
# Annual Global Climate and Catastrophe Report

Impact Forecasting — 2013

Empower Results®

# Contents

# Executive Summary: 2013—Many Events; Fewer Losses

Global natural disasters[1] in 2013 combined to cause economic losses of USD192 billion, 4% below the ten year average of USD200 billion. The losses were generated by 296 separate events, compared to an average of 259. The disasters caused insured losses of USD45 billion, 22% below the 10-year average of USD58 billion and the lowest total since 2009. In a reversal from 2012, when the year's largest events occurred in the United States, the largest global events of 2013 were heavily concentrated in Europe and Asia. Notable events during the year in these regions included major flooding in Central Europe, Indonesia, the Philippines, China, and Australia, in addition to Super Typhoon Haiyan's landfall in the Philippines. Flood represented 35% of all global economic losses during the year, which marked its highest percentage of aggregate losses since 2010. Severe drought conditions also contributed to billion-dollar (USD) losses in Brazil, China, New Zealand, and the U.S. Despite 84% of the economic losses occurring outside of the U.S., it still accounted for 45% of all insured losses globally, because of greater substantial insurance penetration.

The most deadly event of 2013 was Super Typhoon Haiyan, which left nearly 8,000 people dead or missing in the Philippines. A total of 15 tropical cyclones (Category 1+) made landfall globally in 2013, slightly below the 1980-2012 average of 16. Thirteen of the landfalls were registered in the Northern Hemisphere, including nine in Asia. No hurricanes struck the U.S., as the country extended its record streak without a major (Category 3+) hurricane landfall to eight consecutive years. The previous record was set between September 1900 and October 1906. Also, 2013 ended as the fourth warmest year recorded since global land and ocean temperature records began in 1880.

The May/June floods in Central Europe were the costliest single event of the year causing an estimated USD5.3 billion insured loss and approximately USD22 billion in economic losses. Most of the flood losses were sustained in Germany, which also endured record-level insured hail losses during multiple summer convective thunderstorm events.

Europe, the Middle East and Africa (EMEA) and the Americas (Non-U.S.) each sustained aggregate insured losses above their 10-year averages in 2013. The United States and Asia-Pacific (APAC) regions both incurred below normal insured losses. The top 10 insured loss events in 2013 were five severe weather outbreaks (four in the U.S.), two European windstorms Christian and Xaver in Europe, two floods (Europe and Canada), and losses emanating from drought conditions in the U.S.

New to this year's report is a more comprehensive look at possible loss trends across the four major regions of the globe: United States, Americas (Non-U.S.), EMEA, and APAC.

Along with this report, we continue to welcome users to access current and historical natural catastrophe data and event analysis on Impact Forecasting's website: **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.

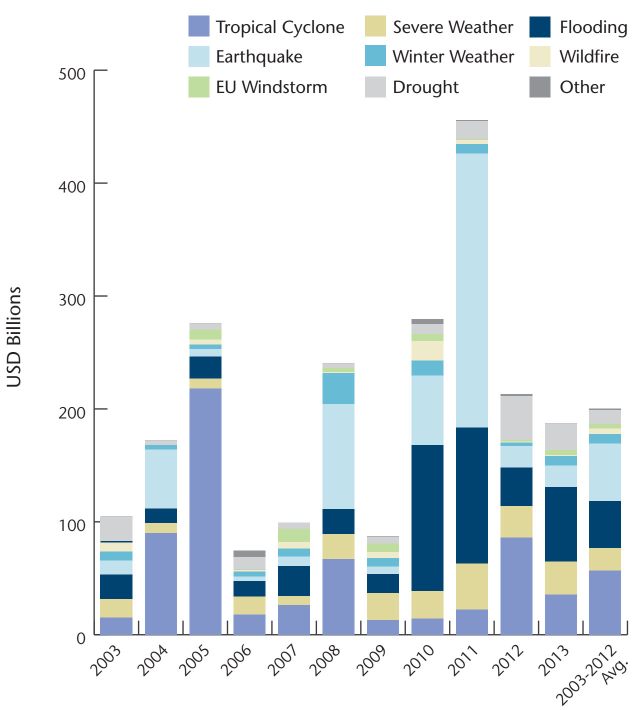
# Global Economic Losses

### Exhibit 1: Top 10 Global Economic Loss Events

| Date(s) | Event | Location | Deaths | Structures/ Claims | Economic Loss (USD) | Insured Loss (USD) |
|---|---|---|---|---|---|---|
| May/June | Flooding | Central Europe | 25 | 150,000 | 22 billion | 5.3 billion |
| April 20 | Earthquake | China | 196 | 620,000 | 14 billion | 250 million |
| November 7-10 | STY Haiyan | Philippines, Vietnam | 8,000 | 1,300,000 | 13 billion | 1.5 billion |
| October 5-8 | TY Fitow | China, Japan | 8 | 97,000 | 10 billion | 1.0 billion |
| Jan/Sept | Drought | China | N/A | N/A | 10 billion | 350 million |
| Jan/May | Drought | Brazil | N/A | N/A | 8.0 billion | 350 million |
| June | Flooding | Canada | 4 | 25,000 | 5.2 billion | 1.7 billion |
| Aug/Sept | Flooding | China | 118 | 215,000 | 5.0 billion | 405 million |
| July | Flooding | China | 125 | 375,000 | 4.5 billion | 150 million |
| September 13-20 | HU Manuel | Mexico | 169 | 35,000 | 4.2 billion | 685 million |
| | | | | All Other Events | 95 billion | 34 billion |
| | | | | **Totals** | **192 billion[1]** | **45 billion[1,2]** |

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

### Exhibit 2: Global Economic Losses by Peril




Economic losses in 2013 were largely driven by flood, which accounted for 35% of global natural disaster losses. Four of the top ten costliest events were flood-related, including a major late-spring flood event that inundated Central Europe and caused upwards of USD22 billion in damages. Major flood events during the year were also registered in Canada, China, Australia, Indonesia, and the United States. Other perils that caused aggregate economic losses in excess of USD20 billion were tropical cyclone, severe weather and drought. Approximately 84% of economic losses in 2013 were caused by events that occurred outside of the United States. This is above the 2003-2012 average of 65%.

Total losses in 2013 were 4% below the 10-year mean of USD200 billion on an inflation adjusted basis. Since 2003, only 2006, 2007 and 2009 have sustained global economic losses attributable to natural disaster events below USD100 billion. 2013 becomes the sixth-costliest year since 2000, and the seventh-costliest year on record since 1950.

There were 43 billion-dollar economic loss events in 2013, well above the 10-year average of 28. The tally in 2013 represents the second-highest number of billion-dollar events since at least 2000 and only behind the record 47 sustained in 2010. APAC endured the most billion-dollar-plus events in 2013 with 19 separate instances, most of which occurred in China. The United States registered nine billion-dollar events, which was the fewest number seen since 2009 and lower than the 11 in 2012. The Americas (Non-U.S.) recorded eight events, while EMEA saw seven—an increase from their totals in 2012.

**Exhibit 3: Global Billion-Dollar Economic Loss Events**

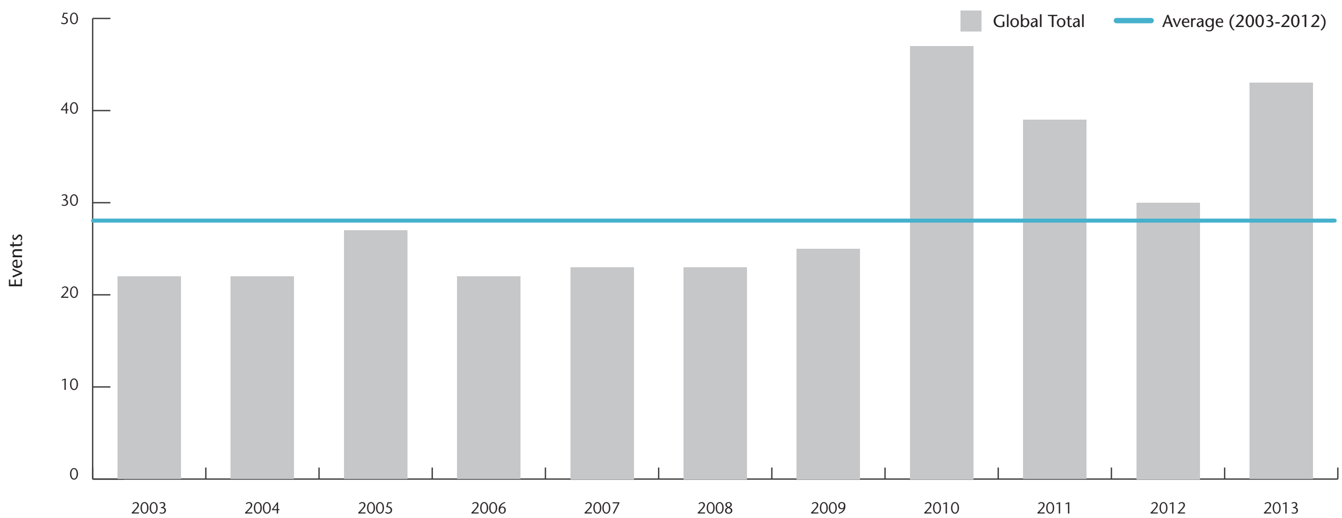
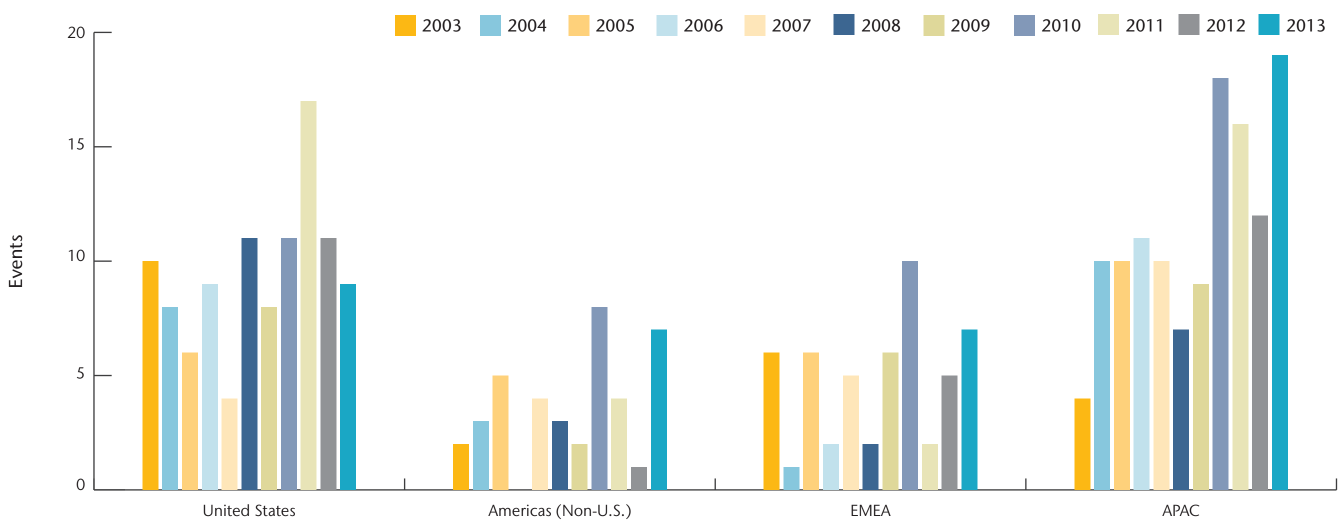



**Exhibit 4: Global Billion-Dollar Economic Loss Events by Region**




Note: Exhibits 3 & 4 include events which reached the billion-dollar (USD) threshold after being adjusted for inflation based on the 2013 U.S. Consumer Price Index.

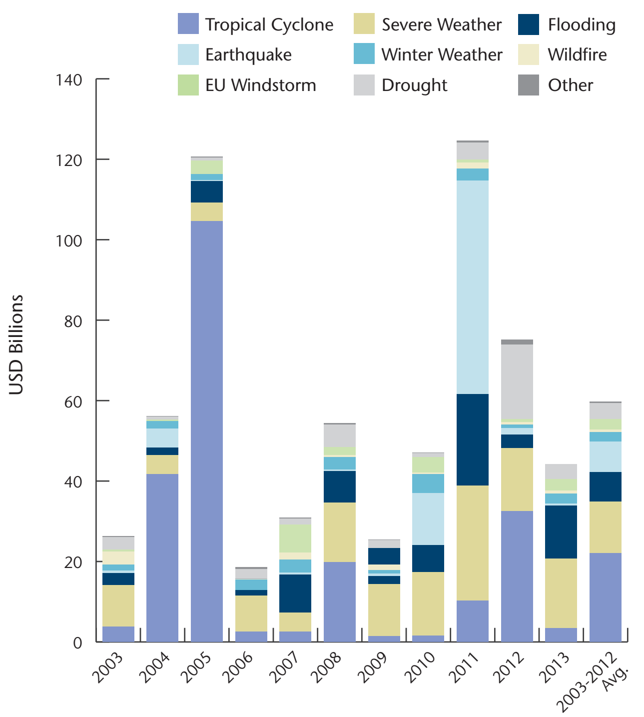
# Global Insured Losses

**Exhibit 5: Top 10 Global Insured Loss Events**

| Date(s) | Event | Location | Deaths | Structures/ Claims | Economic Loss (USD) | Insured Loss (USD) |
|---|---|---|---|---|---|---|
| May/June | Flooding | Central Europe | 25 | 150,000 | 22 billion | 5.3 billion |
| July 27-28 | Severe Weather | Germany, France | 0 | 750,000 | 4.0 billion | 3.0 billion |
| Jan/Dec | Drought | United States | N/A | N/A | 3.5 billion | 2.8 billion |
| May 18-22 | Severe Weather | United States | 29 | 160,000 | 3.8 billion | 2.0 billion |
| June | Flooding | Canada | 4 | 25,000 | 5.2 billion | 1.7 billion |
| March 18-20 | Severe Weather | United States | 2 | 250,000 | 2.5 billion | 1.6 billion |
| November 7-10 | STY Haiyan | Philippines, Vietnam | 8,000 | 1,300,000 | 13 billion | 1.5 billion |
| May 26-June 2 | Severe Weather | United States | 27 | 150,000 | 2.3 billion | 1.4 billion |
| October 27-29 | WS Christian | Western/Northern Europe | 18 | 50,000 | 2.0 billion | 1.4 billion |
| April 7-11 | Severe Weather | United States | 3 | 135,000 | 1.8 billion | 1.1 billion |
| | | | | All Other Events | 128 billion | 20 billion |
| | | | | **Totals** | **192 billion[1]** | **45 billion[1,2]** |

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

**Exhibit 6: Global Insured Losses by Peril**




The two costliest global insured events in 2013 both occurred in Europe: the May/June flood event in Central Europe, and a late-July hailstorm that affected Germany and France. Windstorms Christian and Xaver also caused significant insured losses in Western and Northern Europe. However, five of the top ten insured loss events occurred in the United States, four of which were attributable to severe weather, convective thunderstorm events and one linked to crop insurance payments by the U.S. Department of Agriculture's Risk Management Agency program due to drought losses. Additional notable insured loss events in 2013 included flooding events in Canada (in both Calgary and Toronto) and Australia, plus Hurricane Manuel in Mexico. Super Typhoon Haiyan caused record insured losses in the Philippines.

2013 insured losses were 22% below the inflation-adjusted, 10-year average (2003-2012) of approximately USD58 billion. Despite being below normal, the year became the eighth-costliest global insured loss year on record since 1950.

There were 13 billion-dollar insured loss events in 2013. This number is larger than the 11 seen in 2012, but substantially fewer than the 19 sustained in 2011. Of the 13, five occurred in the United States, which was the fewest number of events in the country since 2010. EMEA had four such events in 2013, which was the most in the region since 2007. APAC recorded three events, and the Americas (outside of the U.S.) had one billion-dollar insured loss event after both did not sustain any in 2012.

**Exhibit 7: Global Billion-Dollar Insured Loss Events**

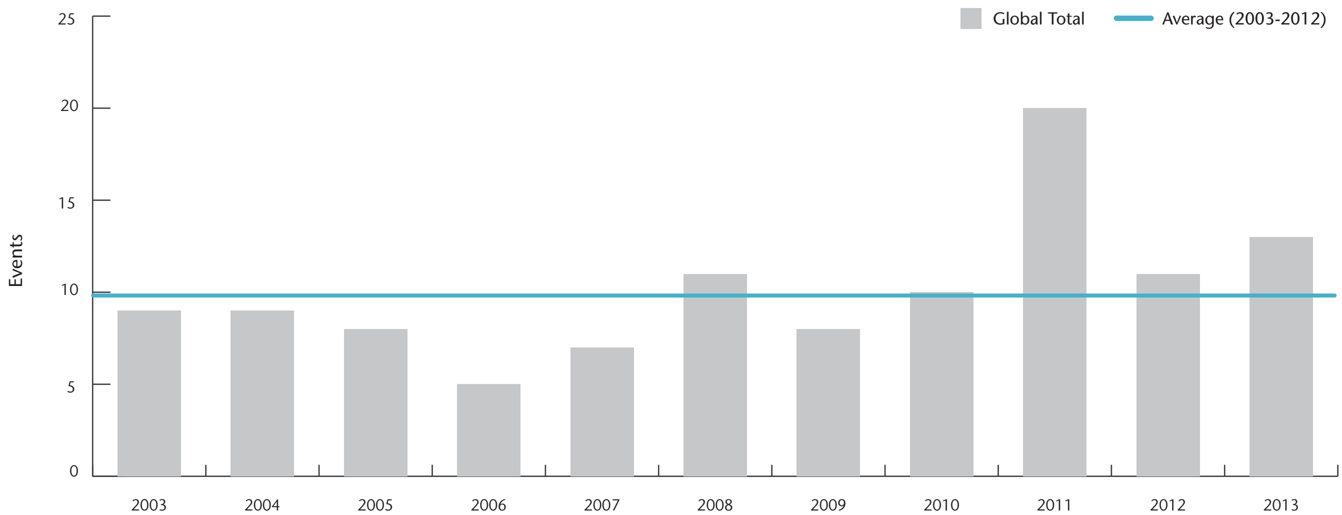
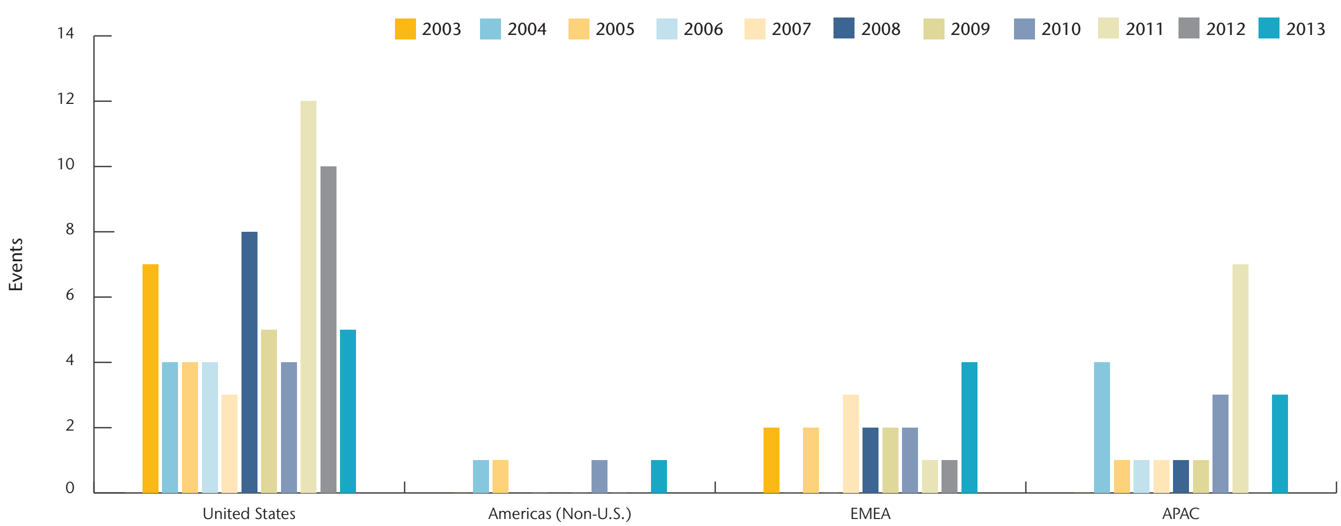



**Exhibit 8: Global Billion-Dollar Insured Loss Events by Region**



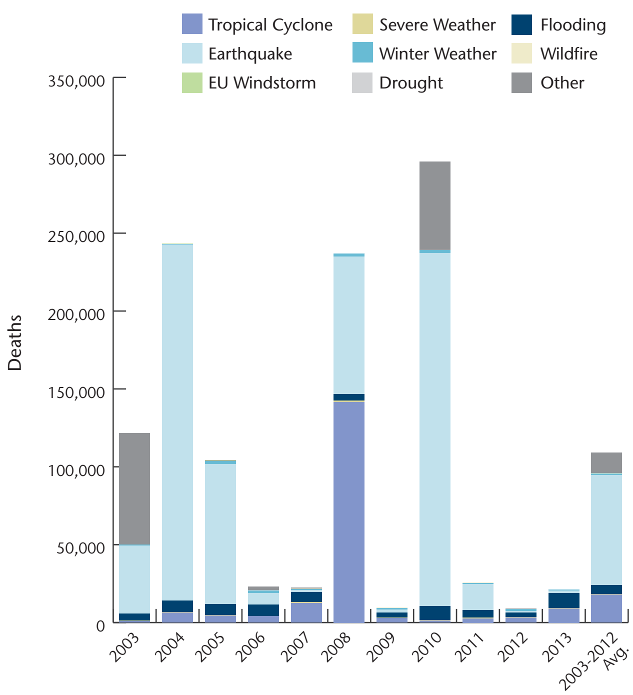

Note: Exhibits 7 & 8 include events which reached the billion-dollar (USD) threshold after being adjusted for inflation based on the 2013 U.S. Consumer Price Index.

## Global Fatalities

### Exhibit 9: Top 10 Human Fatality Events

| Date(s) | Event | Location | Deaths | Economic Loss (USD) |
|---|---|---|---|---|
| November 7-10 | STY Haiyan | Philippines, Vietnam, China | 8,000 | 22 billion |
| June | Flooding | India, Nepal | 6,748 | 4.0 billion |
| September 24 & 28 | Earthquake | Pakistan | 825 | 3.5 billion |
| November 9 | TS Three | Somalia | 440 | 3.8 billion |
| January 1-20 | Winter Weather | India, Bangladesh, Nepal | 329 | 5.2 billion |
| Aug/Sept | Flooding | Pakistan | 234 | 2.5 billion |
| October 15 | Earthquake | Philippines | 222 | 13 billion |
| April 20 | Earthquake | China | 196 | 2.3 billion |
| Jan/Feb | Flooding | Southern Africa | 175 | 2.0 billion |
| July | Flooding | India | 174 | 1.8 billion |
| | | All Other Events | ~4,000 | 132 billion |
| | | **Totals** | **~21,250** | **192 billion** |

### Exhibit 10: Global Human Fatalities by Peril




The number of human fatalities caused by natural disasters in 2013 was approximately 21,250; eight of the top ten events occurring in Asia. The other two events occurred in Africa. The deadliest event of the year was Super Typhoon Haiyan, which left at least 8,000 people dead or missing in the Philippines, Vietnam and China. The cyclone made landfall in the Philippines at Category 5 strength and brought a significant coastal storm surge that caused the majority of the fatalities. Of the top ten deadliest events in 2013, four were flood-related (India, Pakistan, Nepal, Southern Africa), three were earthquake-related (Pakistan, Philippines, China), two were tropical cyclones (Super Typhoon Haiyan and Tropical Storm Three), and one was winter weather-related (India, Bangladesh, Nepal).

Although 2013 saw a notable uptick in natural disaster-related fatalities from those sustained in 2012, that number was 81% lower than the 2003-2012 average of 109,000. In the last ten years, major singular events (such as earthquakes in Haiti (2010), China (2008), and Indonesia (2004), Cyclone Nargis' landfall in Myanmar (2008), and the major heatwave in Europe (2003)) have skewed the annual average.

## 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 (2013 USD)
- Insured Loss: USD25 million (2013 USD)
- Fatalities: 10
- Injured: 50
- Homes/Structures Damaged: 2,000

Based on these criteria, there were at least 296 separate natural disaster events in 2013, which was above the 2003-2012 average of 259. The second and third quarters are typically the most active during the year, which was also the case in 2013. APAC sustained the highest number of events, but given the region's large land size and susceptibility to natural disaster events, this is to be expected. The United States was the second-most active region of the globe.

**Exhibit 11: Total Events by Quarter**

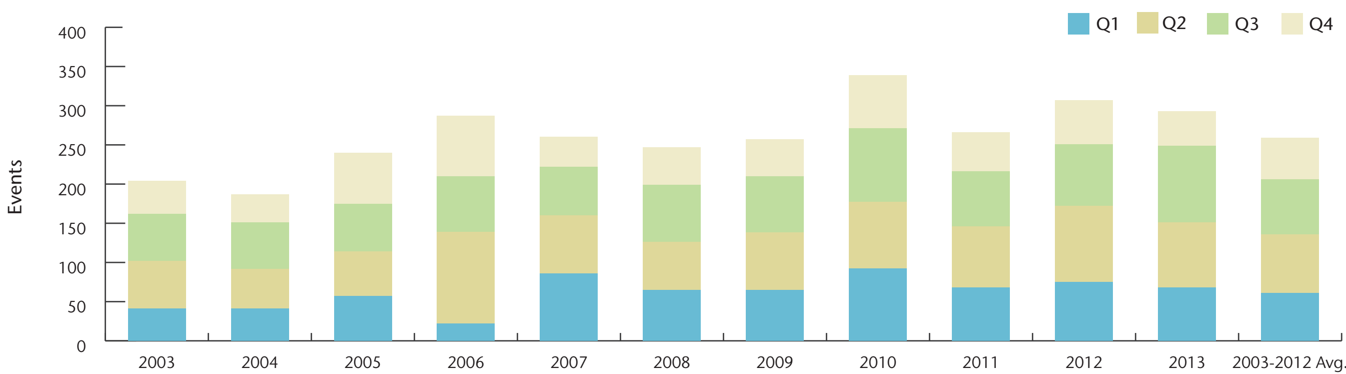
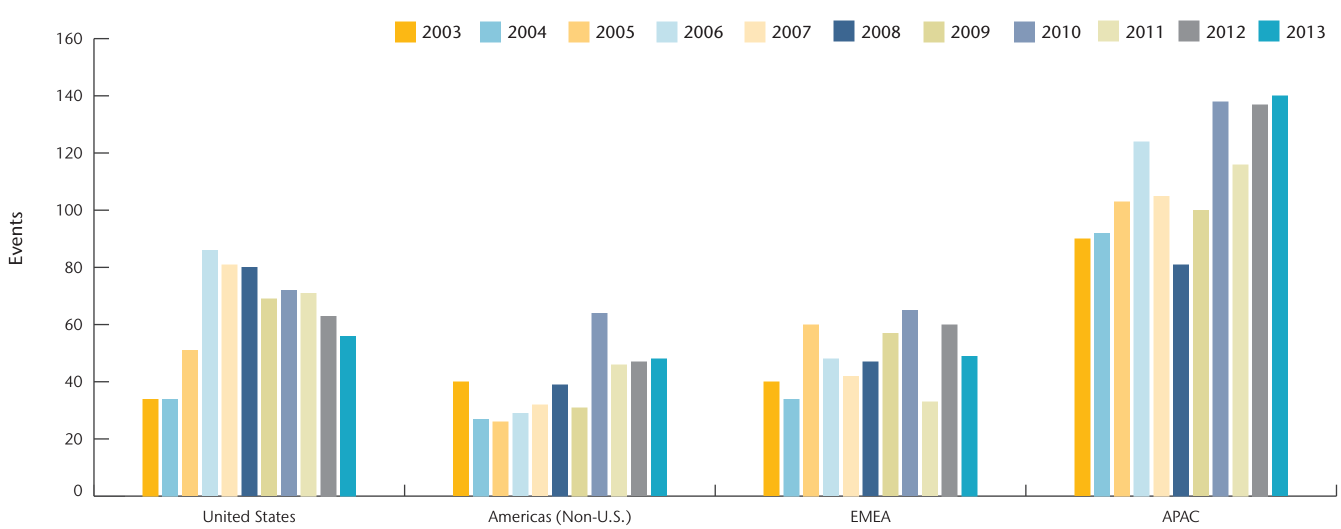



**Exhibit 12: Total Events by Region**



## A Matter of Time: The Next Major U.S. Hurricane Landfall

2013 was a fairly active year for global tropical cyclogenesis, registering the third-most named storms in the last ten years. Despite the uptick in activity, the Atlantic Ocean Basin recorded one of its quietest seasons in decades, including the fewest number of hurricanes since 1982, and the United States escaped another year without a major[2] hurricane making landfall. The U.S. has now gone eight consecutive years, since October 2005's Hurricane Wilma, without a major hurricane landfall. This is the longest such streak ever recorded.

While the Atlantic Basin was quiet, the Western Pacific and North Indian basins on the opposite side of the Northern Hemisphere experienced above normal levels of activity as evidenced by notable storms such as Super Typhoon Haiyan and Cyclone Phailin. The pattern is consistent with findings from various scientific studies suggesting there is some counter-correlation between global tropical basins. Several factors come into play when conducting such correlations, including phases of the El Niño/Southern Oscillation (ENSO), the Atlantic Multidecadal Oscillation (AMO), the Pacific Decadal Oscillation (PDO), and the Southern Oscillation Index (SOI).

Of the four indicators listed, ENSO is the most commonly used in the scientific community given the impacts that each phase has on global weather patterns (El Niño, La Niña, ENSO-neutral). During an El Niño phase, ocean temperatures increase to above-normal levels across the east-central Pacific Ocean due to warm water migrating from the Western Pacific. Sea level pressures also fall in the Central/Eastern Pacific, which further aids in creating more favorable atmospheric conditions for cyclogenesis. These circulations and patterns have an opposite effect in the Atlantic Ocean, where cooler waters and rising air pressure occurs. Historical data confirms that during El Niño years, there is heightened Pacific Ocean tropical activity and subdued development in the Atlantic Ocean. During La Niña years, the above patterns are reversed. (Annual tropical cyclone frequency and landfalling data can be found in appendices C and D.)

Exhibit 13 shows ENSO years dating to 1980. Events are defined as having five consecutive months at or above the +0.5˚ sea surface temperature (SST) anomaly for warm events (El Niño) or having at or below the -0.5˚ anomaly for cool (La Niña) events. The threshold is further broken down into Weak (0.5˚ to 0.9˚ SST anomaly), Moderate (1.0˚ to 1.4˚), and Strong (≥1.5˚).

**Exhibit 13: ENSO Years (1980-2013)**

| ENSO Type | Years |
|---|---|
| El Niño | |
| Weak | 2004, 2006 |
| Moderate | 1986, 1987, 1991, 1994, 2002, 2009 |
| Strong | 1982, 1997 |
| La Niña | |
| Weak | 1983, 1984, 1995, 2000, 2005, 2008, 2011 |
| Moderate | 1998, 2007 |
| Strong | 1988, 1999, 2010 |
| Neutral | 1980, 1981, 1985, 1989, 1990, 1992, 1993, 1996, 2001, 2003, 2008, 2012, 2013 |

Source: NOAA's Climate Prediction Center

[2] A "major" hurricane is defined as a storm with winds in excess of 111 mph (179 kph), which is labeled as either a Category 3, 4, or 5 on the Saffir-Simpson Hurricane Wind Scale.

**Exhibit 14: Global Accumulated Cyclone Energy (ACE)**

| Basin | 2013 ACE[1] | ACE Climatology (1981-2010) | 2013 % Normal | 2013 % of Global | Basin % Climatology (1981-2010) |
|---|---|---|---|---|---|
| North Atlantic | 32 | 104 | 31% | 6% | 13% |
| Eastern/Central Pacific | 82 | 138 | 59% | 14% | 18% |
| Western Pacific | 269 | 302 | 89% | 47% | 39% |
| North Indian | 41 | 18 | 228% | 7% | 2% |
| Northern Hemisphere | 424 | 562 | 75% | 74% | 72% |
| Southern Hemisphere | 152 | 209 | 73% | 26% | 28% |
| Global | 576 | 771 | 75% | 100% | 100% |

[1] Calendar year 2013 ACE totals. (Sources: Impact Forecasting; WeatherBELL Models)

Another method used to measure tropical cyclone activity is the Accumulated Cyclone Energy (ACE) Index, which is calculated by summing the squares of 6-hourly maximum sustained wind speeds (in knots) for all systems while they are at least tropical storm strength. This index—while not a perfect indication measure given that it does not take into account a storm's size—does provide an important look into the potential damage from an individual storm or an entire season.

In analyzing seasonal ACE values dating from 1980 to the present solely for the Northern Hemisphere, there does appear to be a correlation between the Atlantic and Pacific Ocean basins. In years with elevated activity and higher ACE values in the Atlantic Ocean, there is typically a lower level of activity in the Western and Eastern Pacific Ocean—and vice versa. The most substantial recent example of this came during the 2010 season, when Atlantic tropical activity was significantly above normal but the combined totals across the Pacific Basin were at their lowest levels in decades. The opposite occurrence was true during the 1997 season. In total, the Northern Hemisphere accounts for roughly 72% of global ACE values.

Exhibit 14 provides a look at ACE Index values for the 2013 season compared to long-term climatology (1981-2010).

Given the cyclical nature of tropical cyclogenesis based on the various global patterns presented above, the historical data ultimately points to the fact that it is not a matter of "if" the United States will sustain another major hurricane landfall; it is just a matter of "when" and "where". It is worth noting that while the impacts from 2012's Hurricane Sandy were catastrophic throughout the eastern U.S., the storm was not officially a tropical cyclone at landfall and it only carried equivalent winds to Category 1 strength.

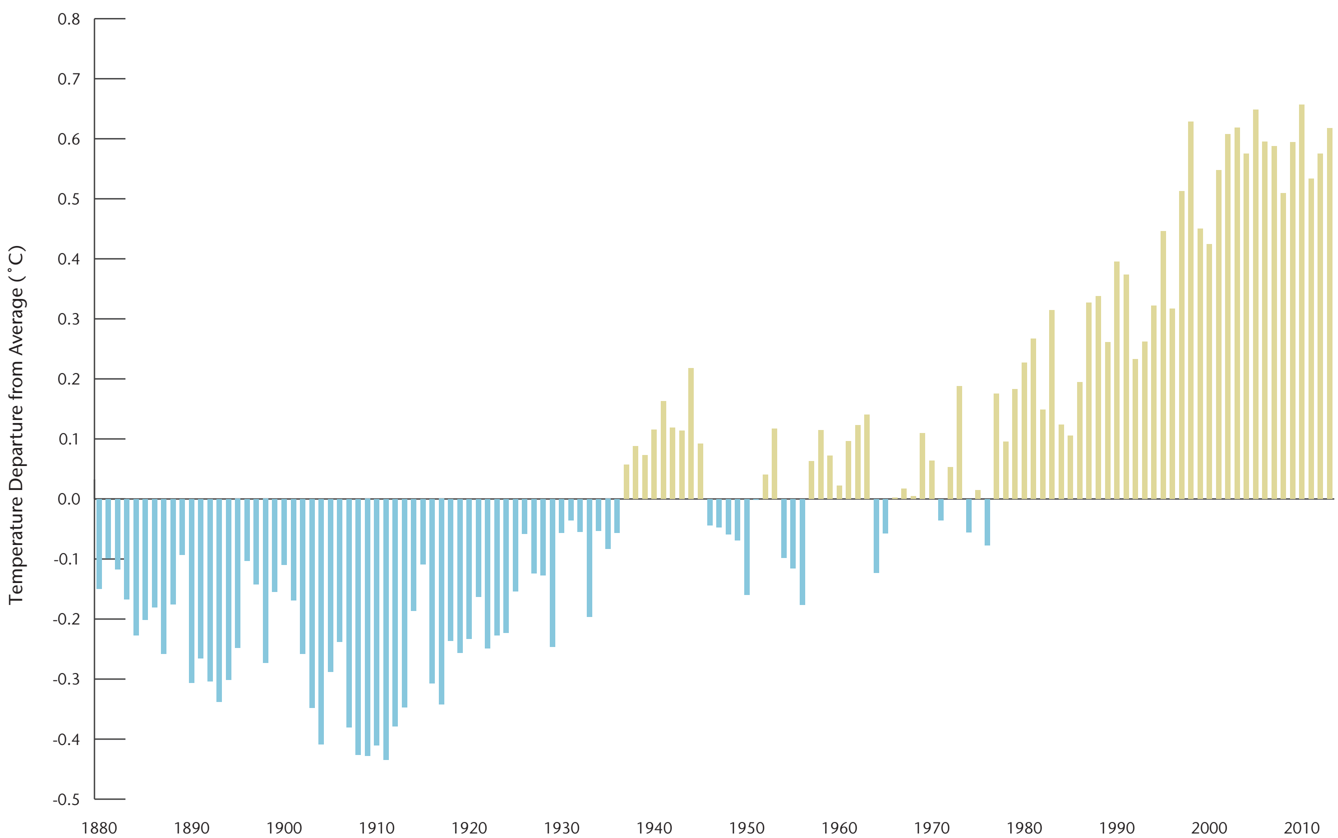
Despite fluctuations in the number of hurricanes across the Atlantic Ocean during the past decade, given the continued warm phase of the AMO—which is marked by above-normal sea surface temperatures in the Atlantic—there remains an elevated risk of a major hurricane coming ashore in the U.S. However, elevated cyclonic activity does not necessarily translate into more landfalls, though the risk remains greater if there are more storms churning in the Atlantic Basin. For example, the 1992 season was one of the quietest ever recorded and only registered one landfalling storm: Hurricane Andrew. The moral taken from the 1992 season was that it only takes one major storm to constitute an active season.

While not scientific in nature, the best rationale for the eight-year major hurricane drought can essentially be attributed to luck. At some point, this good luck will change as the pendulum swings back in the opposite direction. Given record levels of capital held by insurers and re/insurers, the U.S. insurance industry remains well-prepared to handle the next major hurricane event.

# 2013 Climate Review

2013 was the 37th consecutive year of above average global temperatures. Using official data provided by the National Climatic Data Center (NCDC), combined land and ocean temperatures for the earth in 2013 averaged 0.62°C (1.11°F) above the long-term mean, making 2013 the fourth warmest year ever recorded since official data on global temperatures began being kept back in 1880. The year 2010 remains the warmest on record, when the combined land/ocean global temperature was nearly 0.66°C (1.19°F) above NCDC'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) under the long-term average.

**Exhibit 15: Global Land and Ocean Temperature Anomalies: 1880-2013**




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.

According to data from the National Oceanic and Atmospheric Administration's (NOAA) Climate Prediction Center (CPC), 2013 marked the first time since 1993 that ENSO-neutral conditions were prevalent during the entire calendar year meaning that at no point in 2013 were there lingering phases of El Niño or La Niña. The current ENSO-neutral phase has been present since April 2012, following the weakening of a moderate La Niña event. At this time, the long-range ENSO models are in general consensus that ENSO-neutral conditions are likely to persist into the Northern Hemisphere summer of 2014.

The Niño-3.4 Index, which measures the temperature of the ocean waters in the central Pacific, is used to determine ENSO cycles.

Overall global tropical cyclone activity in 2013 saw an uptick from recent years, with 94 named storms across all global ocean basins. This marked both the highest number of named storms and the first year with above-average cyclogenesis since 2008. However, for the eighth consecutive year, the number of hurricanes, typhoons and cyclones (storms with sustained winds of at least 74 mph (119 kph)) was below average with a total of 44. Also, for the third year in a row, only 20 major storms (Saffir-Simpson Hurricane Wind Scale rating of Category 3, 4 or 5 with sustained winds of at least 111 mph (179 kph)) were recorded.

Based on official data from the U.S. National Hurricane Center (NHC) and the Joint Typhoon Warning Center (JTWC) since 1980, the average number of named storms is 85 and the number of Category 1 and above storms is 47. Of those 47 storms, 23 typically strengthen to, or above, Category 3 status.

In terms of global landfalls, 15 storms came ashore in 2013 at Category 1 strength or above. Only four of those made landfall at Category 3 strength or above. Landfall averages (1980-2012) include 16 Category 1+ and five Category 3 events.

**Exhibit 16: Global Tropical Cyclone Activity (1980-2013)**

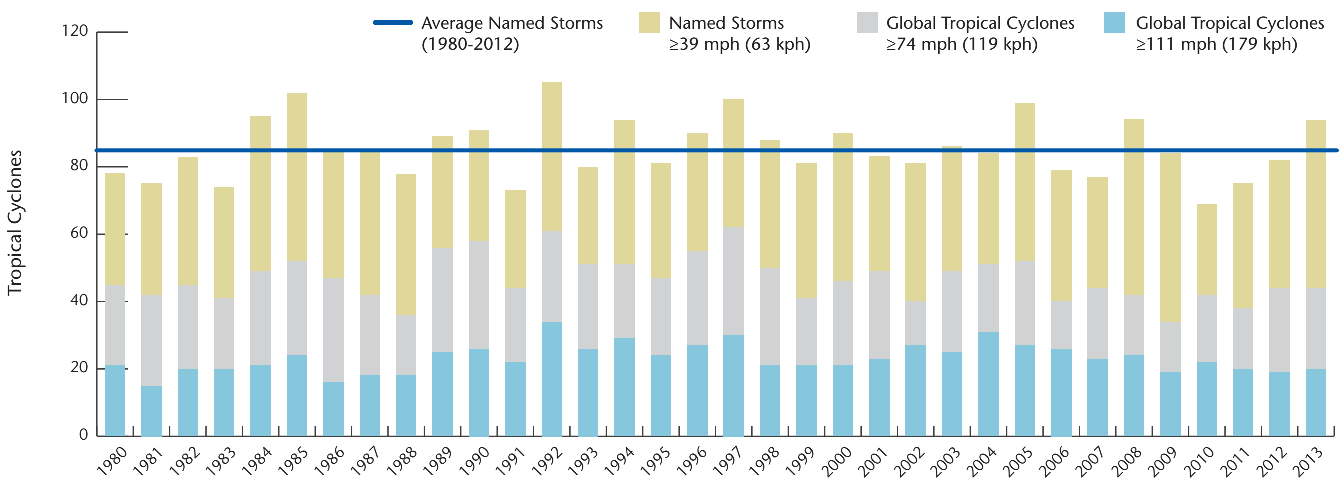
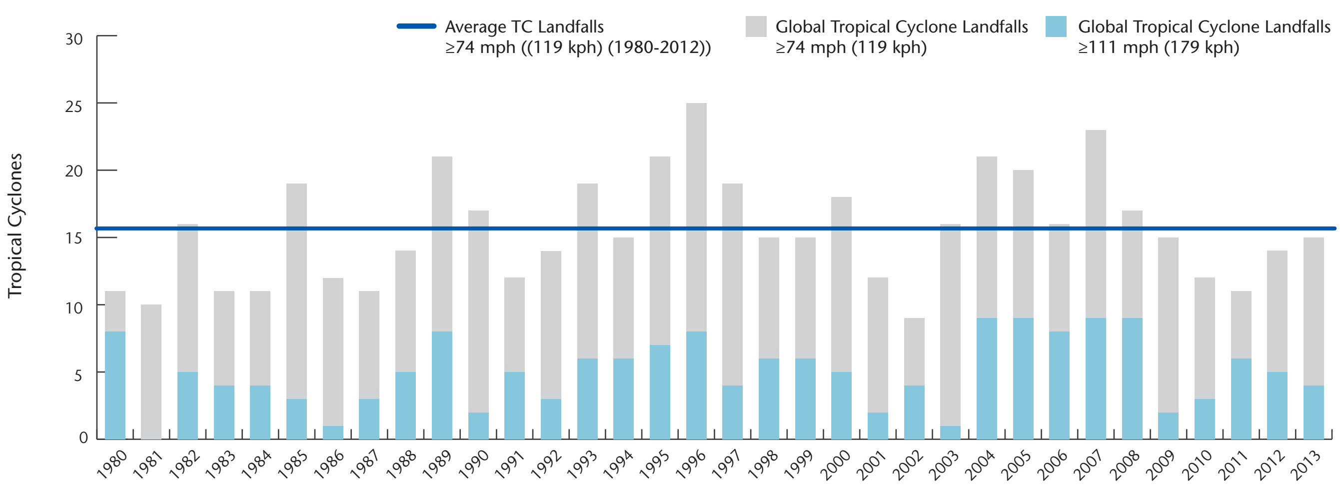



**Exhibit 17: Global Tropical Cyclone Landfalls (1980-2013)**



## 2013 Atlantic Ocean Hurricane Season Review

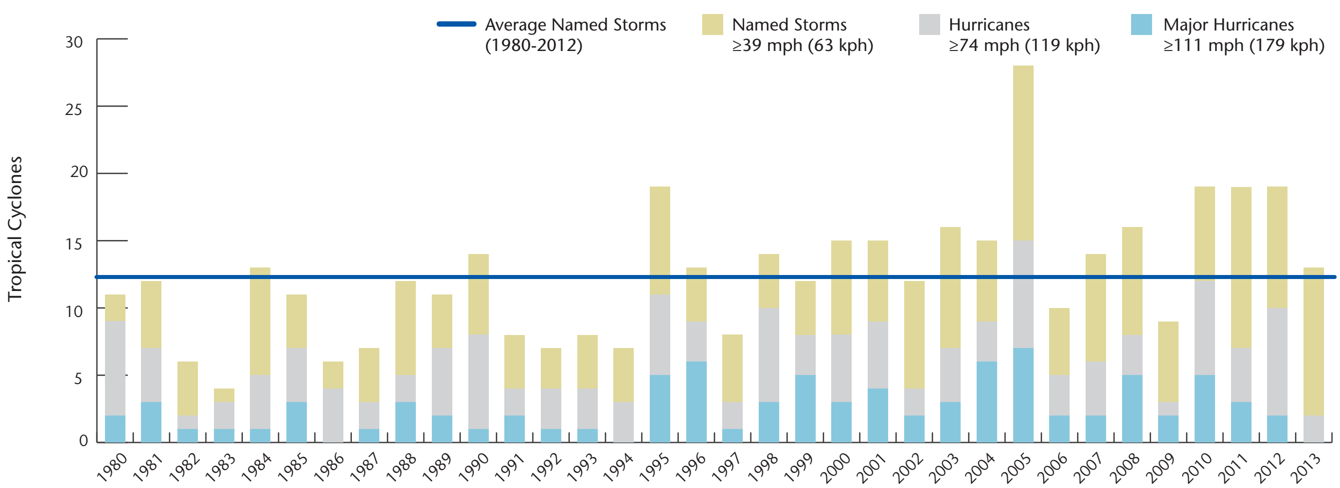
The 2013 Atlantic Hurricane Season was one of the quietest in decades. The season saw 13 named storms and only two hurricanes (Category 1+) – neither of which strengthened into a major hurricane (Category 3+). The 1980-2012 average for named storms is 12.5, and the 13 recorded in 2013 represented the fewest named storms in a season since 2009 (nine). The two hurricanes marked a notable decrease from the 33-year average of 6.6, representing the fewest number of hurricanes in the Atlantic Basin since 1982. It was also the first season since 1968 in which no hurricanes strengthened beyond Category 1 intensity. 2005 continues to hold the record for most hurricanes in a year when 15 formed. With no major hurricanes developing for the first time since 1994, the 2013 season fell short of the longer-term 1980-2012 average of 2.7. 2013 also became the eighth consecutive year in which the U.S. did not sustain a landfalling major hurricane, which is an all-time record.

The lack of activity in the Atlantic Basin in 2013 was heavily influenced by the presence of dry and sinking air across the Tropical Atlantic, much of which occurred as the result of dust borne by winds emanating from North Africa's Sahara Desert. Historically, the combination of ENSO-neutral conditions and above-normal sea surface temperatures has resulted in active years but the unfavorable atmospheric conditions led to a rather benign season. See Appendix C for information on hurricane frequency as it relates to ENSO cycles.

The 2013 Atlantic Hurricane Season began with Tropical Storm Andrea making landfall in Florida's Big Bend region during June, which would be the lone landfalling tropical system in the United States. Six additional consecutive tropical storms developed from mid-June until early September, with Barry and Fernand striking southern Mexico and Chantal tracking through the Caribbean Sea. Humberto became the season's first hurricane in September but remained in the open waters of the Atlantic. The most notable cyclone of the season was Hurricane Ingrid, which struck northern Mexico in September as a Category 1 storm. Ingrid combined with the Eastern Pacific's Hurricane Manuel to spawn extensive flooding and damage throughout Mexico.

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

**Exhibit 18: Atlantic Basin Tropical Cyclone Activity (1980-2013)**



## 2013 Eastern and Central Pacific Ocean Hurricane Season Review

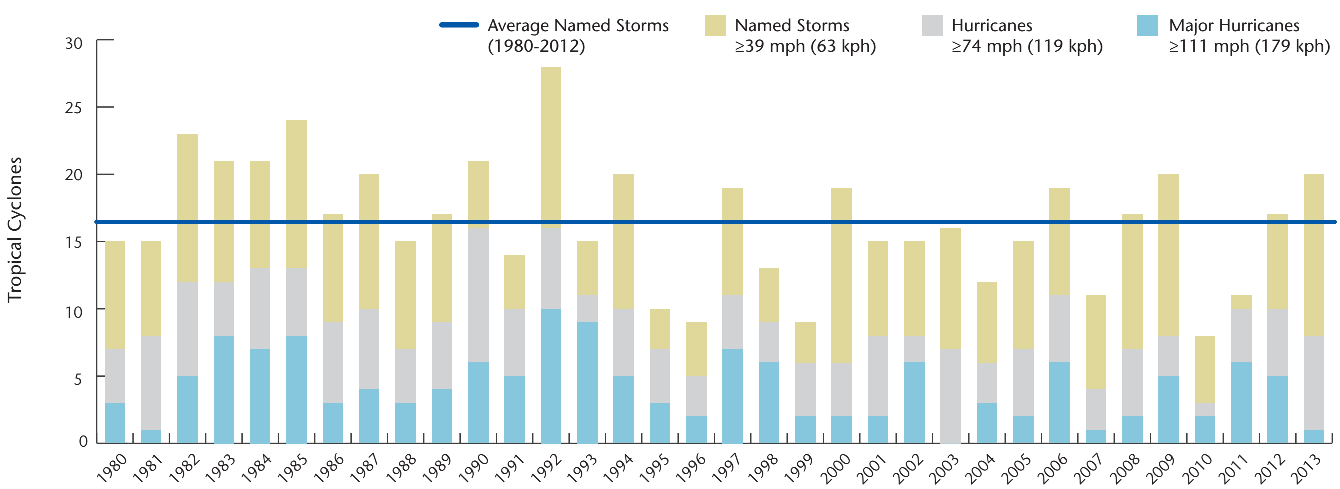
The 2013 Eastern and Central Pacific Hurricane Season was the most active year since 2009 with a combined 20 named storms forming (or approximately 22% above the 1980-2012 average of 16.4 named storms). Of the 20 named storms, eight became hurricanes. This is 11% below the 33-year average of 9.0 and fewer than the 10 hurricanes seen in each of the most recent seasons in 2011 and 2012. Only one of 2013's hurricanes strengthened to major hurricane status, or 77% below the 1980-2012 average of 4.3. There were two hurricane landfalls, both of which occurred in Mexico.

ENSO-neutral conditions lingered throughout the 2013 season, as near-normal or slightly above-normal sea surface temperatures in the central and eastern Pacific Ocean provided ample warmth to allow an above-average level of cyclogenesis in the basin. See Appendix C for information on hurricane frequency as it relates to ENSO cycles.

Despite just two hurricanes officially making landfall, the Eastern and Central Pacific Hurricane Season was one of the more notable seasons in recent years. Hurricane Barbara became the first landfalling hurricane of the season in late May after coming ashore in southern Mexico as a minimal Category 1 storm. In July, hurricanes Dalila and Erick remained offshore but brought heavy rains to coastal Mexico. The season's most significant storm was slow-moving Hurricane Manuel, which made multiple landfalls in western Mexico during mid-September and brought tremendous flooding rains to dozens of states. The damage sustained by Manuel made it one of the costliest tropical cyclones in Mexico's history. The strongest storm of the season was Raymond, which peaked at Category 3 intensity with 125 mph (200 kph) winds in late October. Tropical Storm Sonia was the season's last system, making landfall in Mexico with minimal tropical storm-strength winds.

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 19: Eastern and Central Pacific Basin Tropical Cyclone Activity (1980-2013)**



## 2013 Western Pacific Ocean Typhoon Season Review

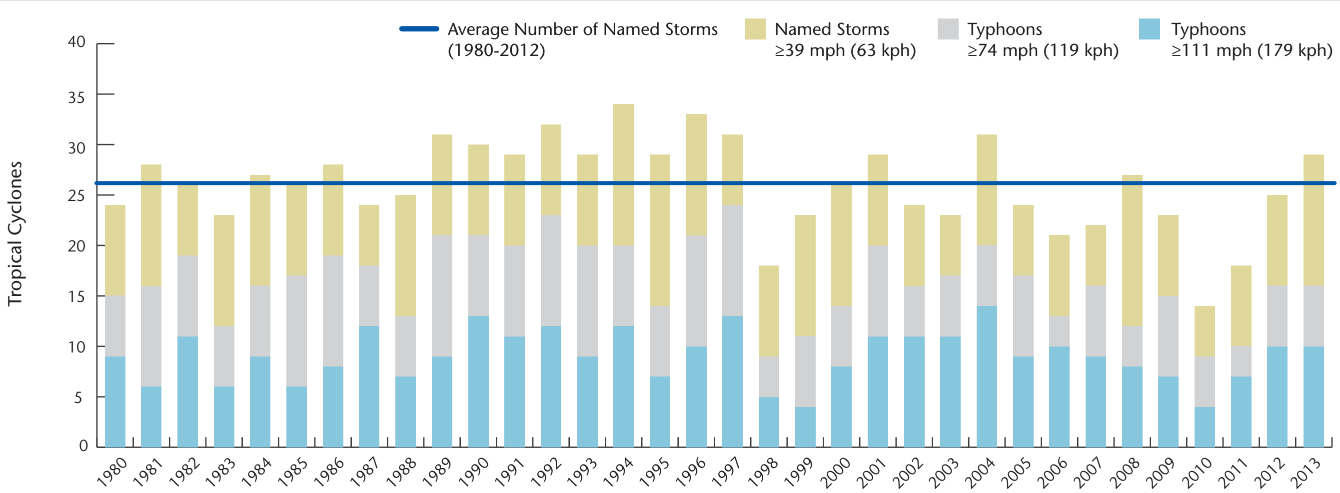
Typhoon activity in 2013 across the Western Pacific Ocean Basin was above the 1980-2012 average for the first time since 2008, and had the highest level of overall activity since 2004. A total of 29 named storms developed during the season, a number that was 12% percent above the 33-year average of 26.0. Of those storms, 16 typhoons formed. This was in line with the 33-year average of 16.5 and equal to the number of typhoons in 2012. Ten of the 16 typhoons reached Category 3 (or higher) strength, approximately 11% above the 1980-2012 average of 9.0. Nine typhoons made landfall, which was slightly above the longer-term average of 8.3. Three typhoons came ashore with intensities greater than Category 3 strength. This is slightly above the 33-year average of 2.2.

The Western Pacific season was dominated by Super Typhoon Haiyan, which made landfall in the Philippines in November as one of the strongest tropical cyclones ever recorded. The Category 5 storm came ashore with estimated sustained winds of 315 kph (195 kph) and a dangerous accompanying storm surge that caused a catastrophic level of damage and fatalities throughout the Philippine archipelago. A much weakened Haiyan would later make a final landfall in northern Vietnam. Haiyan, which was also 2013's strongest storm, became the third Category 5 typhoon to make landfall in the Philippines since 2010. Three additional Category 5 typhoons were registered during the season (Usagi, Francisco and Lekima), though only Usagi affected land as it came ashore in China at borderline Category 1/2 strength.

Other notable typhoons in the year included Typhoon Fitow, which made landfall in eastern China after first crossing Japan's southern Ryukyu Islands. Fitow became the season's costliest storm after spawning major flooding in China. In total, China registered five typhoon landfalls (Rumbia, Soulik, Utor, Trami, and Usagi). Another noteworthy storm was Typhoon Wipha Wipha, which skirted Japan as a transitioning extratropical cyclone, brought very heavy rains and gusty winds to most of the country. In addition to a weakened Haiyan, Vietnam sustained multiple typhoon landfalls, including typhoons Wutip and Nari.

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 20: Western Pacific Basin Tropical Cyclone Activity (1980-2013)**



## 2013 North Indian Ocean Cyclone Season Review

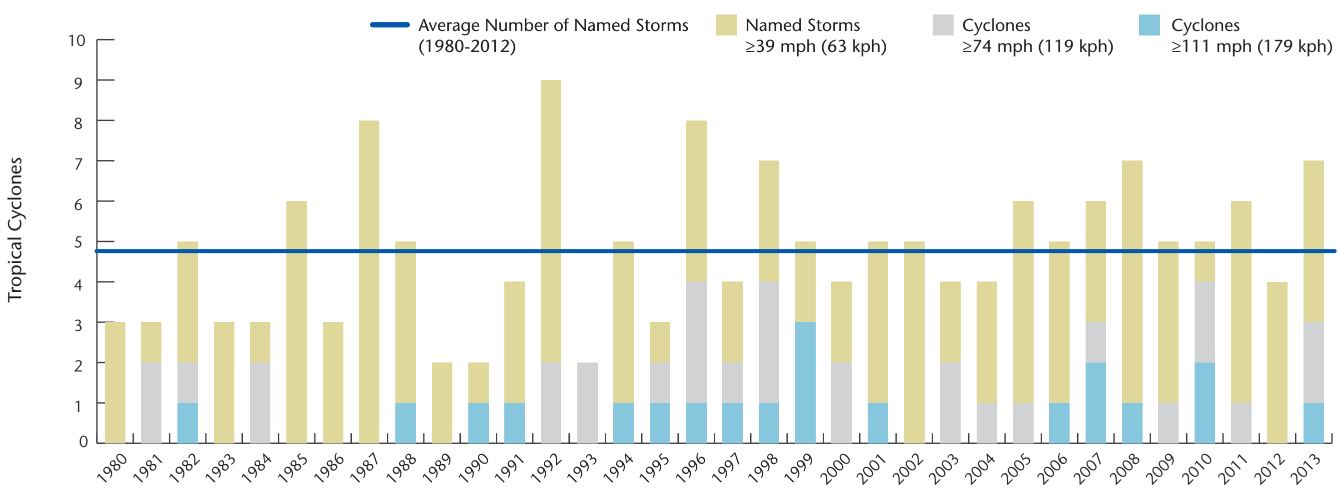
The North Indian Ocean Basin saw above normal tropical cyclone activity in 2013. Seven named storms developed in the region, a number 68% above the 1980-2012 average of 4.8. Of those storms, three cyclones formed, the most since 2010, including one which strengthened beyond Category 3 intensity. Based on the 33-year average, approximately 1.4 cyclones (Category 1+) develop per year and 0.6 cyclones strengthen to Category 3+ intensity. One cyclone made landfall, which was on par with the 1980-2012 average of 1.0.

The season was highlighted by October's Cyclone Phailin; a storm that rapidly strengthened in the Bay of Bengal to a Category 5 storm at its peak. However, Phailin weakened to Category 4 intensity while coming ashore in eastern India. The cyclone caused significant residential and agricultural damage, though the fatality count was much lower than feared due to the Indian government ordering one of the largest mass evacuations in the country's history.

Also in 2013, Tropical Storm Helen made landfall in eastern India and caused extensive agricultural damage from its heavy rainfall. In November, Tropical Storm Three made landfall in Somalia with 65 kph (40 mph) winds and became just the third named tropical cyclone to directly affect the country since 2000. Other cyclones in the basin included Tropical Storm Mahasen (which made landfall in Bangladesh), and cyclones Lehar and Madi (of which each came ashore in India as dissipating storms).

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 21: North Indian Basin Tropical Cyclone Activity (1980-2013)**



## 2013 Southern Hemisphere Cyclone Season Review

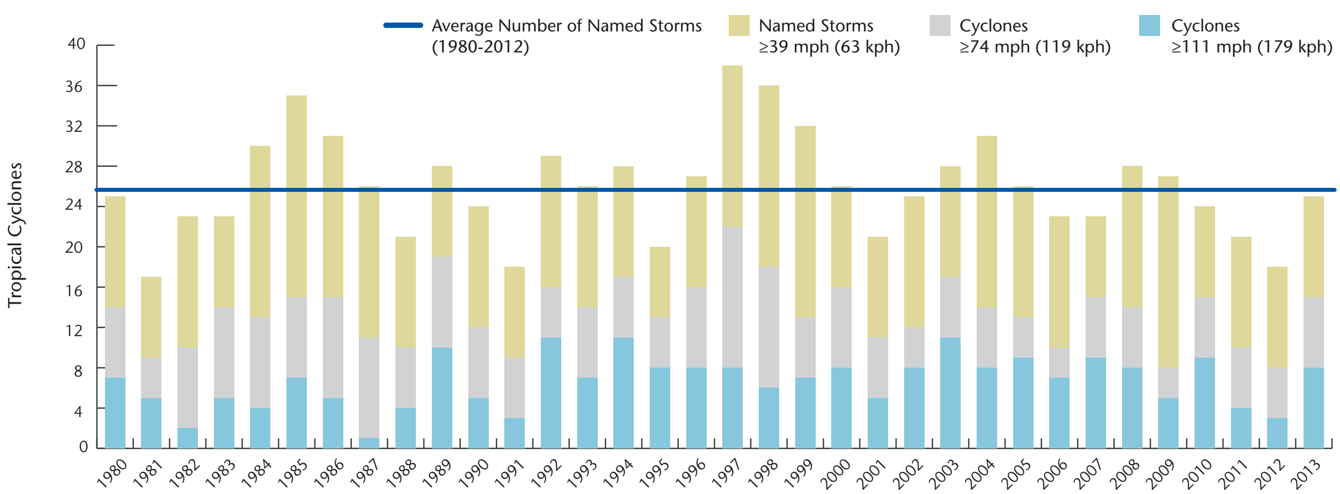
For the fourth consecutive year, the Southern Hemisphere saw below average tropical cyclone activity. A total of 25 named storms developed in the region, which is slightly below the average of 25.7 since 1980. However, 15 cyclones (Category 1+) formed, or 12% above the 1980-2012 average of 13.4. This marks a significant increase from the eight which developed in 2012 and the highest number since 2010. Eight cyclones reached Category 3+ strength, which is approximately 21% above the 33-year average of 6.6. Out of the 15 Category 1+ cyclones, only two made landfall. This was close to the 1980-2012 average of 2.5.

As the case in both 2011 and 2012, only one tropical cyclone made landfall (Category 1+) in Australia. Cyclone Rusty made landfall in Western Australia with 150 kph (90 mph) winds near the community of Pardoo. Damage was largely minimal, as the storm struck in a fairly rural region. The most notable storm in Australia was Tropical Storm Oswald, which came ashore in Queensland and rapidly dissipated. However, the storm's remnants later merged with a plethora of Pacific moisture to spawn major flooding across parts of Queensland and New South Wales.

Outside of Australia, the most significant cyclonic activity occurred in Madagascar. Cyclone Haruna made landfall in Madagascar as a strong Category 2 storm and spread heavy rainfall and gusty winds throughout the island nation. Cyclone Felleng also impacted Madagascar and the Seychelles, though never officially coming ashore. Felleng tied with cyclones Evan and Narelle as the strongest storms in the Southern Hemisphere during the 2013 season with maximum sustained winds of 210 kph (130 mph) – Category 4 strength. Cyclone Evan caused significant damage while crossing the island nations of Fiji, Tonga and the Samoan Islands at peak intensity in December 2012.

The Southern Hemisphere Cyclone Season officially runs from July 1 to June 30. (The 2013 season ran from July 1, 2012 to June 30, 2013.) For additional Southern Hemisphere landfalling tropical cyclone data, please see Appendix D.

**Exhibit 22: Southern Hemisphere Tropical Cyclone Activity (1980-2013)**



## 2013 United States Tornado Season Review

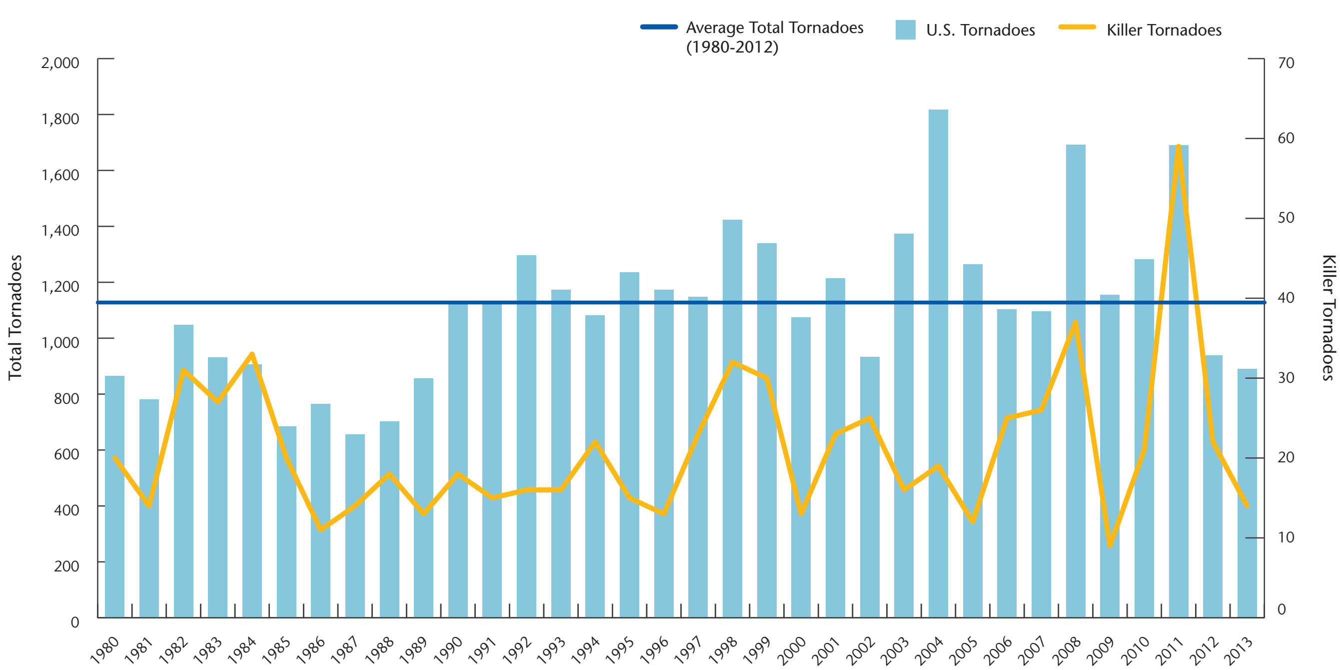
For the second consecutive year, the tornado season in the United States was one of the least active since Doppler radar began being deployed in the early 1990s. Both 2012 and 2013 had significantly fewer tornadoes than 2011, one of the most active years in history. A preliminary count from the Storm Prediction Center (SPC) tallied 891 tornadoes in 2013, roughly 5% below the 939 touchdowns in 2012 and a 47% decrease from the 1,691 in 2011. 2013's tally was 20% below the 1980-2012 average of 1,120. The use of Doppler radar, beginning in the early 1990s has led to markedly improved tornado detection. Because of this, the observed annual average number of tornadoes has risen to approximately 1,300. There were 28 tornadoes rated EF-3 or greater in 2013, with one EF-5 tornado touching down. This compares to the 29 EF-3 or greater tornadoes (no EF-5's) that struck the U.S. in 2012.

A total of 14 killer tornadoes (tornadoes that caused fatalities) occurred across the United States in 2013. This represents a decrease from 2012, when 22 were recorded. The killer tornadoes of 2013 caused 54 fatalities, which was below the 33-year average of 71. Tornado-related fatalities in 2012 totaled 70. The vast majority of the tornado-related deaths in 2013 occurred in the month of May (41). These occurred during multiple tornado outbreaks that effected parts of the Plains and the Mississippi Valley. Seven tornado-related deaths also occurred in a rare major November outbreak that spawned the third-most number of twisters ever recorded (dating from 1950) in November.

The single-deadliest twister of the year came in Cleveland County, Oklahoma on May 20. At least 24 people were killed by an EF-5 tornado with maximum winds of 210 mph (340 kph) that tracked across a 17-mile (27-kilometer) path from just west of Newcastle, OK. That storm spent nearly 50 minutes on the ground, devastating a heavily populated area of Moore, OK, before eventually lifting. The tornado took a very similar path to the infamous May 3, 1999 EF-5 tornado that also devastated Moore. The second-deadliest event was a record-breaking 2.6-mile-wide (4.2-kilometer) multi-vortex tornado that touched down in El Reno, OK on May 31. That tornado, officially rated by the National Weather Service as an EF-3 after initially being rated an EF-5, killed at least eight people—including three professional storm chasers.

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 23: United States Tornado Activity (1980-2013)**



## 2013 United States Wildfire Season Review

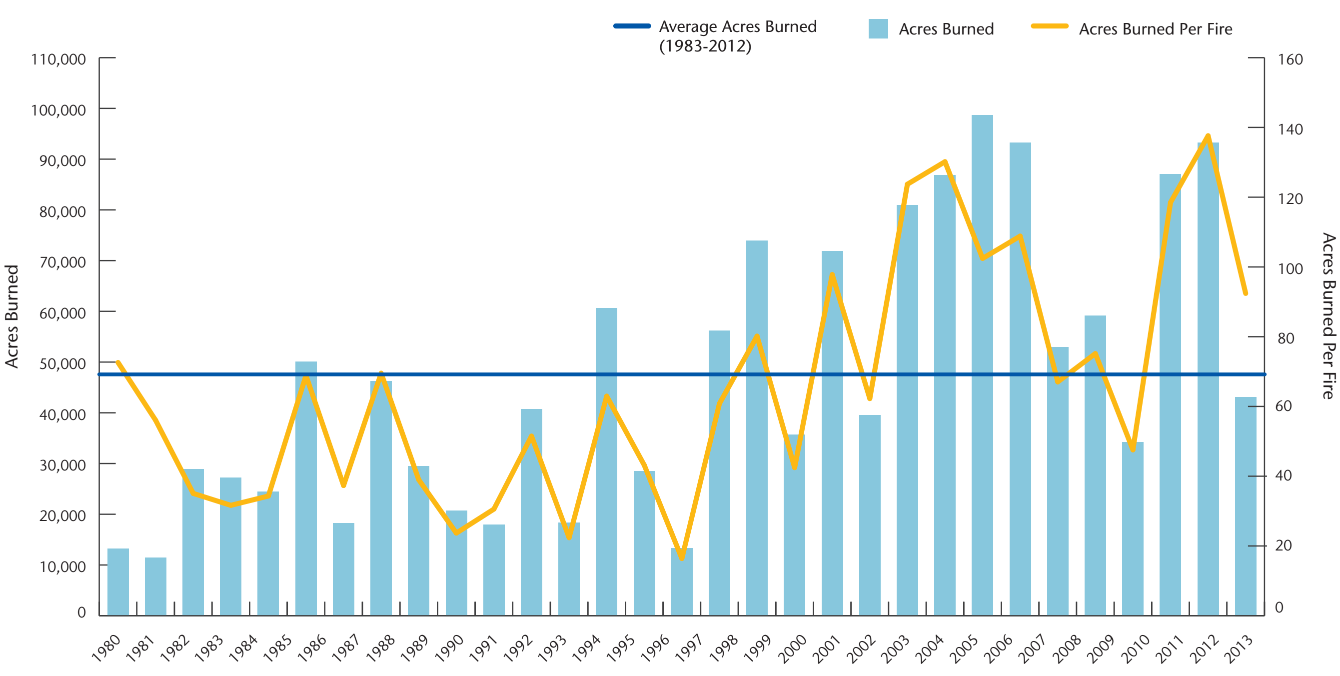
The number of wildfires across the United States in 2013 was significantly lower than the 1983-2012 year average. Despite this decline, the number of acres (hectares) burned per fire was the eighth-highest since the current methodology of recording official fire data began in 1983. The National Interagency Fire Center (NIFC) reported approximately 46,615 wildfires burning 4,307,176 acres (1,744,406 hectares), compared to 67,774 fires burning 9,326,238 acres (3,777,126 hectares) in 2012 and the 30-year average of 72,826 fires burning 4,712,532 acres (1,908,575 hectares). 2013 marked a 54% decline in acres burned from 2012, a year that recorded the third-most acres burned since 1983.

Exhibit 24 shows that the 2013 wildfire season burned an average of 92.40 acres (37.42 hectares) per fire, well above the long-term average of 64.98 acres (37.37 hectares) per fire. This is a large decrease from the 137.61 acres (55.73 hectares) per fire burned in 2012; the highest burn rate ever recorded. The lowest burn rate occurred in 1998, when an average of 16.41 acres (6.64 hectares) burned within each fire, mainly due to heavy precipitation in California early in the year caused by a strong El Niño phase.

The most significant wildfire activity was found across the western United States, as a lingering severe drought during the first half of the year helped create ideal fire conditions. Similar to 2012, the state of Colorado sustained the most significant wildfire damage in 2013. The Black Forest Fire was the costliest wildfire event of the year, having burned in the greater Colorado Springs region during the month of June. The blaze became Colorado's most destructive fire in state history, surpassing 2012's Waldo Canyon Fire, after destroying at least 511 homes and damaging 28 others. Outside of Colorado, the Rim Fire was the highest profile blaze to affect California in 2013. The fire, which became the state's third-largest wildfire in history, destroyed 11 homes, three commercial buildings and 98 outbuildings. In Arizona, 19 firefighters were killed while fighting the Yarnell Hill Fire. This was the largest loss of firefighter lives in an event since the terrorist attacks on September 11, 2011 in New York City.

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

**Exhibit 24: United States Wildfire Activity (1983-2013)**



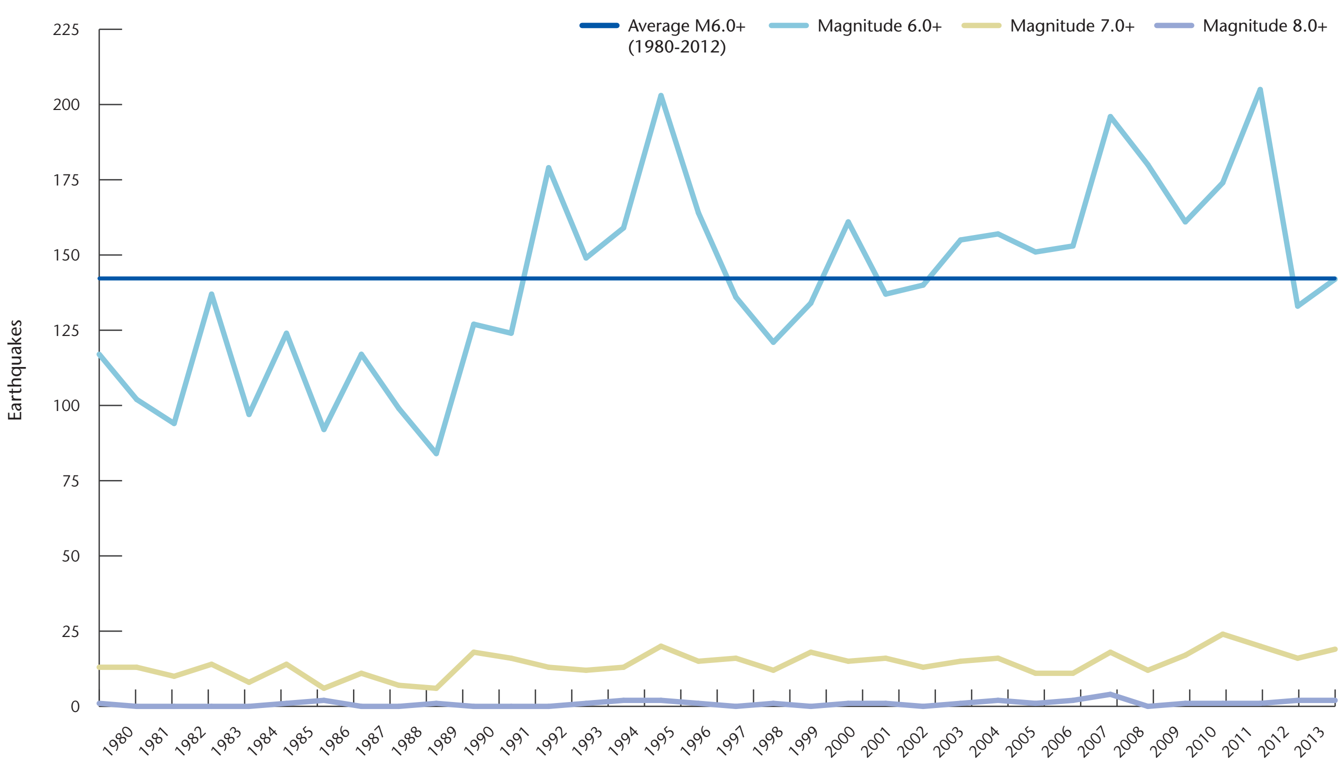
## 2013 Global Earthquake Review

The number of recorded global earthquakes (≥M6.0) was very close to average in 2013. 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 142 earthquakes with magnitudes greater than 6.0, 19 earthquakes with magnitudes greater than 7.0 and two earthquakes with magnitudes greater than 8.0. This compares to the 133 (≥M6.0), 16 (≥M7.0) and two (≥M8.0) seen in 2012, and the 1980-2012 averages of 141 (≥M6.0), 14 (≥M7.0) and one (≥M8.0).

The strongest earthquake of the year was a magnitude-8.3 tremor that struck in the Sea of Okhotsk on May 24. While the temblor was felt more than 7,300 kilometers (4,536 miles) away in Moscow, Russia, the extreme depth of the event (600 kilometers (373 miles)) marginalized any threat of a tsunami or ground motion damage. The deadliest earthquake(s) of the year came in September, when two powerful tremors (magnitudes 7.7 and 6.8) struck within four days of each other in a remote area of Pakistan. The official death toll remains unclear, though unofficial totals indicated that as many as 825 people perished. Other notable earthquakes include an October magnitude-7.1 tremor in the Philippines and an April magnitude-6.6 tremor in China.

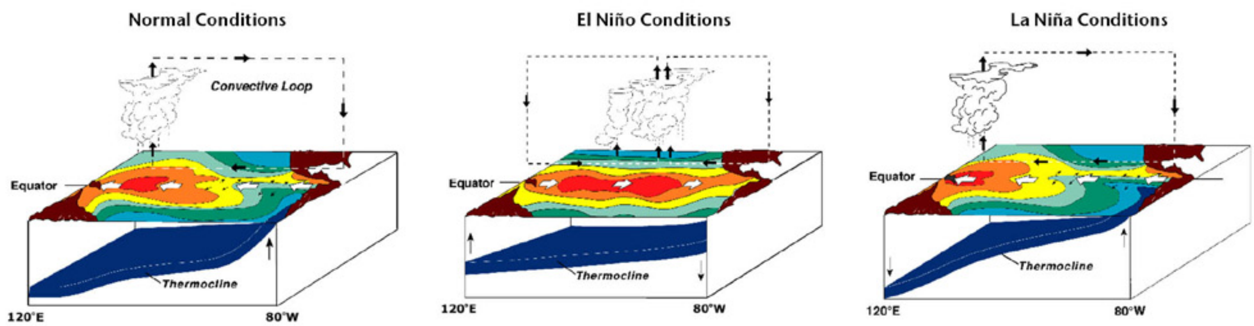
While Exhibit 25 may appear to indicate an increase in seismic activity since 1990, the USGS cites that a substantial increase in seismograph stations and continued improvements in global technology and communication has greatly strengthened the quality of earthquake data collection. It should also be 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 25: Global Earthquake Activity ≥M6.0 (1980-2013)**



# El Niño/Southern Oscillation (ENSO) Background

**Exhibit 26: Phases of the El Niño/Southern Oscillation (ENSO)**




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 U.S. 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.

The difficulty of improving on the long-term average is apparent from these Exhibits. For every 2013 projection shows the long-term average is closest to the actual result.

**Exhibit 27: 2013 Forecasts**

| | May/June Atlantic Hurricane Season Forecast | | | | |
|---|---|---|---|---|---|
| Forecast Parameter | 1980-2013 Average | CSU | NOAA | TSR | 2013 Season Total |
| Named Storms | 13 | 18 | 13-20 | 16 | 13 |
| Hurricanes | 7 | 9 | 7-11 | 8 | 2 |
| Major Hurricanes | 3 | 4 | 3-6 | 4 | 0 |

**Exhibit 28: 5-Year Average Forecasts**

| | May/June Atlantic Hurricane Season Forecast | | | | |
|---|---|---|---|---|---|
| Forecast Parameter | 1980-2013 Average | CSU | NOAA | TSR | 2013 Season Total |
| Named Storms | 13 | 15 | 11-18 | 15 | 16 |
| Hurricanes | 7 | 8 | 6-10 | 7 | 7 |
| Major Hurricanes | 3 | 4 | 2-5 | 3 | 2 |

## 2014 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 29: CSU 2014 United States & Caribbean Landfall Probabilities (issued December 10, 2013)**

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

**Exhibit 30: TSR 2014 Atlantic Basin Hurricane Season Forecast (issued December 12, 2013)**

| Atlantic and Caribbean Overall Forecast | TSR Average Year | TSR Forecast |
|---|---|---|
| Named Storms | 11 | 14 (±4) |
| Hurricanes | 6 | 6 (±3) |
| Intense Hurricanes | 3 | 3 (±2) |
| ACE Index | 102 | 106 (±58) |

**Exhibit 31: TSR 2014 United States Landfall Forecast (issued December 12, 2013)**

| U.S. Landfalling Storms Forecast | TSR Average Year | TSR Forecast |
|---|---|---|
| Named Storms | 3 | 4 (±2.0) |
| Hurricanes | 1 | 2 (±1.3) |
| ACE U.S. Landfall Index | 2.4 | 2.6 (±2.1) |

The Accumulated Cyclone Energy Index is equal to the sum of the squares of 6-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 6).

# 2013 Global Catastrophe Review

## United States

**Exhibit 32: Top 5 Most Significant Events in the United States**

| Date(s) | Event | Location | Deaths | Economic Loss (USD) | Insured Loss (USD) |
|---|---|---|---|---|---|
| May 18-22 | Severe Weather | Plains, Midwest, Southeast | 29 | 3.8 billion | 2.0 billion |
| Jan/Dec | Drought | Plains, Midwest, West | N/A | 3.5 billion | 2.8 billion |
| March 18-20 | Severe Weather | Southeast, Northeast | 2 | 2.5 billion | 1.6 billion |
| May 26-June 2 | Severe Weather | Plains, Midwest, Northeast | 27 | 2.3 billion | 1.4 billion |
| September | Flooding | Colorado | 9 | 2.0 billion | 250 million |
| | | All Other Events | 155 | 16 billion | 12 billion |
| | | **Totals** | **222** | **30 billion**[1] | **20 billion**[1,2] |

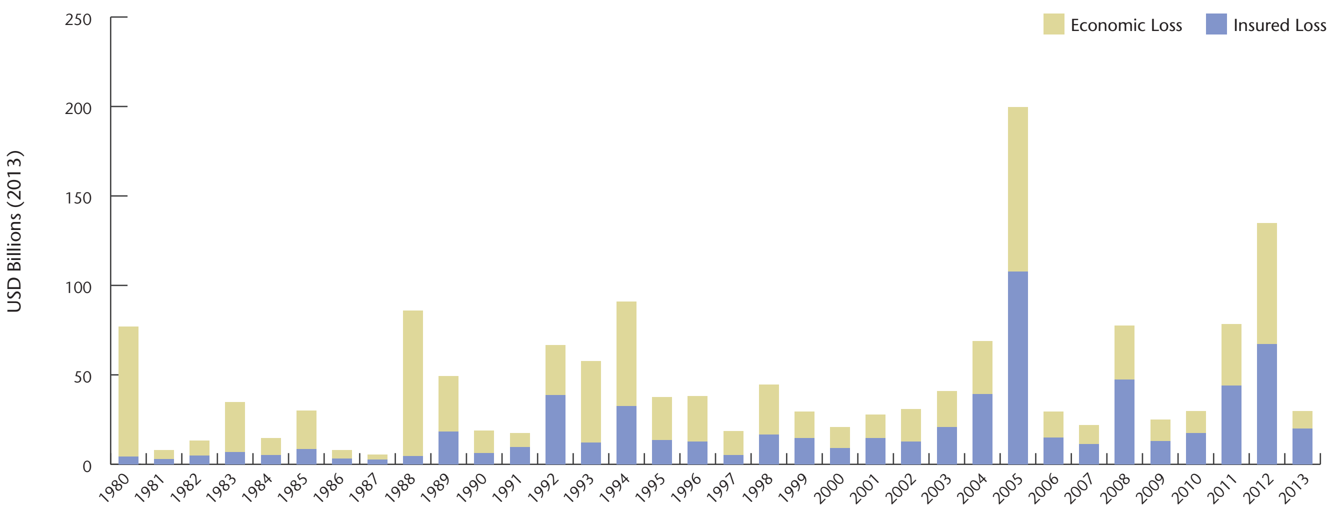
1 Subject to change as loss estimates are further developed
2 Includes losses sustained by private insurers and government-sponsored programs

Overall economic and insured losses from natural disaster activity in the United States during 2013 were down substantially from 2012. However, several large and costly events did occur. The most significant event was one of two widespread tornado and severe weather outbreaks during the second half of May that crossed the central and eastern U.S. The costliest stretch was highlighted by an EF-5 tornado that devastated Moore, Oklahoma on May 20. In total, at least six severe weather outbreaks (one emanating from a larger winter storm) caused more than USD1.0 billion in economic losses. Severe weather losses were elevated despite a well-below normal year for tornadic activity. A large portion of the losses were attributed to thunderstorms producing large hail and damaging straight-line winds.

Other notable events included the continuation of severe drought conditions from 2012 lingering into the first half of 2013. Heavy agricultural damage occurred as the USDA's Risk Management Agency (RMA) crop insurance program paid out more than USD2.8 billion in drought-related claims. Also, record rainfall fell across eastern Colorado in September that caused catastrophic flooding only weeks after some of the same areas had sustained heavy losses from June's Black Forest Fire in the Colorado Springs region.

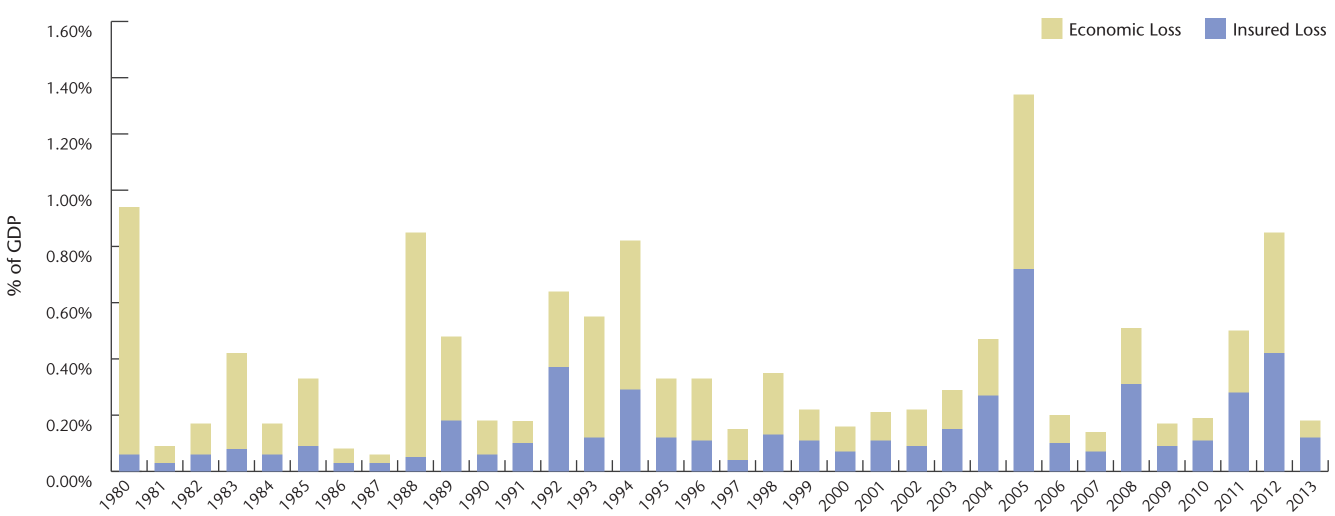
For a detailed review of all events in 2013, please visit **aonbenfield.com/catastropheinsight** and click on "Thought Leadership" to download updated monthly Global Catastrophe Recaps.

**Exhibit 33: United States Economic and Insured Losses (1980-2013)**



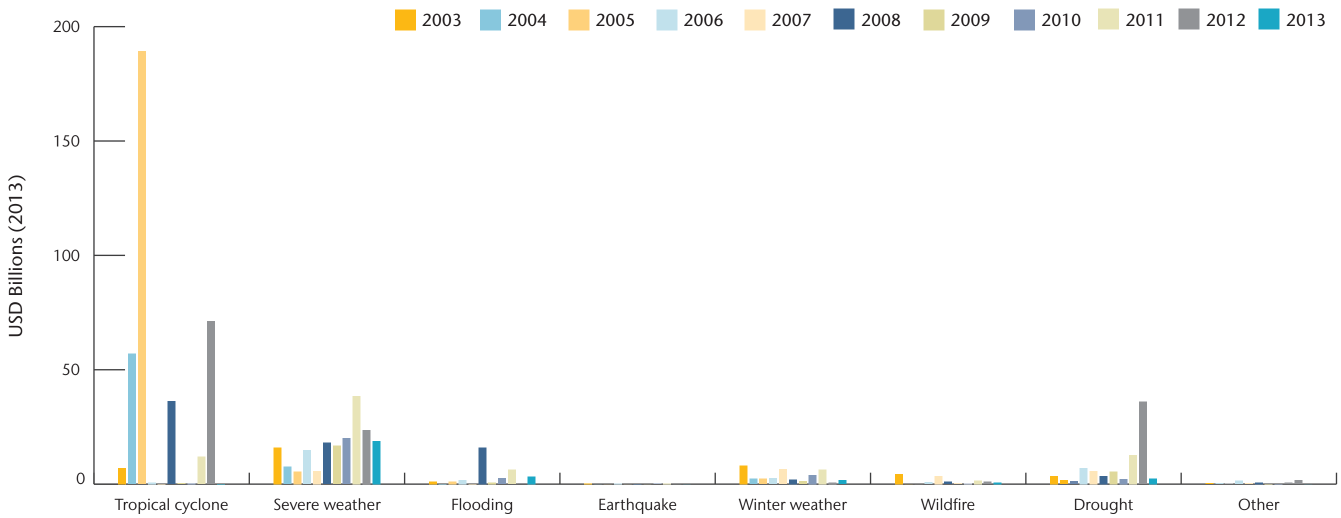

Since 1980, economic losses have increased about 3.2% annually on an inflation-adjusted basis in the United States. Insured losses have increased at a slightly higher rate of 6.8%. These upward trending losses can be attributed to increasing population and risk exposure, and higher levels of insurance penetration. However, when analyzing loss data during the past ten years, U.S. economic and insured losses from natural disasters have actually shown a decreasing trend (3.4% and 2.4%, respectively). Much of the decrease can be attributed to the recent decline in major hurricane landfalls and also the lack of a major earthquake event.

**Exhibit 34: United States Economic & Insured Losses as Percentage of GDP (1980-2013)**



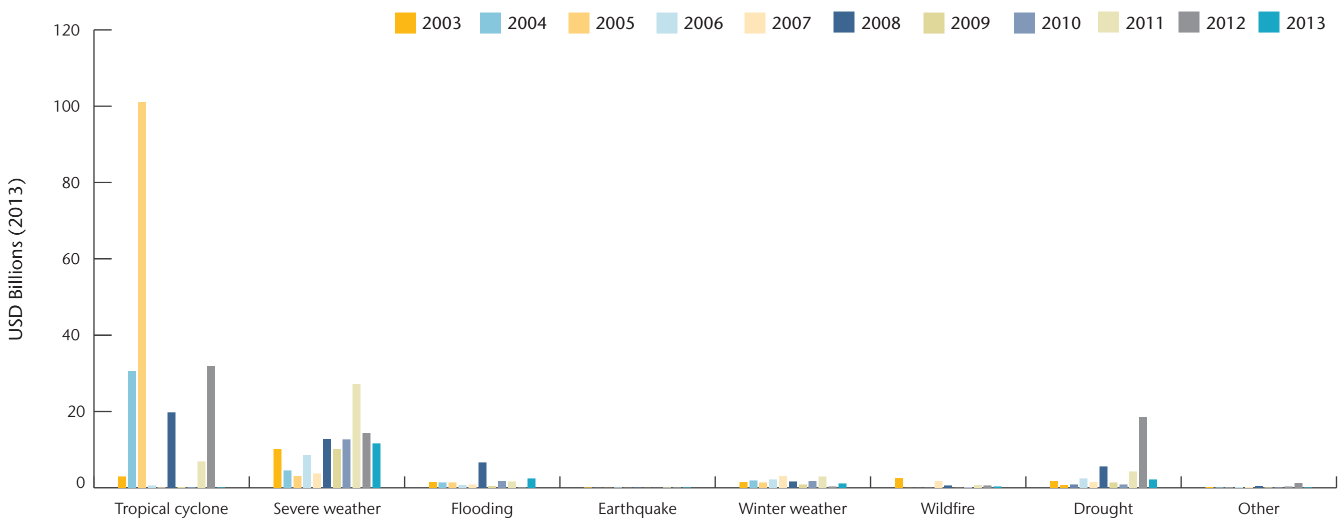

When analyzing natural disaster losses as a percentage of U.S. GDP (World Bank), the rate of growth since 1980 has increased annually by 0.8% for economic losses and 4.3% for insured losses. However, during the past ten years, there has been a downward trend on both an economic (-4.3%) and insured (-3.3%) basis.

**Exhibit 35: United States Economic Losses by Peril (2003-2013)**




The severe weather peril dominated economic losses in the United States in 2013 and was slightly above the peril's 10-year average. Flood was the only other peril type to see above normal losses during the year, with tropical cyclone, winter weather, earthquake, drought, and wildfire all below average. During the past ten years, losses associated with tropical cyclones have been the predominant driver of damage in the U.S. (especially in 2004, 2005, 2008, and 2012).

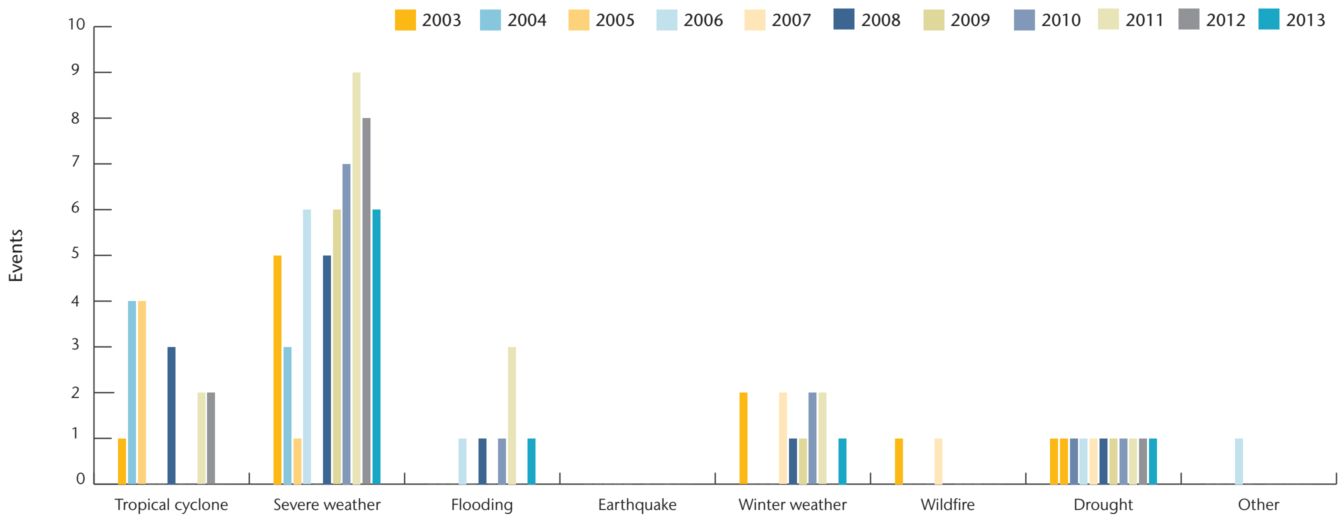
**Exhibit 36: United States Insured Losses by Peril (2003-2013)**




Losses from severe weather accounted for the majority of insured losses in the United States in 2013. The nearly USD12 billion in insured losses were slightly above the peril's 10-year average. Insured flood losses were also above average and at their highest levels since 2008. The winter weather peril caused a slightly below normal level of losses, while the rest of the major perils were well below normal. Since 2003, tropical cyclones have accounted for nearly 50% of annual losses in the U.S.

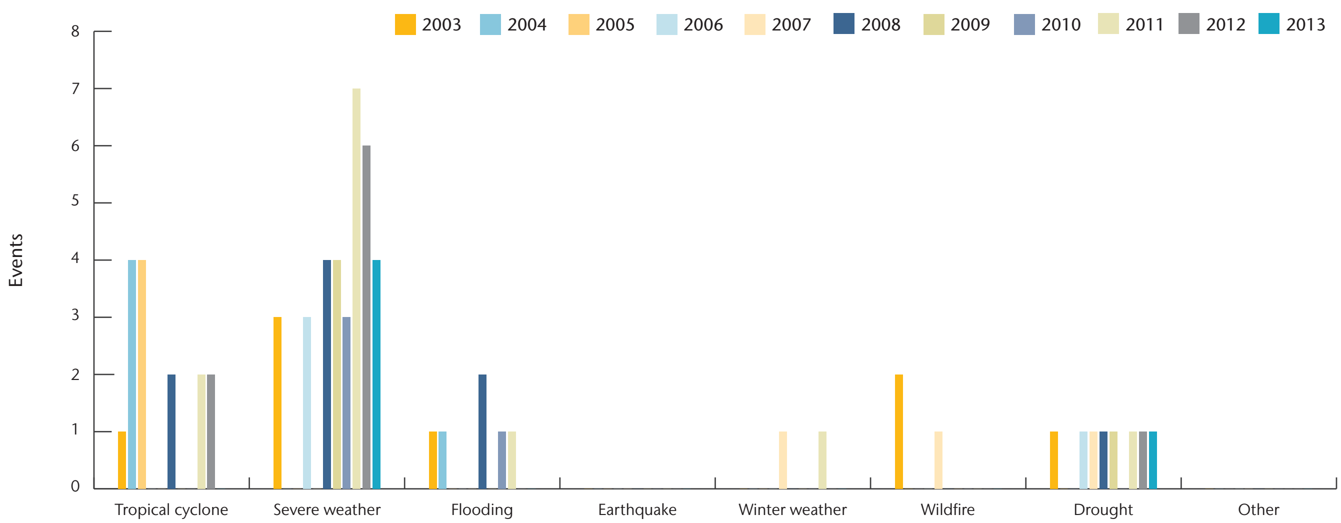
Please note that insured losses include those sustained by private insurers and government-sponsored programs such as the National Flood Insurance Program and the Federal Crop Insurance Corporation (run by the USDA's Risk Management Agency).

**Exhibit 37: United States Billion-Dollar Economic Loss Events by Peril (2003-2013)**




There were nine events that caused at least USD1.0 billion in economic losses in 2013, which was one below the 10-year average of 10. Six were attributed to severe weather, with the flood, winter weather and drought perils each registering an event that crossed the billion-dollar threshold. The 2003-2012 averages include: severe weather (5), tropical cyclone (2), winter weather (1), flood (1), and drought (1).

**Exhibit 38: United States Billion-Dollar Insured Loss Events by Peril (2003-2013)**




There were five events that triggered insured losses beyond USD1.0 billion in 2013, or one below the 10-year average of six. Four of the events were caused by severe weather and the other was attributed to drought. The 2003-2012 averages include: severe weather (3), tropical cyclone (2), flooding (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) |
|---|---|---|---|---|---|
| Jan/Dec | Drought | Brazil | N/A | 8.0 billion | 350 million |
| June | Flooding | Canada (Alberta) | 4 | 5.2 billion | 1.7 billion |
| September 13-20 | HU Manuel | Mexico | 169 | 4.2 billion | 685 million |
| July | Severe Weather | Canada (Ontario) | 0 | 1.7 billion | 825 million |
| September 13-17 | HU Ingrid | Mexico | 23 | 1.5 billion | 230 million |
| | | All Other Events | 364 | 5.4 billion | 750 million |
| | | **Totals** | **560** | **26 billion**[1] | **4.5 billion**[1,2] |

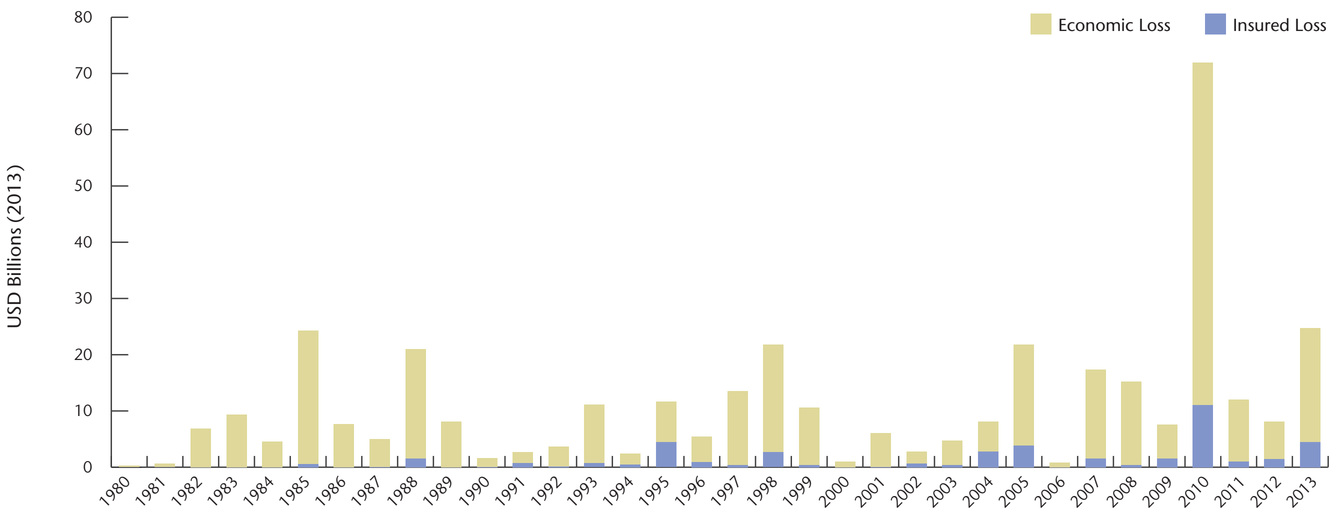
[1] Subject to change as loss estimates are further developed
[2] Includes losses sustained by private insurers and government-sponsored programs

Overall economic and insured losses from natural disaster activity in the Americas (Non-U.S.) during 2013 were significantly higher than what was seen in 2012. The costliest event occurred in northeastern Brazil, where one of the country's most severe droughts in history was recorded. The government allocated more than USD8.0 billion to account for damages and direct impacts associated with the drought, primarily which occurred to the agricultural sector. In Mexico, two hurricanes (Manuel and Ingrid) made landfall on opposite sides of the country within 24 hours and prompted massive flooding in dozens of states. Damage was substantial and the combined losses made each storm one of the costliest tropical cyclones in Mexico's history.

Elsewhere, Canada endured two major summer events which were highlighted by significant flooding in Calgary, Alberta in June. Torrential rainfall caused several rivers to burst their banks throughout Alberta as thousands of properties were inundated in the province. A second major flood event was spawned in Ontario's Toronto metropolitan region in July after severe thunderstorms brought rains that overwhelmed the city's drainage systems. Major flooding was also registered in South America's Brazil and Argentina, where economic damages exceeded USD1.0 billion in both events.

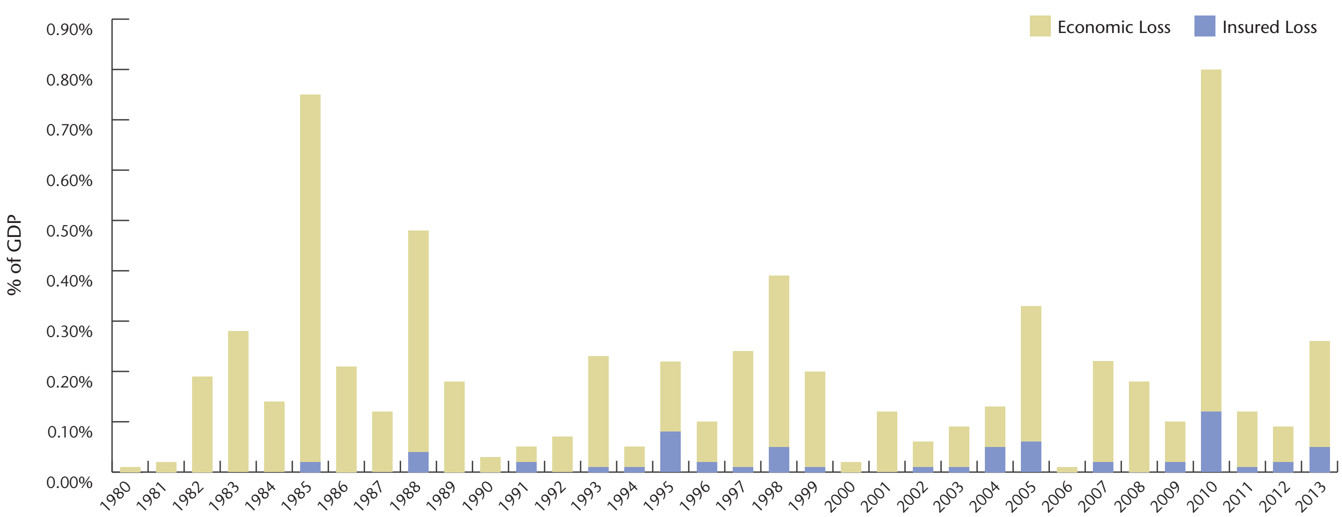
For a detailed review of all events in 2013, please visit **aonbenfield.com/catastropheinsight** and click on "Thought Leadership" to download updated monthly Global Catastrophe Recaps.

**Exhibit 40: Americas (Non-U.S.) Economic and Insured Losses (1980-2013)**



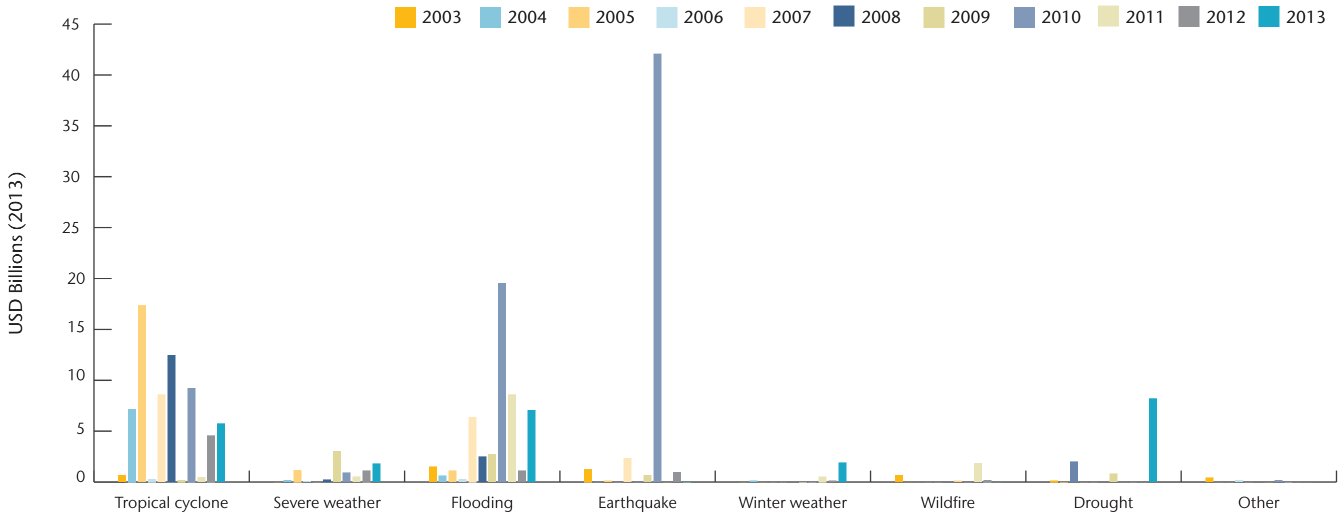

Since 1980, economic losses have increased about 4.7% and insured losses have increased at a higher 8.7%. These upward trending losses can be attributed to increasing population and risk exposure, and higher levels of insurance penetration (particularly in developing markets in Latin America). When analyzing natural disaster loss data in the Americas over the last ten years, economic losses have accelerated to an annual rate of nearly 13%. Insured losses during this time have remained nearly flat, showing just a 0.8% annual increase. The differential in increases during the last ten years can be attributed to major catastrophe events occurring in areas with minimal insurance penetration. For example, 2010's Haiti earthquake caused USD8.6 billion in damages but only USD110 million was covered by insurance (2013 USD).

**Exhibit 41: Americas (Non-U.S.) Economic & Insured Losses as Percentage of GDP (1980-2013)**



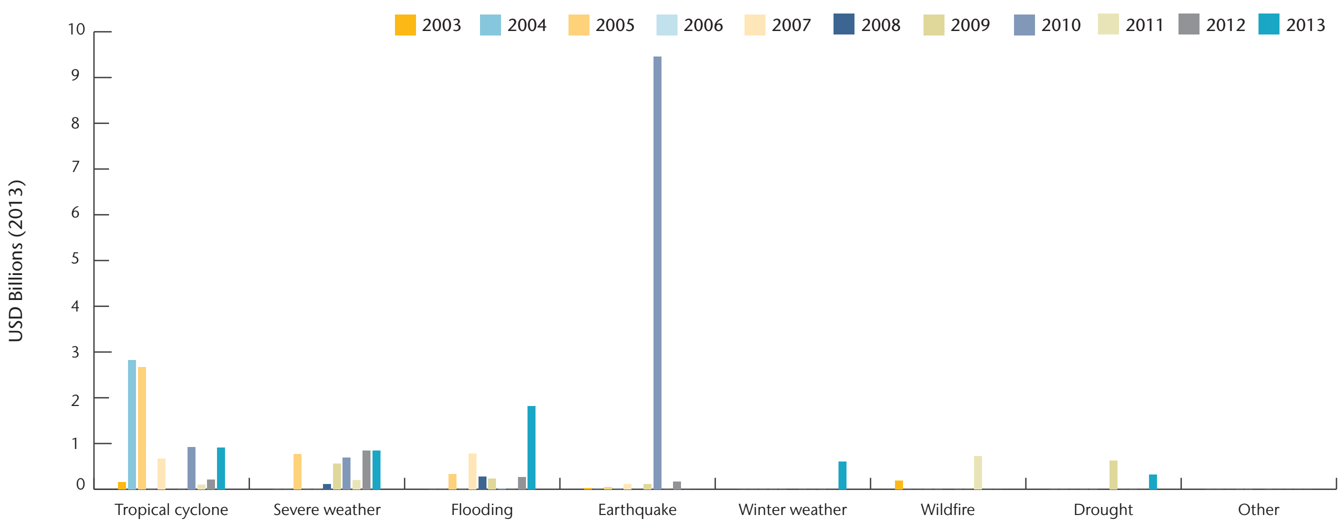

When analyzing natural disaster losses as a percentage of GDP (World Bank) for the Americas (Non-U.S.), the rate of growth since 1980 has increased annually by 1.6% for economic losses and 5.3% for insured losses. During the past ten years, economic losses have shown a more significant increase by 7.2%. However, insured losses have actually trended downward by 4.2%.

**Exhibit 42: Americas (Non-U.S.) Economic Losses by Peril (2003-2013)**




Multiple perils recorded economic losses above their ten year averages, including drought, severe weather, winter weather, and flooding. Tropical cyclone losses were slightly below average, while earthquake and wildfire were well below normal. During the past ten years, the tropical cyclone peril has been the costliest on an annual basis (USD6.2 billion) though earthquake and flooding are fairly close behind at USD4.8 billion and USD4.5 billion.

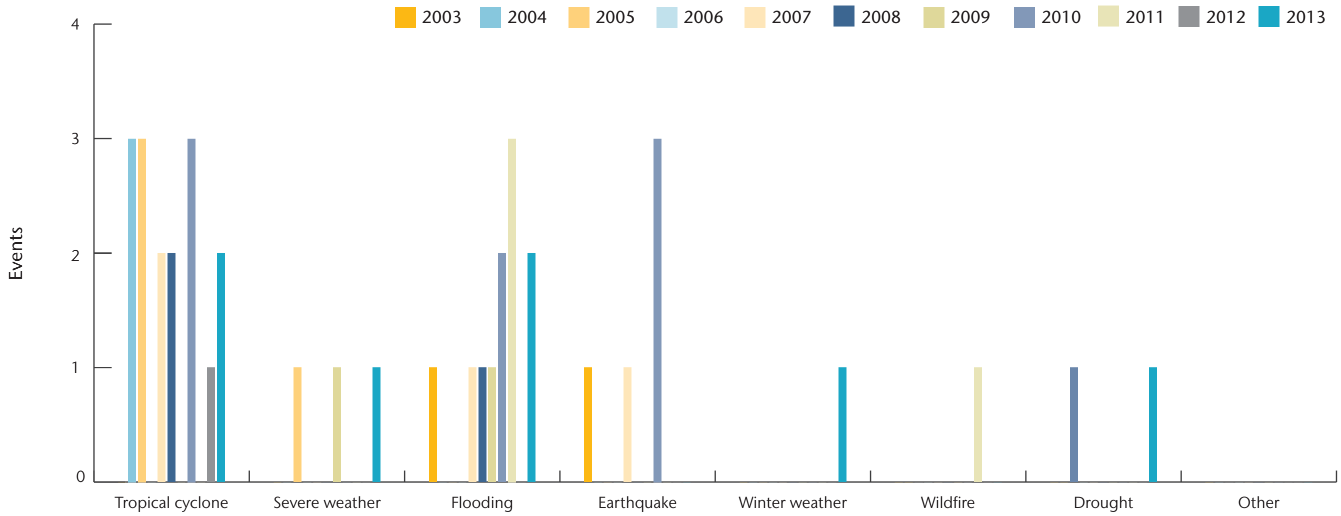
**Exhibit 43: Americas (Non-U.S.) Insured Losses by Peril (2003-2013)**




Insured losses were above the ten-year normal for nearly every major peril type in 2013. Losses from flooding accounted for the highest percentage of payouts, and it was the only peril to see aggregate losses in excess of USD1.0 billion. It also marked one of the costliest insured flood years ever recorded for the Americas. Tropical cyclone insured losses were their highest since 2010 and also slightly above the 10-year average. Severe weather and drought were also above their recent averages.

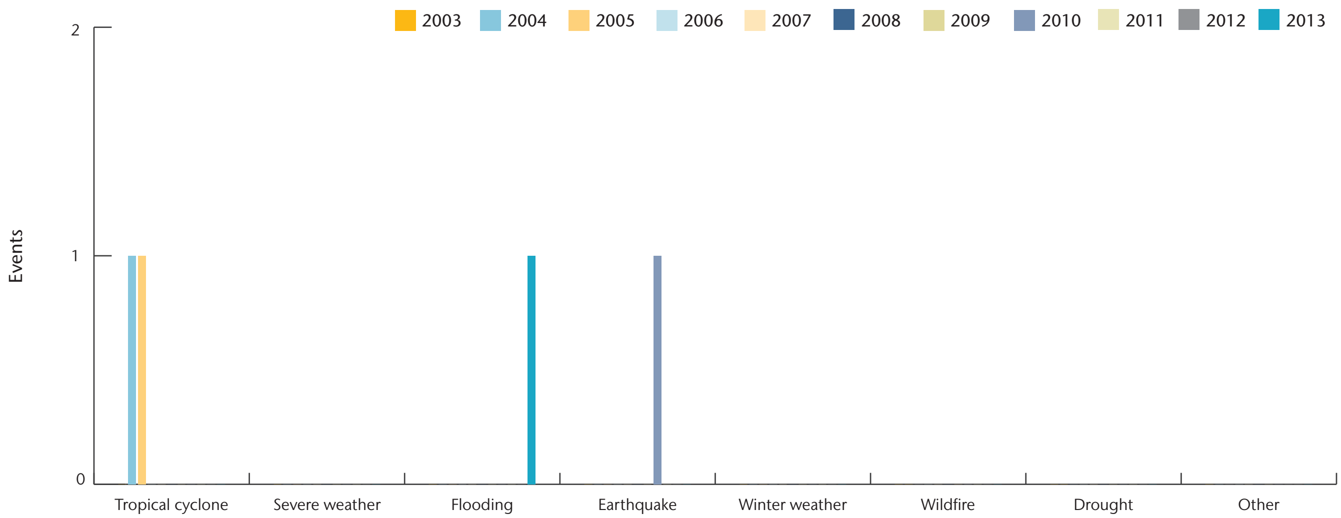
Please note that insured losses include those sustained by private insurers and government-sponsored programs.

**Exhibit 44: Americas (Non-U.S.) Billion-Dollar Economic Loss Events by Peril (2003-2013)**




There were seven events that caused at least USD1.0 billion in economic losses in 2013, which was more than double the ten-year average of three. This was the highest number of events since 2010, when eight were registered. Two flood events and two tropical cyclones both crossed the billion-threshold, while singular severe weather, winter weather and drought events also occurred. The 2003-2012 averages include: tropical cyclone (1), flooding (1) and earthquake (1).

**Exhibit 45: Americas (Non-U.S.) Billion-Dollar Insured Loss Events by Peril (2003-2013)**




There was just one event that triggered insured losses beyond USD1.0 billion in 2013. Since 2003, billion-dollar insured loss events happen on average once every two years. The combination of lower levels of insurance penetration and available data in Latin America contribute to the lower frequency of such events occurring.

# 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) |
|---|---|---|---|---|---|
| May/June | Flooding | Central Europe | 25 | 22 billion | 5.3 billion |
| July 27-28 | Severe Weather | Germany, France | 0 | 4.0 billion | 3.0 billion |
| October 27-29 | WS Christian | Western/Northern Europe | 18 | 2.0 billion | 1.4 billion |
| March 12-31 | Winter Weather | Western/Central/Northern Europe | 30 | 1.8 billion | 130 million |
| December 4-7 | WS Xaver | Northern Europe | 15 | 1.5 billion | 1.1 billion |
| | | All Other Events | 982 | 6.7 billion | 2.1 billion |
| | | **Totals** | **1,086** | **37 billion[1]** | **13 billion[1,2]** |

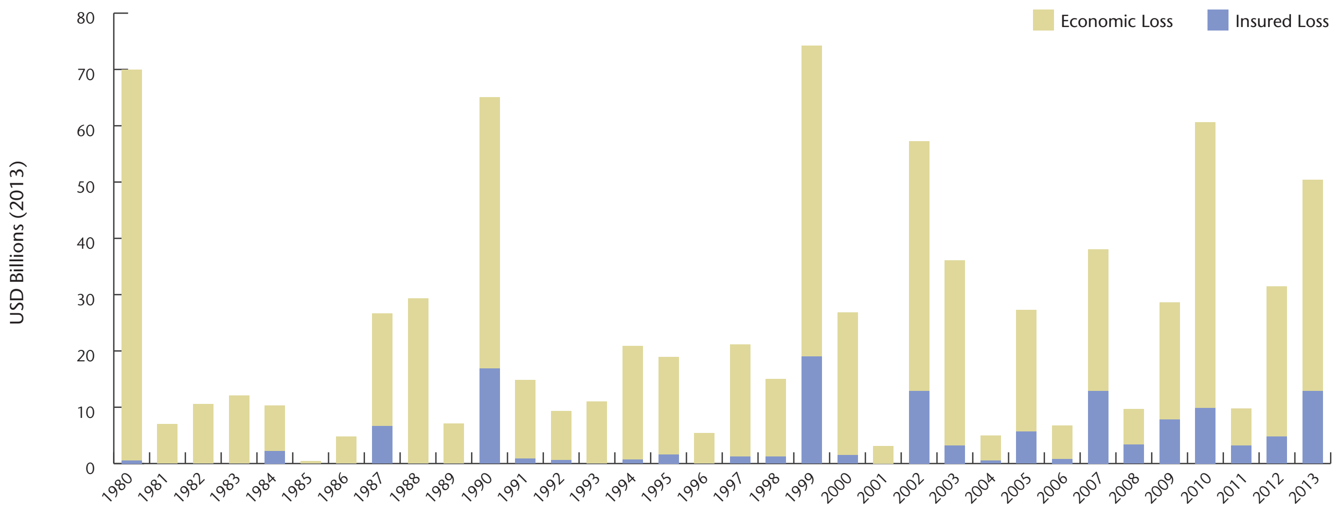
[1] Subject to change as loss estimates are further developed
[2] Includes losses sustained by private insurers and government-sponsored programs

Overall economic and insured losses from natural disaster activity in EMEA during 2013 were both elevated from their totals in 2012. Much of the losses were attributed to one of the costliest European floods ever recorded, which occurred from late May into early June. The Central Europe floods resulted from an exceptionally wet spring that was exacerbated by a heavy rain event at the end of May. Most of the flood losses were sustained in Germany. Germany also endured a series of significant severe weather events in June, July and August that caused significant hail damage. The hailstorm in late July became one of the costliest disasters in history for the German insurance industry.

Other notable events included two strong European windstorms (Christian and Xaver) that each caused more than USD1.0 billion in economic and insured losses. A prolonged winter weather event in Europe marked by bitter cold forced the shutdown of several major shipping routes in the continent. Outside of Europe, heavy rains from both seasonal monsoon and tropical cyclone events during the year led to hundreds of fatalities in Africa. In December, an unusually strong winter storm heavily impacted most of the Middle East.

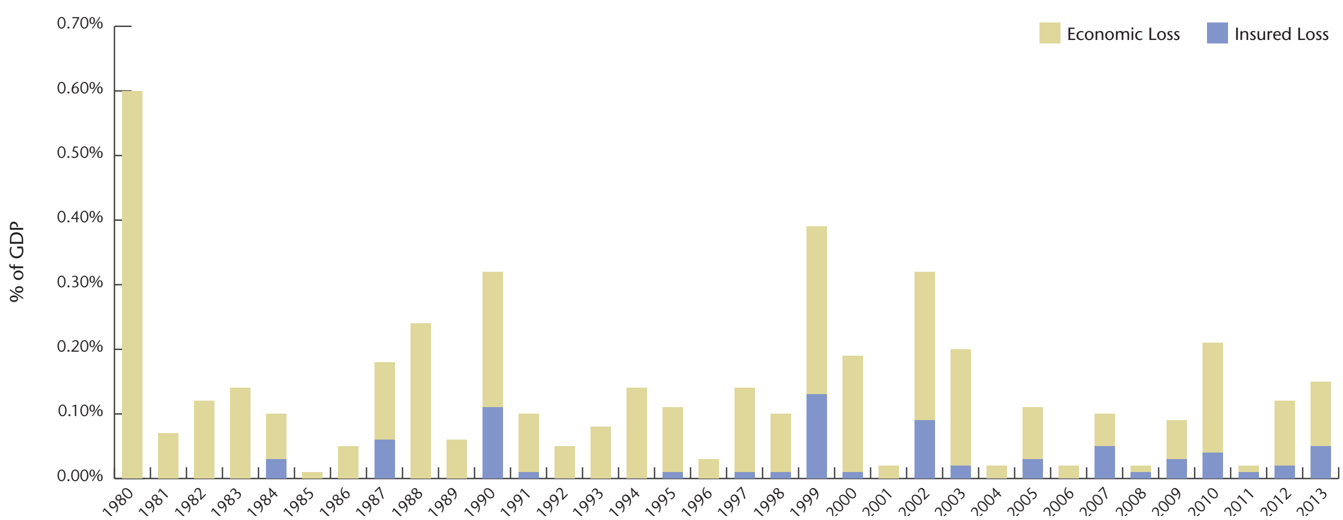
For a detailed review of all events in 2013, please visit **aonbenfield.com/catastropheinsight** and click on "Thought Leadership" to download updated monthly Global Catastrophe Recaps.

**Exhibit 47: EMEA Economic and Insured Losses (1980-2013)**



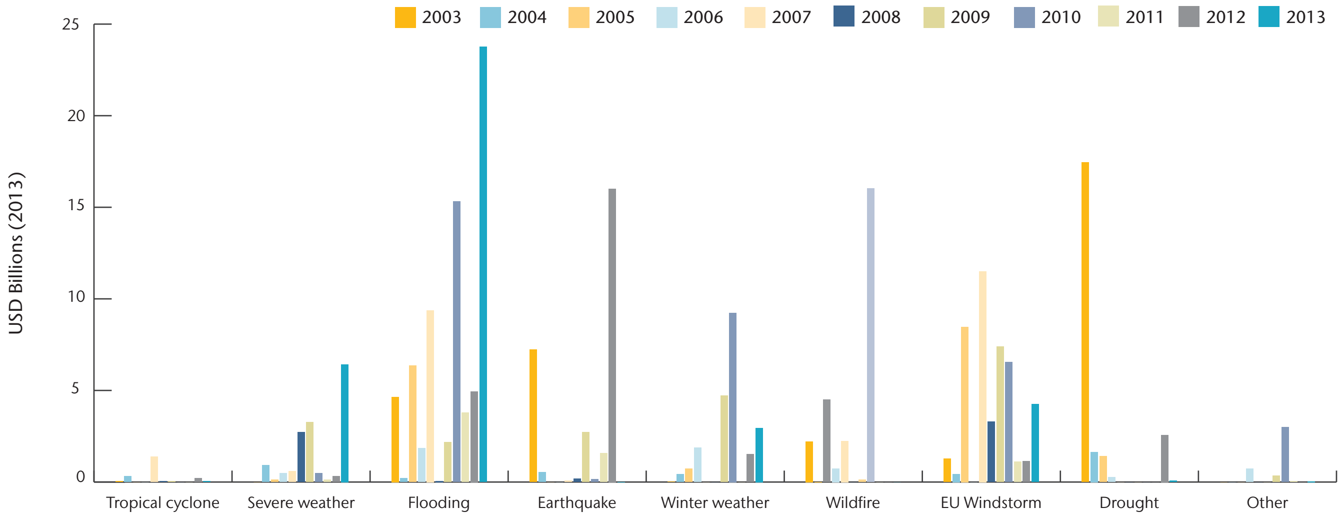

Since 1980, economic losses have increased by 2.2% annually on an inflation-adjusted basis in EMEA. Insured losses have increased at a slightly higher rate of 5.2%. However, when analyzing loss data during the past ten years, there has been a much more significant upward trend. On the economic loss side, losses have trended upward annually by 16%. Insured losses have seen an even larger increase, with losses trending upward by 23%.

**Exhibit 48: EMEA Economic and Insured Losses as Percentage of GDP (1980-2013)**



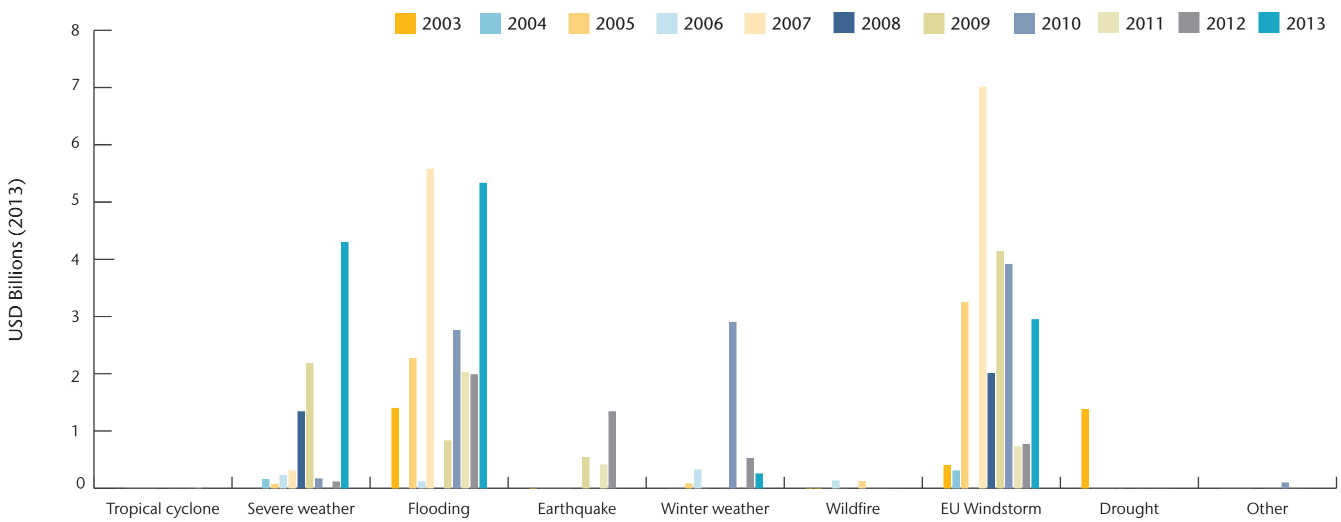

When analyzing natural disaster losses for EMEA as a percentage of GDP (World Bank), the rate of growth since 1980 has shown a slight downward trend in economic losses by 1.0% though insured losses have annually increased by 2.1%. However, there has been a markedly accelerated growth rate during the past ten years in the region. Economic losses have trended upwards by 13% and insured losses have trended even higher at 21%. Despite these seemingly increased trends over the last ten year period, it is worth pointing out that the losses as a percent of GDP remain low (having only surpassed 0.20% once during this time (2010)). EMEA governments and the insurance industry have been able to manage the associated losses.

**Exhibit 49: EMEA Economic Losses by Peril (2003-2013)**




The flood peril dominated economic losses sustained in EMEA, as flood losses in 2013 were well above its 10-year average (and their highest since 2002). Losses attributed to severe weather and winter weather were also well above their recent norms. The European windstorm, wildfire, tropical cyclone, and drought perils were each below normal. Despite being below normal, the European windstorm losses were at their highest level since 2010.

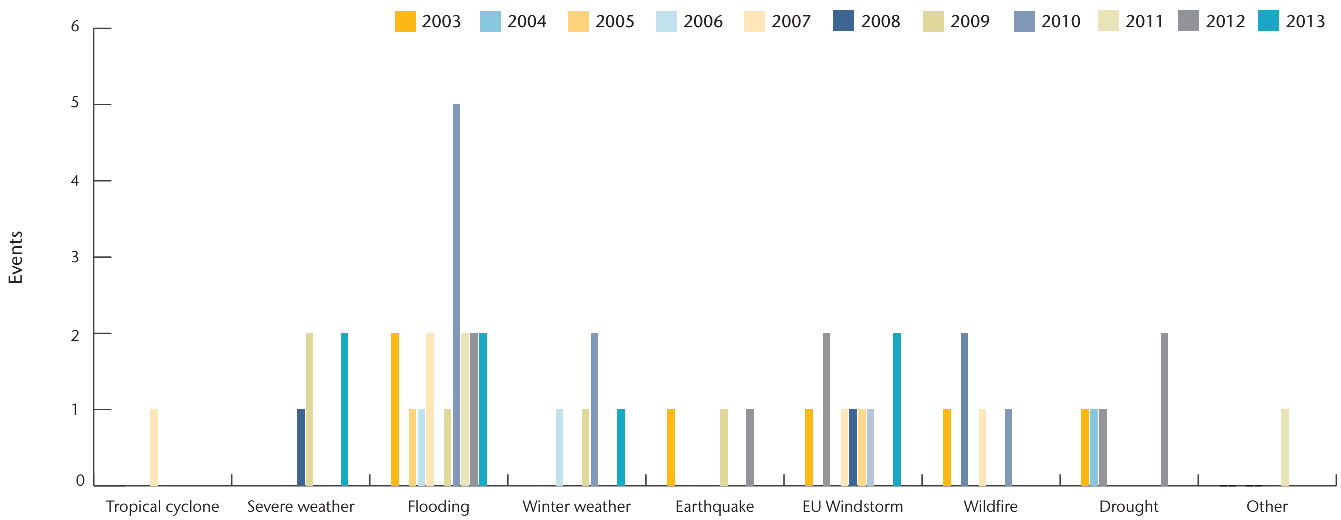
**Exhibit 50: EMEA Insured Losses by Peril (2003-2013)**




Insured losses were above the ten-year average for three perils: flooding, severe weather, and European windstorm. Most notably, aggregate insured losses attributed to severe weather were some of the highest ever recorded in EMEA. The severe weather tally in 2013 was the highest since 2007 and the European windstorm losses were the highest since 2010. The rest of the perils were below their recent averages.

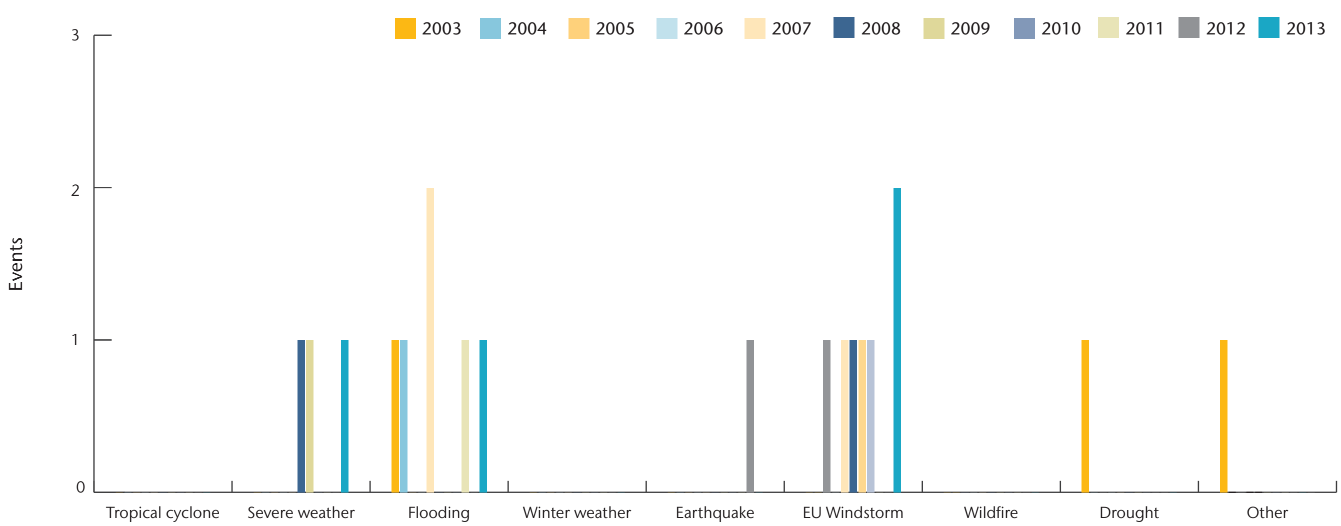
Please note that insured losses include those sustained by private insurers and government-sponsored programs.

**Exhibit 51: EMEA Billion-Dollar Economic Loss Events by Peril (2003-2013)**




There were seven events that caused at least USD1.0 billion in economic losses in 2013, which were two above the 10-year average of five. This was the highest number of such events since the 10 that occurred in 2010. Three perils each had two separate billion-dollar events: flooding, severe weather and European windstorm. This was the first time since 2005 that two European windstorms crossed the billion-dollar threshold in a year, and the first time since 2009 that two occurred for the severe weather peril. The 2003-2012 averages include: flooding (2), European windstorm (1), wildfire (1), and drought (1).

**Exhibit 52: EMEA Billion-Dollar Insured Loss Events by Peril (2003-2013)**




There were four events that triggered insured losses beyond USD1.0 billion in 2013, or two above the 10-year average of two. Two of the events were European windstorms (Christian and Xaver), while the other two were the May/June floods in Central Europe and a July severe weather event in Germany. Based data from 2003-2012, the only perils to average a billion-dollar insured loss event each 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) |
|---|---|---|---|---|---|
| April 20 | Earthquake | China | 196 | 14 billion | 250 million |
| November 7-10 | STY Haiyan | Philippines, Vietnam, China | 8,000 | 13 billion | 1.5 billion |
| October 5-8 | TY Fitow | China, Japan | 12 | 10 billion | 1.0 billion |
| January | Flooding | Australia | 6 | 2.5 billion | 1.0 billion |
| June | Flooding | India | 6,748 | 1.9 billion | 585 million |
| | | All Other Events | 4,400 | 57 billion | 3.5 billion |
| | | **Totals** | **19,309** | **99 billion[1]** | **7.5 billion[1,2]** |

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

Overall economic and insured losses from natural disaster activity in APAC during 2013 were nearly double those registered in 2012. However, both totals were well below what was sustained most recently in 2010 and 2011. The large disparity between the economic and insured losses in 2013 continues to highlight the low levels of insurance penetration throughout the region that are often the most vulnerable to large events.

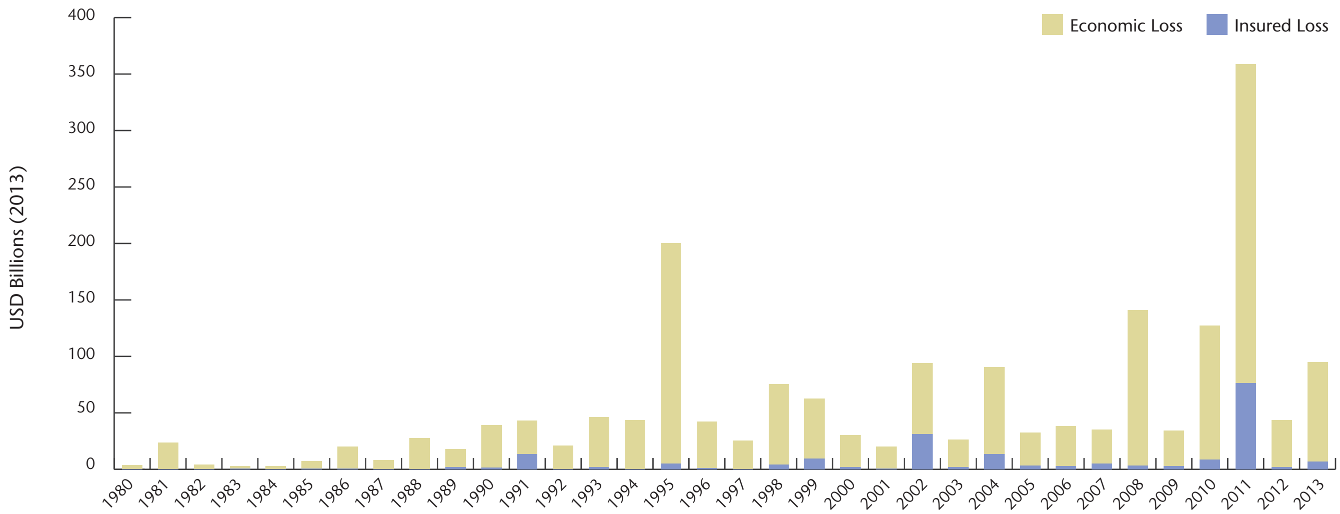
In a year with several major events in APAC, Super Typhoon Haiyan was the most noteworthy. Nearly 8,000 people were killed or left missing in the Philippines after the storm came ashore as one of the strongest tropical cyclones in world history. Had Haiyan not affected a very poor region of the country, and instead had tracked closer to a more urban region, the losses would have been even more catastrophic than already realized. Given the frequency of tropical cyclone activity in the Western Pacific, Haiyan served as an additional warning for coastal cities in the APAC region for future major cyclonic events and their potentially devastating financial implications.

Other significant tropical cyclone events included Typhoon Fitow (China, Japan), Cyclone Phailin (India), Super Typhoon Usagi (China, Philippines, Taiwan), Super Typhoon Utor (China, Philippines), and Typhoon Wipha (Japan). It is worth mentioning that the billion-dollar insured loss attributed to Typhoon Fitow was the second-costliest insured event ever in China.

The costliest three events of the year in APAC, which each caused more than USD10 billion in economic losses, occurred in China. Beyond Super Typhoon Haiyan, the two events were: 1) A magnitude-6.6 earthquake struck China's Sichuan Province on April 20, killing nearly 200 people and causing extensive damage; and 2) A severe drought across central and eastern China that was enhanced by record summer heat. Other notable events surrounded the flood peril, including a massive June flood event in North India that left more than 6,500 people dead in the state of Uttarakhand alone. Additional substantial flood events were recorded in Australia, Indonesia, China, Philippines, Pakistan, and Cambodia.

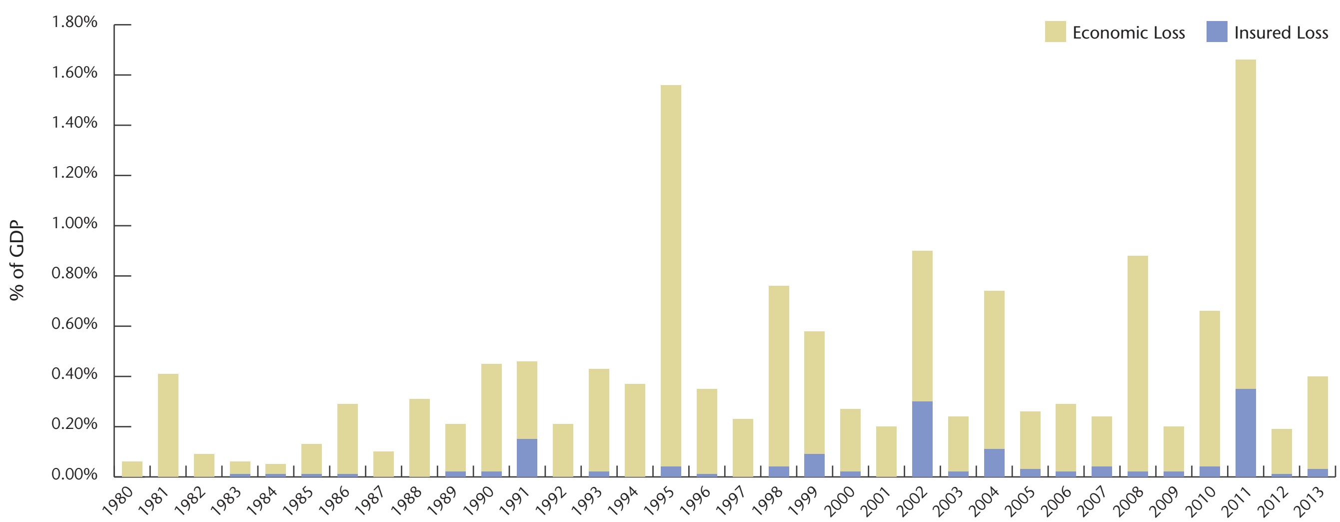
For a detailed review of all events in 2013, please visit **aonbenfield.com/catastropheinsight** and click on "Thought Leadership" to download updated monthly Global Catastrophe Recaps.

**Exhibit 54: APAC Economic and Insured Losses (1980-2013)**



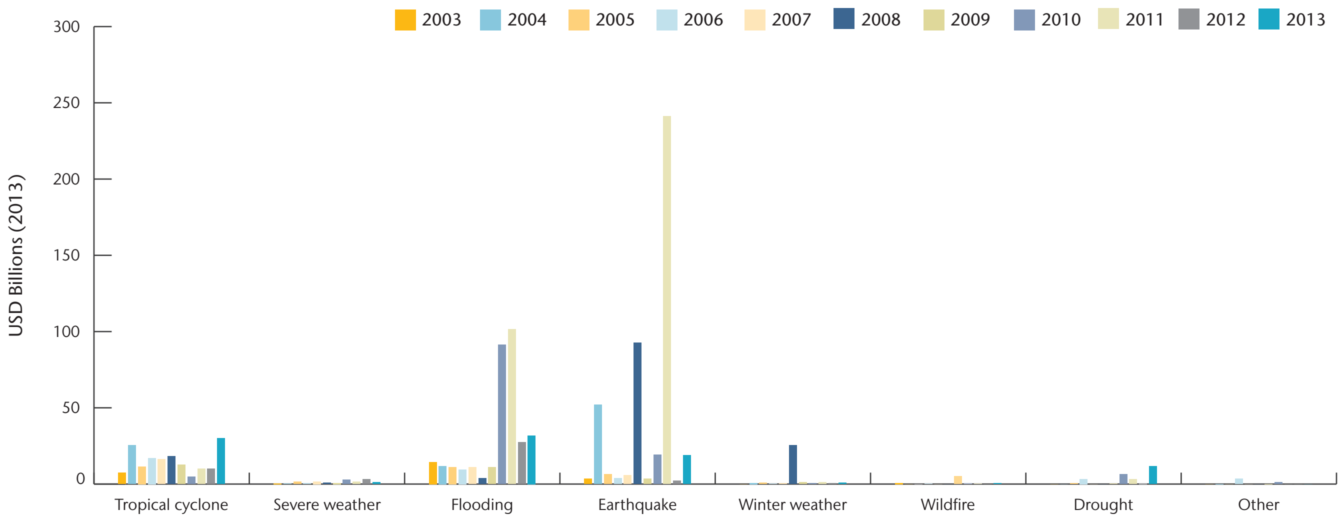

Since 1980, economic losses in APAC have shown an annual increase of 8.8% while insured losses have grown at an expedited rate of 13.4%. Outside of the outlier years in 1995 and 2011, economic losses in the region have not shown exponential growth over time. With insurance penetration continuing to expand across emerging markets in APAC (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 ten years, economic losses have trended higher at a slightly increased 10.3% annual rate. Insured losses have shown a slower 5.0% rate of growth.

**Exhibit 55: APAC Economic and Insured Losses as Percentage of GDP (1980-2013)**



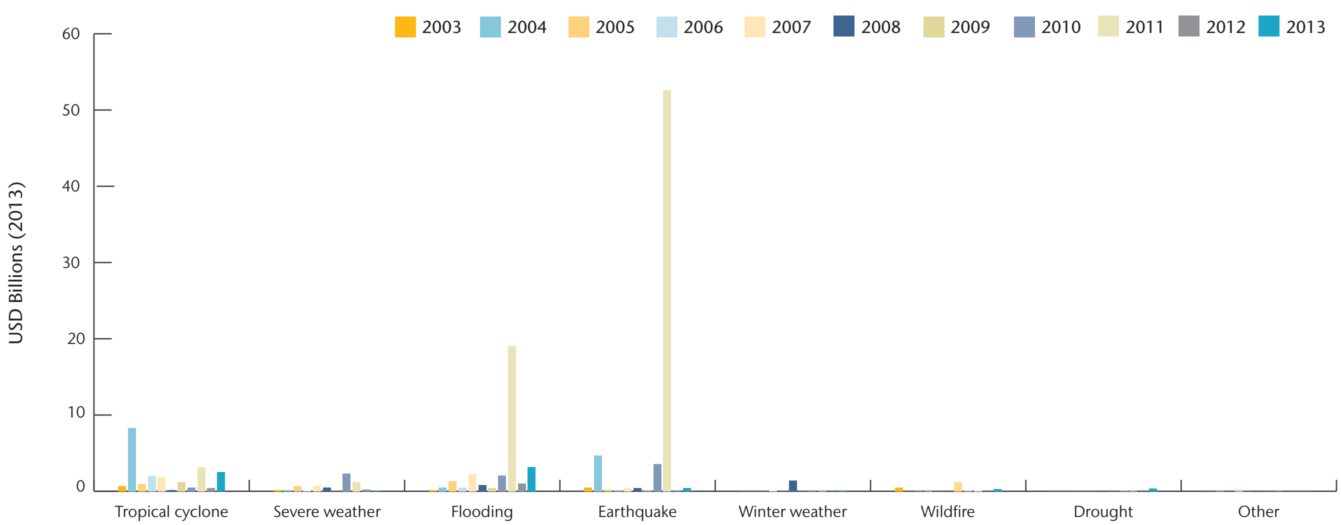

When analyzing natural disaster losses for APAC as a percentage of GDP (World Bank), the rate of growth since 1980 has increased annually by 4.6% for economic losses and 9.0% for insured losses. During the past ten years, economic losses have shown a more muted annual increase of 1.7% and insured losses have actually trended downward by 3.2%. APAC 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.

**Exhibit 56: APAC Economic Losses by Peril (2003-2013)**




The flooding, tropical cyclone and earthquake perils caused the vast majority of economic losses in APAC during 2013. However, earthquake losses were below the 10-year mean that were primarily skewed by the historic losses derived from the 2011 Japan earthquake and tsunami. Losses derived from tropical cyclones were at their highest level since 2004. Drought losses were also above normal. The winter weather, wildfire, and severe weather perils were each below their recent averages.

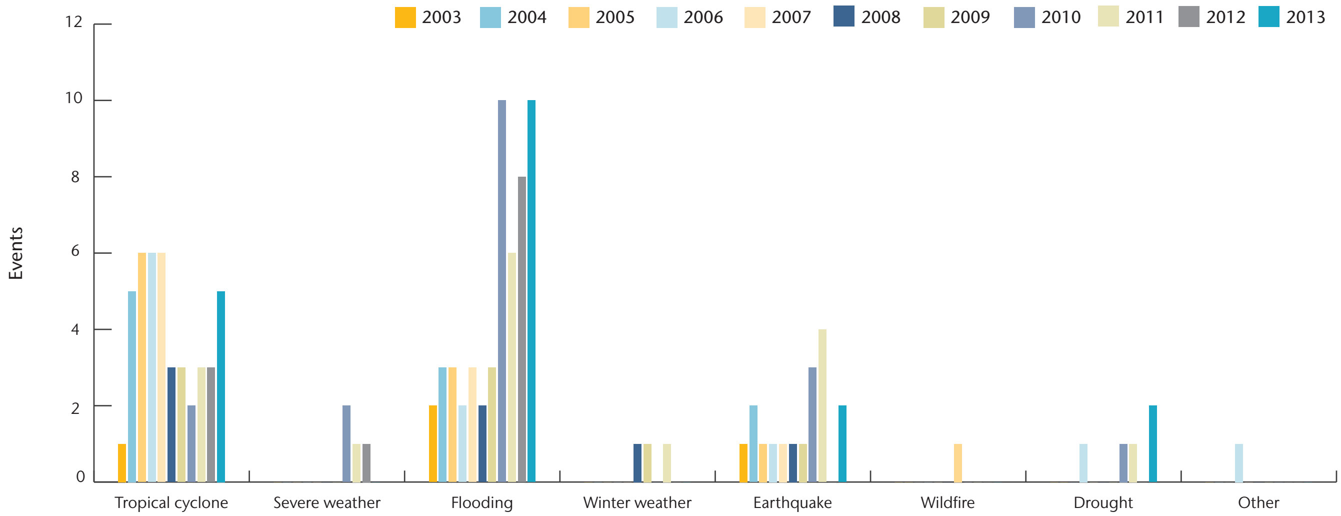
**Exhibit 57: APAC Insured Losses by Peril (2003-2013)**




The wildfire, flood, drought and tropical cyclone perils sustained above-average losses in 2013. Despite tropical cyclone economic losses being in the tens of billions (USD), only a fraction of those losses were covered by insurance—signifying the dearth of penetration in the region (particularly in China and the Philippines). However, insured losses were still above the recent average. Most of the wildfire losses occurred in Australia, which registered its highest insured bushfire costs since 2009. The rest of the perils were below their 10-year averages.

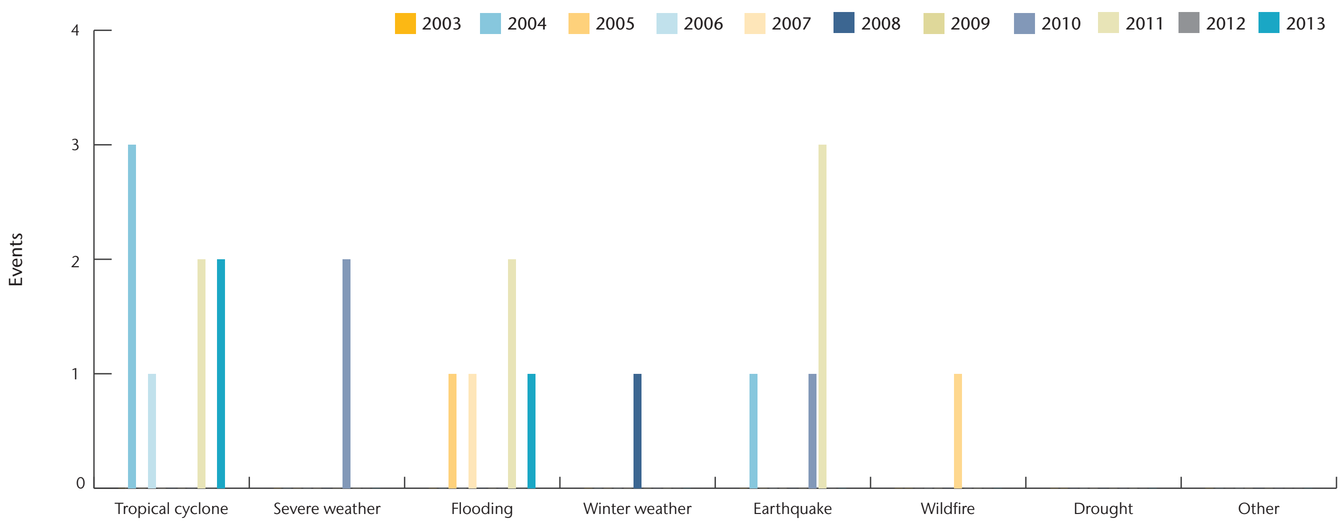
Please note that insured losses include those sustained by private insurers and government-sponsored programs.

**Exhibit 58: APAC Billion-Dollar Economic Loss Events by Peril (2003-2013)**




There were 19 separate events which caused more than USD1.0 billion in economic losses in APAC in 2013, which was nearly double the 10-year average of 11. This was the highest number of such events recorded in the region since at least 2000. Ten flood events crossed the billion-dollar threshold, which was the most since 2010. Five events were attributed to the tropical cyclone peril – the highest number since 2007. The earthquake and drought perils each had two events that were billion-dollar disasters. The 2003-2012 averages include: tropical cyclone (four), flooding (4), earthquake (2), and severe weather (1).

**Exhibit 59: APAC Billion-Dollar Insured Loss Events by Peril (2003-2013)**




Despite 19 events causing more than USD1.0 billion in economic losses, only three such events had insured losses beyond the same threshold. This was slightly above the 10-year average. The highest number of insured billion-dollar events occurred in 2011, when a record seven events were registered.

# Appendix A: 2013 Global Disasters

**Exhibit 60: United States**

| Date(s) | Event | Location | Deaths | Structures / Claims | Economic Loss (USD) |
|---|---|---|---|---|---|
| 1/1-12/31 | Drought | Nationwide | 0 | Unknown | 3.5+ billion |
| 1/8-1/10 | Severe Weather | Southeast | 0 | 500+ | 10+ million |
| 1/11-1/17 | Winter Weather | California | 0 | Unknown | 28+ million |
| 1/29-1/30 | Severe Weather | Southeast, Midwest, Plains | 3 | 25,000+ | 350+ million |
| 2/8-2/9 | Winter Weather | Northeast, Mid-Atlantic | 15 | 10,000+ | 100+ million |
| 2/9-2/11 | Winter Weather | Midwest, Plains, Southeast | 1 | 7,500+ | 100+ million |
| 2/21-2/22 | Winter Weather | Plains, Midwest, Southeast | 2 | Thousands+ | Millions+ |
| 2/24-2/27 | Winter Weather | Plains, Midwest, Northeast | 3 | 100,000+ | 1.0+ billion |
| 3/4-3/8 | Winter Weather | Plains, Midwest, Northeast | 5 | Thousands+ | 50+ million |
| 3/18-3/20 | Severe Weather | Southeast, Northeast | 2 | 225,000+ | 2.0+ billion |
| 3/23-3/25 | Winter Weather | Plains, Midwest, Northeast | 0 | Unknown | Unknown |
| 3/29-3/31 | Severe Weather | Plains, Southeast | 0 | 35,000+ | 325+ million |
| 4/1-4/2 | Severe Weather | Texas | 0 | 25,000+ | 250+ million |
| 4/7-4/11 | Severe Weather | Nationwide | 3 | 135,000+ | 1.75+ billion |
| 4/17-4/19 | Severe Weather | Central and Eastern U.S. | 3 | 75,000+ | 900+ million |
| 4/17-4/30 | Flooding | Midwest, Mississippi Valley | 4 | 25,000+ | 325+ million |
| 4/26-4/28 | Severe Weather | Plains, MS Valley, Southeast | 0 | 45,000+ | 350+ million |
| 4/29 | Severe Weather | Midwest | 0 | 12,500+ | 125+ million |
| 5/8-5/11 | Severe Weather | Texas, Oklahoma, Kansas | 0 | 30,000+ | 200+ million |
| 5/15-5/17 | Severe Weather | Plains, Southeast | 6 | 25,000+ | 500+ million |
| 5/18-5/22 | Severe Weather | Plains, Midwest, Northeast | 29 | 160,000+ | 3.75+ billion |
| 5/19 | Flooding | Georgia | 0 | Hundreds+ | 10+ million |
| 5/23 | Severe Weather | Texas | 0 | Thousands+ | Millions+ |
| 5/25 | Flooding | Texas | 3 | Thousands+ | Millions+ |
| 5/26-6/2 | Severe Weather | Plains, Midwest, Northeast | 27 | 150,000+ | 2.25+ billion |
| 5/30-6/8 | Wildfire | California | 0 | 58+ | 21.4+ million |
| 6/6-6/8 | TS Andrea | Florida, Eastern Seaboard | 3 | Hundreds+ | Unknown |

| Date(s) | Event | Location | Deaths | Structures / Claims | Economic Loss (USD) |
|---|---|---|---|---|---|
| 6/11-6/20 | Wildfire | Colorado | 2 | 4,500+ | 500+ million |
| 6/12-6/13 | Severe Weather | Midwest, Northeast, Mid-Atlantic | 4 | 75,000+ | 625+ million |
| 6/20-6/28 | Severe Weather | Central and Eastern U.S. | 2 | 80,000+ | 800+ million |
| 6/28-7/10 | Wildfire | Arizona | 19 | 129+ | Millions+ |
| 7/8-7/10 | Severe Weather | Central and Eastern U.S. | 1 | 20,000+ | 175 + million |
| 7/19-7/20 | Severe Weather | Plains, Midwest, Northeast | 1 | 25,000+ | 215+ million |
| 7/21-7/24 | Severe Weather | Plains, Rockies, Midwest | 0 | 20,000+ | 275+ million |
| 7/27-7/28 | Flooding | North Carolina, Pennsylvania | 2 | Hundreds+ | 25+ million |
| 8/1 | Severe Weather | Rockies, Plains | 0 | Thousands+ | 50+ million |
| 8/2-8/3 | Severe Weather | Rockies | 0 | 30,000+ | 400+ million |
| 8/5-8/7 | Severe Weather | Midwest, Plains | 2 | 85,000+ | 1.25+ billion |
| 8/5-8/12 | Flooding | Plains, Tennessee Valley | 3 | 5,000+ | 25+ million |
| 8/22 | Severe Weather | Colorado | 0 | 15,000+ | 250+ million |
| 8/17-9/20 | Wildfire | California | 0 | 111+ | 175+ million |
| 8/30-8/31 | Severe Weather | Plains, Midwest | 0 | 20,000+ | 170+ million |
| 9/9-9/15 | Wildfire | California | 1 | 211+ | 10+ million |
| 9/9-9/16 | Flooding | Colorado, New Mexico | 10 | 25,000+ | 2.0+ billion |
| 9/29-9/30 | Severe Weather | Washington, Oregon | 0 | Hundreds+ | Millions+ |
| 10/3-10/7 | Winter Weather | Plains, Midwest, Northeast | 3 | Thousands+ | 100+ million |
| 10/29-11/1 | Severe Weather | Plains, Midwest, Northeast | 3 | 15,000+ | 250+ million |
| 11/17-11/18 | Severe Weather | Midwest, Ohio Valley, Northeast | 10 | 70,000+ | 1.6+ billion |
| 11/23-11/27 | Winter Weather | Nationwide | 14 | Unknown | Millions+ |
| 12/1-12/10 | Winter Weather | United States | 18 | Thousands+ | 100+ million |
| 12/19-12/22 | Winter Weather | Midwest, Southeast, Northeast | 19 | Thousands+ | 100s of Millions+ |

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

| Date(s) | Event | Location | Deaths | Structures / Claims | Economic Loss (USD) |
|---|---|---|---|---|---|
| 1/1-5/31 | Drought | Panama | 0 | Unknown | 200+ million |
| 2/7-2/10 | Winter Weather | Canada | 3 | Thousands+ | 4.0+ million |
| 4/18 | Severe Weather | Canada | 0 | Hundreds+ | Unknown |
| 4/15-5/10 | Flooding | Canada | 0 | 2,000+ | Millions+ |
| 5/22 | Flooding | Bahamas | 0 | 1,000+ | 45+ million |
| 5/28-5/30 | HU Barbara | Mexico, Central America | 4 | 5,000+ | Unknown |
| 6/19-6/24 | Flooding | Canada | 4 | 25,000+ | 5.3+ billion |
| 6/20-6/21 | TS Barry | Mexico, El Salvador, Belize | 3 | 2,000+ | Unknown |
| 7/5-7/9 | HU Erick | Mexico | 2 | Hundreds+ | Unknown |
| 7/8 | Severe Weather | Canada | 0 | 25,000+ | 1.65+ billion |
| 7/9-7/11 | TS Chantal | Caribbean | 1 | Unknown | 10+ million |
| 7/19-7/20 | Severe Weather | Canada | 1 | Hundreds+ | Millions+ |
| 7/20-7/21 | Severe Weather | Canada | 0 | Hundreds+ | Millions+ |
| 8/21 | Earthquake | Mexico | 0 | Hundreds+ | Unknown |
| 8/25-8/26 | TS Fernand | Mexico | 14 | 1,000+ | Millions+ |
| 8/28-8/29 | TS Juliette | Mexico | 1 | Unknown | Unknown |
| 9/5-9/8 | Flooding | Mexico | 13 | Hundreds+ | Unknown |
| 9/6 | Earthquake | Guatemala | 1 | 500+ | Millions+ |
| 9/10-9/11 | TS Gabrielle | Bermuda | 0 | Unknown | Unknown |
| 9/13-9/17 | HU Ingrid | Mexico | 23 | 10,000+ | 1.5+ billion |
| 9/13-9/20 | HU Manuel | Mexico | 169 | 35,000+ | 4.2+ billion |
| 11/28-12/1 | Flooding | Cuba | 2 | 1,000+ | Unknown |
| 12/1-12/3 | Winter Weather | Canada | 0 | Thousands+ | Millions+ |
| 12/20-12/23 | Winter Weather | Canada | 10 | Thousands+ | 100s of Millions+ |
| 12/24-12/25 | Flooding | Leeward Islands | 9 | 1,000+ | 10+ million |

**Exhibit 62: South America**

| Date(s) | Event | Location | Deaths | Structures / Claims | Economic Loss (USD) |
|---|---|---|---|---|---|
| 1/1-5/31 | Drought | Brazil | 0 | Unknown | 8.0+ billion |
| 1/1-1/20 | Flooding | Brazil | 4 | 10,000+ | Millions+ |
| 1/1-2/20 | Flooding | Peru | 31 | 12,000+ | Unknown |
| 1/24 | Flooding | Ecuador | 10 | Dozens+ | Unknown |
| 1/28-2/15 | Flooding | Bolivia | 24 | 582+ | 2.5+ million |
| 1/30 | Earthquake | Chile | 1 | Hundreds+ | Unknown |
| 2/9 | Earthquake | Colombia | 0 | 4,050+ | 4.0+ million |
| 2/21-2/22 | Wildfire | Chile | 0 | 100+ | Unknown |
| 3/15-3/18 | Flooding | Colombia | 0 | 11,200+ | Unknown |
| 3/17-3/18 | Flooding | Brazil | 30 | 1,000+ | 1.5+ million |
| 4/2-4/4 | Flooding | Argentina | 86 | 105,000+ | 1.3+ billion |
| 4/23 | Flooding | Ecuador | 14 | Dozens+ | Unknown |
| 6/20-7/19 | Flooding | Paraguay, Argentina, Brazil | 0 | 13,000+ | Unknown |
| 7/16 | Earthquake | Peru | 0 | 691+ | Millions+ |
| 8/24-8/31 | Winter Weather | Bolivia, Peru, Paraguay | 15 | Thousands+ | Millions+ |
| 9/10-9/30 | Winter Weather | Chile | 0 | Unknown | 1.15+ billion |
| 9/21-9/22 | Severe Weather | Brazil, Paraguay | 4 | 20,000+ | 115+ million |
| 9/23 | Flooding | Bolivia | 19 | Unknown | Unknown |
| 9/25 | Earthquake | Peru | 0 | 1,411+ | Unknown |
| 11/15-12/1 | Flooding | Colombia | 7 | 13,000+ | Millions+ |
| 12/3 | Severe Weather | Argentina | 4 | Hundreds+ | Millions+ |
| 12/7-12/11 | Flooding | Brazil | 19 | 1,000+ | Millions+ |
| 12/15-12/31 | Flooding | Brazil | 45 | 15,000+ | 100s of Millions+ |

**Exhibit 63: Europe**

| Date(s) | Event | Location | Deaths | Structures / Claims | Economic Loss (USD) |
|---|---|---|---|---|---|
| 1/17-1/22 | Winter Weather | Western Europe | 7 | 7,000+ | 715+ million |
| 1/28 | Flooding | Turkey | 7 | Unknown | Unknown |
| 2/15 | Meteor Explosion | Russia | 0 | 108,000+ | 33+ million |
| 2/22 | Flooding | Greece | 1 | 1,000+ | Millions+ |
| 2/24-2/26 | Flooding | Macedonia, Serbia | 1 | 2,000+ | Millions+ |
| 3/12-3/31 | Winter Weather | West/Central/East Europe | 30 | 150,000+ | 1.8+ billion |
| 3/14 | Severe Weather | Azores | 3 | 500+ | 45+ million |
| 4/23 | Earthquake | Hungary | 0 | 600+ | Unknown |
| 5/3 | Severe Weather | Italy | 0 | 5,000+ | 13.1+ million |
| 5/11-5/14 | Severe Weather | Turkey | 3 | 1,000+ | Unknown |
| 5/12 | Severe Weather | Armenia | 0 | 12,800+ | 61+ million |
| 5/22 | Severe Weather | Russia | 0 | 250+ | 3.2+ million |
| 5/30-6/15 | Flooding | Central Europe | 25 | 150,000+ | 22+ billion |
| 6/18-6/19 | Severe Weather | France, Spain | 3 | 100,000+ | 1.25+ billion |
| 6/20-6/21 | Severe Weather | Switzerland | 0 | 25,000+ | 250+ million |
| 7/19 | Flooding | Georgia | 0 | 3,800+ | Unknown |
| 7/27-7/28 | Severe Weather | Germany, France | 0 | 750,000+ | 4.25+ billion |
| 8/4-8/7 | Severe Weather | Central/Western Europe | 0 | 50,000+ | 500+ million |
| 8/4-8/31 | Flooding | Russia | 0 | 11,500+ | 1.0+ billion |
| 9/11-9/15 | Flooding | Romania | 9 | 2,000+ | 11+ million |
| 9/14-9/15 | Flooding | Ukraine | 2 | Hundreds+ | 21+ million |
| 10/27-10/29 | WS Christian | Western/Northern Europe | 18 | Thousands+ | 2.0+ billion |
| 11/17-11/20 | Flooding | Saudi Arabia, Iraq | 22 | 10,000+ | Millions+ |
| 11/18-11/19 | Flooding | Italy | 18 | Hundreds+ | 140+ million |
| 12/4-12/7 | WS Xaver | Northern Europe | 15 | Thousands+ | 1.5+ billion |
| 12/11-12/14 | Winter Weather | Middle East | 10 | 10,000+ | 500+ million |
| 12/23-12/25 | WS Dirk | Western/Northern Europe | 6 | Thousands+ | Millions+ |

**Exhibit 64: Africa**

| Date(s) | Event | Location | Deaths | Structures / Claims | Economic Loss (USD) |
|---|---|---|---|---|---|
| 1/1-8/31 | Drought | Namibia | 0 | Unknown | 64+ million |
| 1/10-2/28 | Flooding | Southern Africa | 175 | 125,000+ | 525+ million |
| 1/10-3/31 | Flooding | Namibia | 0 | 12,000+ | Unknown |
| 1/27-2/2 | CY Felleng | Madagascar, Seychelles | 18 | 9,965+ | 10+ million |
| 2/13 | Flooding | Mauritius | 0 | 1,500+ | 30+ million |
| 2/20-2/23 | CY Haruna | Madagascar | 26 | 16,449+ | 25+ million |
| 3/4 | Severe Weather | Central African Republic | 0 | 1,314+ | Unknown |
| 3/30 | Flooding | Mauritius | 11 | Thousands+ | Millions+ |
| 3/1-4/30 | Flooding | Ghana | 5 | 10,000+ | Unknown |
| 3/10-4/30 | Flooding | Kenya | 66 | 35,000+ | 36+ million |
| 4/6-4/7 | Flooding | Angola | 9 | 1,000+ | Unknown |
| 4/10-4/30 | Flooding | Ethiopia | 0 | 5,256+ | 2.2+ million |
| 5/1-5/5 | Flooding | Uganda | 10 | 5,000+ | 3.1+ million |
| 6/1 | Severe Weather | South Africa | 3 | 547+ | Unknown |
| 7/17 | Earthquake | Algeria | 0 | Thousands+ | Unknown |
| 7/15-8/19 | Flooding | Niger | 20 | 15,000+ | Unknown |
| 8/1-8/4 | Flooding | Sudan | 73 | 40,000+ | 7.0+ million |
| 8/9 | Flooding | Nigeria | 1 | 1,000+ | Unknown |
| 8/28 | Flooding | Mali | 55 | 1,000+ | Unknown |
| 8/5-9/25 | Flooding | Mauritania | 8 | 1,000+ | Millions+ |
| 9/20-11/30 | Flooding | Somalia | 0 | 30,000+ | Unknown |
| 11/9 | TS Three | Somalia | 440+ | 10,000+ | Millions+ |
| 11/28 | Severe Weather | South Africa | 0 | 40,000+ | 300+ million |

**Exhibit 65: Asia**

| Date(s) | Event | Location | Deaths | Structures / Claims | Economic Loss (USD) |
|---|---|---|---|---|---|
| 1/1-1/20 | Winter Weather | India, Bangladesh, Nepal | 389 | Unknown | Unknown |
| 1/1-8/31 | Drought | China | 0 | Unknown | 10+ billion |
| 1/3-1/9 | Winter Weather | China | 0 | 7,500+ | 204+ million |
| 1/6-1/9 | Winter Weather | Middle East | 11 | 5,000+ | 345+ million |
| 1/11 | Flooding | China | 46 | 63+ | 48+ million |
| 1/15-1/23 | Flooding | Philippines | 10 | 5,000+ | 2.8+ million |
| 1/17-1/18 | Winter Weather | India | 0 | Thousands+ | 185+ million |
| 1/20-1/27 | Flooding | Indonesia | 41 | 100,274+ | 3.31+ billion |
| 1/22 | Earthquake | Indonesia | 1 | 100+ | Unknown |
| 1/25-1/27 | Flooding | Sri Lanka | 1 | 2,164+ | Unknown |
| 1/27 | Flooding | Indonesia | 21 | 100+ | Unknown |
| 1/28 | Earthquake | Kazakhstan, China | 1 | 8,900+ | 29+ million |
| 2/15-2/22 | Flooding | Indonesia | 17 | 11,608+ | Millions+ |
| 2/18-2/20 | TD Two | Philippines | 5 | 5,000+ | 1.68+ million |
| 2/18-2/21 | Winter Weather | China | 2 | 2,700+ | 124+ million |
| 2/19-2/20 | Earthquakes | China | 0 | 3,271+ | 67+ million |
| 2/26-2/28 | Flooding | Indonesia | 3 | 3,000+ | Unknown |
| 2/23-3/3 | Winter Weather | Japan | 9 | 384+ | 14.2+ million |
| 3/3 | Earthquake | China | 0 | 85,542+ | 56+ million |
| 3/9-3/13 | Severe Weather | China | 1 | 46,650+ | 161+ million |
| 3/11 | Earthquake | China | 0 | 864+ | Unknown |
| 3/17-3/18 | Flooding | China | 0 | 7,000+ | 13+ million |
| 3/18-3/20 | Severe Weather | China | 25 | 279,600+ | 259+ million |
| 3/22 | Severe Weather | Bangladesh | 37 | 3,387+ | 20+ million |
| 3/25 | Flooding | Indonesia | 13 | 10+ | Unknown |
| 3/26-4/2 | Severe Weather | Vietnam | 1 | 25,000+ | 14.4+ million |
| 3/27 | Earthquake | Taiwan | 1 | 1,000+ | 1.0+ million |
| 3/29-3/30 | Severe Weather | China | 3 | 5,000+ | 26+ million |
| 3/29-3/30 | Severe Weather | Bangladesh, India | 11 | 5,004+ | Unknown |
| 4/6-4/9 | Severe Weather | Japan | 3 | 555+ | Unknown |
| 4/7-11 | Flooding | Indonesia | 11 | 22,830+ | Unknown |
| 4/9 | Earthquake | Iran | 40 | 3,100+ | 600+ million |
| 4/13 | Earthquake | Japan | 0 | 2,802+ | Unknown |

| Date(s) | Event | Location | Deaths | Structures / Claims | Economic Loss (USD) |
|---|---|---|---|---|---|
| 4/16 | Earthquake | Iran, Pakistan | 41 | 6,270+ | 50+ million |
| 4/17 | Earthquake | China | 0 | 16,109+ | 38+ million |
| 4/17-4/19 | Severe Weather | China | 2 | 57,100+ | 309+ million |
| 4/20 | Earthquake | China | 196 | 620,000+ | 14+ billion |
| 4/20-5/15 | Flooding | Maldives | 0 | 1,000+ | Unknown |
| 4/22 | Flooding | China | 11 | Unknown | Unknown |
| 4/23-4/24 | Flooding | Afghanistan | 24 | 2,500+ | Unknown |
| 4/24 | Earthquake | Afghanistan | 18 | 4,345+ | Unknown |
| 4/25 | Earthquake | China | 1 | 29,000+ | 47+ million |
| 4/28-5/1 | Severe Weather | China | 12 | 43,400+ | 154+ million |
| 5/1 | Earthquake | India | 3 | 70,000+ | 120+ million |
| 5/6-5/10 | Flooding | China | 19 | 51,000+ | 293+ million |
| 5/13-5/16 | CY Mahasen | Bangladesh, Myanmar, India | 72 | 151,000+ | 200+ million |
| 5/14-5/16 | Flooding | China | 55 | 60,000+ | 935+ million |
| 5/19-5/23 | Flooding | China | 12 | 20,000+ | 445+ million |
| 5/24-5/27 | Flooding | China | 12 | 40,000+ | 333+ million |
| 6/1 | Earthquake | Taiwan | 4 | 500+ | 1.1+ million |
| 6/1-6/3 | Earthquake | Philippines | 0 | 500+ | Unknown |
| 6/1-8/31 | Flooding | Laos | 20 | 20,000+ | 60+ million |
| 6/5-6/8 | Flooding | China | 15 | 5,000+ | 277+ million |
| 6/8-6/10 | Severe Weather | Sri Lanka | 58 | 4,295+ | Millions+ |
| 6/14-6/18 | Flooding | India, Nepal | 6,748 | 25,000+ | 1.91+ billion |
| 6/14-6/21 | Flooding | China | 11 | 56,100+ | 555+ million |
| 6/21-6/23 | TS Bebinca | China, Vietnam | 0 | 1,000+ | 45+ million |
| 6/23-6/25 | Severe Weather | China | 11 | 10,000+ | 118+ million |
| 6/29-7/3 | Flooding | China | 55 | 125,000+ | 1.4+ billion |
| 6/29-7/2 | TY Rumbia | China, Philippines | 7 | 4,500+ | 178+ million |
| 7/1-7/31 | Flooding | North Korea | 33 | 6,000+ | Unknown |
| 7/1-8/31 | Flooding | Nepal | 138 | 10,000+ | Unknown |
| 7/2 | Earthquake | Indonesia | 39 | 20,333+ | 134+ million |
| 7/7-7/17 | Flooding | China | 125 | 375,000+ | 4.5+ billion |
| 7/9-7/10 | Flooding | India | 174 | Thousands+ | Millions+ |
| 7/13-7/15 | STY Soulik | China, Taiwan | 9 | 10,000+ | 460+ million |
| 7/16-7/18 | TS Cimaron | China, Philippines | 1 | 10,000+ | 253+ million |
| 7/21-7/25 | Flooding | China | 36 | 143,700+ | 1.4+ billion |

| Date(s) | Event | Location | Deaths | Structures / Claims | Economic Loss (USD) |
|---|---|---|---|---|---|
| 7/22 | Earthquake | China | 95 | 80,000+ | 3.25+ billion |
| 7/25-7/28 | Flooding | Myanmar, Thailand | 13 | 20,000+ | 97+ million |
| 7/25-8/1 | Flooding | China | 10 | 25,000+ | 571+ million |
| 7/28 | Flooding | Japan | 5 | 5,863+ | Millions+ |
| 7/28-7/30 | Flooding | Vietnam | 5 | 1,000+ | 6.5+ million |
| 7/28-7/30 | Flooding | Indonesia | 12 | 1,628+ | Unknown |
| 8/1-8/9 | Flooding | Philippines | 11 | Hundreds+ | 36+ million |
| 8/2-8/4 | TS Jebi | China, Vietnam | 7 | 2,000+ | 21+ million |
| 8/3-8/15 | Flooding | Afghanistan | 68 | 1,400+ | Unknown |
| 8/3-9/30 | Flooding | Pakistan | 234 | 79,208+ | 2.0+ billion |
| 8/4-8/8 | Flooding | China | 18 | 20,000+ | 490+ million |
| 8/5-11/30 | Flooding | Cambodia | 188 | 377,354+ | 1.0+ billion |
| 8/9-9/5 | Flooding | China | 118 | 215,000+ | 5.0+ billion |
| 8/10-8/14 | Flooding | Afghanistan | 31 | 500+ | Unknown |
| 8/12-8/15 | STY Utor | China, Philippines | 86 | 126,053+ | 2.6+ billion |
| 8/14-9/4 | Flooding | Yemen | 43 | 10,000+ | Unknown |
| 8/18-8/21 | Flooding | Philippines | 27 | Thousands+ | 2.2+ billion |
| 8/19-8/21 | Flooding | China | 43 | 51,000+ | 457+ million |
| 8/21-8/23 | TY Trami | China, Taiwan | 2 | 11,100+ | 406+ million |
| 8/23-8/26 | Flooding | Japan | 2 | 1,861+ | Millions+ |
| 8/22-8/27 | Flooding | India | 73 | 5,000+ | Unknown |
| 8/23-8/27 | Flooding | China | 12 | 9,000+ | 278+ million |
| 8/27-8/31 | TS Kong-rey | Philippines, Taiwan, Japan | 4 | 1,000+ | 25+ million |
| 8/31 | Earthquake | China | 3 | 107,600+ | 155+ million |
| 9/1-10/31 | Flooding | Thailand | 80 | 35,000+ | 482+ million |
| 9/2-9/4 | Severe Weather | Japan | 0 | 1,518+ | Millions+ |
| 9/3-9/4 | Flooding | Vietnam | 29 | Hundreds+ | Unknown |
| 9/3-9/5 | TS Toraji | Japan | 1 | 1,439+ | Millions+ |
| 9/10 | Flooding | Afghanistan | 24 | 500+ | Unknown |
| 9/16-9/17 | TS Man-yi | Japan | 6 | 11,919+ | Millions+ |
| 9/16-9/18 | Flooding | China | 17 | 30,000+ | 343+ million |
| 9/16-9/18 | TD 18 | Vietnam, Laos | 13 | 15,000+ | 61+ million |
| 9/20-9/23 | STY Usagi | China, Philippines, Taiwan | 47 | 105,000+ | 3.8+ billion |
| 9/23-9/27 | Flooding | Philippines | 33 | 1,000+ | 4.0+ million |
| 9/24 & 9/28 | Earthquake | Pakistan | 825 | 47,000+ | 100+ million |

| Date(s) | Event | Location | Deaths | Structures / Claims | Economic Loss (USD) |
|---|---|---|---|---|---|
| 9/29-10/2 | TY Wutip | Vietnam, China | 33 | 250,000+ | 517+ million |
| 10/4-10/8 | Flooding | Philippines | 20 | 1,500+ | 3.2+ million |
| 10/5-10/8 | TY Fitow | China, Japan | 12 | 97,000+ | 10.4+ billion |
| 10/11-10/13 | CY Phailin | India | 46 | 430,000+ | 1.1+ billion |
| 10/11-10/15 | TY Nari | Philippines, Vietnam | 37 | 171,000+ | 153+ million |
| 10/14-10/16 | TY Wipha | Japan | 39 | 6,594+ | 100s of Millions |
| 10/15 | Earthquake | Philippines | 222 | 100,000+ | 163+ million |
| 10/19 | Flooding | Indonesia | 0 | 4,000+ | Unknown |
| 10/21-10/26 | Flooding | India | 72 | 75,000+ | 260+ million |
| 10/22 | Earthquake | Indonesia | 1 | 650+ | Unknown |
| 10/31 | TY Krosa | Philippines | 3 | 28,220+ | 5.0+ million |
| 11/7-11/10 | STY Haiyan | Philippines, Vietnam, China | 8,000 | 1.3+ million | 13+ billion |
| 11/15-11/20 | Flooding | Vietnam | 42 | 427,258+ | 72+ million |
| 11/21-11/23 | CY Helen | India | 10 | Thousands+ | 800+ million |
| 11/28 | Earthquake | Iran | 8 | 5,000+ | Unknown |
| 12/1-12/10 | Flooding | Malaysia | 4 | Thousands+ | Millions+ |
| 12/14-12/15 | Flooding | Indonesia | 4 | 16,850+ | Millions+ |
| 12/14-12/16 | Flooding | China | 0 | 15,000+ | 410+ million |
| 12/16 | Earthquake | China | 0 | 18,100+ | 6.3+ million |
| 12/16-12/17 | Winter Weather | Vietnam | 0 | Thousands+ | 2.0+ million |
| 12/28-12/31 | Flooding | Indonesia | 0 | 4,500+ | Millions+ |

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

| Date(s) | Event | Location | Deaths | Structures / Claims | Economic Loss (USD) |
|---|---|---|---|---|---|
| 1/1-5/10 | Drought | New Zealand | 0 | Unknown | 1.6+ billion |
| 1/1-1/17 | Wildfires | Australia (TAS, NSW, VIC) | 1 | 3,500+ | 175+ million |
| 1/21-1/30 | Flooding | Australia (QLD, NSW) | 6 | 87,843+ | 2.5+ billion |
| 2/6 | Earthquake | Solomon Islands | 13 | 1,066+ | Millions+ |
| 2/22-2/24 | Severe Weather | Australia (NSW, QLD) | 1 | 6,000+ | 16+ million |
| 2/25-2/27 | CY Rusty | Australia (WA) | 0 | Unknown | Unknown |
| 3/21 | Severe Weather | Australia (VIC, NSW) | 0 | 1,198+ | 21+ million |
| 4/19-4/22 | Flooding | New Zealand | 0 | 1,500+ | 39+ million |
| 6/20-6/22 | Winter Weather | New Zealand | 0 | 9,500+ | 40+ million |
| 7/21 | Earthquake | New Zealand | 0 | 5,452+ | 50+ million |
| 8/3 | Severe Weather | Australia (South Australia) | 0 | 100+ | 9.1+ million |
| 8/16 | Earthquake | New Zealand | 0 | 5,903+ | 50+ million |
| 8/29-9/2 | Flooding | Solomon Islands | 0 | 2,055+ | Millions+ |
| 9/10-9/11 | Severe Weather | New Zealand | 0 | 2,000+ | 20+ million |
| 10/17-10/31 | Bushfires | Australia (NSW) | 2 | 1,632+ | 250+ million |
| 11/16 | Severe Weather | Australia (QLD, NSW) | 0 | Thousands+ | Millions+ |
| 11/18-11/23 | Severe Weather | Australia (QLD, NSW) | 0 | Thousands+ | Millions+ |
| 12/16 | Severe Weather | New Zealand | 0 | Thousands+ | Millions+ |
| 12/30-12/31 | CY Christine | Australia (WA) | 0 | Unknown | Unknown |

# 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 (2013 USD) totals were converted using the U.S. Consumer Price Index (CPI). Insured losses include those sustained by private industry and government entities such as the U.S. National Flood Insurance Program (NFIP).

For additional top 10 lists, please visit **aonbenfield.com/catastropheinsight**

**Exhibit 67: Top 10 Costliest Global Economic Loss Events ((1950-2013) (2013 USD))**

| Date(s) | Event | Location | Economic Loss[1] Actual (USD) | Economic Loss[2] (2013 USD) |
|---|---|---|---|---|
| March 11, 2011 | EQ/Tsunami | Japan | 210,000,000,000 | 218,400,000,000 |
| January 17, 1995 | Earthquake | Japan | 102,500,000,000 | 158,500,000,000 |
| August 2005 | Hurricane Katrina | United States | 125,000,000,000 | 147,900,000,000 |
| May 12, 2008 | Earthquake | China | 85,000,000,000 | 91,200,000,000 |
| Summer 1988 | Drought | United States | 40,000,000,000 | 80,300,000,000 |
| October 2012 | Hurricane Sandy | U.S., Caribbean, Bahamas, Canada | 72,000,000,000 | 72,300,000,000 |
| January 17, 1994 | Earthquake | United States | 44,000,000,000 | 69,900,000,000 |
| Summer 1980 | Drought | United States | 20,000,000,000 | 59,700,000,000 |
| November 23, 1980 | Earthquake | Italy | 18,500,000,000 | 50,300,000,000 |
| July - December 2011 | Flooding | Thailand | 45,000,000,000 | 46,300,000,000 |

[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 68: Top 10 Costliest Global Insured Loss Events ((1950-2013) (2013 USD))**

| Date(s) | Event | Location | Insured Loss[1] Actual (USD) | Insured Loss[2] (2013 USD) |
|---|---|---|---|---|
| August 2005 | Hurricane Katrina | United States | 66,900,000,000 | 79,200,000,000 |
| March 11, 2011 | EQ/Tsunami | Japan | 35,000,000,000 | 36,400,000,000 |
| October 2012 | Hurricane Sandy | U.S., Caribbean, Bahamas, Canada | 30,000,000,000 | 30,300,000,000 |
| August 1992 | Hurricane Andrew | U.S., Bahamas | 15,700,000,000 | 25,800,000,000 |
| January 17, 1994 | Earthquake | United States | 15,300,000,000 | 24,300,000,000 |
| Yearlong 2012 | Drought | United States | 20,000,000,000 | 20,300,000,000 |
| September 2008 | Hurricane Ike | United States | 15,200,000,000 | 16,300,000,000 |
| June - December 2011 | Flooding | Thailand | 15,500,000,000 | 15,900,000,000 |
| October 2005 | Hurricane Wilma | United States | 12,500,000,000 | 14,600,000,000 |
| February 22, 2011 | Earthquake | New Zealand | 13,500,000,000 | 14,200,000,000 |

[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 69: Top 10 Global Human Fatality Events (1950-2013)**

| Date(s) | Event | Location | Economic Loss[1] Actual (USD) | Insured Loss[2] Actual (USD) | Fatalities |
|---|---|---|---|---|---|
| November 1970 | Tropical Cyclone | Bangladesh | 90,000,000 | N/A | 300,000 |
| July 27, 1976 | Earthquake | China | 5,600,000,000 | N/A | 242,769 |
| December 26, 2004 | EQ/Tsunami | Indonesia | 14,000,000,000 | 3,000,000,000 | 227,898 |
| January 12, 2010 | Earthquake | Haiti | 8,000,000,000 | 100,000,000 | 222,570 |
| April 1991 | CY Gorky | Bangladesh | 2,000,000,000 | 100,000,000 | 138,866 |
| May 2008 | CY Nargis | Myanmar | 10,000,000,000 | N/A | 138,366 |
| August 1971 | Flooding | Vietnam | N/A | N/A | 100,000 |
| May 12, 2008 | Earthquake | China | 85,000,000,000 | 366,000,000 | 87,587 |
| October 8, 2005 | Earthquake | Pakistan | 5,200,000,000 | 50,000,000 | 86,000 |
| Summer 2003 | Drought/Heatwave | Europe | 13,500,000,000 | 1,100,000,000 | 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 ((1950-2013) (2013 USD))**

| Date(s) | Event | Location | Economic Loss[2] Actual (USD) | Economic Loss[2] (2013 USD) |
|---|---|---|---|---|
| August 2005 | Hurricane Katrina | Southeast | 125,000,000,000 | 147,900,000,000 |
| Summer 1988 | Drought | Nationwide | 40,000,000,000 | 80,300,000,000 |
| January 17, 1994 | Earthquake | California | 44,000,000,000 | 69,900,000,000 |
| October 2012 | Hurricane Sandy | Eastern U.S. | 68,000,000,000 | 68,300,000,000 |
| Summer 1980 | Drought | Nationwide | 20,000,000,000 | 59,700,000,000 |
| August 1992 | Hurricane Andrew | Southeast | 27,000,000,000 | 44,500,000,000 |
| Yearlong 2012 | Drought | Nationwide | 35,000,000,000 | 35,000,000,000 |
| June - August 1993 | Flooding | Midwest, Mississippi Valley | 21,000,000,000 | 33,800,000,000 |
| September 2008 | Hurricane Ike | Texas, Midwest, Northeast | 27,000,000,000 | 28,700,000,000 |
| October 2005 | Hurricane Wilma | Florida | 16,000,000,000 | 18,700,000,000 |

[1] Economic loss include those sustained from direct damages, plus additional directly attributable event costs
[2] Adjusted using U.S. Consumer Price Index (CPI)

# 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 (1950-2013)**

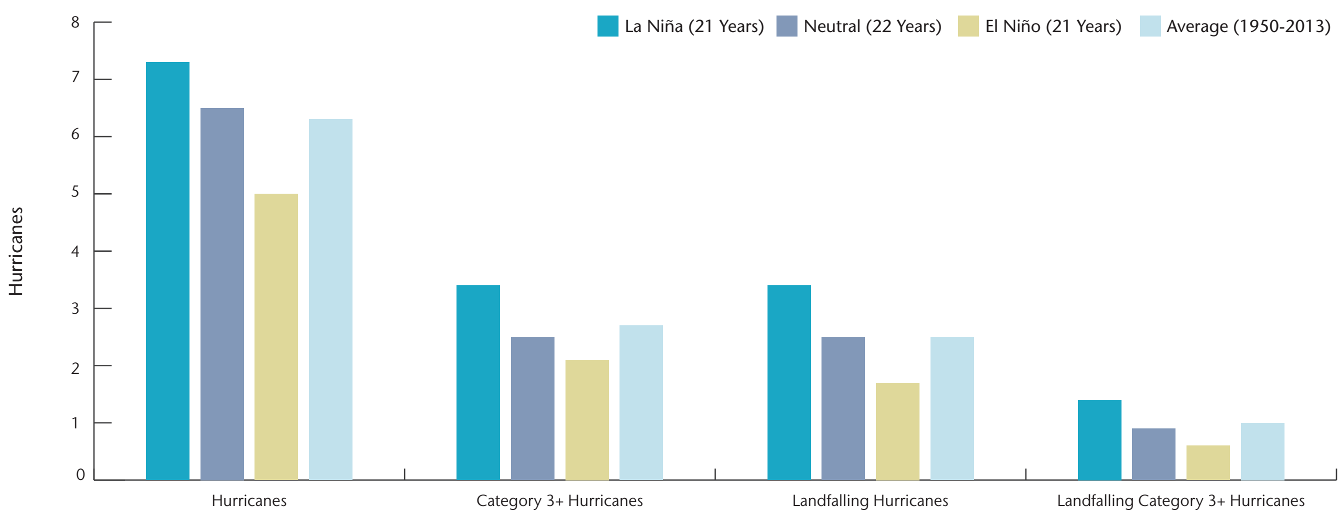



**Exhibit 72: Atlantic Basin Hurricane Frequency by AMO Phase (1950-2013)**

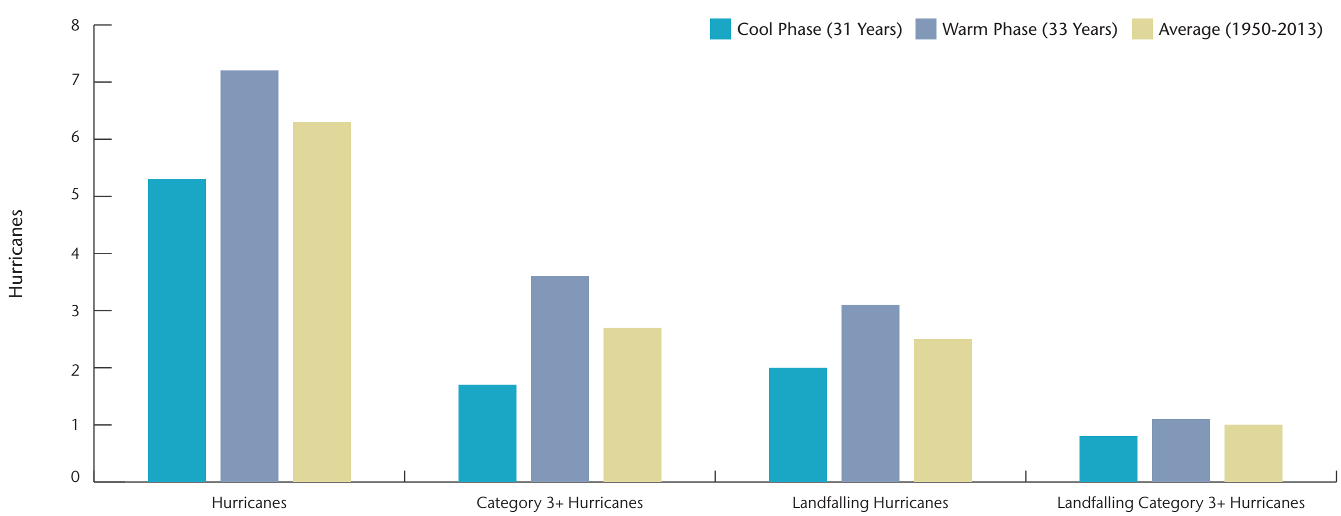


**Exhibit 73: United States Hurricane Landfall Frequency by ENSO Phase (1950-2013)**

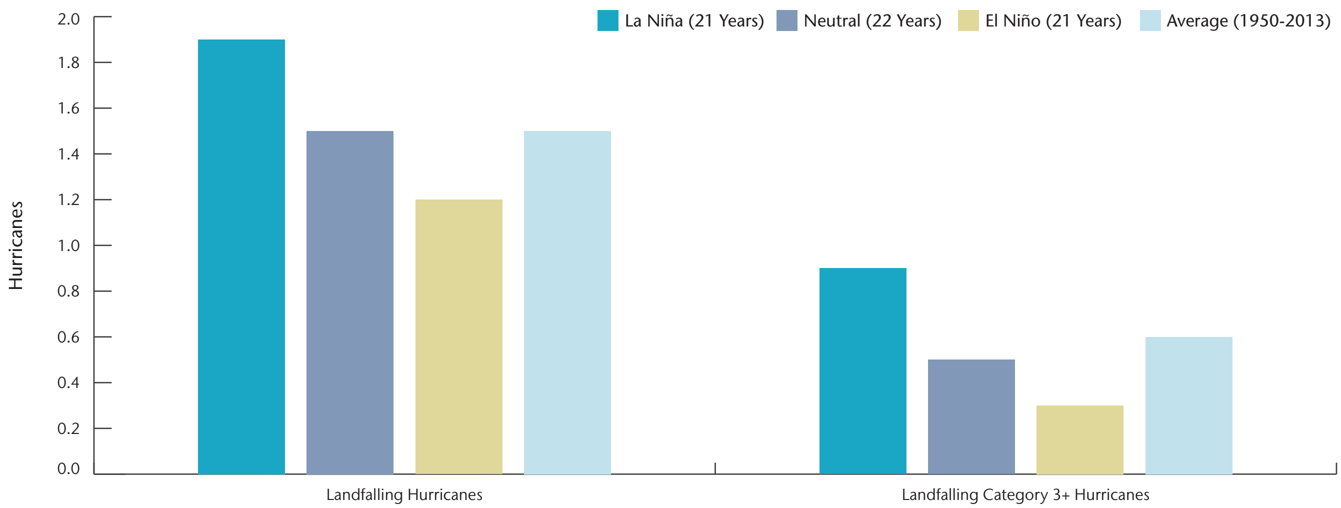
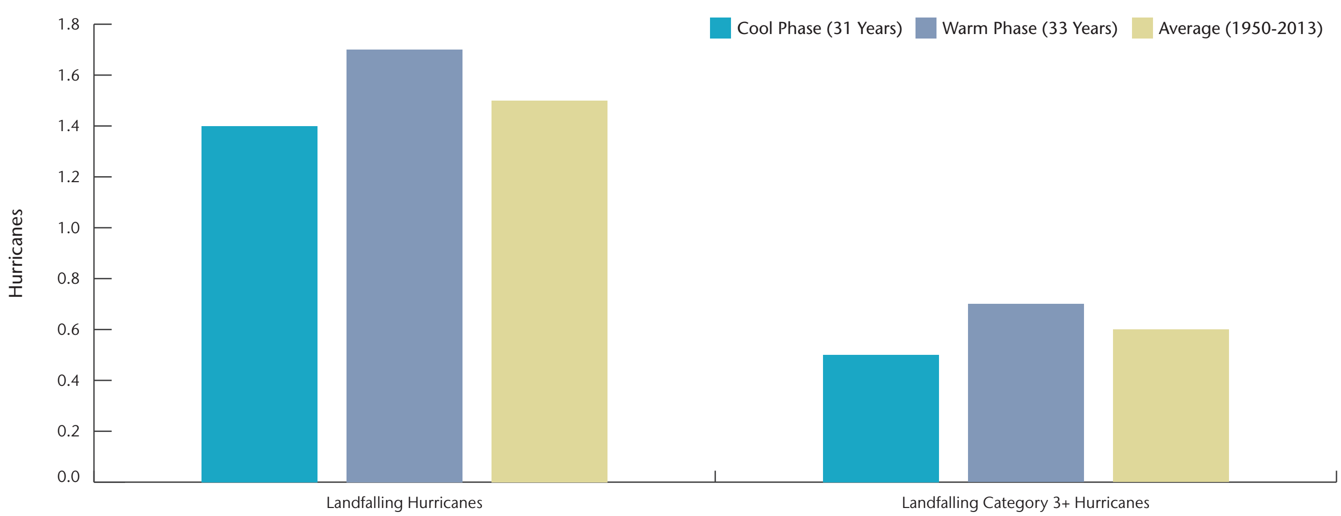
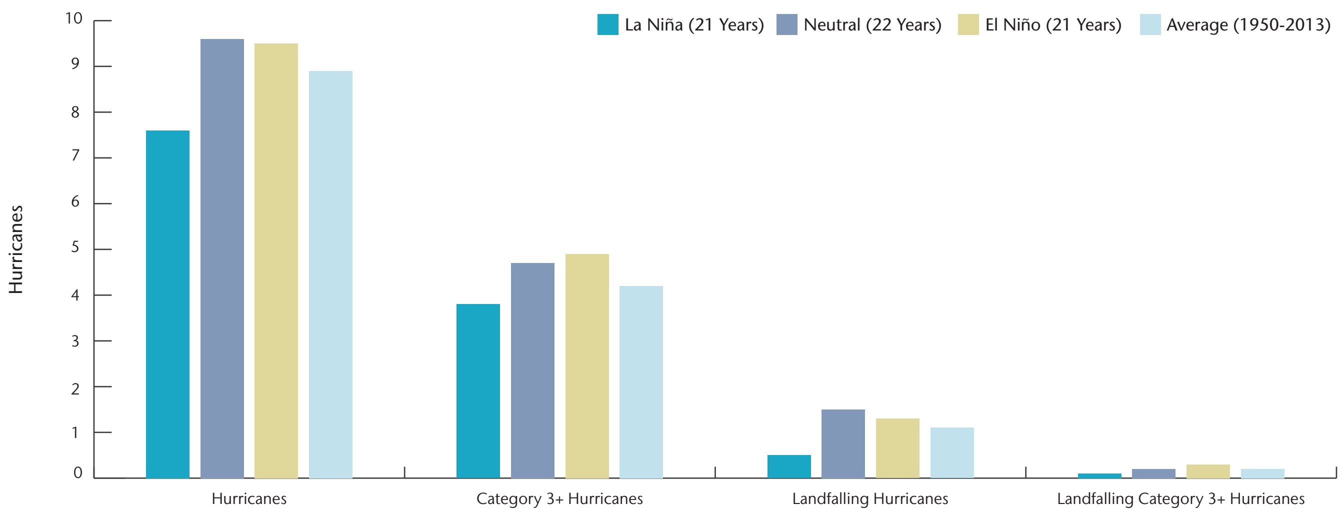



**Exhibit 74: United States Hurricane Landfall Frequency by AMO Phase (1950-2013)**



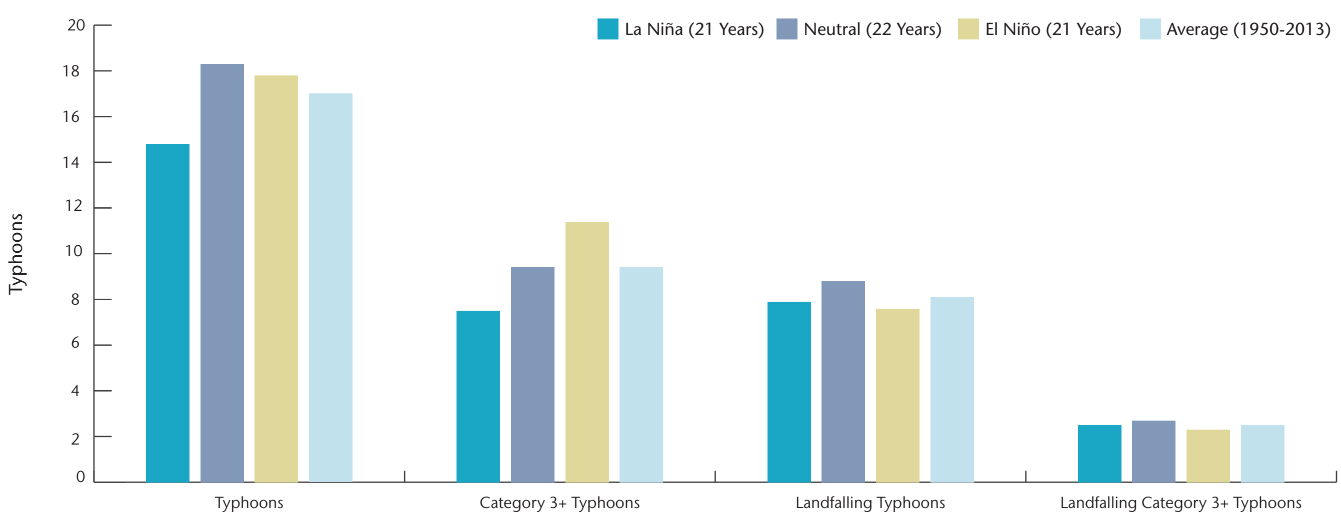
## Eastern Pacific Ocean Basin

**Exhibit 75: Eastern & Central Pacific Basin Hurricane Frequency by ENSO Phase (1980-2013)**



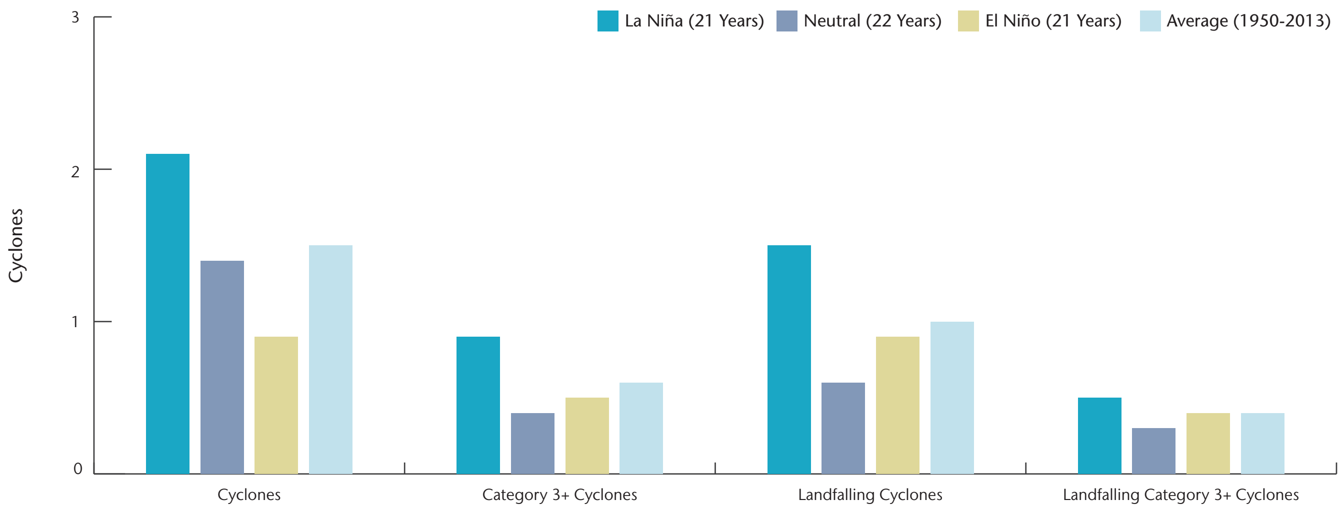

## Western Pacific Ocean Basin

**Exhibit 76: Western Pacific Basin Typhoon Frequency by ENSO Phase (1950-2013)**



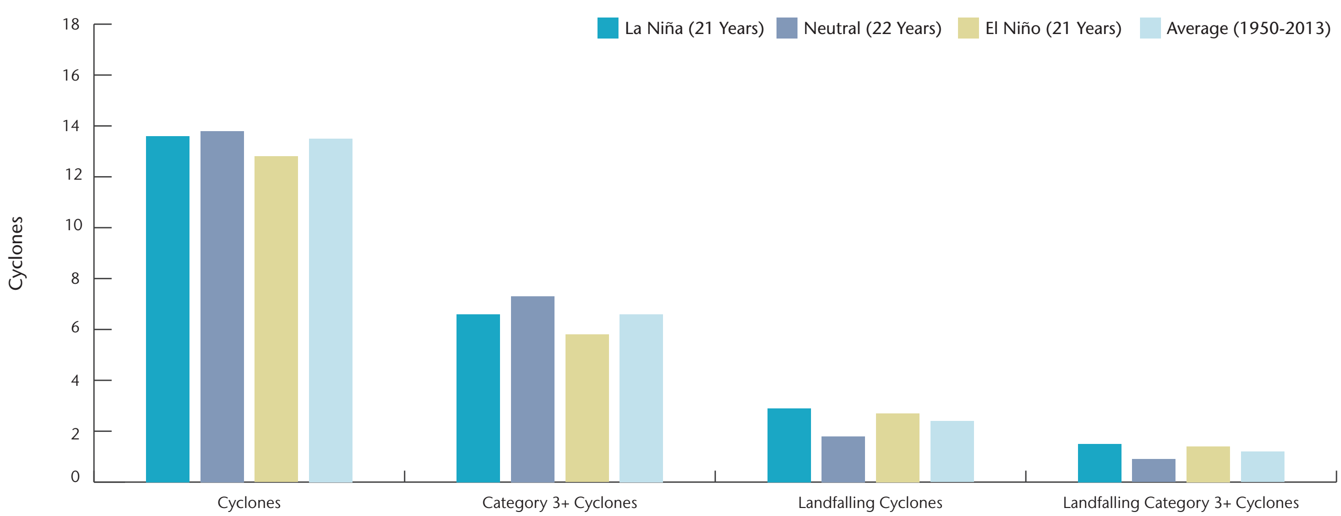
## North Indian Ocean Basin

**Exhibit 77: North Indian Basin Cyclone Frequency by ENSO Phase (1980-2013)**




## Southern Hemisphere

**Exhibit 78: Southern Hemisphere Cyclone Frequency by ENSO Phase (1980-2013)**



# 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 (1950-2013)**

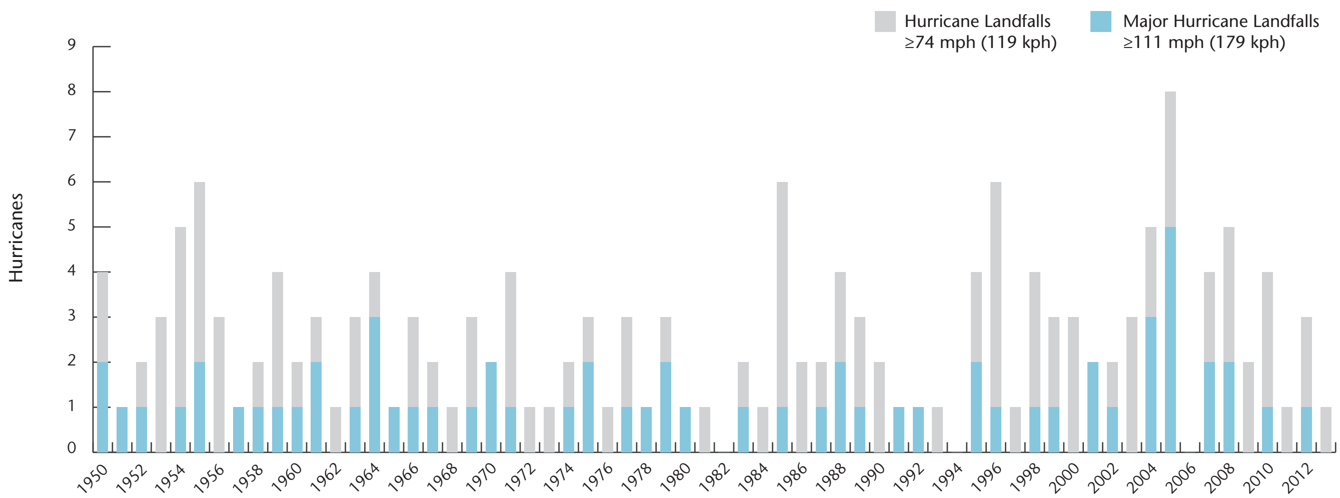



**Exhibit 80: United States Hurricane Landfalls (1950-2013)**

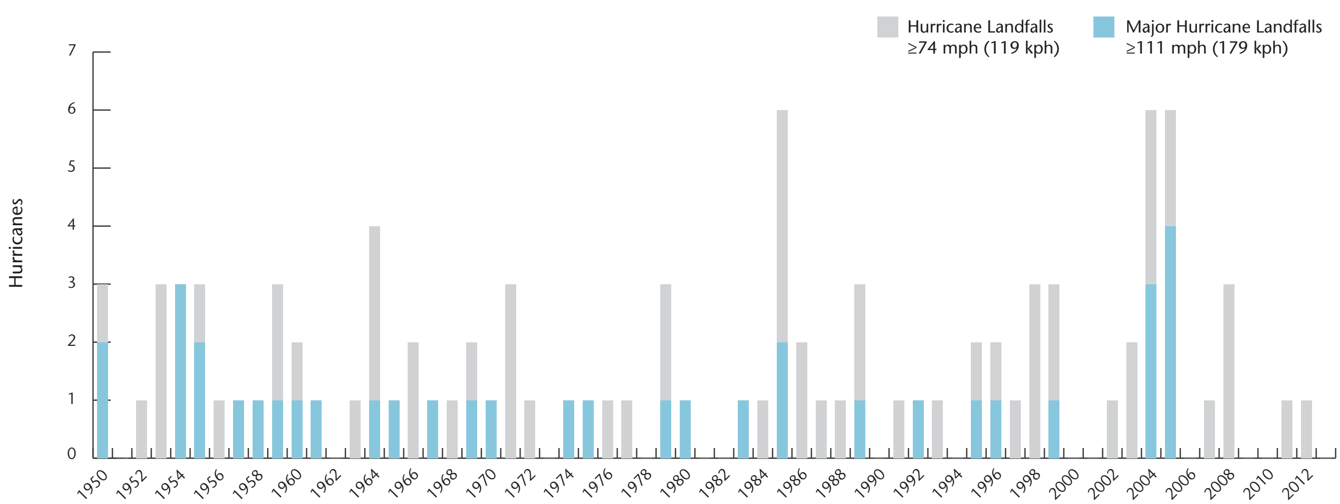


**Exhibit 81: Eastern Pacific Ocean Basin Hurricane Landfalls (1980-2013)**

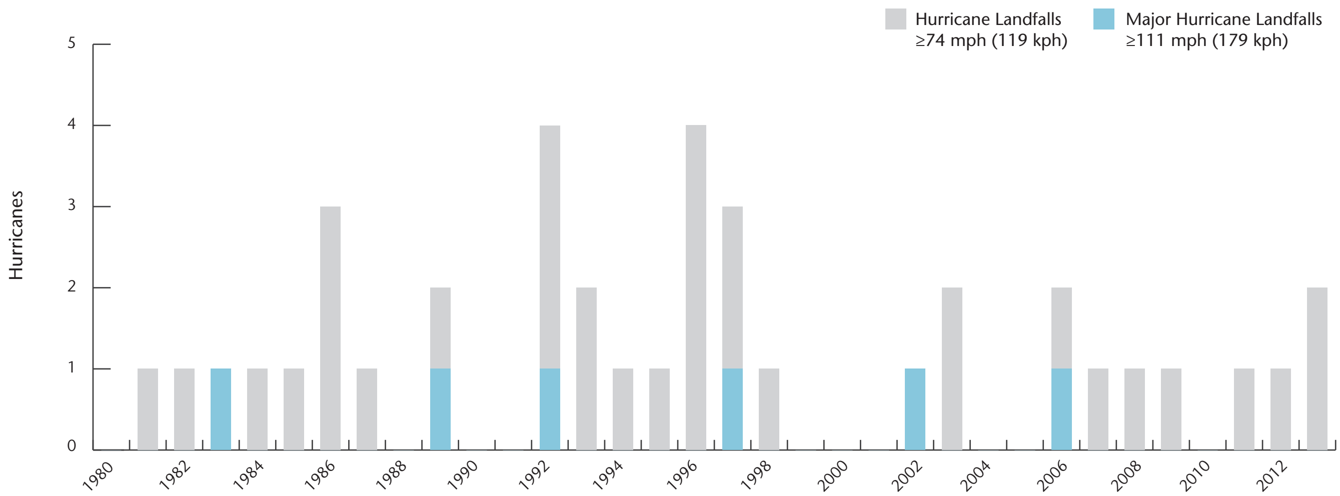



**Exhibit 82: Western Pacific Ocean Basin Typhoon Landfalls (1950-2013)**

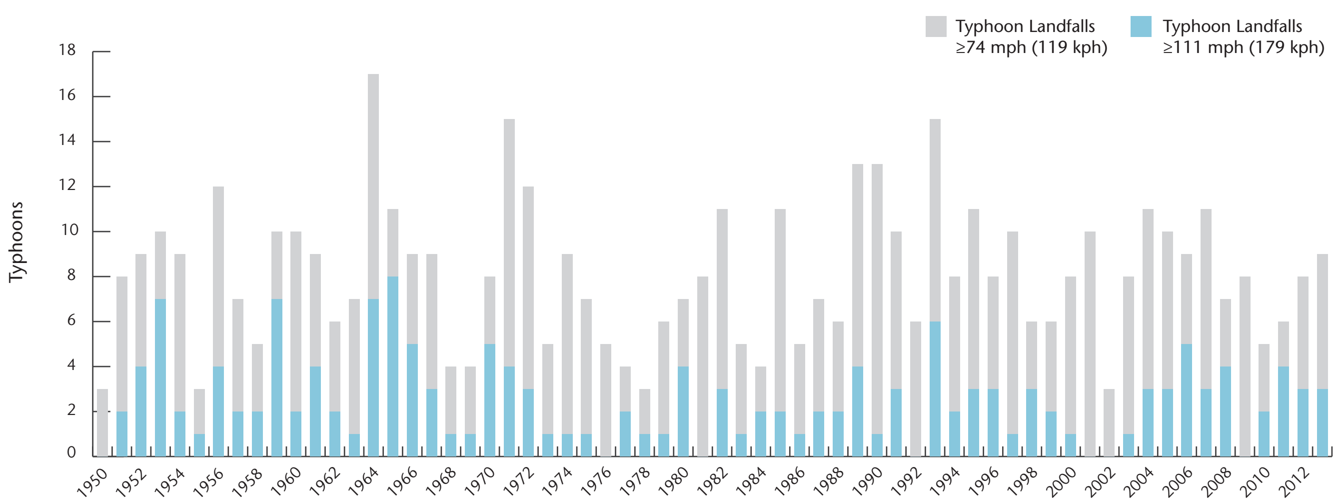


**Exhibit 83: North Indian Ocean Basin Cyclone Landfalls (1980-2013)**

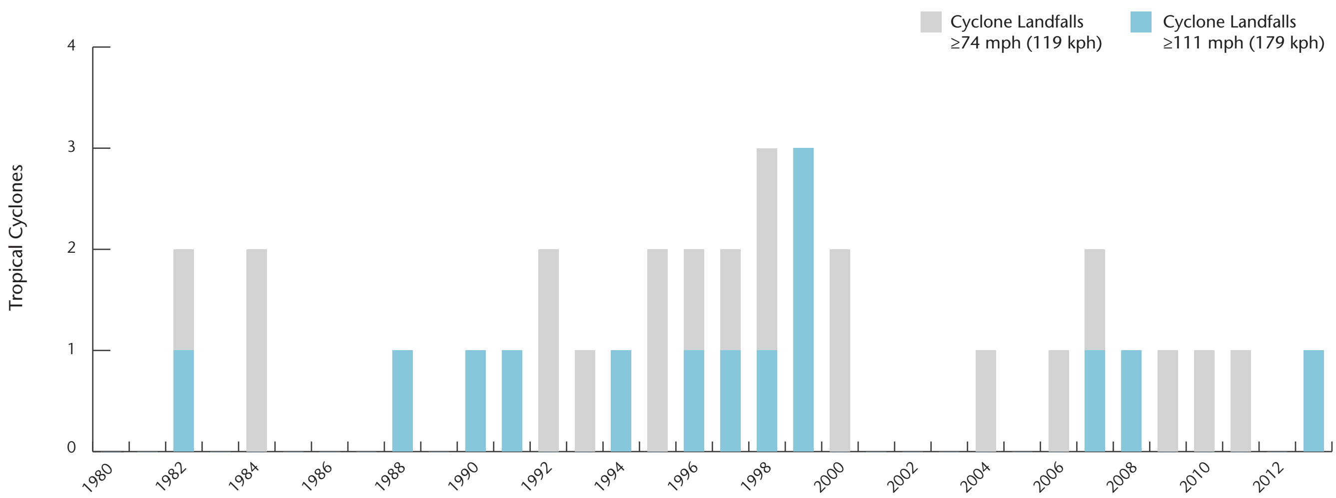
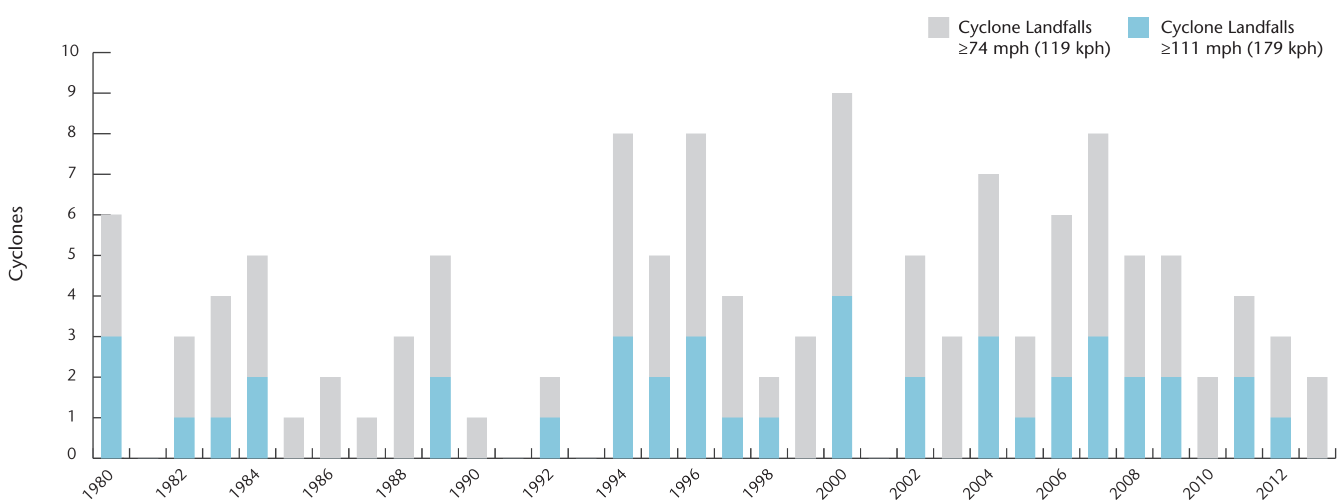



**Exhibit 84: Southern Hemisphere Cyclone Landfalls (1980-2013)**



# Appendix E: United States Tornado Frequency Data

The following shows a breakdown of U.S. tornado frequency activity 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/EF-0 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/EF-3 strength. When trying to determine potential tornado frequency trends, a more accurate method is to use tornadoes with F1/EF-1 intensity or greater given the larger confidence level in data collection of such twisters (as opposed to F0/EF-0).

**Exhibit 85: All U.S. Tornadoes (1950-2013)**

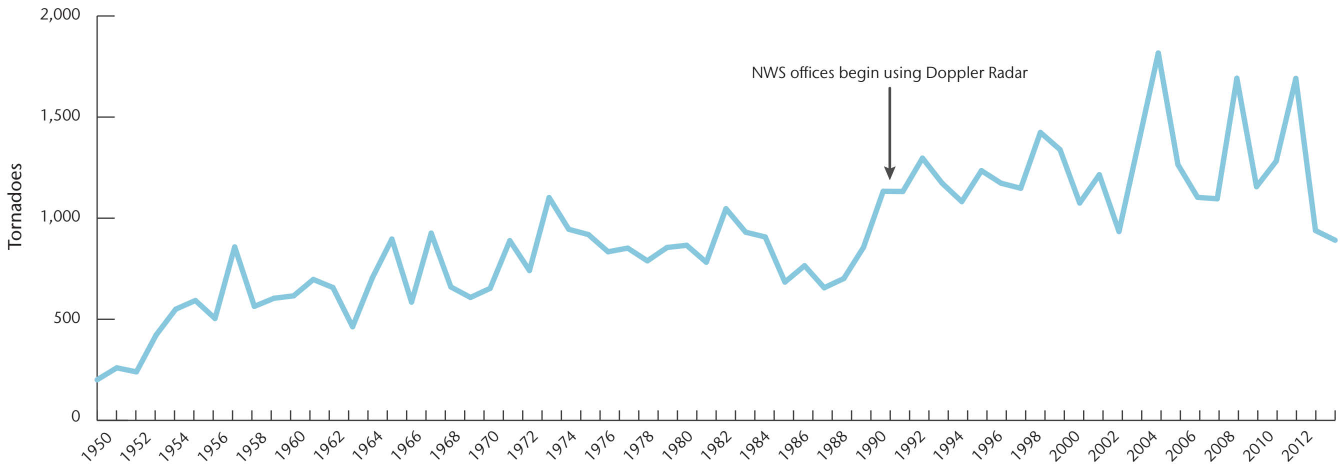
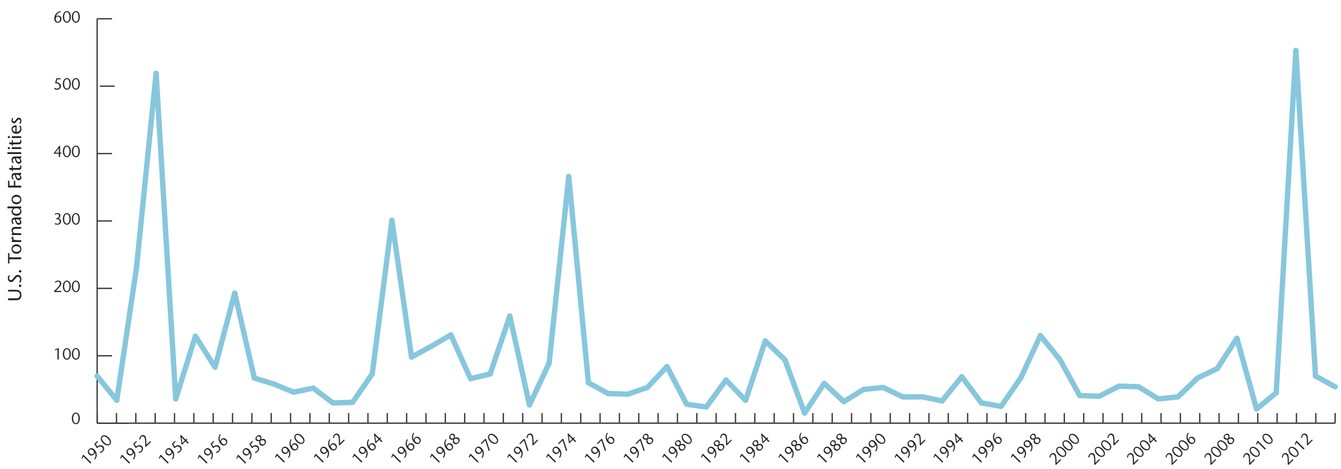
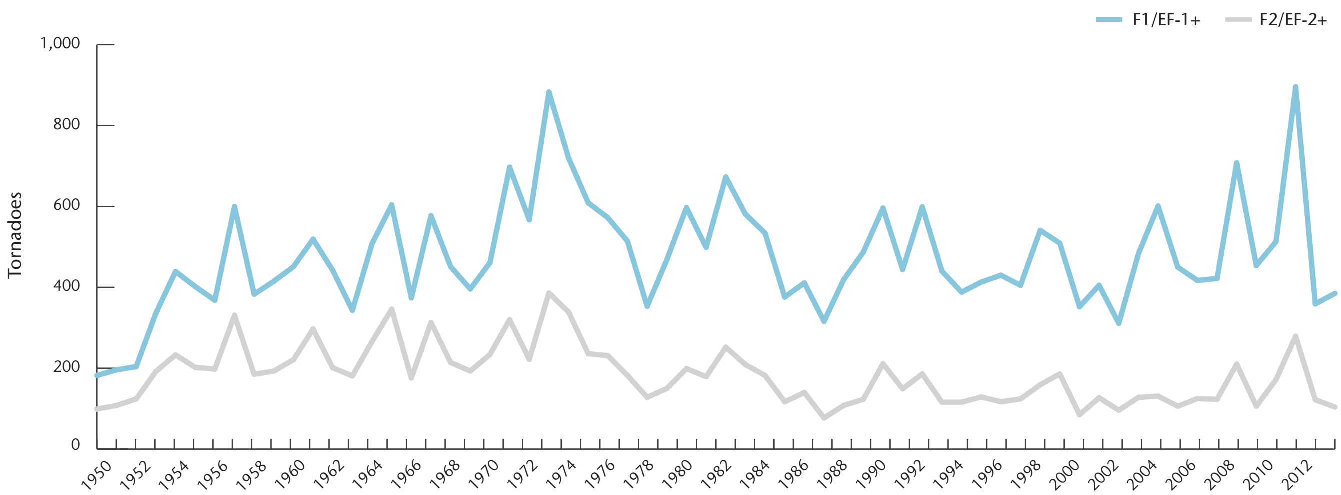



**Exhibit 86: U.S. Tornado Fatalities (1950-2013)**



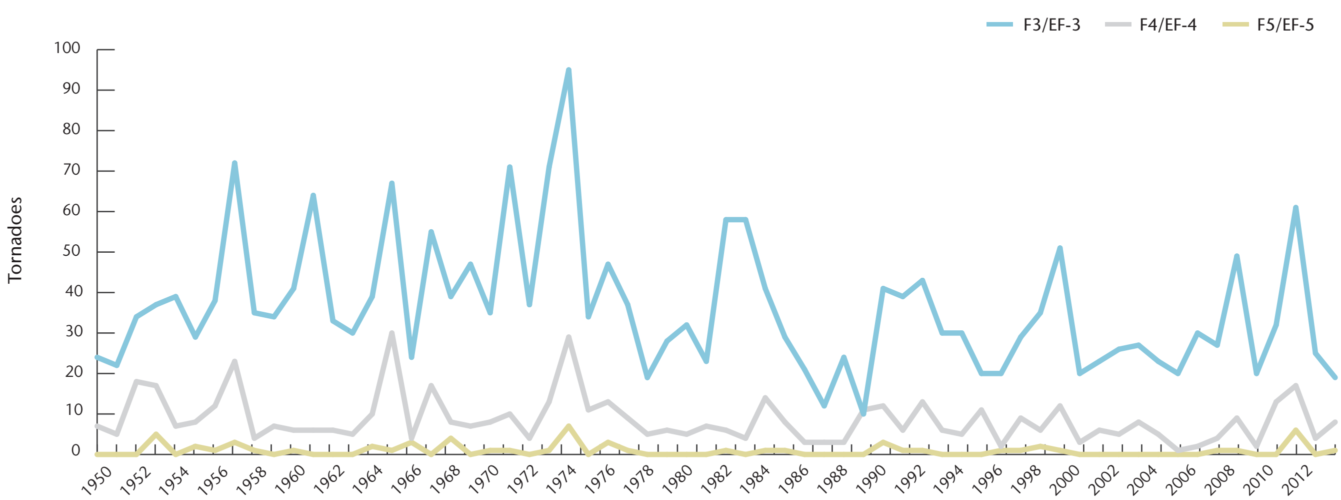
Since 1950, the overall trend of tornadoes rated at F1/EF-1 and above has remained nearly flat with a minimal 0.4% annual growth. Dependable data since the advent of the Doppler-era in 1990 shows a similar flat annual growth trend at just 0.2%. When breaking down data to just the last 10 years, there has been a slight downward trend of 1.0%.

**Exhibit 87: U.S. Tornadoes by Rating ((F1/EF-1+, F2/EF-2+) (1950-2013))**




Since 1950, the overall trend of higher-end tornadoes rated at F3/EF-3 and above has remained nearly flat and shows a slight annual decrease of 0.8%. The same 0.8% 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 slight upward trend of 4.4%.

**Exhibit 88: U.S. Tornadoes by Rating ((F3/EF-3+, F4/EF-4+, F5/EF-5) (1950-2013))**



Given the level of tornadic activity in recent years across the United States, there has been an increased interest in attempting to determine whether certain atmospheric phases can be used to correlate seasonal patterns. The following exhibits analyze U.S. 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/EF-3 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/EF-1+, F2/EF-2+) (1950-2013))**

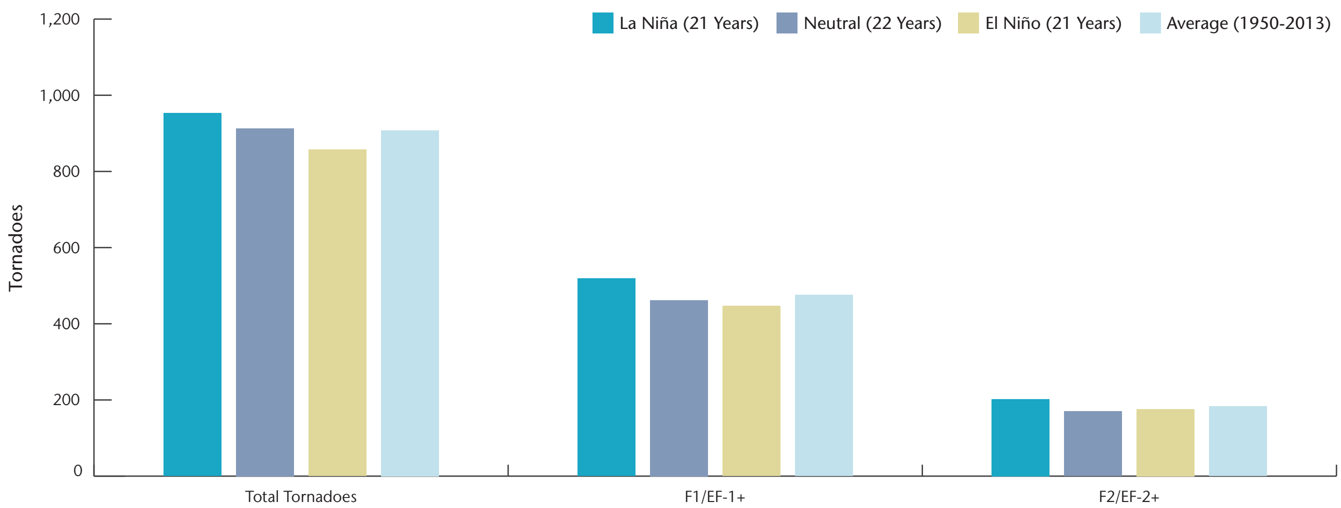
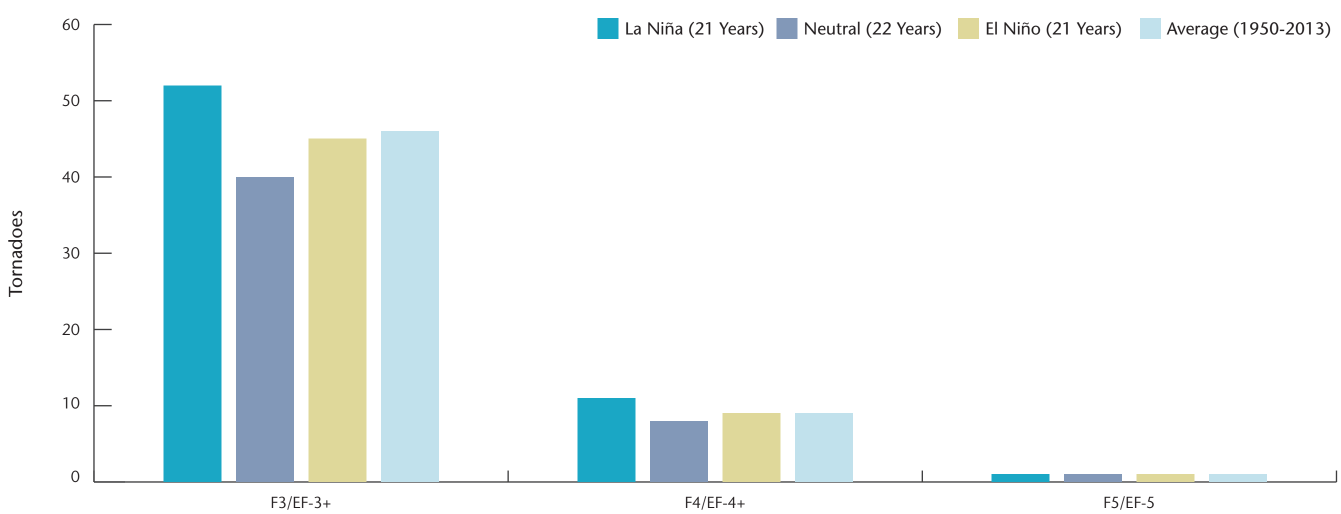



**Exhibit 90: U.S. Tornado Frequency by ENSO Phase ((F3/EF-3+, F4/EF-4+, F5/EF-5) (1950-2013))**



# 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). As to be expected, 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 Burn Frequency (1960-2013)**

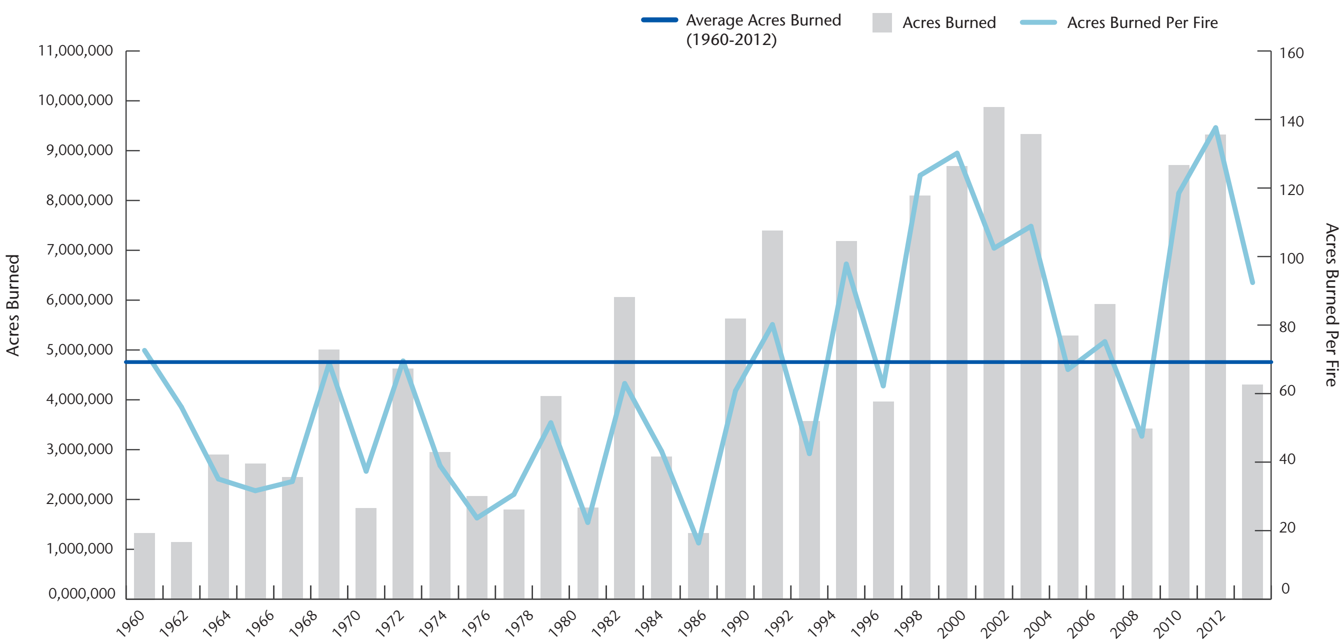
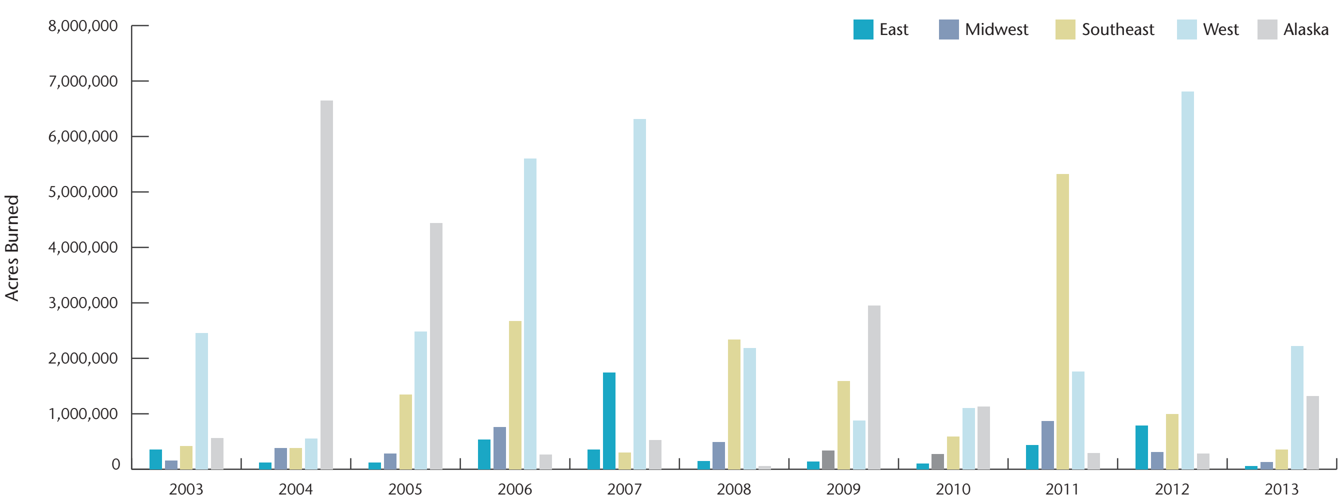



**Exhibit 92: U.S. Wildfire Burn Frequency by Region (2003-2013)**



**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. Insured losses are defined as any economic loss covered by insurance.

# Contact Information

**Bryon Ehrhart**
CEO of Aon Benfield Americas
Chairman of Aon Benfield Analytics
Chairman of Aon Benfield Securities
1.312.381.5350
bryon.ehrhart@aonbenfield.com

**Adam Podlaha**
Head of Impact Forecasting
Impact Forecasting
44.0.20.7522.3820
adam.podlaha@aonbenfield.com

**Stephen Mildenhall**
Global CEO of Analytics
Aon Analytics and Innovation Center
+65 6231 6481
stephen.mildenhall@aon.com

**Steve Bowen**
Senior Scientist/Meteorologist
Impact Forecasting
1.312.381.5883
steven.bowen@aonbenfield.com

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**Impact Forecasting**
200 E. Randolph Street
Chicago, Illinois 60601
t +1.312.381.5300
f +1.312.381.0160
impactforecasting.com


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