925+ million
4/25	Severe Weather	Australia (NSW)	0	14,239+	500+ million
4/30 – 5/03	Flooding	Australia (QLD, NSW)	6	27,825+	400+ million
5/14 – 5/15	Flooding	New Zealand	1	Thousands	100+ million
5/14	STY Dolphin	Northern Mariana Islands	0	Hundreds	Unknown
6/20	Flooding	New Zealand	0	2,839+	171+ million
6/30 – 7/05	CY Raquel	Solomon Islands	1	150+	Millions
8/25 – 8/26	Severe Weather	Australia (NSW)	0	1,600+	Millions
7/1 – 10/31	Drought	Papua New Guinea	0	Unknown	60+ million
10/27 – 10/28	Severe Weather	Australia (QLD)	0	Hundreds	Millions
11/25 – 11/27	Wildfires	Australia (South Australia)	2	1,861+	200+ million
11/29 – 11/30	Severe Weather	Australia (QLD, NSW)	0	Hundreds	10s of Millions
12/16	Severe Weather	Australia (NSW)	0	2,600+	25+ million
12/25	Wildfires	Australia (VIC)	0	100+	100+ million

Appendix B: Historical Natural Disaster Events

The following tables provide a look at specific global natural disaster events since 1950. (Please note that the adjusted for inflation (2015 USD) totals were converted using the US Consumer Price Index (CPI). Insured losses include those sustained by private industry and government entities such as the US National Flood Insurance Program (NFIP). For additional top 10 lists, please visit **www.aonbenfield.com/catastropheinsight**

Exhibit 67: Top 10 Costliest Global Economic Loss Events (1950-2015)

Date	Event	Location	Economic Loss[1] Actual (USD)	Economic Loss[2] (2015 USD)
March 11, 2011	EQ/Tsunami	Japan	210 billion	223 billion
January 17, 1995	Earthquake	Japan	103 billion	162 billion
August 2005	Hurricane Katrina	United States	125 billion	151 billion
May 12, 2008	Earthquake	China	85 billion	93 billion
October 2012	Hurricane Sandy	US, Caribbean, Bahamas, Canada	72 billion	74 billion
January 17, 1994	Earthquake	United States	44 billion	71 billion
November 23, 1980	Earthquake	Italy	19 billion	51 billion
July – December 2011	Flooding	Thailand	45 billion	47 billion
August 1992	Hurricane Andrew	United States, Bahamas	27 billion	45 billion
July/August 1998	Flooding	China	31 billion	44 billion

[1] Economic loss include those sustained from direct damages, plus additional directly attributable event costs

[2] Adjusted using US Consumer Price Index (CPI)

Exhibit 68: Top 10 Costliest Global Insured Loss Events (1950-2015)

Date	Event	Location	Insured Loss[1] Actual (USD)	Insured Loss[2] (2015 USD)
August 2005	Hurricane Katrina	United States	66.9 billion	80.8 billion
March 11, 2011	EQ/Tsunami	Japan	35.0 billion	37.1 billion
October 2012	Hurricane Sandy	US, Caribbean, Bahamas, Canada	30.2 billion	31.0 billion
August 1992	Hurricane Andrew	US, Bahamas	15.7 billion	26.4 billion
January 17, 1994	Earthquake	United States	15.3 billion	24.8 billion
September 2008	Hurricane Ike	United States	15.2 billion	16.5 billion
June-December 2011	Flooding	Thailand	15.5 billion	16.2 billion
Yearlong 2012	Drought	United States	15.0 billion	15.7 billion
October 2005	Hurricane Wilma	United States	12.5 billion	14.8 billion
February 22, 2011	Earthquake	New Zealand	13.5 billion	14.5 billion

[1] Insured loss include those sustained from direct damages, plus additional directly attributable event costs

[2] Adjusted using US Consumer Price Index (CPI)

Exhibit 69: Top 10 Global Human Fatality Events (1950-2015)

Date	Event	Location	Economic Loss[1] Actual (USD)	Insured Loss[2] (2015 USD)	Fatalities
November 1970	Tropical Cyclone	Bangladesh	90 million	N/A	300,000
July 27, 1976	Earthquake	China	5.6 billion	N/A	242,769
December 26, 2004	EQ/Tsunami	Indonesia	14.0 billion	3.0 billion	227,898
January 12, 2010	Earthquake	Haiti	8.0 billion	100 million	222,570
April 1991	Cyclone Gorky	Bangladesh	2.0 billion	100 million	138,866
May 2008	Cyclone Nargis	Myanmar	10.0 billion	N/A	138,366
August 1971	Flooding	Vietnam	N/A	N/A	100,000
May 12, 2008	Earthquake	China	85.0 billion	366 million	88,000
October 8, 2005	Earthquake	Pakistan	5.2 billion	50 million	88,000
Summer 2003	Drought/Heatwave	Europe	13.5 billion	1.1 billion	70,000

[1] Economic loss include those sustained from direct damages, plus additional directly attributable event costs

[2] Adjusted using U.S. Consumer Price Index (CPI)

Exhibit 70: Top 10 Costliest United States Natural Disaster Events (1950-2015)

Date	Event	Location	Economic Loss[1] Actual (USD)	Economic Loss[2] (2015 USD)
August 2005	Hurricane Katrina	Southeast	125 billion	151 billion
January 17, 1994	Earthquake	California	44 billion	71 billion
October 2012	Hurricane Sandy	Eastern US	68 billion	70 billion
August 1992	Hurricane Andrew	Southeast	27 billion	45 billion
Summer 1988	Drought	Nationwide	20 billion	41 billion
Summer 1993	Flooding	Mississippi Valley	21 billion	34 billion
Yearlong 2012	Drought	Nationwide	30 billion	31 billion
Yearlong 1980	Drought	Nationwide	10 billion	30 billion
September 2008	Hurricane Ike	Texas, Midwest, Northeast	27 billion	29 billion
October 2005	Hurricane Wilma	Florida	19 billion	23 billion

[1] Losses sustained by private insurers and government-sponsored programs

[2] Adjusted using US Consumer Price Index (CPI)

Appendix C: Tropical Cyclone Frequency Comparisons

The following shows how the El Niño/Southern Oscillation (ENSO) affects global tropical cyclone frequencies and also how the Atlantic Multidecadal Oscillation (AMO) affects activity in the Atlantic Ocean Basin. Note that data for the Atlantic and Western Pacific Basins in this section extend to 1950 given the level of quality data as provided by NOAA's IBTrACS historical tropical cyclone database. All other basins include data to 1980.

Atlantic Ocean Basin

Exhibit 71: Atlantic Basin Hurricane Frequency by ENSO Phase

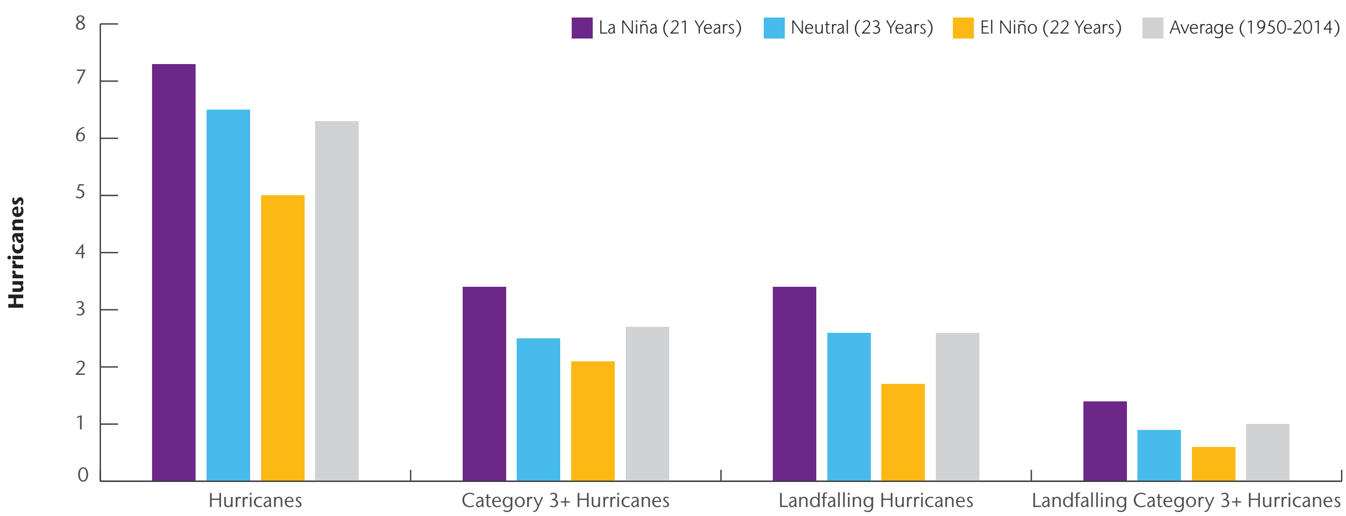


Exhibit 72: Atlantic Basin Hurricane Frequency by AMO Phase

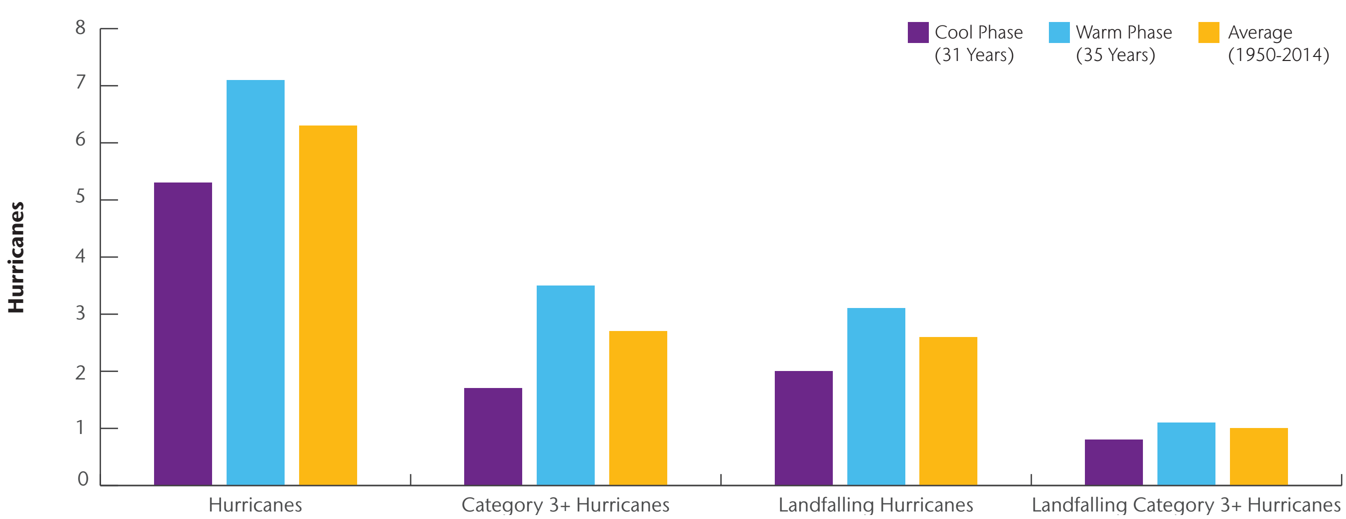


Exhibit 73: United States Hurricane Landfall Frequency by ENSO Phase

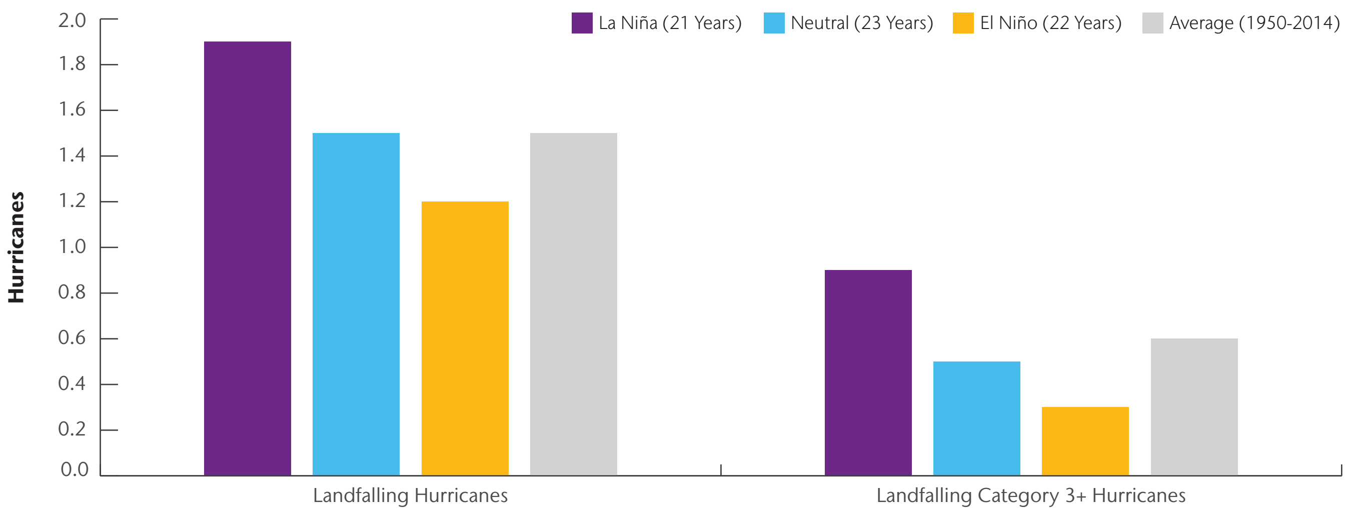
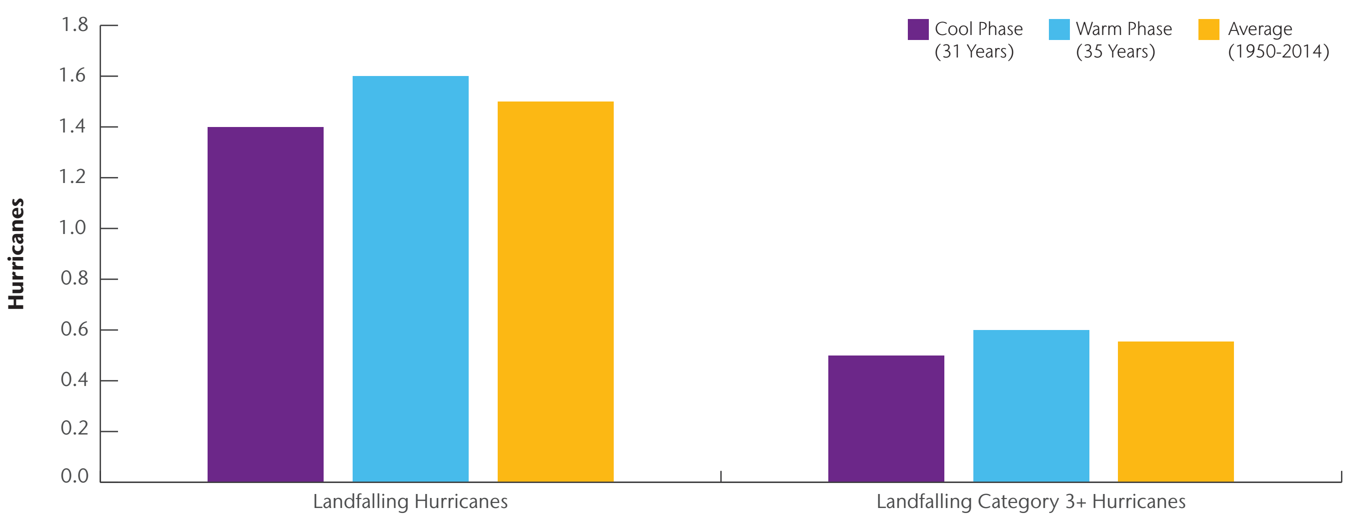
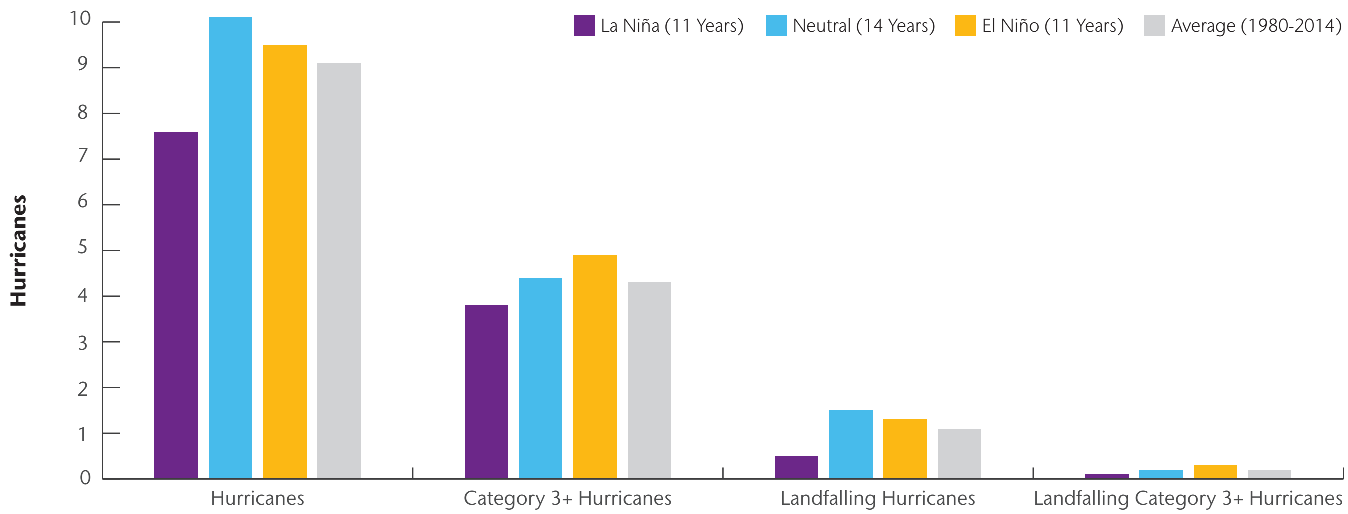


Exhibit 74: United States Hurricane Landfall Frequency by AMO Phase



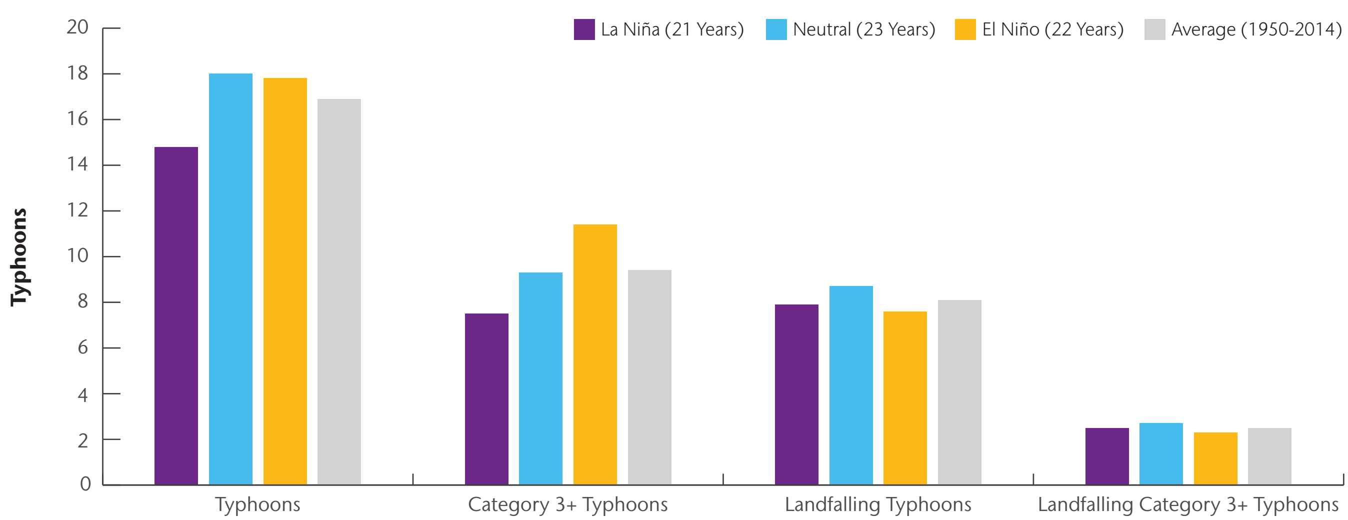
Eastern Pacific Ocean Basin

Exhibit 75: Eastern and Central Pacific Basin Hurricane Frequency by ENSO Phase



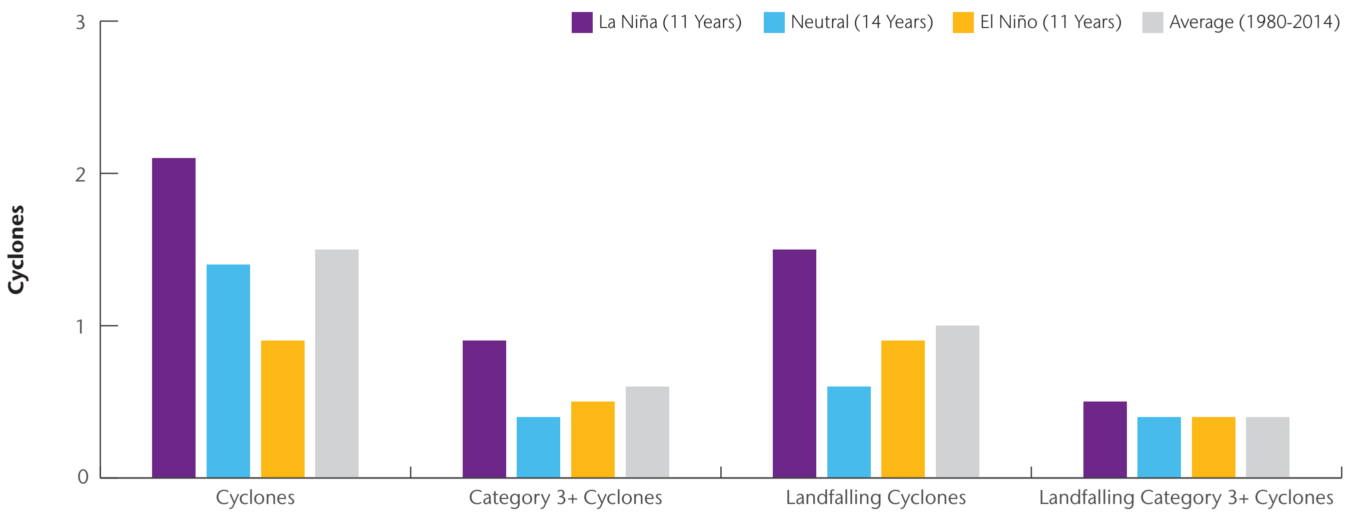
Western Pacific Ocean Basin

Exhibit 76: Western Pacific Basin Typhoon Frequency by ENSO Phase



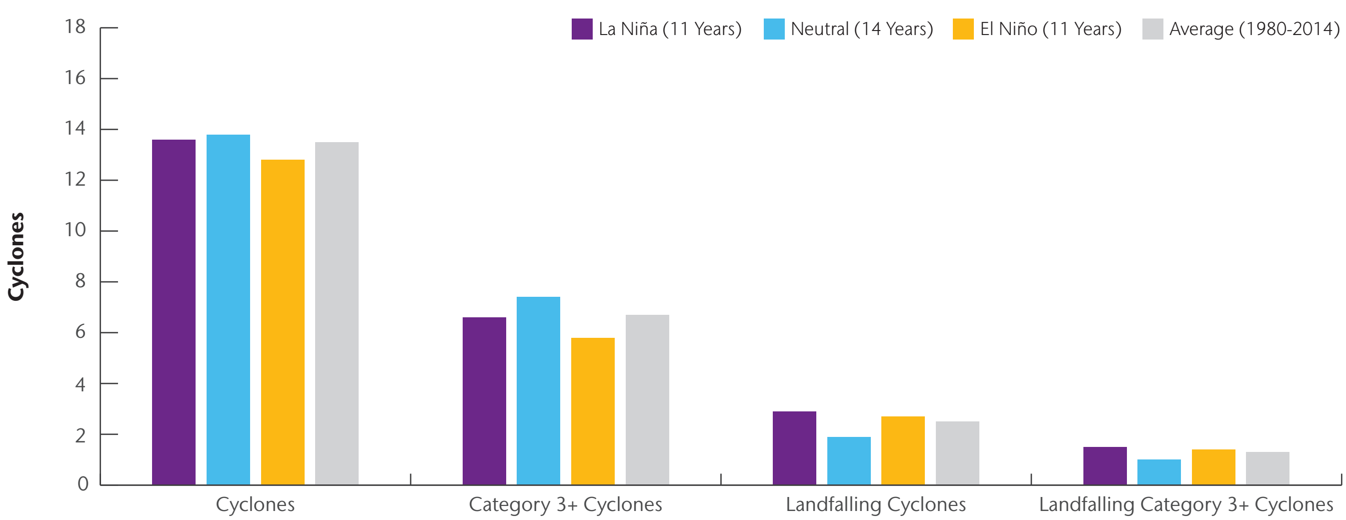
North Indian Ocean Basin

Exhibit 77: North Indian Basin Cyclone Frequency by ENSO Phase



Southern Hemisphere

Exhibit 78: Southern Hemisphere Cyclone Frequency by ENSO Phase



Appendix D: Tropical Cyclone Landfall Data by Basin

The following shows a breakdown of historical tropical cyclone landfall data by basin. Note that data for the Atlantic and Western Pacific Basins in this section extend to 1950 given the level of quality data as provided by NOAA's IBTrACS historical tropical cyclone database. All other basins include data to 1980.

Exhibit 79: Atlantic Ocean Basin Hurricane Landfalls

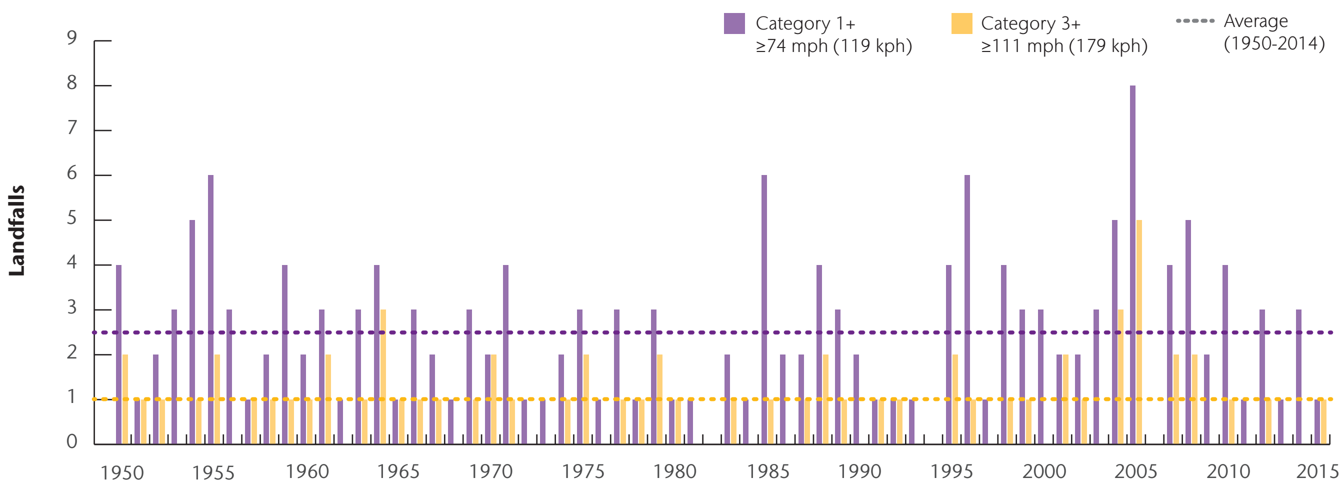


Exhibit 80: United States Hurricane Landfalls

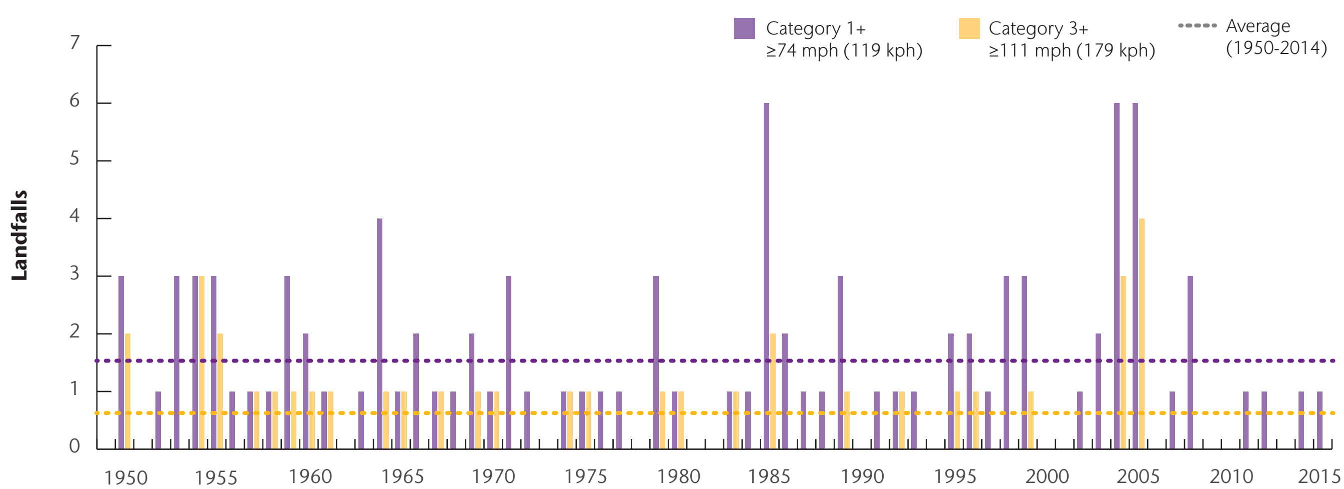


Exhibit 81: Eastern Pacific Ocean Basin Hurricane Landfalls

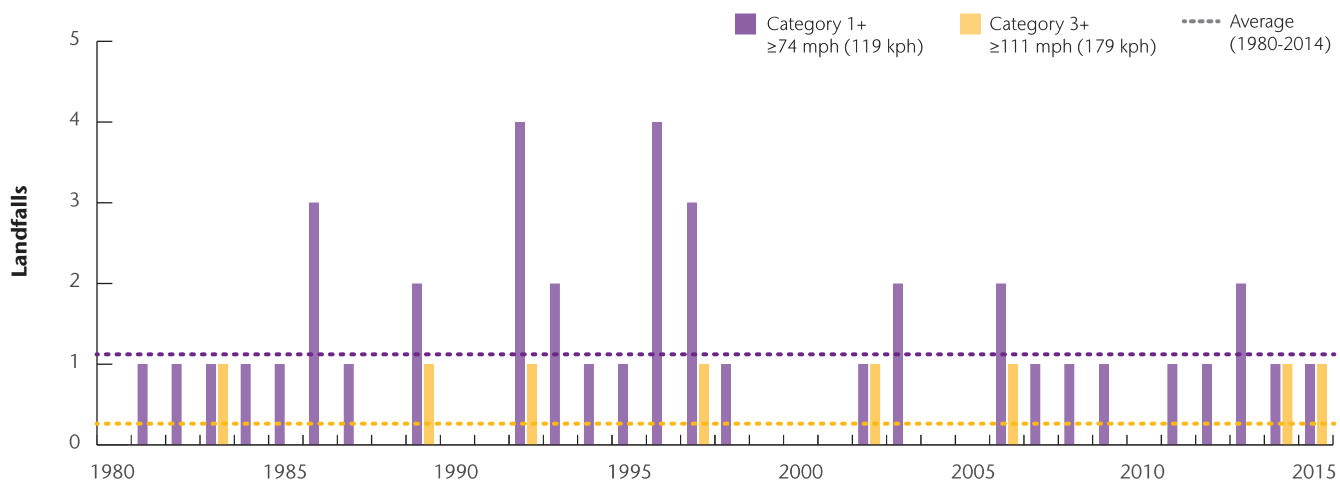


Exhibit 82: Western Pacific Ocean Basin Typhoon Landfalls

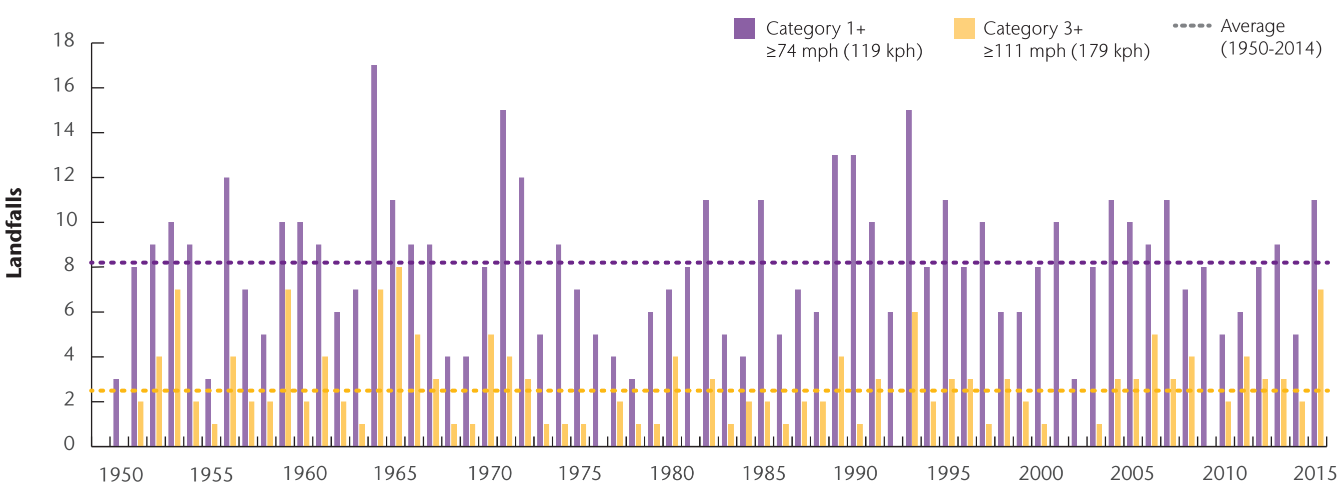


Exhibit 83: North Indian Ocean Basin Cyclone Landfalls

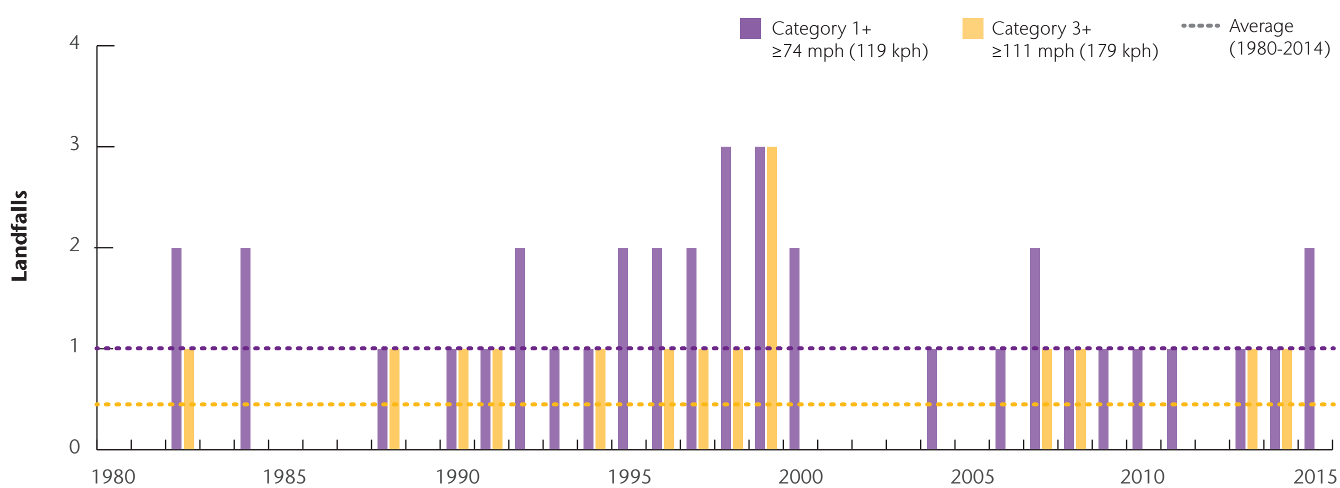
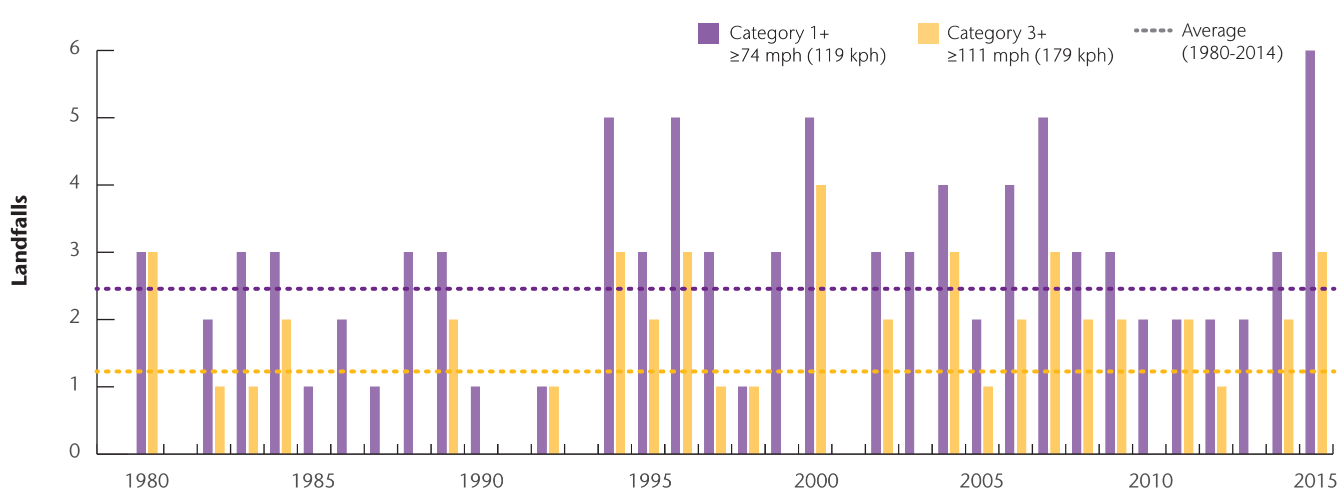


Exhibit 84: Southern Hemisphere Cyclone Landfalls



Appendix E: United States Tornado Frequency Data

The following is a breakdown of US tornado frequency since 1950 as provided by data from the Storm Prediction Center. Also included is the total number of tornado-related fatalities. Please note that advances in technology, particularly the implementation of Doppler radar, have resulted in more precise tornado detection rates – particularly with F0/EF0 tornadoes—since the early 1990s. Data sets prior to this time are typically considered incomplete, especially in regards to the number of tornadoes below F3/EF3 strength. When trying to determine potential tornado frequency trends, a more accurate method is to use tornadoes with F1/EF1 intensity or greater given the larger confidence level in data collection of such twisters (as opposed to F0/EF0).

Exhibit 85: U.S. Tornadoes

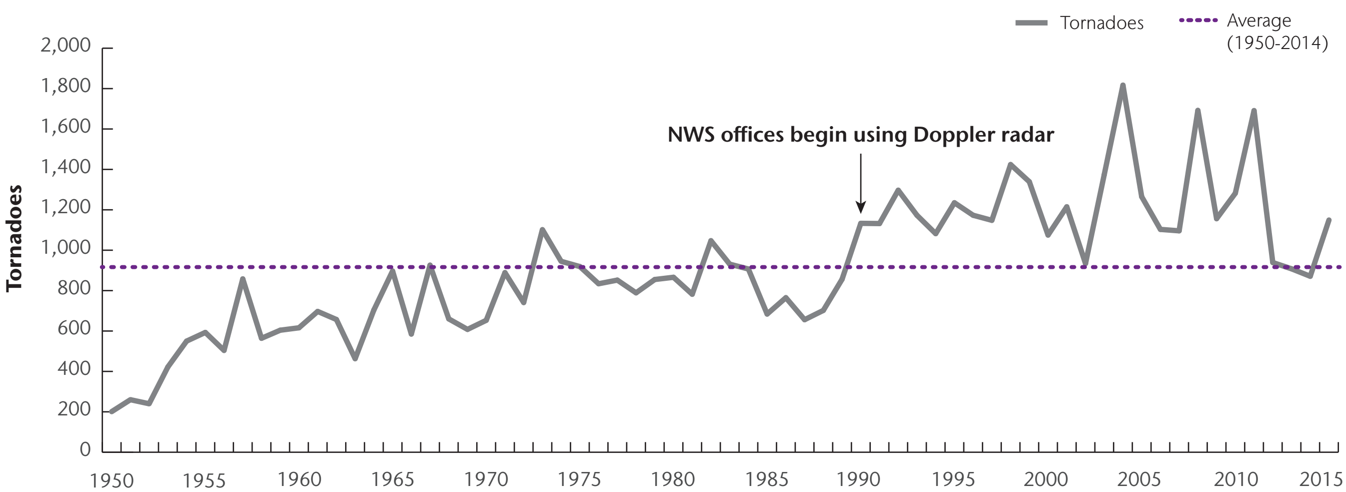
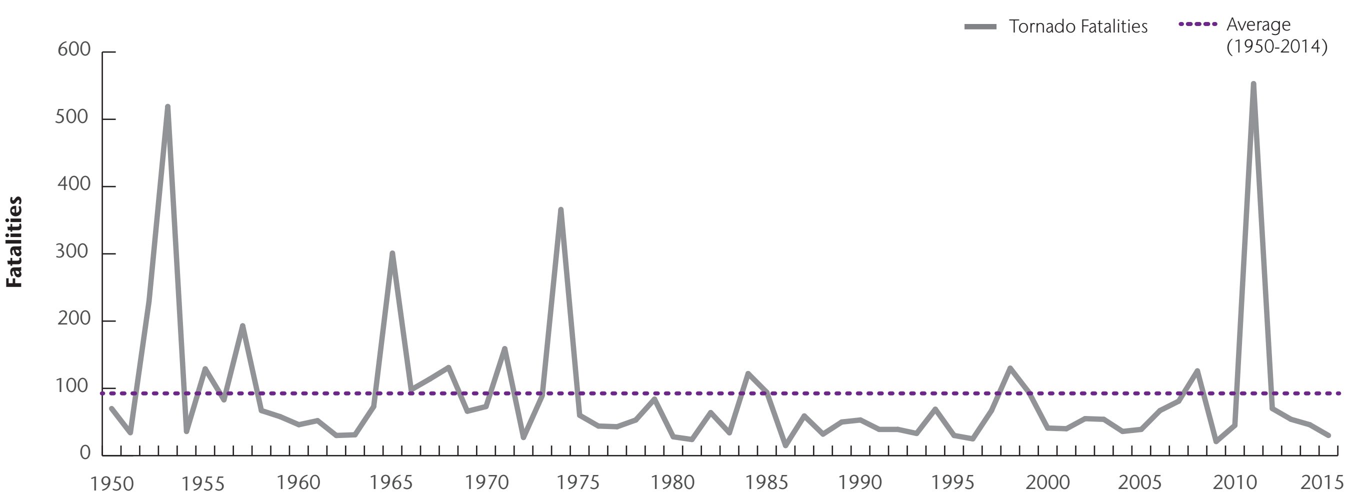
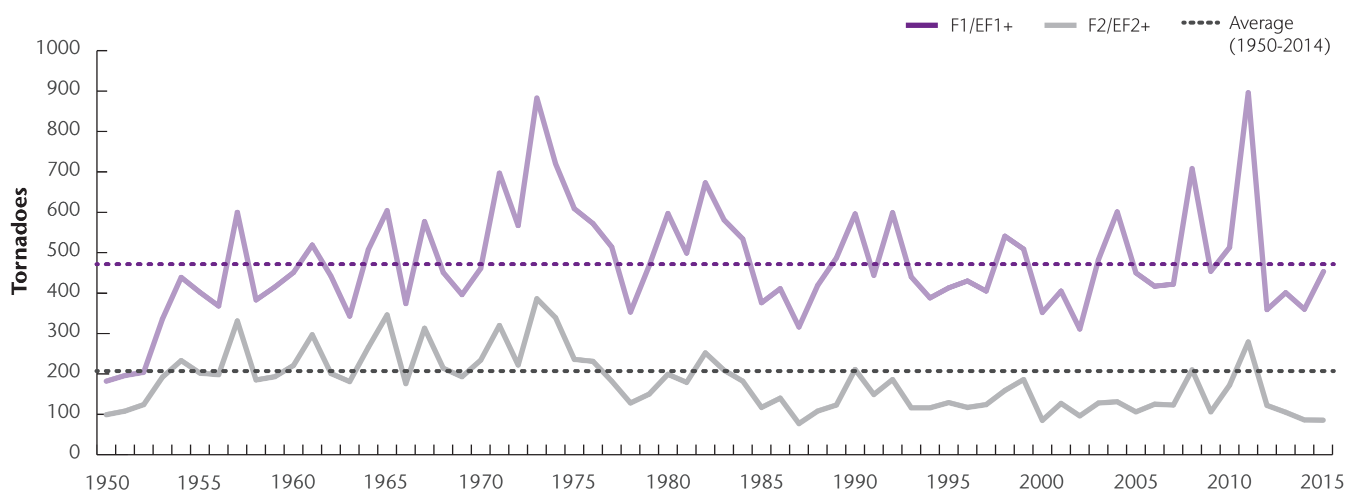


Exhibit 86: U.S. Tornado Fatalities



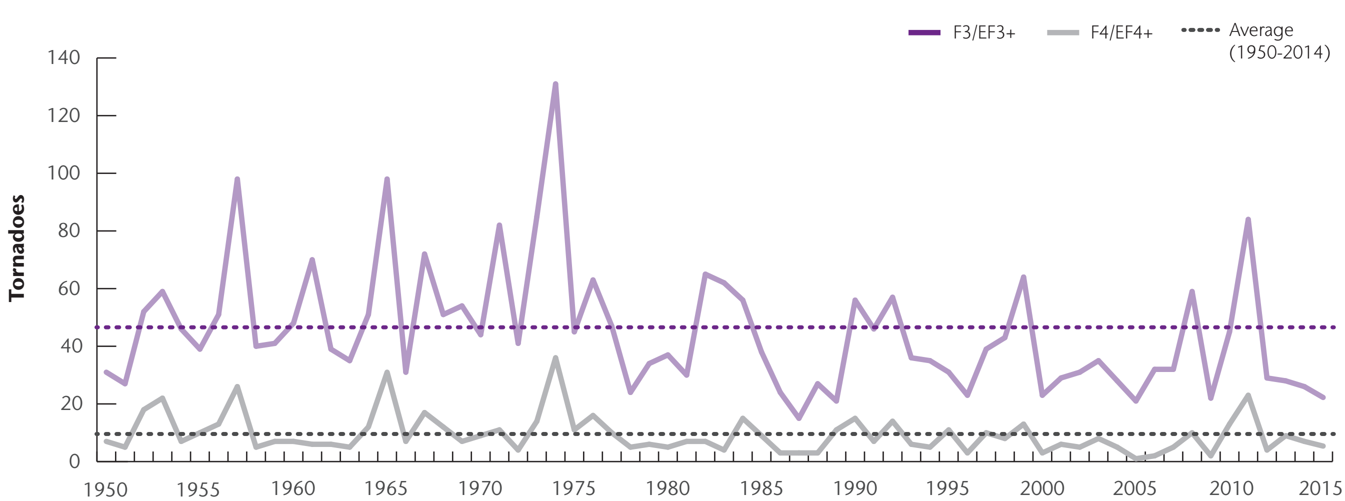
Since 1950, the overall trend of tornadoes rated at F1/EF1 and above has remained nearly flat with a minimal 1.3 percent annual growth. Dependable data since the advent of the Doppler-era in 1990 shows a similar flat annual growth trend at just 0.2 percent. When breaking down data to just the last 10 years, there has been a slight downward trend of 1.6 percent.

Exhibit 87: U.S. Tornadoes by Rating (F1/EF1+, F2/EF2+)



Since 1950, the overall trend of higher-end tornadoes rated at F3/EF3 and above has remained nearly flat and shows a slight annual decrease of 0.8 percent. A comparable 1.2 percent annual decrease is also found when looking at dependable data since the advent of Doppler radar in 1990. When breaking down data to just the last 10 years, there has been a similar nearly flat growth at 0.5 percent.

Exhibit 88: U.S. Tornadoes by Rating (F3/EF3+, F4/EF4+)



Given the level of attention that tornadic activity causes in the United States, there has been increased interest in attempting to determine whether certain atmospheric phases can be used to correlate seasonal patterns. The following exhibits analyze US tornado frequencies in relation to ENSO phases. Based on data from the Storm Prediction Center since 1950, it appears that tornadic activity is slightly elevated during La Niña phases, especially higher-end tornadoes with ratings at or above F3/EF3 strength. However, the number of tornadoes during ENSO-neutral conditions is near the long-term average, and the totals from El Niño phases are slightly below average.

Exhibit 89: U.S. Tornado Frequency by ENSO Phase (Total, F1/EF1+, F2/EF2+)

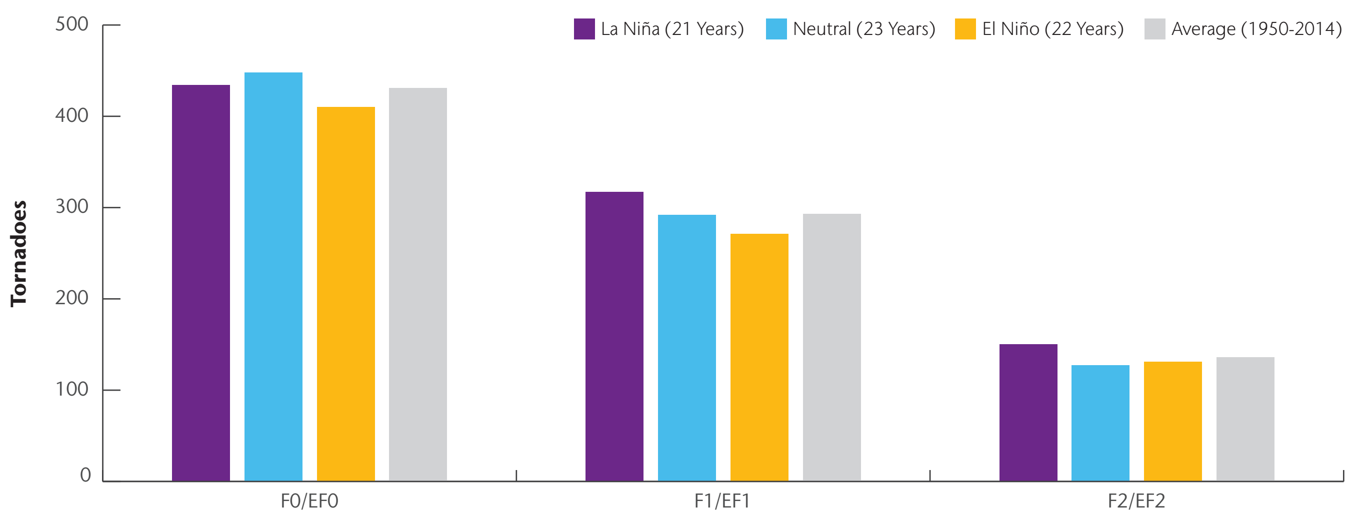
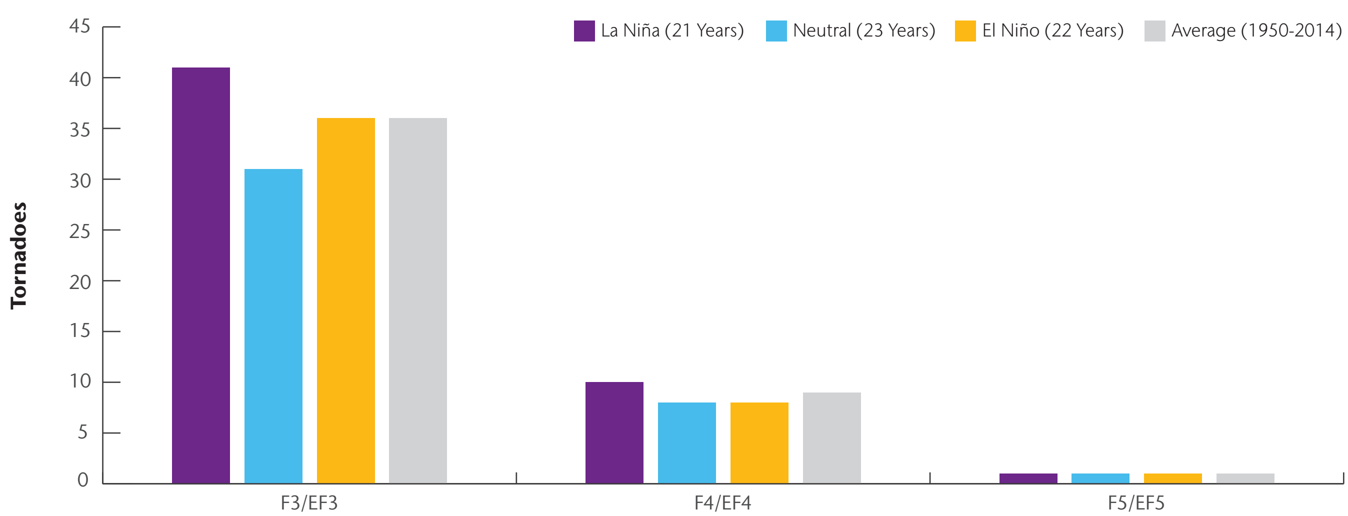


Exhibit 90: U.S. Tornado Frequency by ENSO Phase (F3/EF3+, F4/EF4+, F5/EF5)



Appendix F: United States Wildfire Frequency Data

The following provides a breakdown of United States wildfire frequency activity since 1960 as provided by data from the National Interagency Fire Center (NIFC) and the National Interagency Coordination Center (NICC). Historically, the West and Alaska frequently endure the largest amount of burn acreage with the Southwest also seeing regular elevated burn totals. Please note that the NICC maintained wildfire records from 1960 to 1982 before the NIFC began their current method of data compilation from states and other agencies in 1983.

Exhibit 91: U.S. Wildfire Acres Burned

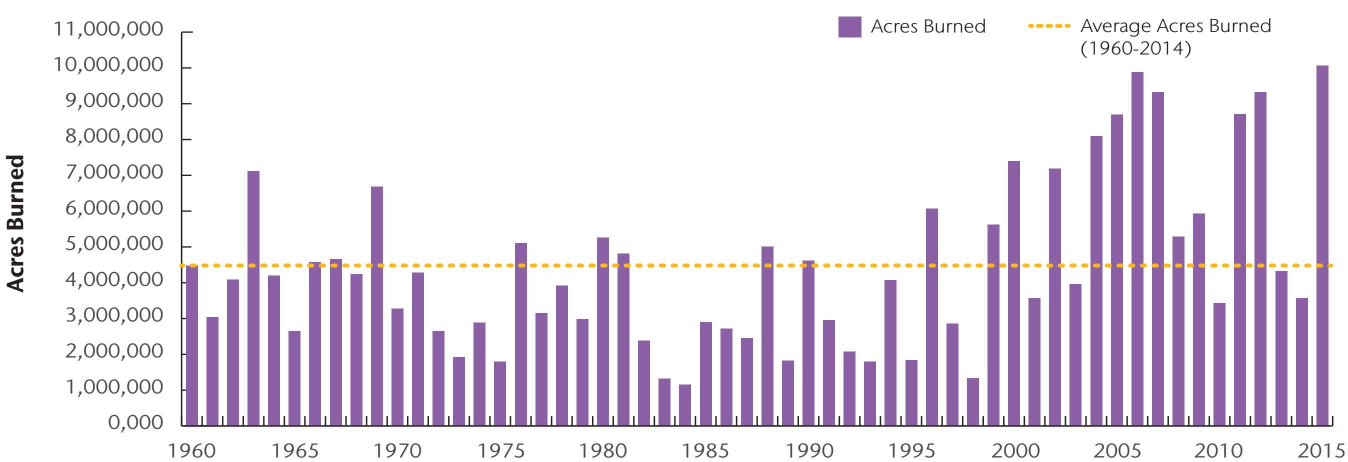
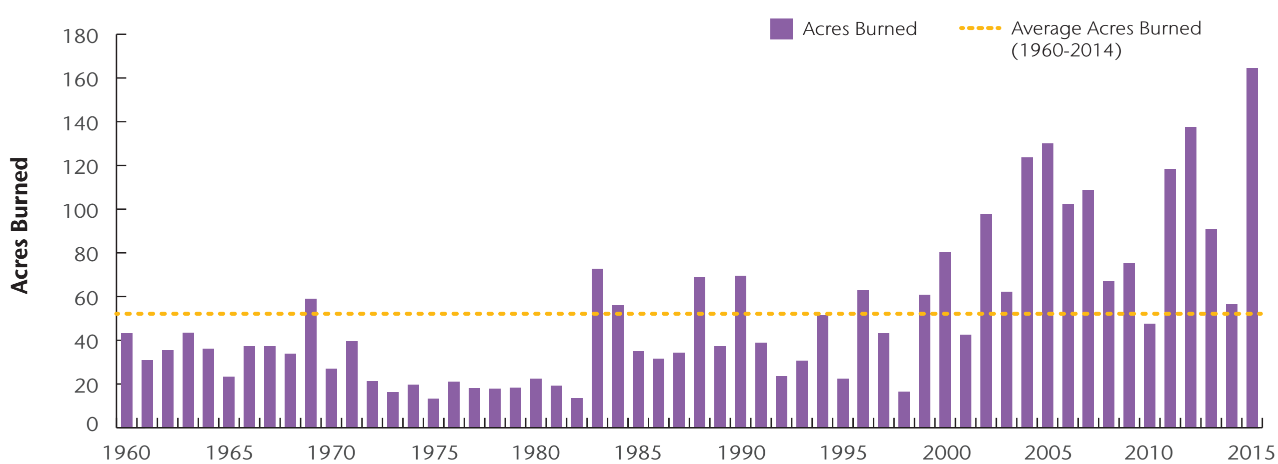


Exhibit 92: U.S. Wildfire Acres Burned Per Fire



Additional Report Details

TD = Tropical Depression, TS = Tropical Storm, HU = Hurricane, TY = Typhoon, STY = Super Typhoon, CY = Cyclone

Fatality estimates as reported by public news media sources and official government agencies.

Structures defined as any building — including barns, outbuildings, mobile homes, single or multiple family dwellings, and commercial facilities — that is damaged or destroyed by winds, earthquakes, hail, flood, tornadoes, hurricanes or any other natural-occurring phenomenon. Claims defined as the number of claims (which could be a combination of homeowners, commercial, auto and others) reported by various insurance companies through press releases or various public media outlets.

Damage estimates are obtained from various public media sources, including news websites, publications from insurance companies, financial institution press releases and official government agencies. Economic loss totals include any available insured loss estimates, which can be found in the corresponding event text.

This report use publicly available data from the internet and other sources. Impact Forecasting® summarizes this publicly available information for the convenience of those individuals who have contacted Impact Forecasting® and expressed an interest in natural catastrophes of various types. To find out more about Impact Forecasting or to sign up for the Cat Reports, visit Impact Forecasting's webpage at **www.impactforecasting.com**.

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Impact Forecasting is a catastrophe model development center of excellence within Aon Benfield whose seismologists, meteorologists, hydrologists, engineers, mathematicians, GIS experts, finance, risk management and insurance professionals analyze the financial implications of natural and man-made catastrophes around the world. Impact Forecasting's experts develop software tools and models that help clients understand underlying risks from hurricanes, tornadoes, earthquakes, floods, wildfires and terrorist attacks on property, casualty and crop insurers and reinsurers. Impact Forecasting is the only catastrophe model development firm integrated into a reinsurance intermediary. To find out more about Impact Forecasting®, visit **www.impactforecasting.com**.

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