OCTOBER 2023 | Q3

Gallagher Re

Natural Catastrophe Report

Preliminary Overview

Global Overview

Annual Insured Losses from Natural Catastrophes on Track to Surpass USD100 Billion-Plus as US Events Continue to Dominate

Preliminary YTD Q1–Q3 Global Loss Totals: Economic (USD290 billion) and Insured (USD93 billion)

An active and impactful first three quarters of 2023 (January–September) had resulted in elevated natural catastrophe losses for the globe. Total economic losses were estimated at USD290 billion. The portion of this total resulting from weather-/climate-related events was USD237 billion. For the insurance industry, the overall tally rose to USD93 billion with more than USD86 billion tied to weather/climate events. This puts 2023 on track to become the sixth year since 2017 to exceed USD100 billion in annual insured losses. The decadal average (2013–2022) is USD112 billion, which signifies that a USD100 billion-plus year has become a 'new normal' for public and private insurance entities. The USD197 billion (68%) insurance protection gap again highlights how much opportunity exists to better prepare global citizens for natural catastrophe risk. While this is most urgent in countries with emerging and developing economies, there are large gaps which exist in even the most mature insurance markets with individual perils.

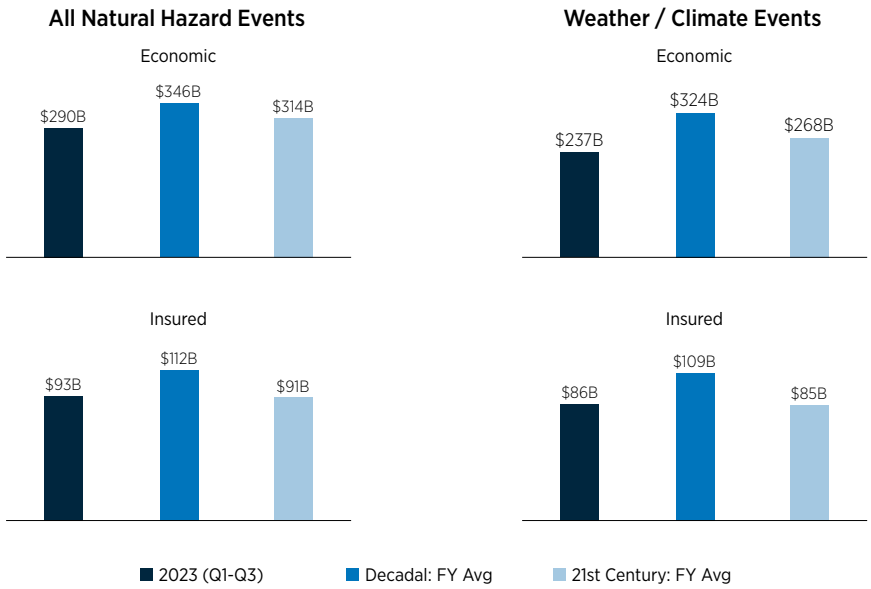
The dominant peril for insured natural hazard losses continued to be severe convective storm (SCS), which has accounted for two-thirds (USD60 billion-plus) of all losses, thus far, this year. SCS events in the United States (US) have resulted in a staggering USD54 billion-plus in preliminary insured losses. This marks the first time on record that the US has surpassed USD50 billion for the peril. For context, the tropical cyclone peril has only topped this threshold on the US mainland three times on record (2005, 2017 and 2022). Overall, the US accounted for 74% of all global insured losses. Major SCS events were likewise cited in Europe, where a series of prolific summer hail events prompted widespread damage in parts of Italy, Germany, France, and Croatia. Total European SCS insured losses for the year topped USD4.5 billion for the third consecutive year.

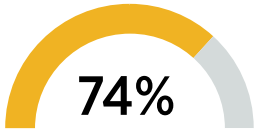
Global tropical cyclone activity was elevated across the Atlantic and Pacific Ocean basins. Several landfalling events occurred, including Hurricane Idalia (US), Hurricane Lee (Canada), Typhoon Doksuri (China), Typhoon Haikui (China), Typhoon Saola (China), and Hurricane Hilary (Mexico). The Atlantic Basin was particularly active despite the presence of a strengthening El Niño, which typically reduces the frequency of storms in the basin.

The presence of El Niño and the continued influence of climate change have led to notable events this year, including extensive flood events (Italy, Libya, Greece, Slovenia, China, India, and Canada), drought conditions (South America, the US, Canada, Europe, and Asia), and wildfires (US, Canada, Greece, and Algeria).

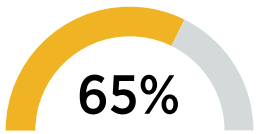
A major earthquake in Morocco resulted in nearly 3,000 fatalities and caused extensive damage. The event caused a Gallagher Re-placed parametric-based threshold to be reached that was expected to result in a sizeable insurance payout for the Moroccan government.

With three months left in the year, focus will be on whether a significant landfalling tropical cyclone will occur in the Atlantic or Pacific basins, how much additional impacts will occur due to El Niño conditions, and whether any other nominally large unexpected catastrophes may put further pressure ahead of the January 1 reinsurance renewal deadline. Q4 has accounted for 16% of annual insured losses during the past decade.

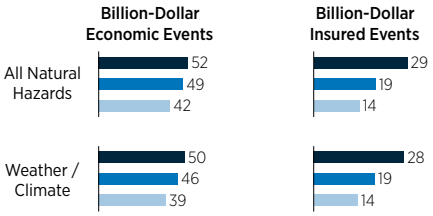




Portion of Insured Losses from the United States



Portion of Insured Losses from Severe Convective Storms



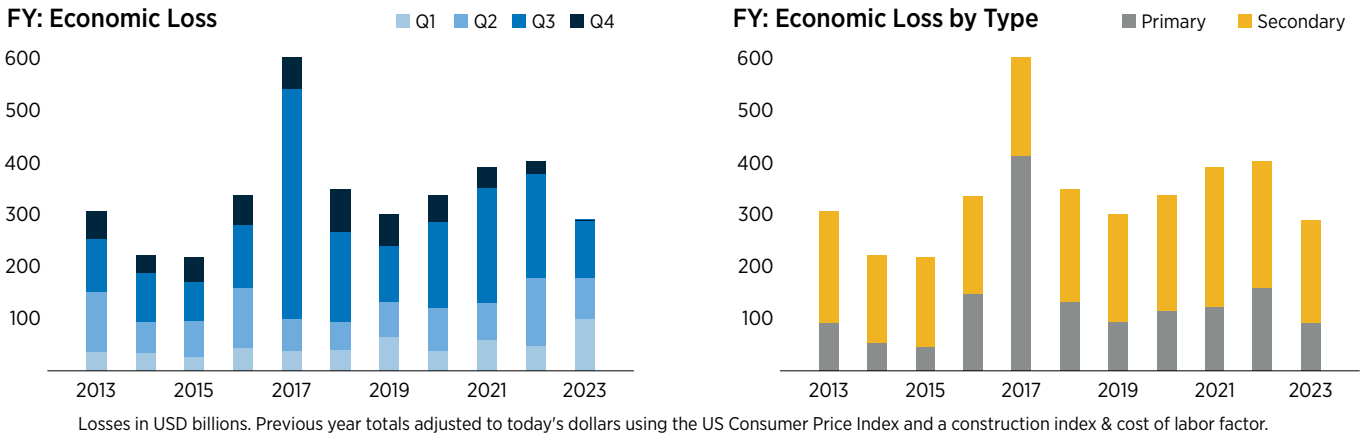
*Note: All loss totals in this document are adjusted to 2023 USD unless explicitly stated otherwise.
Totals were adjusted using the US Consumer Price Index and a construction index and cost of labor factor.

Economic loss

Event Name	Date	Region	Countries	Economic Loss	Insured Loss
Turkey and Syria EQ Sequence	Feb. 6–23	Europe	TR, and SY	45,000+	5,800+
Typhoon Doksuri	Sep. 24–31	Asia	CN, TW, and PH	20,000+	1,340+
Storm Daniel	Sep. 4–11	Europe	GR, TR, BG, and LY	10,100+	500+
Italy Flood/Minerva	May 12–16	Europe	IT, BA, and HR	10,000+	557+
Argentina Drought	Annual	South America	AR	9,200+	257+

Table 1: Top five costliest economic loss events (millions USD) in 2023 (Q1–Q3). | **Data and Graphic:** Arthur J. Gallagher & Co.

The direct economic loss costs from natural catastrophes through the first nine months of the year totaled USD290 billion. With three full months left and expected further loss development, the comparison(s) to full-year averages include 8% lower than the 21st century average (USD314 billion) and 16% lower than the decadal average (USD346 billion). The three costliest perils were severe convective storm (29%), flooding (21%), and earthquake (18%). 'Secondary' perils—which exclude the defined primary perils—tropical cyclone, earthquake, and European windstorm—accounted for 68% (USD198 billion) of the total. There were at least 52 natural catastrophe events which topped USD1 billion in direct economic damage, including 28 in the US alone. All but two (Turkey and Syria Earthquake Sequence in February and the earthquake sequence in September) were weather/climate related.



Losses in USD billions. Previous year totals adjusted to today's dollars using the US Consumer Price Index and a construction index & cost of labor factor.

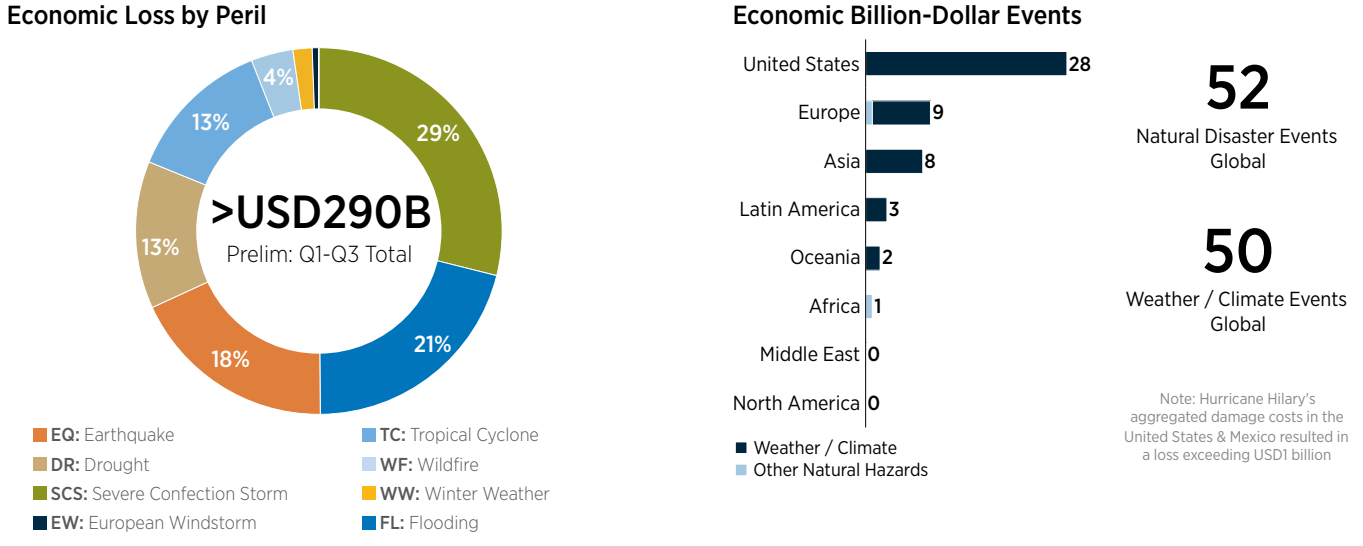


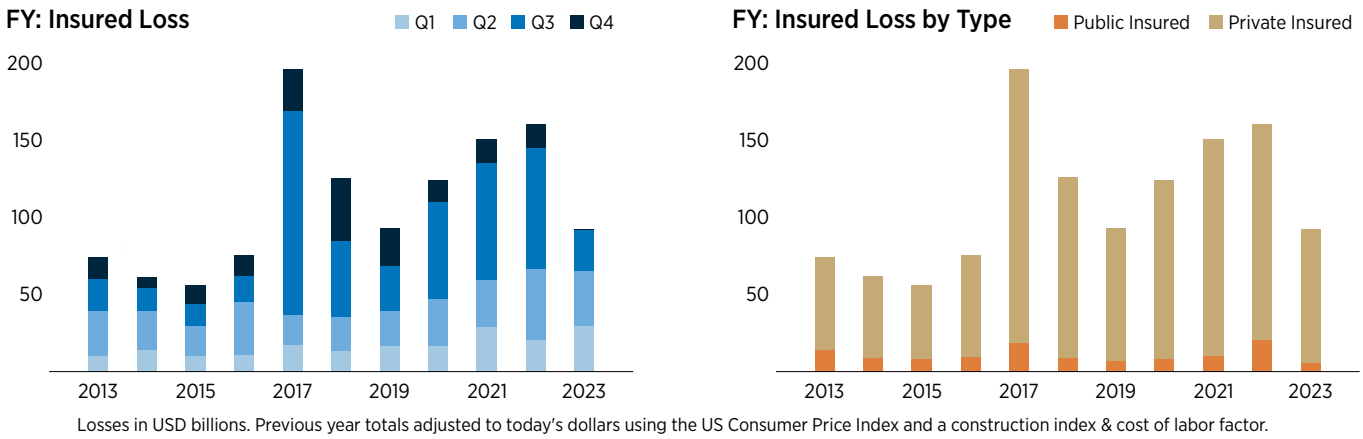
Figure 1: 2023 (Q1-Q3) global economic loss statistics | **Data & Graphic:** Arthur J. Gallagher & Co.

Insured loss

Event Name	Date	Region	Countries	Economic Loss	Insured Loss
Turkey and Syria EQ Sequence	Feb. 6–23	Europe	TR and SY	46,300+	5,800+
Early March SCS and Wind	Mar. 1–3	United States	US	6,430+	4,900+
Central US Outbreak	Mar. 30–Apr. 1	United States	US	6,100+	4,800+
CO and TX Outbreak and SCS	Jun. 21–26	United States	US	5,530+	4,300+
Lahaina Wildfire	Aug. 8–10	United States	US	5,500+	3,350+

Table 2: Top five costliest insured loss events (millions USD) in 2023 (Q1–Q3). | **Data and Graphic:** Arthur J. Gallagher & Co.

The insured loss from natural catastrophes (including those from private insurance companies and public insurance entities) through the first nine months of the year totaled USD93 billion. 2023 is on pace to surpass the USD100 billion threshold for the sixth time in the last seven years. With three full months left and expected further loss development, the comparison(s) to full-year averages include—2% higher than the 21st century average (USD91 billion) and 17% lower than the decadal average (USD112 billion). The SCS peril alone accounted for 65% of all insured losses, and US SCS losses accounted for 58% of all insured global catastrophe losses. There were at least 28 natural catastrophe events which topped USD1 billion in insured losses, including 22 solely in the US. Beyond the significant SCS activity, a deadly and major US wildfire in Hawaii (Maui Island) left the state with its second-costliest disaster on record (USD3.4 billion insured loss). A minimum of 11 individual events topped USD2 billion, which sees 2023 tied 2021 and 2018 for the third-highest annual total number of events on record. The largest total of individual events was 17, which occurred in 2020, followed by a total of 12 events in 2022, 2017 and 2011.



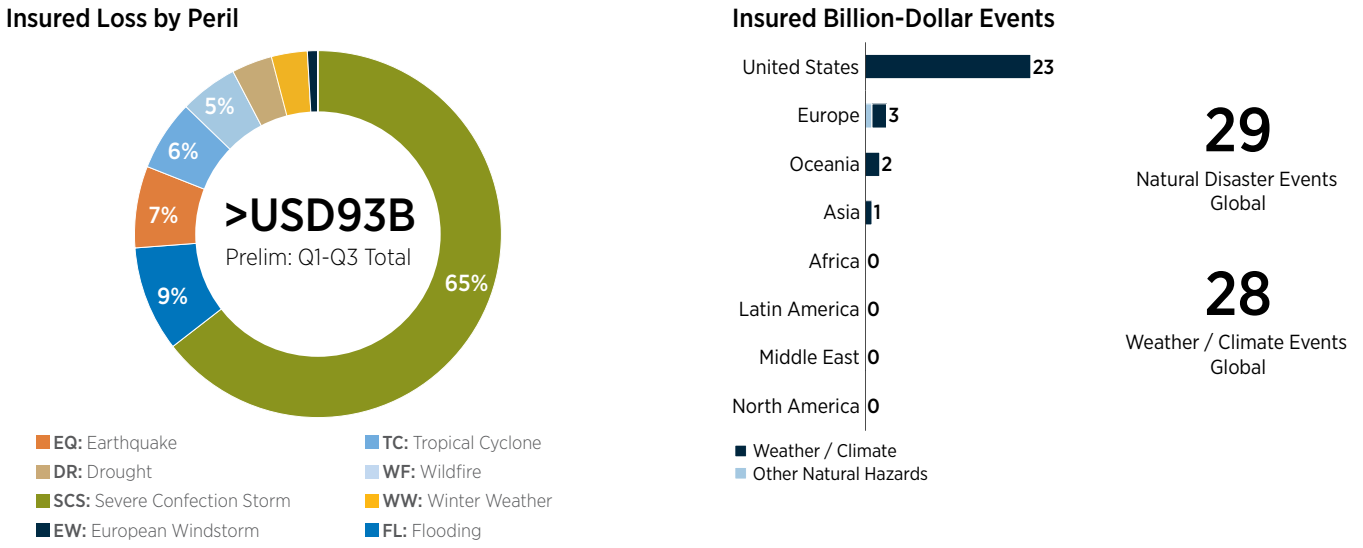
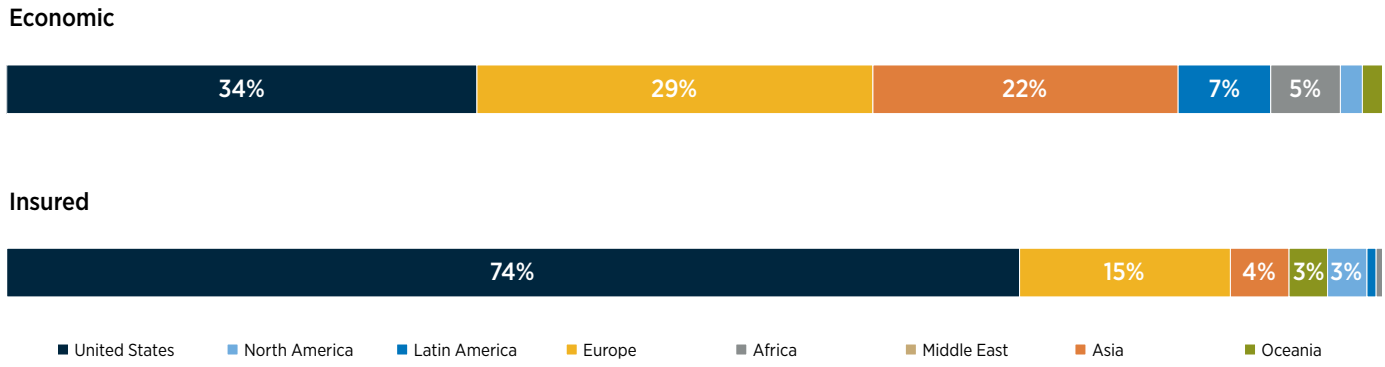


Figure 2: 2023 (Q1-Q3) global insured loss statistics | **Data & Graphic:** Arthur J. Gallagher & Co.

The US has driven the bulk of natural catastrophe losses in 2023 YTD. While the country led with 33% of global economic losses (USD99 billion), it accounted for nearly three-quarters (USD 68 billion) of global insured losses. This was dominated by SCS activity, but additional impacts from flooding, drought, winter weather, and tropical cyclones (Idalia, Lee, Ophelia and Hilary). Slightly more than 30% of US losses were uninsured. This was the lowest gap of any region in the world. Historically, parts of Latin America, Africa, and Asia have shown the largest opportunity for further insurance penetration. Europe's abnormally high gap was primarily driven by the significant uninsured costs from February's earthquake sequence in Turkey and Syria. Elevated costs associated with drought and flood also aided in the wide gap between economic and insured impacts in areas with currently limited insurance take-up or availability from a residential, commercial structure, and agricultural perspective.



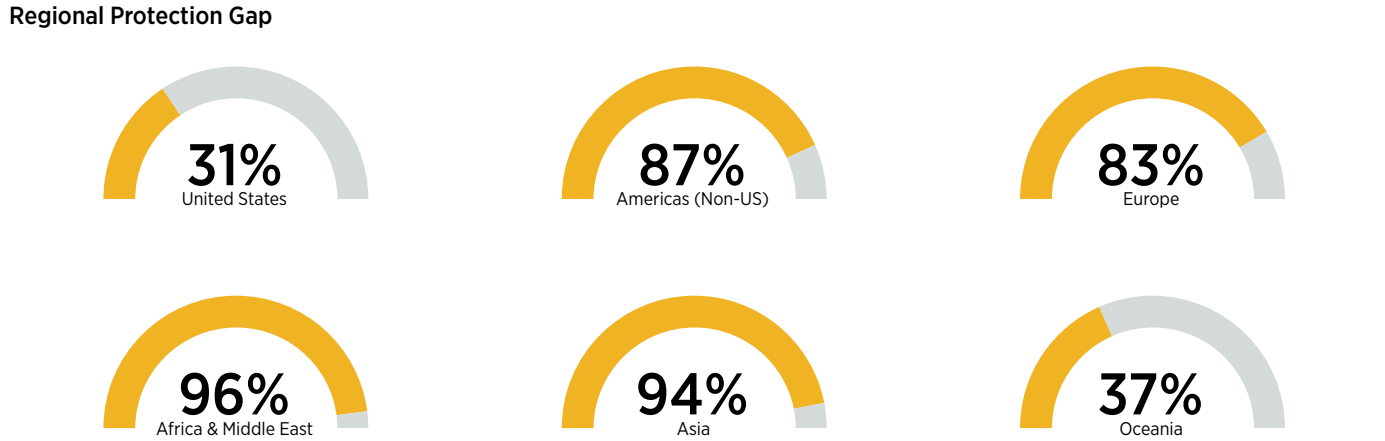


Figure 3: 2023 YTD Economic and Insured loss total percentages by region (top) and regional protection gap YTD (bottom) | **Data & Graphic:** Arthur J. Gallagher & Co.

Conversation Starters: Q3 2023

The Continued Rise of Secondary' or 'Non-Modeled Catastrophe Peril Risk

The record-setting loss costs from the SCS peril in 2023 continue what has been a growing trend and level of concern for insurers during the last decade—or longer. The notion of bucketing perils into 'primary' or 'secondary' categories have torically have been driven by the expectation that hurricanes and earthquakes (or European windstorms) individually cause the most robust damage costs, and thus are of primary concern. These 'primary' perils are also generally the ones best captured by the various catastrophe model vendors. While it is true that these perils have a greater potential to cause enormous losses, there are recent examples during the past decade of nearly every type of 'secondary' peril having a singular event that exceeded as high as USD10 billion in loss claims for insurers.

The challenge for primary insurance carriers remains the reality that the high frequency of 'secondary' events is driving up loss costs to new heights. Since 2000, these 'secondary' perils have seen 6.9% annual growth above the rate of inflation (US Consumer Price Index). Annual insured losses for these perils have averaged USD70 billion in the most recent decade alone. This compares to 'primary' perils averaging USD42 billion during the same timeframe. While the influence of climate change varies by peril/region and is moving the needle on loss performance, the larger driving factors continue to center on exposure growth, inflationary pressure, claims litigation, and higher construction/labor costs.

These higher losses come at a time when the volume of reinsurance aggregate cover placements continues to decline. This has occurred in concert with previous recent reinsurance renewal cycles that resulted in more insurance carriers taking on more premium for less reinsurance coverage. The upcoming January 1 renewal cycle is likely to be much less volatile than it was leading up to January 1, 2023, but prices will likely remain elevated and put pressure on insurers. Such pricing issues, in addition to higher insurance claims payouts and growing climate-related risks, can be tied to the news of insurers pulling individual lines of business or entire portfolio exposure out of certain markets in the US and elsewhere.

Despite a higher frequency, 'secondary' peril losses in most individual event instances end up being largely (or fully) borne by the insurance carrier. This is due to event losses not being large enough to reach the threshold of written reinsurance protection layers. In turn, such losses are reflected during earnings periods and through elevated property and casualty (P&C) underwriting loss ratios. The result can often mean higher insurance premiums for the policyholder.

Moving forward, it will be critical for a more targeted focus on developing better tools or catastrophe models that can more accurately assess the growing risks that such 'secondary' perils bring. The granular complexity of hazard behavior such as hail/tornado swaths, wildfire footprints, or prolonged business interruption from extended power outages makes it imperative for the industry to better recognize the compounded risks that today's catastrophes bring. Innovative solutions from reinsurers to protect insurers from a high frequency of loss events would also be welcomed by the industry and could help ameliorate the pricing pressure faced by the original insured.

Expectations for the Remainder of 2023's global tropical cyclone season

As described throughout this report, the insurance industry faces another USD100 billion-plus natural catastrophe loss year, the reality is this total will most likely be reached due to the high frequency of low/mid-level costs aggregating to a high number. The peak global insured loss event through Q3 2023 is USD5.8 billion (Turkey/Syria earthquake sequence). If the rest of the year remains without a 'mega' event, 2023 would be the first year since 2016 in which the industry did not face an individual USD10 billion event.

High industry loss years are typically driven in large part by landfalling tropical cyclone events. Global tropical cyclone activity through Q3 has been running at or above normal in the Northern Hemisphere. This includes the number of named storms (Actual: 46/Climatology: 46), hurricane-equivalent storms (25/25), and major hurricane-equivalent storms (17/13). The total amount of Accumulated Cyclone Energy (ACE), which is a measure of seasonal or individual storm intensity, and longevity, was running well above normal at 502 versus the YTD climatological average of 414.

The perception of what constitutes 'normal' or 'above/below average' can be distinctly different from a scientific perspective versus the insurance industry. The YTD financial toll from tropical cyclones has thus far been relatively benign considering the volume of storms that have developed across the Atlantic and Pacific Ocean basins. During El Niño phases of ENSO, the Bermuda High in the Atlantic Ocean tends to be weaker and less expansive. This often leads to storms recurving into the open waters of the Atlantic and away from the US coastline.

The one landfalling hurricane in the US, Hurricane Idalia, formed in the Caribbean Sea and tracked northward through the Gulf of Mexico. Idalia's landfall as a Category 3 storm into Florida resulted in a significantly lower financial loss as the storm came ashore in one of the least exposed and populated parts of the state. In the Eastern Pacific, Tropical Storm Hilary's anomalous impacts in California and the Desert Southwest were additionally not as significant as expected. Though it is worth mentioning that Hilary became the first tropical cyclone to affect California since 1939.

The continued strengthening of El Niño was anticipated to bring more activity in the Western Pacific through the rest of the calendar year. It is continually worth mentioning that the current El Niño has not performed as historical such phases have. Record-setting warmth across the Atlantic Ocean has offset any El Niño influence that typically occurs. Given the very warm waters in the Gulf of Mexico and Caribbean Sea—which are the two primary areas for Atlantic storm activity in the final months of the season—there needs to be close attention paid to these areas for late season activity.

The (re)insurance implications remain significant. Hurricane Ian's 2022 landfall contributed to a decline in reinsurance capital. Despite the 2022 decline, there has been a quick recovery already in 2023. Per Gallagher Re's H1 2023 Reinsurance Market Report, there was USD709 billion in capital as of Q2 2023, which marked a 13% increase from the end of 2022 (USD629 billion).

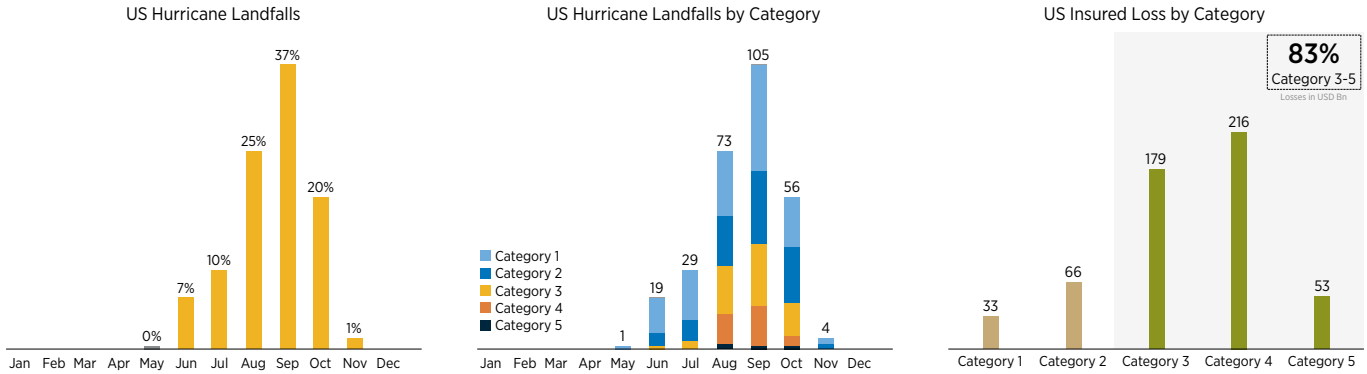


Figure 4: US mainland landfalling hurricane activity and loss statistics (1851-2023) | **Data:** NOAA & Arthur J. Gallagher & Co. | **Graphic:** Arthur J. Gallagher & Co.

Weather/Climate Review

2023 is on Track to Become the Warmest Year

Climate Change Supercharges El Niño Influence (USD92 billion)

2023 is on track to become the warmest year on record, with NOAA projecting a >99.5% likelihood of such an occurrence. This has become increasingly likely as the rate of warming accelerated during the third quarter of the year. Global monthly temperature anomalies consistently topped 1.0°C (1.8°F) since the month of June. Marine heatwaves and heat domes, (a persistent or stuck ridge of high-pressure which traps heat over a particular region for an extended period of time), are becoming more prevalent and intense under an amplified El Niño influence. The average global temperatures during meteorological summer from June to August ranked as one of the top two warmest ever officially recorded by NASA. According to Copernicus, a branch of the European Union Space Program, the temperature anomalies were at or near the important 1.5°C (2.7°F) threshold for three consecutive months (July, August, September) when compared against the pre-industrial baseline (1850–1990). Annual average temperature anomalies will show the globe inching closer to the 1.5°C (2.7°F) climate benchmark by the end of 2023. Such heat extremes are worrying, as they reinforce the melting of ice sheets, the intensity of tropical cyclones, and the frequency of heatwaves.

Rank	Year	20th Century Baseline	Pre-Industrial Baseline
1	2023	1.10°C/1.98°F	1.26°C/2.28°F
2	2016	1.07°C/1.93°F	1.23°C/2.22°F
3	2010	1.04°C/1.87°F	1.20°C/2.17°F
4	2019	0.96°C/1.73°F	1.12°C/2.02°F
5	2017	0.95°C/1.71°F	1.11°C/2.01°F
6	2022	0.93°C/1.67°F	1.09°C/1.97°F
7	2015	0.86°C/1.55°F	1.02°C/1.84°F
8	2021	0.84°C/1.51°F	1.00°C/1.81°F
9	2018	0.83°C/1.49°F	0.99°C/1.79°F
10	2014	0.77°C/1.39°F	0.93°C/1.68°F

Table 3: 2023 (Q1-Q3) NOAA temperature anomalies showing baselines for the 20th Century (1901-2000) and the Pre-Industrial Era (1850-1900) | **Source:** NOAA

The monthly average global temperatures shattered numerous records around the world during the boreal (Northern Hemisphere) late spring and summer months. Daily temperature anomalies relative to the 1991–2020 baseline continued an increasing trend as El Niño further established during Q3. The anomalies were almost higher than any other daily anomalies since late May. As we moved into October, global cities, such as Sydney, Australia, continued to endure record daily heat.

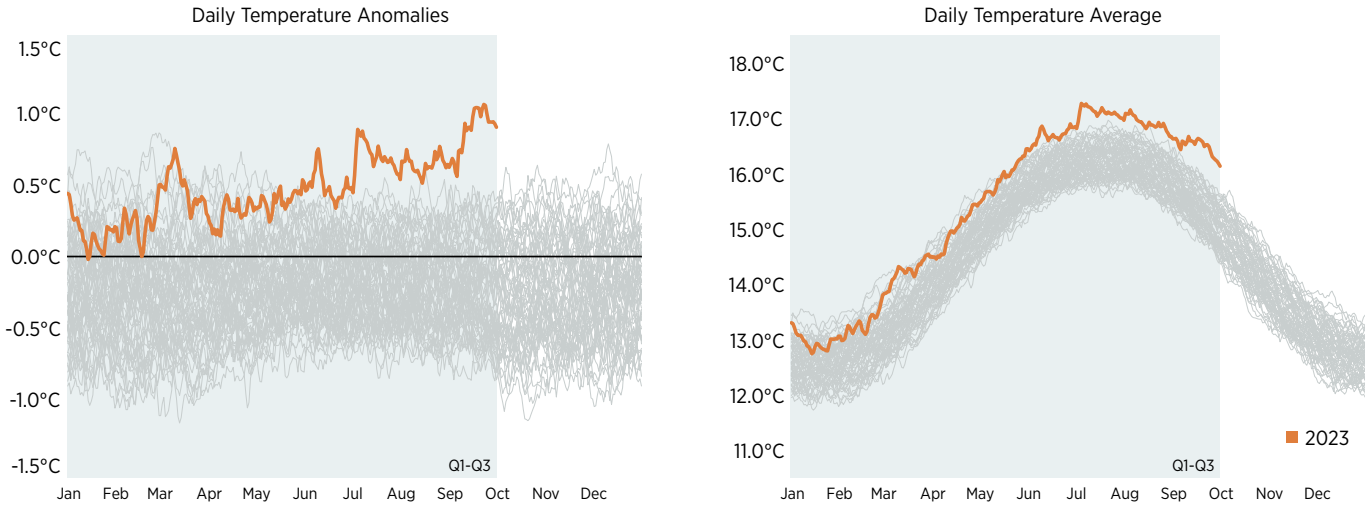


Figure 5: Global daily temperature anomalies (left) and daily temperature average (right) from 1958-2023 showing 2023 far surpassing modern era records for warmth
Data: Japan Meteorological Agency (JRA-55) | **Graphic:** Arthur J. Gallagher & Co.

Temperature and Precipitation Anomalies Over Land

The expanse of warm anomalies over global land surfaces visibly increased during Q3. Multiple countries worldwide reported record heat during the months of August and September. Per Copernicus, the European Union's Earth observation program, the summer of 2023 was the fifth warmest for Europe on record. Areas in the southern US, Europe, Japan, and South Korea experienced moderate to severe heatwaves. Higher than normal temperatures had also fueled further wildfire activity in Canada. The Southern Hemisphere, including Australia and several countries in South America, recorded their hottest winter seasons in the official record.

Overall, large areas of the populated continents recorded above normal temperatures from Q1 to Q3. A small percent of land areas had below normal temperatures.

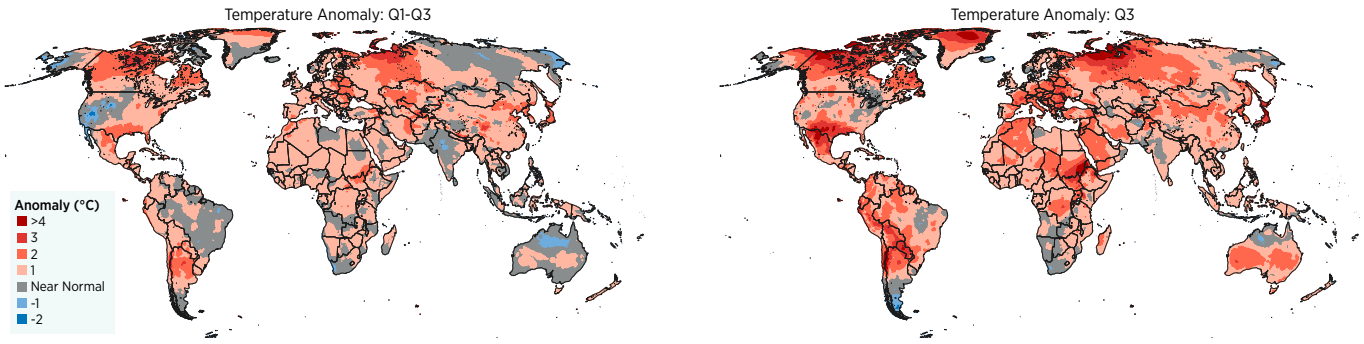


Figure 6: 2023 Q1–Q3 (left) and Q3 (right) global temperature anomalies compared to the 1991-2020 climatological normal
Data: Copernicus (ERA5) | **Graphic:** Arthur J. Gallagher & Co.

There were obvious shifts in rainfall patterns as more areas, including northeast South America, India, and Australia, became drier in Q3. Australia just had its driest September on record, while India had its driest August. On the opposite side of the spectrum, eastern China and Taiwan turned slightly wetter compared to H1 due to the passage of typhoons and synoptic interactions with storm remnants to spawn anomalous rain totals. Northeastern Libya saw unprecedented rainfall from the impacts of Storm Daniel. Likewise, Storm Hans and a series of low-pressure systems led to wetter conditions in the Nordics.

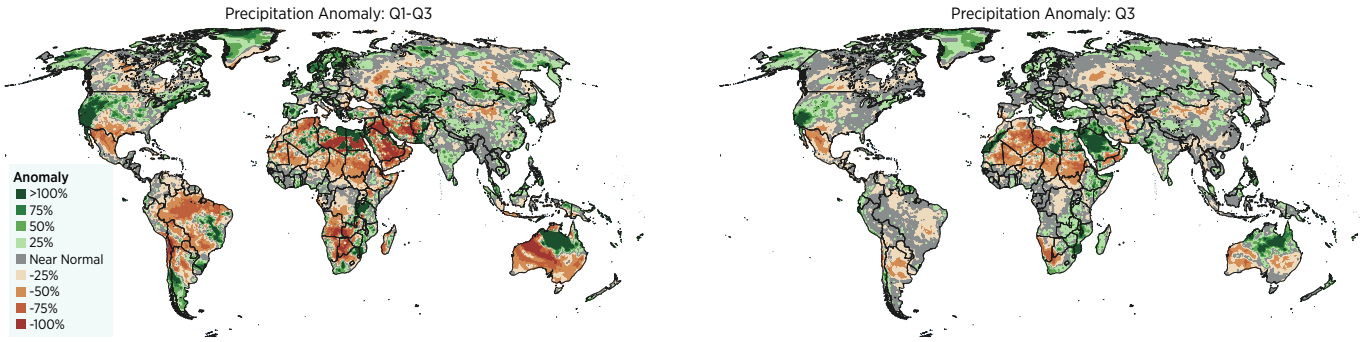


Figure 6: 2023 Q1–Q3 (left) and Q3 (right) global precipitation anomalies compared to the 1991-2020 climatological normal
Data: Copernicus (ERA5) | **Graphic:** Arthur J. Gallagher & Co.

Antarctic and Arctic Sea Ice Extent

Satellite-derived data from the National Snow and Ice Data Center (NSIDC) indicated that the 2023 maximum Antarctic sea ice extent was the lowest in recent recorded history, with satellite records dating back through 1979. The 2023 annual maximum extent was reached on September 10, at which time ice spanned approximately 16.96 million square kilometers (6.55 million square miles).

For perspective, this total was the lowest since 1986. In fact, the 2023 extent was 1.03 million square kilometers lower (398,000 square miles) than the surface area recorded in 1986. The average maximum extent between 1981 and 2010 covered an area of 18.71 million square kilometers (7.22 million square miles).

Furthermore, the 2023 maximum extent was registered at one of the earliest dates on record, occurring before the 1981-2010 mean maximum extent date of September 23. After likewise setting a record minimum extent in February 2023 of 1.79 million square kilometers (691,000 square miles), Antarctic sea ice has subsequently remained at record low levels since April 2023. While localized weather phenomena such as diurnal temperature fluctuations and winds can influence deviations in the ice extent, an accelerated downward trend since at least 2016 has been particularly concerning and likely aided by warming in the upper ocean. This trend is projected to continue alongside global ocean warming coinciding with warmer water mixing into the Southern Ocean. Conversely, prior to 2014, Antarctic sea ice extent showed a slight increasing trend (on the order of 1% per decade).

The Antarctic ice sheet and sea ice coverage in the surrounding ocean are essential to climate regulation. The bright ice reflects energy from the sun back into the atmosphere, while the darker ocean surface absorbs most incoming energy and reinforces increases in temperature. Decreasing sea ice and amplified polar warming could lead to greater coastal exposure and erosion.

In the Arctic, the 2023 sea ice minimum annual extent ranked as the sixth lowest on record. In addition to extent, data regarding the age and depth of sea ice is a critical component, particularly in the Arctic, as younger and thinner ice enables more heat to escape into the atmosphere.

The concern for the insurance industry and other financial sectors is the further growth in coastal risk from sea level rise or other water-related event impacts. Higher seas will bring higher potential premium costs or the prospect of reduced property values.

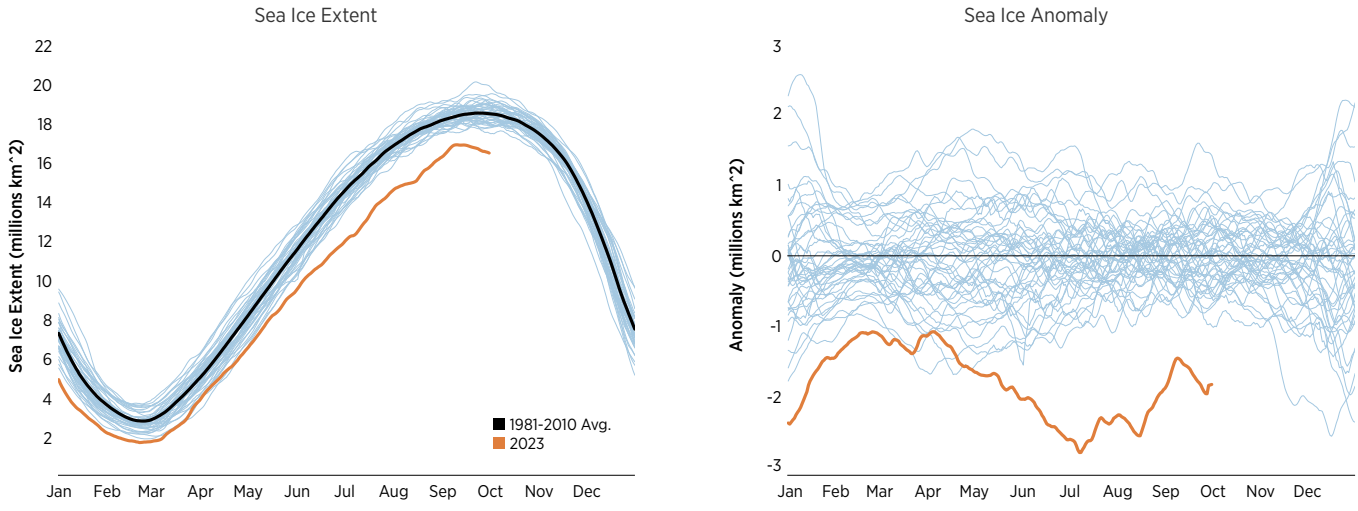


Figure 8: Anomalously warm ocean and air temperatures have led to record low sea ice extent and anomalies (square kilometers) in Antarctica during 2023
Data: NSIDC | **Graphic:** Arthur J. Gallagher & Co.

Indian Ocean Dipole (IOD) Quickly Shifts to Positive Phase

The Bureau of Meteorology (BoM) declared on September 19 that El Niño had officially arrived, and that a transition to a positive phase of the Indian Ocean Dipole (IOD) had occurred. NOAA and the World Meteorological Organization (WMO), which uses a differing methodology from BoM to declare phases of ENSO or the IOD, had previously declared El Niño's arrival earlier in 2023. El Niño has continued to further strengthen across the central and eastern Pacific Ocean, and is forecast to persist until at least the end of February 2024. The IOD is a broad pattern of year-to-year sea surface temperature (SST) changes in the western and eastern Indian Ocean. During a positive IOD event, the following ocean and atmospheric conditions are typically observed:

- Warmer sea surface temperatures in the western Indian Ocean relative to the east
- Easterly wind anomalies across the Indian Ocean, compared to weak westerlies during a neutral phase
- Increased convection over eastern Africa, and less rainfall in the Maritime Continent and parts of Australia

The IOD index trended above the positive IOD threshold +0.4°C/+0.7°F in mid-August. Per BoM, which uses a climatological baseline from 1951–1990, the IOD was +1.69°C (+3.04°F) for the week ending October 1. By comparison, NOAA, which uses a climatological baseline from 1991–2020, noted a positive phase arrival +0.84°C/+1.51°F for the month of September. When El Niño and a positive IOD occur together, a larger area of eastern Australia faces an enhanced potential of sustained dry atmospheric conditions. This can often correlate to an elevated wildfire risk. Previous years where El Niño coincided with a positive IOD include 1997, 2006, and 2015. Bushfire risks also increase against the backdrop of record heat. For context, Australia saw its costliest insured bushfire season on record in 2019-20 (USD2 billion), which was the country's warmest year on record and coincided with a positive IOD event. That season was also preceded by a lengthy drought from 2017 to 2019 which led to an abundance of bushfire fuel. While it remains too early at this point to conclude the 2023–2024 season, several signs such as a record dry spring (September) and strengthening IOD indicate the risks are not to be underestimated.

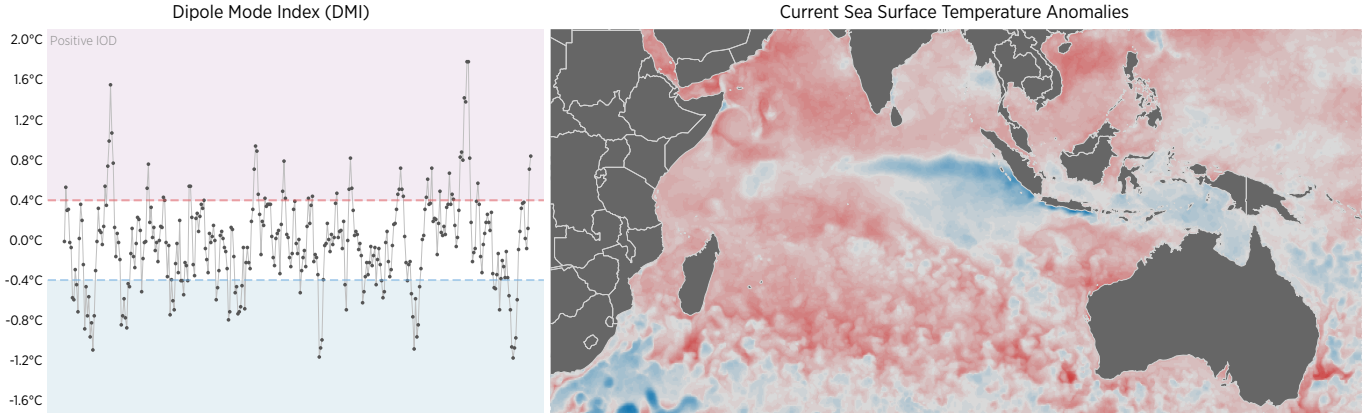


Figure 9: Monthly Indian Ocean Dipole Mode Index since 1995 and Sea Surface Temperature Anomalies in early October
Data: NOAA | **Graphic:** Arthur J. Gallagher & Co.

Major Event Reviews

Severe Convective Storms: United States

US severe convective storm (SCS) insured losses through Q3 2023 minimally reached USD54 billion-plus. 2023 will become only the third year on record to reach the USD40 billion threshold, and the first time topping USD50 billion. In fact, there have been six years since 2010 where all annual inflated US natural catastrophe losses combined did not reach USD50 billion. Here are some statistics to further put the YTD financial toll of 2023 US SCS into perspective:

- 2023 already sits as the costliest insured year on record for US SCS; followed by 2020 (USD44 billion) and 2011 (USD40 billion)
- 2023 marks the fifth consecutive year with insured inflated US SCS losses exceeding USD20 billion
- Economic loss records: 22 billion-dollar events (previous: 18 in 2020); 11 multi-billion-dollar events (previous: eight in 2020)
- Insured loss records: 19 billion-dollar events (previous: 15 in 2020); nine multi-billion-dollar events (previous: five in 2020 and 2011)

The year 2023 has been characterized by a high frequency of SCS events, which generated an above-average number of tornadoes, large hail (2+ inches/5+ centimeters), and severe wind reports through the end of Q3. Losses in the US continue to be predominantly driven by hail. In any given year, hail typically accounts for 50%–80% of SCS loss claims across the country. Expanding urban footprints in hail-prone regions in tandem with the increasing cost and size of homes has further enhanced hail-related claims in recent years.

Year-to-date 2023 ranks second for the most annual large hail reports reaching and/or exceeding two inches (5.1 centimeters) with at least 1,053. There were 1,079 reports in all of 2011. In Q2, an active stretch of SCS in mid-June brought consecutive days of notable hail-driven losses to the Southern Plains and Southeast, with significant damage occurring in urbanized regions which included Dallas-Fort Worth (TX) and Little Rock (AR). In Q3, a hail-driven SCS outbreak on August 11 generated a billion-dollar economic, with much of the damage occurring in the Minneapolis (Minnesota) metro region. In late September, tennis ball size and larger hail resulted in widespread damage across the Southern Plains, particularly urbanized corridors in north and central Texas.

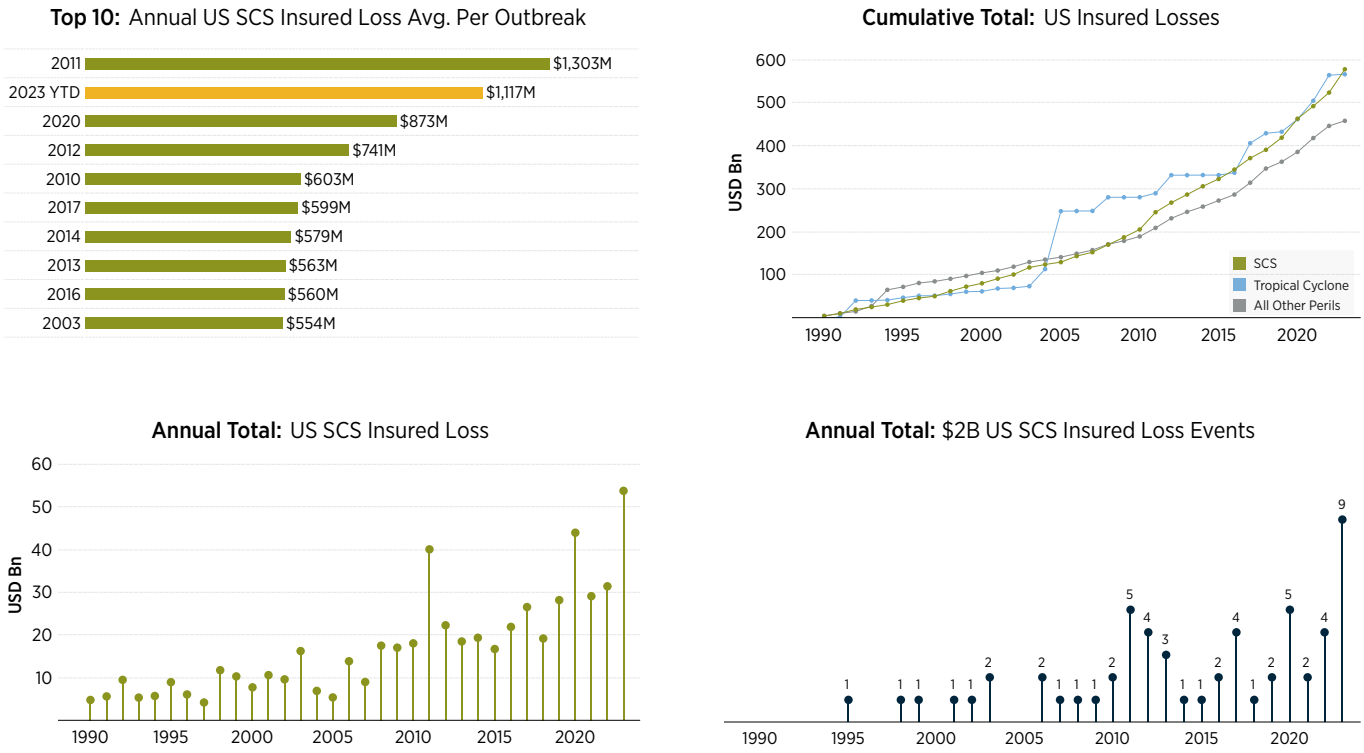


Figure 10: Insured costs from US severe convective storms are already at record levels through Q3 2023 | **Data & Graphic:** Arthur J. Gallagher & Co.

Severe Convective Storms: Europe

(SCS)outbreaks likewise generated significant losses across Europe during Q3. Most of the losses were driven by large hail and high winds. Localities in France, Germany, Italy, and Croatia were particularly affected. Through the first nine months of 2023, SCS insured losses in Europe had minimally exceeded USD4.5 billion across Europe.

- At least three SCS events in 2023 generated a billion-dollar (USD) economic loss
- A record European hailstone of 7.48 inches (19 centimeters) fell in Italy on July 24, surpassing a record set just days earlier on July 19
- European Severe Storms Laboratory (ESSL): Northern Italy is among the regions seeing the largest rise in hail frequency in Europe
- Initial view: SCS losses between July 18–25 exceeded USD4 billion economic; USD1.1 billion-plus insured
- The European Severe Weather Database (ESWD) recorded more than 9,600 instances of severe weather reports in July

A prolonged stretch of exceptional SCS activity impacted the continent in mid- to late-July. The near-daily outbreaks were driven by contrasting air masses along the northern periphery of a ridge of high pressure, colloquially known as a heat dome, and aided by a series of frontal boundaries interacting with very warm air and abundant moisture being pulled northward from the Mediterranean Sea. The continent's highest July temperature ever officially recorded—48.2°C (118.8°F)—was measured in Sardinia, Italy, on July 24.

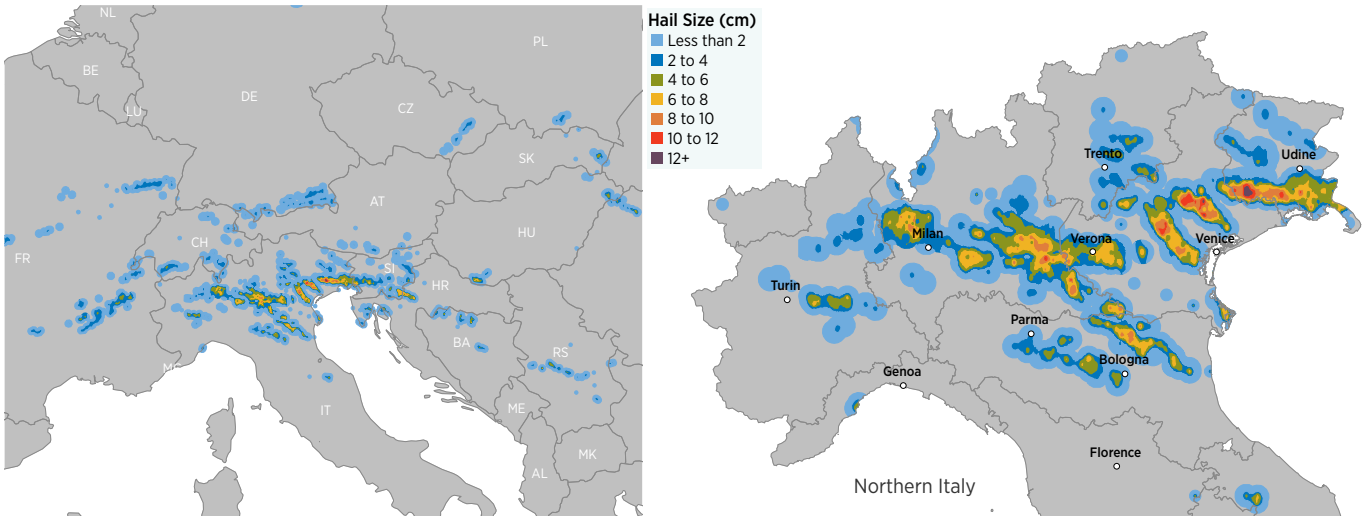


Figure 11: Extrapolated hail swaths across Europe (left) and northern Italy (right) between July 18-25, 2023
Data: ESSL / ESWD | **Graphic:** Arthur J. Gallagher & Co.

In Italy, a 7.48 inches (19 centimeters) hailstone fell in Azzano Decimo of the Friuli Venezia Giulia Region on July 24, setting a new European record for largest hail (this broke the record set by an Italian hailstone measured days prior on July 19). Most of the losses generated by the July 18–25 outbreaks were driven by hail of which a majority occurred in northern Italy. Data from ESSL has shown a marked increase of large hail (5+ cm/2+ in) across northern Italy since the 1950s.

Notable industry hail losses likewise occurred in France on July 11-12, primarily in the Auvergne-Rhône-Alpes and Burgundy regions. In southern Germany, a loss of nearly USD960 million was tallied between August 24–30, Southern Bavaria was particularly hard hit by hail up to 3.9 inches (10 centimeters). The towns of Bad Bayersoien and Benediktbeuern incurred widespread damage.

What It Means: The insured costs associated with the thunderstorm peril have globally continued to drive a greater portion of annual losses. While the US typically dominates losses as the "thunderstorm loss capital of the world," the SCS loss trends are growing more notable in parts of Europe, Asia, and Australia. While there remains notable uncertainty in current scientific research regarding the role of climate change and an overall increased frequency of events, emerging research is beginning to coalesce around the reality of more environmentally conducive days for large SCS outbreaks. This would mean more tornadoes or reports of large hail of damaging winds per event. This has very real implications for the insurance industry as more climate-fueled intense outbreaks affecting expanding population centers will lead to higher costs. Such trends are significant as gaining access to aggregate cover schemes from reinsurers grows more expensive and difficult to obtain.

EMEA Flooding: Storm Daniel, Storm Petar, and Storm Hans

A series of catastrophic flooding events affected widespread regions of EMEA in Q3, with the most significant impacts occurring in parts of Greece, Libya, Slovenia, Austria, and Norway.

- Storm Daniel became the deadliest weather event of 2023 with approximately 4,360-plus fatalities, most occurring in Libya
- Daniel to become the costliest weather event for the Greek insurance market, with losses estimated between USD375—USD525 million
- Storm Elias further produced flooding rains across Thessaly and Central Greece in late September
- Storm Petar spawned the worst flooding in Slovenia's history in early August as direct damage costs topped USD5 billion-plus
- Storm Hans, which formed from the merging of Antoni and Petar, caused significant damage in the Nordic countries

Storm Daniel became the deadliest weather event to date (excluding heatwaves) in 2023 and ranked as one of the costliest Mediterranean storms. The area of low pressure was the result of an omega blocking pattern across Europe, characterized by a ridge of high pressure stuck in-between two persistent areas of low pressure. This system generated torrential rainfall and deadly flooding in Greece, Bulgaria, and Turkey between September 5-8. In Greece's Thessaly region, a monitoring station near Zagora measured 43.1 inches (1,096 millimeters) of rainfall. A national record daily rainfall of 30 inches (759 millimeters) was recorded on September 5. Multiple localities received between 50% and 75% of their annual rainfall from Daniel. Industry losses in Greece were likely between USD375–USD525 million, a majority of which resulted from commercial and industrial risks.

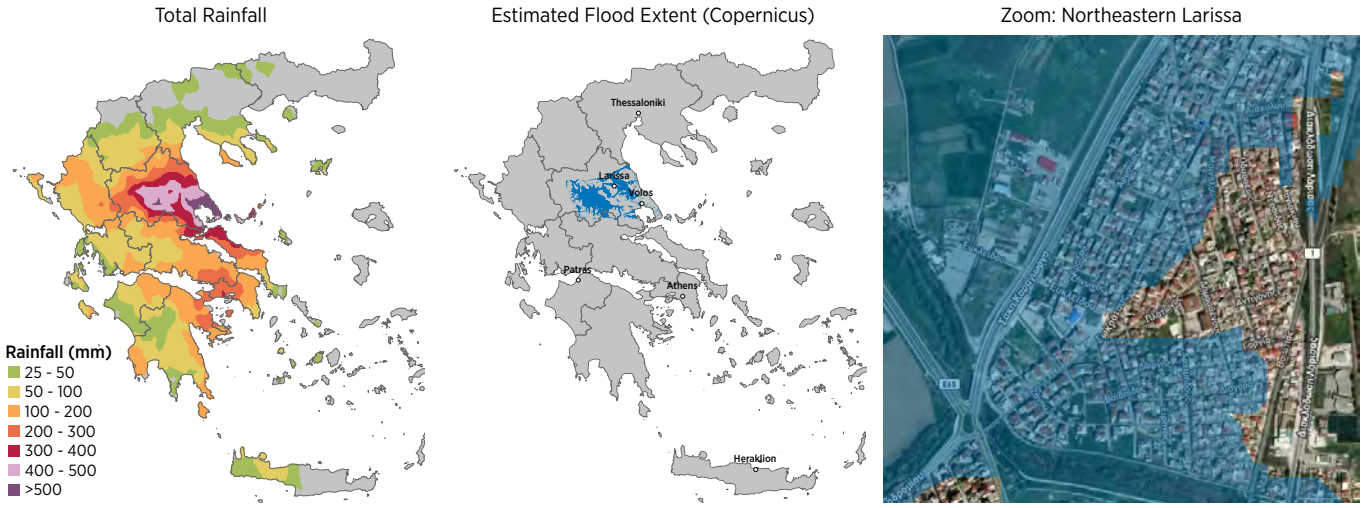


Figure 12: Greece rainfall (left), Copernicus estimated flood extent (middle), and flooded parts of Larissa (right) between September 4-8, 2023 (UTC) due to Storm Daniel
Data: NASA / GPM, Copernicus | **Graphic:** Arthur J. Gallagher & Co.

Daniel came ashore in northeastern Libya on September 10, after intensifying over unseasonably warm waters in the Mediterranean Sea. Copious rainfall and exceptional flooding, aided by the breach of two dams, resulted across Libya's Derna District. The city of Derna was particularly affected, as entire neighborhoods were swept away. A humanitarian emergency unfolded as more than 4,360 fatalities were officially recorded by the World Health Organization.

In early August, incessant rainfall fell across regions of northern and central Slovenia and southern Austria. In Slovenia, record 48-hour rainfall totals ending August 5 topped 200 millimeters (8 inches). Government officials cited the August floods ranked among the worst natural disasters recorded in modern Slovenian history. Direct damage from the floods were expected to reach or exceed USD5 billion. Days later, Storm Hans subsequently became Norway's worst flood event in at least two decades.

What It Means: The catastrophic floods in Greece and Slovenia emphasized the notable protection gap that continues to exist within territories that have less than robust take-up in residential insurance markets. In Greece, nearly 80% of the insured losses arose from commercial/industrial risks. Flood-related risk is anticipated to grow in the coming years, aided by higher rainfall rates linked to continued greenhouse gas emissions. Expanding urban corridors and deforestation further leaves assets at higher risk levels. The floods in Libya showcased the importance of understanding the hazards associated with extreme rainfall and the urgent need to modernize infrastructure to meet the needs of the climate today and in the future.

Global Tropical Cyclone Activity

Atlantic Ocean

The 2023 Atlantic Hurricane season remained active through Q3. Though less than initially feared, losses to date were driven by Hurricane Idalia's Category 3 landfall in Florida's Big Bend region near Keaton Beach in late August. Additional landfalling storms included Tropical Storm Franklin in the Dominican Republic, Tropical Storm Harold in Texas, Post-Tropical Cyclone Lee in Nova Scotia, Canada, and Tropical Storm Ophelia in North Carolina.

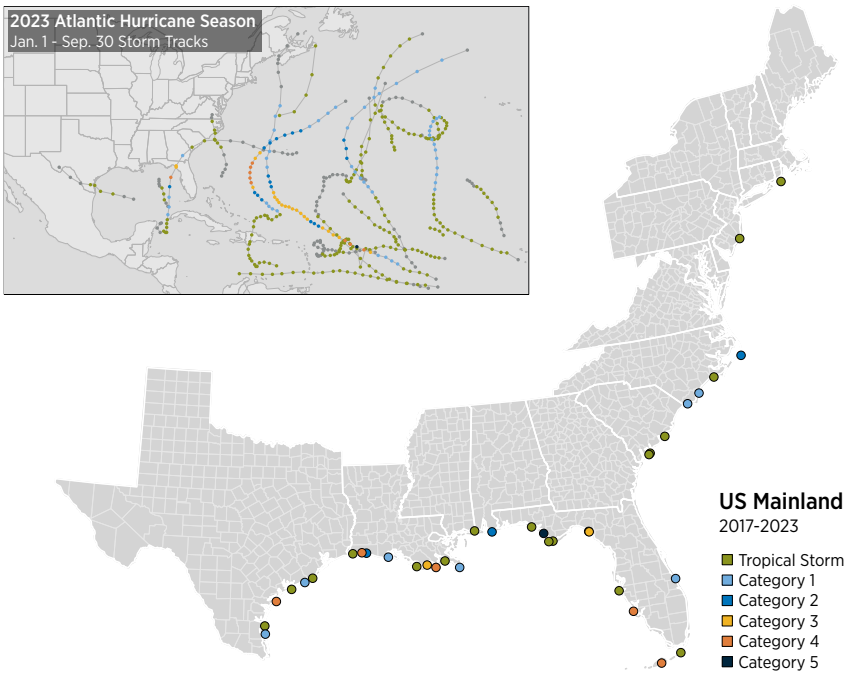
- Seasonal Overview (through September): 18 named storms, six hurricanes, three major hurricanes (Category 3+)
- Hurricane Idalia's Category 3 landfall in Florida generated insured losses approaching USD1.25 billion
- Hurricane Lee intensified into a Category 5 storm, marking the 16th Category 5 in the Atlantic since 2000 (1966–1999: 11)
- Despite El Niño conditions, anomalously warm sea surface temperatures aided in an above-average season

Including Idalia's landfall, Florida recorded four hurricanes coming ashore with at least 125 mph (200 kph) winds since 2017 (Irma, Michael, Ian and Idalia). There have been 21 such storms that have struck the state dating back to 1851. Looking at the broader mainland US, there have been eight major hurricane landfalls since 2017 (Harvey, Irma, Michael, Laura, Zeta, Ida, Ian, and Idalia).

Idalia's damage was limited due to the hurricane making landfall in Florida's Big Bend region, which is characterized by low population and exposure density. However, the cost of claims was made higher by continued elevated inflation levels in Florida compared to the rest of the US and standard demand surge (spikes in product costs following a disaster). Inland flooding was also a concern as copious rains from Idalia inundated localities along and north of the storms track from Florida into the Carolinas.

After rapidly intensifying by 80 mph (130 kph) in a 24-hour period, Hurricane Lee became the season's first Category 5 hurricane on the Saffir-Simpson Hurricane Wind Scale (SSHWS), with peak winds of 165 mph (265 kph). The storm later substantially weakened while tracking northward. It ultimately came ashore as a post-tropical cyclone in Nova Scotia, Canada on September 16. The large wind field and expansive rain bands allowed adverse impacts to span from the northeastern US into Atlantic Canada.

Tropical Storm Ophelia's landfall in North Carolina on September 23 generated high seas and storm surge which resulted in instances of coastal inundation and erosion across the Southeast and Mid-Atlantic.



Landfall Category	Season	Storm
Tropical Storm	2023	Ophelia
		Harold
	2022	Colin
	2021	Mindy
		Henri
		Fred
		Elsa
		Danny
		Claudette
	2020	Fay
		Eta
		Cristobal
		Beta
		Bertha
	2019	Imelda
	2018	Gordon
		Alberto
	2017	Emily
		Cindy
Category 1	2022	Nicole
	2021	Nicholas
	2020	Isaias
		Hanna
	2019	Barry
	2018	Florence
	2017	Nate
Category 2	2020	Sally
		Delta
	2019	Dorian
Category 3	2023	Idalia
	2020	Zeta
Category 4	2022	Ian
	2021	Ida
	2020	Laura
	2017	Irma
		Harvey
Category 5	2018	Michael

Figure 13: Summary graphic of landfalling tropical storms and hurricanes in the US mainland (2017-2023), and a 2023 YTD storm track map (upper left inset)
Data: NOAA | **Graphic:** Arthur J. Gallagher & Co.

Pacific Ocean

Tropical cyclone activity in the Western North Pacific (WNP) became much more active during the third quarter of 2023 as El Niño conditions intensified. Ten storms formed in the basin during Q3, with six reaching Category 4+ equivalent status, the highest since 2018. Eight of the 10 storms made landfall in East Asia and the Philippines.

- JTWC Seasonal Overview (through September 30): 13 named storms,
  10 typhoons (74+ mph), and 3 super typhoons (150+ mph)
- Taiwan recorded its first landfalling typhoon in four years (Haikui)
- Remnants of multiple typhoons combined with synoptic factors to bring major flooding to China, Hong Kong, and Japan

The most significant event was Tropical Cyclone Doksuri. The storm and its remnants ended as one of the costliest storms to impact Mainland China on record as economic losses were minimally estimated at USD20 billion. Doksuri's remnants brought historic rainfall and flooding to parts of northern China, including a maximum total of 29.33 inches (745 millimeters) in Changping District, Beijing. This marked the heaviest rainfall in Beijing since records began 140 years ago. The Hai River Basin experienced its largest flood extent in 60 years. More than 200,000 homes were damaged or destroyed. China's Banking and Insurance Regulatory Commission (CBIRC) cited at least 266,000 claims had been filed with an insured value of CNY9.76 billion (USD1.3 billion). Typhoon Haikui also struck Fujian province, China before its remnants later tracked into southern China, and led to substantial rainfall in the greater Hong Kong region. The Hong Kong Observatory recorded its highest hourly rainfall since 1884. Extensive flooding was cited in several regions, including parts of Guangdong and Guangxi provinces. Haikui arrived just a week after Typhoon Saola, which spawned more than 35,000 insurance claims in China.

Elsewhere, Japan was affected by two landfalling storms—Lan and Yun-Yeung. Heavy rains associated with another storm—Typhoon Mawar—interacted with the seasonal "Maiyu" monsoon front that spawned nearly JPY40 billion (USD280 million) in insurance claims, per the General Insurance Association of Japan.

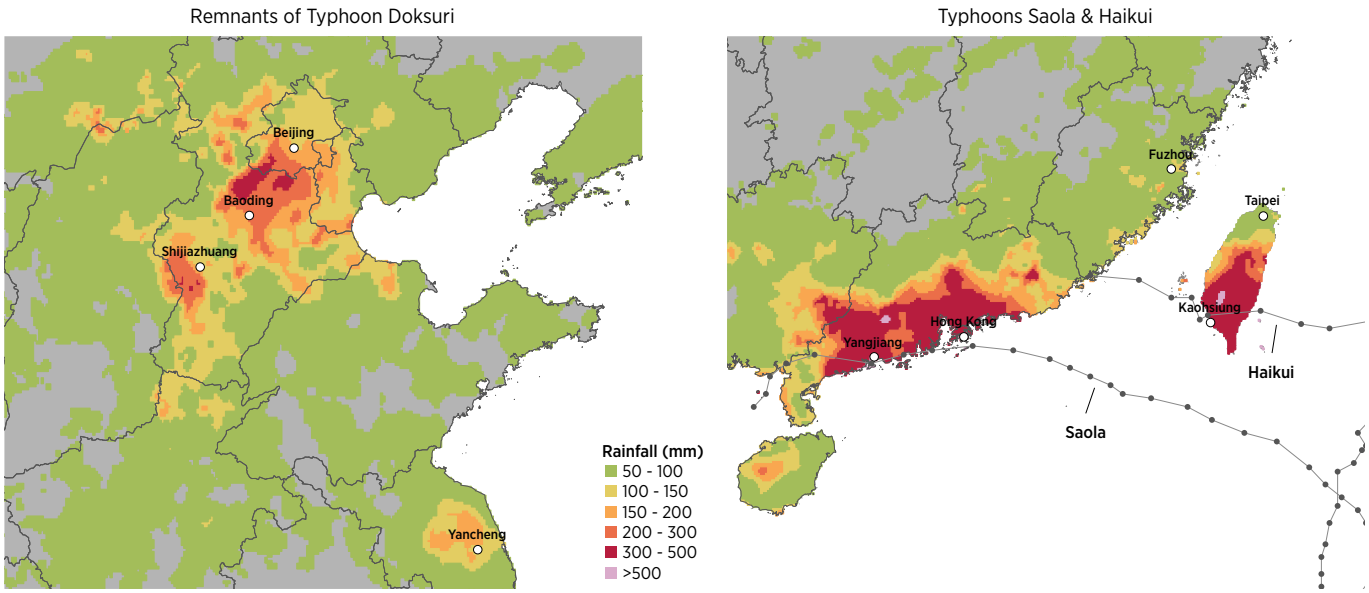


Figure 14: Satellite-derived rainfall for northern and southern China from the remnants of Typhoon Doksuri (August) and Typhoons Saola & Haikui (September)
Data: NASA / GPM | **Graphic:** Arthur J. Gallagher & Co.

What It Means: Wind impacts from tropical cyclones were relatively benign thus far as intense hurricanes/typhoons made landfall in less exposed regions (e.g., Idalia, Mocha and Saola). However, induced floods from tropical cyclones are increasingly impacting the market and society. As the atmosphere warms and holds more water vapor, places exposed to tropical cyclone risks are more likely to see heavier rainfall in the future and will need to plan for infrastructure that can handle higher return period events. Compound flooding can be difficult to forecast, and limits the time allowed for evacuations and the mobilizations of resources. The insurance industry will need to consider the totality of tropical cyclone impacts moving forward and recognize that the precipitation component is expected to drive a higher portion of future losses and humanitarian impacts.

US Flooding: New York City/New England Flash Floods

Torrential rainfall inundated highly urbanized areas of southern New York, Connecticut, and Massachusetts through September 29 and prompted multiple flash flood warnings. A state of emergency was declared in New York City.

- The most notable inundation occurred in the populated regions of New York City, Long Island, and Connecticut
- Localities in southwestern Long Island recorded rainfall totals of 9+ inches (225+ millimeters) on September 29
- Extensive impacts to infrastructure, buildings, vehicles, and public transportation were incurred across New York City
- Economic impact is expected to result in a billion-dollar-plus loss

An uncommon weather pattern featuring a slow-moving low-pressure system approaching the East Coast, a ridge of high pressure exiting New England, and an intensifying low off the Mid-Atlantic seaboard allowed for a corridor of heavy to moderate rainfall and repeating or training storms to impact the Northeast between September 28–29. Rainfall, was aided by an inverted (north-to-south-oriented) trough that extended from the coastal low-pressure system, indicating a convergence (or coming together) of winds. When the winds collide, air is forced upwards producing bands of shower and thunderstorms that can lead to flooding when they move over land.

Significant flooding occurred in New York City, where multiple locations received 6 to 9+ inches (150 to 225+ millimeters) of rainfall in less than a day. A particularly bad situation unfolded in neighborhoods of the Bronx, Queens, and Long Island as impacts to infrastructure, vehicles, and public transportation were extensive. The National Weather Service (NWS) indicated September 29 became the wettest calendar day on record at John F. Kennedy (JFK) Airport (since 1948), beating the previous record set by Irene in August 2011.

The significant inundation was aided by the combination of torrential rain falling on highly urbanized boroughs in tandem with aging infrastructure and overwhelmed sewer systems which struggled to keep up with the high impact of the event. Extreme precipitation events and higher rainfall intensities become more likely as the environment continues to warm, given that warmer air can hold increasingly more moisture. The extensive flooding was expected to result in a billion-dollar-plus economic loss. This is the second such billion-dollar economic loss resulting from flash-flooding in the US this year, following an event in Fort Lauderdale in April. With flooding dominant events, a large portion of the damage often goes uninsured.

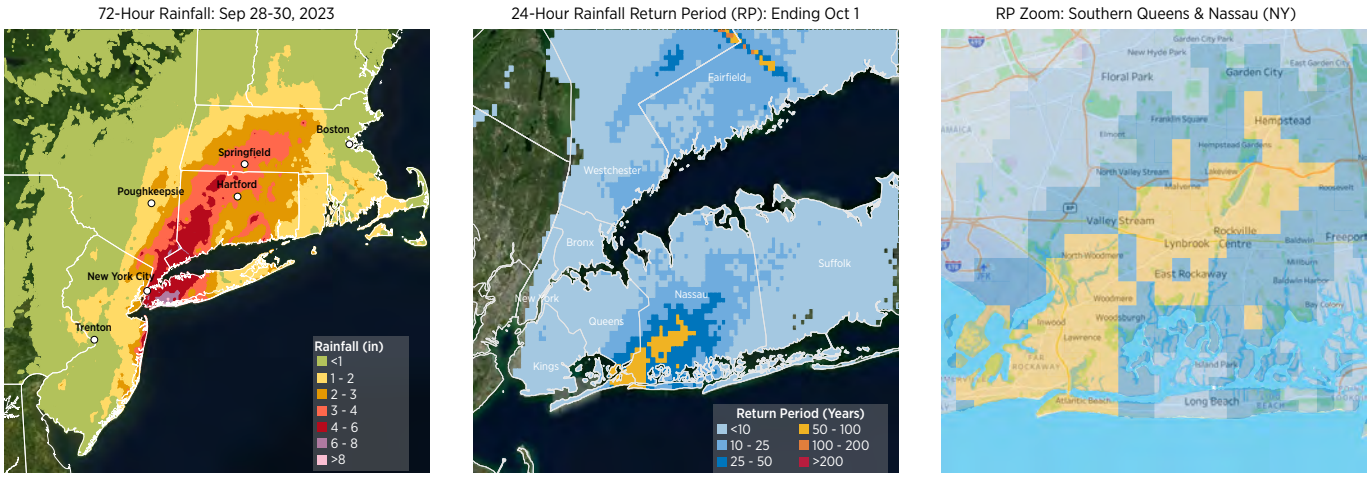


Figure 15: 72-hour radar estimated rainfall (left); 24-hour recurrence interval (center); return period zoom in some of the hardest-hit areas of Queens & Nassau, NY (right)
Data: NOAA (NSSL / MRMS) | **Graphic:** Arthur J. Gallagher & Co.

What It Means: High intensity/low probability rainfall events are occurring with greater frequency and severity. As the atmosphere and oceans continue to warm, it sets the stage for more intense rain events which prove problematic in areas that are not equipped to handle such volumes of precipitation. The return intervals of events are likely to shift to nearer-term frequencies in the future. This suggests that a 1-in-100-year event (1% probability of occurrence in any given year) from decades prior is likely a 1-in-75 year (1.3%) or 1-in-50 year (2%) today. Such changes in probability will translate to higher losses becoming more regularly expected from lower return period events.

Miscellaneous Events (Q3)

North America/US

In the US, the Lahaina wildfire rapidly spread across western portions of the Island of Maui in Hawaii, resulting in at least 97 fatalities in early August. The wind-driven fire destroyed no fewer than 2,207 structures and ranked among the state's costliest natural disasters on record—only behind 1992s Hurricane Iniki. Total economic losses were estimated to approach USD5.5 billion, with insured losses likely reaching USD3.4 billion. The Maui fires reinforced that wildfire risk is not just limited to certain areas of North America. Any ignited fire can spread and lead to extensive damage given favorable environmental conditions and vegetation. This is particularly concerning as more properties continue to develop into the Wildland Urban Interface (WUI) or intermix, further increasing the potential of damaging wildfires.

Canada recorded nearly 18 million hectares (44.5 million acres) burned by wildfire through Q3—ranking as the largest annual wildfire extent in the country's record (dating back until 1959). The previous record of 7.1 million hectares (17.5 million acres) was set in 1995. The fires in 2023 had a significant impact on forestry, tourism, infrastructure, and human health. In British Columbia, the Bush Creek East wildfire damaged or destroyed at least 270 structures. The McDougall wildfire and Kelowna Area fires impacted more than 200 properties and generated hundreds of millions (USD) in insured loss. In the Northwest Territories, tens of thousands of people were evacuated in August, including the entire capital of Yellowknife, as-out-of-control wildfires encroached upon the region. Smoke from the wildfires had caused prolonged periods of air quality alerts and warnings across Canada and the US in recent months.

After making landfall in Mexico's Baja California as a tropical storm on August 20, Hilary accelerated northward and brought rare tropical-storm conditions to parts of California and the southwestern US. In California, many locations saw their wettest August day on record, including Los Angeles, San Diego, and Palm Springs. The rainiest day on record at Death Valley and subsequent damage temporarily shuttered the national park. Further flooding and mudslides occurred in Mexico's Baja California Peninsula and Sinaloa. Localities in Baja California Sur received several months' worth of rainfall from the storm. While less than initially feared, Hilary resulted in industry losses which minimally reached USD450 million.

South America

In South America, a severe and multiyear drought continued to result in widespread humanitarian, environmental, and agricultural impacts primarily across the La Plata Basin and surrounding regions through Q3 2023. Year-to-date economic drought losses in Brazil, Argentina, and Uruguay combined were expected to exceed USD16 billion. Ongoing El Niño conditions were anticipated to aid in increased rainfall across some of the most impacted localities in the months ahead.

Incessant rainfall generated from an extratropical cyclone resulted in deadly flooding and significant damage across Brazil's Rio Grande do Sul state in early September. Record rainfall during the first five days of September was measured in Passo Fundo 11.7 inches/297.8 millimeters and Cruz Alta 291.8 millimeters/11.5 inchesamong other locations. In Cruz Alta, 6.3 inches (160 millimeters) of rainfall accumulated on September 4 alone. At least 47 weather-related deaths were confirmed, and thousands were left displaced or homeless. Rio Grande do Sul was previously impacted by an extra tropical cyclone in June which resulted in notable flooding and 16 additional fatalities across the state.

Asia

Floods hit North India during the monsoon period. The Yamuna River in Delhi swelled to an all-time high as the capital saw its wettest July day. Floodwaters reached places like the Red Fort and the outer circle of Connaught Place. Himachal Pradesh became the hardest-hit state when two other unprecedented spells in August triggered massive landslides. More than 400 deaths were reported in the state alone during the rainy season. Damage to property in the state were cited as more extensive than the last five years combined. While the north was rain-battered, the whole of India generally experienced its driest August since 1901. Drought-like conditions was particularly prevalent in Karnataka, which saw 28% less rainfall during the summer monsoon season.

Torrential rainfall from an enhanced Baiu front pummeled Kyushu, southwestern Japan, in early July. More than 1,500 properties were destroyed or damaged, with another 6,000-plus incurring flood inundation, mainly in Fukuoka and Yamaguchi prefectures. A high-level attrition study by the Japanese ministry revealed that the intensity of the rainfall could partially be attributed to ongoing atmospheric warming. The stagnated front additionally impacted neighboring South Korea, which saw its third-wettest East Asian monsoon season. The Goesan Dam overflowed for the second time in 43 years.

Oceania

States of emergency were declared in Queenstown, Gore, and Southland in New Zealand on September 21–22. Queenstown recorded its wettest 24-hour period in 24 years, and stormwater networks were overwhelmed. In Australia, the ICA had cautioned for early bushfire preparation due to heightened fire risks. Bushfires were already burning in several states, including New South Wales and Queensland.

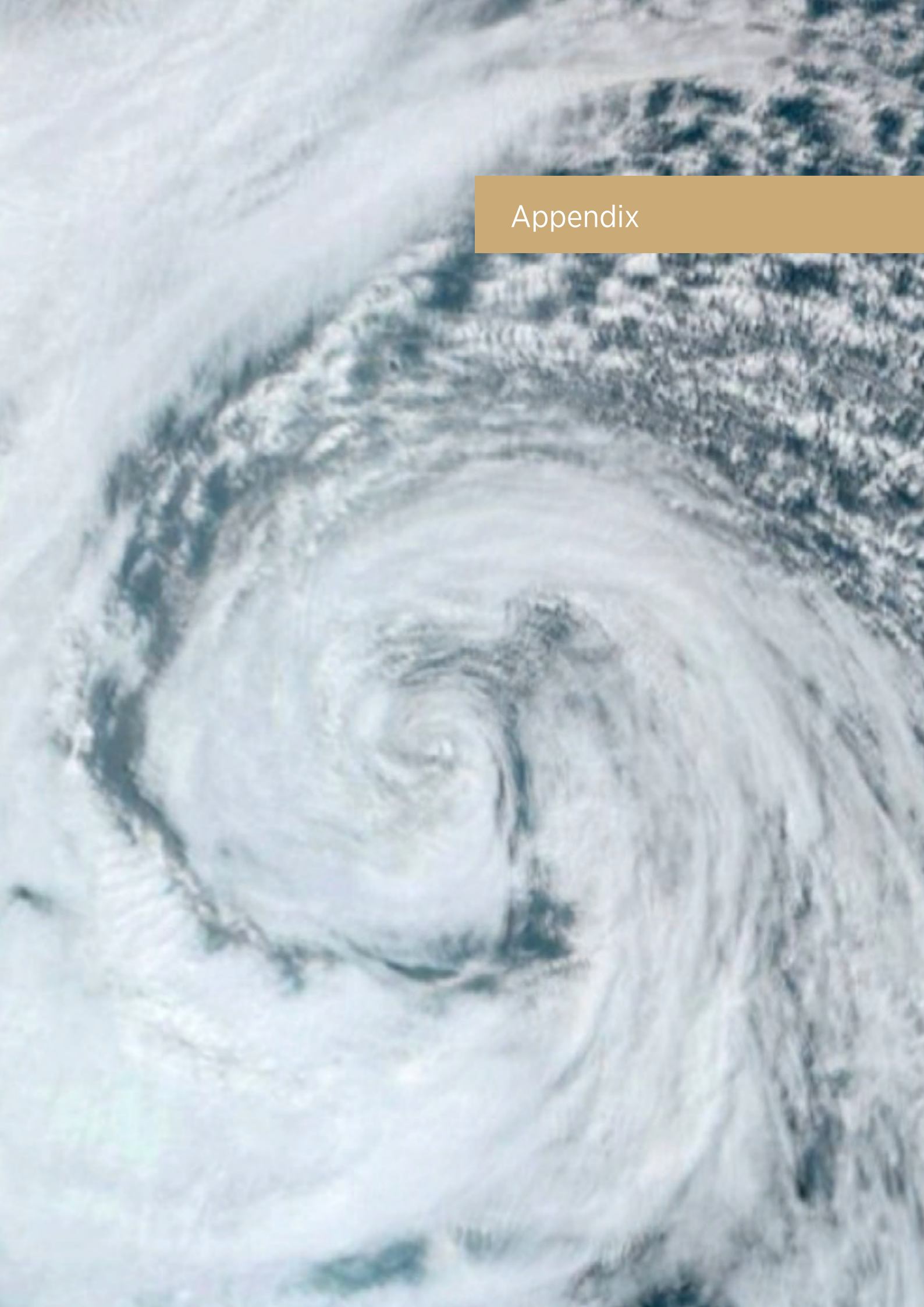
Europe

A succession of heatwaves and localized precipitation deficits drove expanding drought conditions across regions of western and central Europe during the first nine months of 2023. Drought was particularly severe in Spain, where record drought-driven crop loss claims through Q3 were expected to exceed those paid in all of 2022.

Greece was particularly impacted by a summer of extreme weather, as wildfires, heatwaves, and floods affected the Balkan nation in Q3. A wildfire, which ignited near the city of Alexandroupolis in Western Thrace in late August, grew to become the largest in the European Union's recorded history, burning at least 96,000 hectares (237,200 acres). By the end of Q3, 174,000 hectares (430,000 acres) were affected by wildfire nationwide, well above the 2006–2022 average of 42,800 hectares (105,750 acres). As of this publication, 28 wildfire deaths and 76 injuries were recorded. Economic losses from the Greek summer fires were anticipated to reach at least USD1.7 billion.

Africa

On September 8, a powerful magnitude 6.8 earthquake struck Morocco's Al Haouz province in the High Atlas Mountains, around 46 miles (75 kilometers) southwest of the historic city of Marrakech. This ranked as the strongest event recorded in Morocco since at least 1900. A magnitude 4.9 aftershock was recorded minutes after the initial tremor. The temblor resulted in a humanitarian crisis as no fewer than 2,960 people were killed and more than 5,500 injured, many in remote areas. The event caused extensive damage to homes, businesses, automobiles, and world heritage sites in the region. As many as 60,000 homes were damaged or destroyed. Direct damage from the earthquake was likely to top USD6 billion. Insured costs were likely to approach USD500 million.



Appendix

January–September 2023 Events: Preliminary Statistics

Please note that the appendix solely includes a listing of global events that resulted in >USD100 million in economic loss and/or >10 fatalities. It typically does not include a listing of aggregated loss totals from agencies that are not easily attributed to an individual event. Economic losses are provided in USD millions and are adjusted to year-to-date dollar values using the US Consumer Price Index, and a construction index and cost of labor factor. Some totals may be rounded.

Drought

Event Name	Date	Region	Countries	Economic Loss	Fatalities
China Drought	Jan. 1–Sep. 30	Asia	CN	2,800+	–
India Drought	Jan. 1–Sep. 30	Asia	IN	2,550+	–
Italy Drought	Jan. 1–Sep. 30	Europe	IT	770+	–
France Drought	Jan 1– Sep 30	Europe	FR	410+	–
Spain Drought	Jan. 1–Sep. 30	Europe	ES	8,200+	–
Argentina Drought	Jan. 1–Sep. 30	Latin America	AR	9,200+	–
Brazil Drought	Jan. 1–Sep. 30	Latin America	BR	6,200+	–
Uruguay Drought	Jan. 1–Sep. 30	Latin America	UY	1,300+	–
US Drought	Jan. 1–Sep. 30	US	US	4,100+	–

Earthquake

Event Name	Date	Region	Countries	Economic Loss	Fatalities
Marrakesh-Safi Earthquake	Sep. 8	Africa	MA	6,000+	2,946
Jurm Earthquake	Mar .21	Asia	AF and PK	–	21
Turkey and Syria EQ Sequence	Feb. 6-23	Europe	TR and SY	46,300+	59,259+
Courcon France Earthquake	June 16	Europe	FR	300+	–
Guayas Earthquake	Mar. 19	Latin America	EC and PE	Millions	18
Western Azerbaijan Earthquake	Jan. 28	Middle East	IR	100+	3

European Windstorm

Event Name	Date	Region	Countries	Economic Loss	Fatalities
Gerard	Jan. 15-18	Europe	GB, FR, CZ, BE, DE, and CH	100+	–
Larisa/Diethelm	Mar. 7-10	Europe	AT, BE, CZ, DE, FR, IE, GB, NL, and LU	100+	–
Mathis/Markus	Mar. 30-31	Europe	GB, FR, CZ, BE, DE, and CH	100+	2
Poly	Jul. 4-6	Europe	NL, DE, and IT	300+	2
Hans	Aug. 6-8	Europe	DK, DE, EE, FI, LV, LT, NO, and SE	690+	2

Flooding/Landslides

Event Name	Date	Region	Countries	Economic Loss	Fatalities
Southern Africa Floods	Feb. 4-14	Africa	ZA, MZ, and SW	390+	29
	Mar. 20-Apr. 1	Africa	ET	–	29
Gu Rainy Season	Mar. 22-May 19	Africa	SO	25+	22
	Mar. 23-27	Africa	KE	–	12
Burundi Flooding	Mar. 30-Apr.7	Africa	BI	-	14
Angola April Floods	Apr. 1-28	Africa	AO	-	54
	Apr. 23-27	Africa	KE	-	12
East-Central Floods	May 2-9	Africa	RW, UG, and CD	170+	629
Niger Rain Season	July 1-Sep. 30	Africa	NE	–	41
West Cape Floods	Sep. 23 -26	Africa	SA	150+	11
Philippines Flooding	Jan. 1-18	Asia	PH	30+	45
Serasan Landslide	Mar. 6	Asia	ID	–	50
	Mar. 18-20	Asia	PK	Millions	10
	Apr. 16	Asia	IN	–	13
Torkham Landslide	Apr. 18	Asia	PK	-	12
Southeast China Floods	May 2-7	Asia	CN	200+	4
	Jun. 1-5	Asia	CN	105+	22
	Jun. 7-10	Asia	CN	170+	-
India Seasonal Floods	Jun. 14-Sep. 30	Asia	IN	5,025+	2,432
China Seasonal Floods	Jun. 17-Sep. 30	Asia	CN	10,000	302
	Jun. 25-Sep. 30	Asia	PK	Millions	226
	Jun. 29-Jul. 11	Asia	JP	950+	13
	Jul. 2-6	Asia	CN	–	15
	Jul. 9-18	Asia	KR	73+	47
	Jul. 15-16	Asia	JP	100+	1
	Jul. 20	Asia	BT	–	23
	Jul. 23	Asia	AF	-	38
	Aug. 1	Asia	BD	25+	57
Xi'An Mudslide	Aug. 8	Asia	CN	–	21
Jade Mine Collapse	Aug. 13	Asia	MM	-	33
	Aug. 27-28	Asia	TJ	-	21
	Sep. 12	Asia	VN	Millions	10
	Mar. 15	Europe	TR	–	18

Flooding/Landslides (continued)

Event Name	Date	Region	Countries	Economic Loss	Fatalities
Italy Flood/Minverva	May 12–17	Europe	IT, BA, and HR	10,000+	15
Shovi Landslide	Aug. 3	Europe	GE	–	19
Petar/Zacharias	Aug. 3–6	Europe	AT, HR, and SI	5,310+	7
September Dana Floods	Sep. 2–6	Europe	ES, and DZ	300+	10
Storm Daniel	Sep. 4–11	Europe	GR, TR, BG, and LY	10,100+	4,361+
Storm Elias	Sep. 25–27	Europe	GR	100+	–
Ecuador Rainy Season	Jan. 1–Mar. 12	Latin America	EC	Millions	25
Peru Flooding H1	Feb. 5–Jun. 13	Latin America	PR	100+	79
Sao Paulo Floods	Feb. 18–20	Latin America	BR	30+	64
Cyclone Yaku	Mar. 7–13	Latin America	PE	380+	6
Alausi Landslide	Mar. 26	Latin America	EC	Millions	33
Chimborazo Landslide	Apr. 26	Latin America	EC	–	23
Guatemala Rainy Season	Jun. 1–Sep. 20	Latin America	GT	10s of millions	35
Haiti June Floods	Jun. 3–5	Latin America	HT	Millions	58
June Extratropical Cyclone	Jun. 15–19	Latin America	BR	200+	16
	July 7–12	Latin America	BR	Millions	15
	July 17–18	Latin America	CO	Millions	15
Chile Atmospheric River	Aug. 17–22	Latin America	CL	400+	3
Rio Grande do Sul Floods	Sep. 2–7	Latin America	BR	475+	47
Nova Scotia Flooding	Jul. 21–22	North America	CA	380+	3
Ottawa Flooding	Aug. 10	North America	CA	175+	–
North Island Floods	Jan. 26–Feb. 2	Oceania	NZ	1,890+	4
CA Atmospheric River #1	Jan. 4–10	United States	US	870+	11
CA Atmospheric River #2	Jan. 11–16	United States	US	615+	2
CA Atmospheric River #3	Jan. 17–19	United States	US	140+	–
Western US Upper-Level Low	Feb. 21–22	United States	US	355+	–
CA Atmospheric River #4	Feb. 23–25	United States	US	405+	–

Flooding/Landslides (continued)

Event Name	Date	Region	Countries	Economic Loss	Fatalities
CA Atmospheric River #5	Feb. 26–Mar. 2	United States	US	215+	–
CA Atmospheric River #6	Mar. 9–12	United States	US	250+	2
CA Atmospheric River #7	Mar. 13–15	United States	US	610+	2
CA Bomb Cyclone	Mar. 21–23	United States	US	230+	5
Ft. Lauderdale Flash Flood	Apr. 10–13	United States	US	1,110+	
West Kentucky Floods	July. 19	United States	US	150+	–
New York City Flash Flood	Sep. 28–29	United States	US	>1,000	–

Severe Convective Storm

Event Name	Date	Region	Countries	Economic Loss	Fatalities
	May 5–10	Africa	SL	–	15
	Mar. 16–20	Asia	IN	Millions	16
	May 23–24	Asia	BD	–	18
	May 26	Asia	IN	Millions	13
	Jun.. 9–11	Asia	CN	100	–
	Jun. 10–11	Asia	PK	–	27
Jiangsu Tornado and SCS	Sep. 19	Asia	CN	160+	10
Lows Kay and Lambert	June 18–23	Europe	AT, BE, CZ, DE, FR and SK	1,440+	1
Zaragoza Flooding and SCS	Jul. 6	Europe	ES and FR	230	–
July SCS Outbreak #1	Jul. 11–13	Europe	AT, CZ, FR, DE, IT, RS and SI	795+	–
July SCS Outbreak #2	Jul. 17–19	Europe	AT, BA, HR, DE, IT, RS, SK and SI	975+	6
July SCS Outbreak #3	Jul. 20–25	Europe	BA, HR, FR, DE, HU, IT, RO, RS, SK, SI and CH	3,195+	10

	Jul. 30	Europe	RU	Millions	10
Arend/Bernd	Aug. 12–16	Europe	AT, CZ, DE, FR, IT, and PO	290+	–
Denis/Rae	Aug. 24–30	Europe	AT, CZ, FR, DE, IT, LT, LV, NO, PL, ES, and CH	1,970+	–
Canada Day SCS	Jul. 1	North America	CA	180+	–
ON and QB Storms	Jul. 13	North America	CA	255+	–
Calgary July Hail	Jul. 15–16	North America	CA	125+	–
Southeast Canada SCS	Jul. 20–21	North America	CA	125+	–
Early August Outbreak	Aug. 3	North America	CA	125+	–
S. Ontario SCS and Flood	Aug. 23–25	North America	CA	130+	–
Winnipeg Hail	Aug. 24	North America	CA	155+	–
Newcastle Hailstorm	May 26	Oceania	AU	215+	–
Selma Tornado and SCS	Jan. 12	United States	US	845+	8
Houston Tornado and SCS	Jan. 24	United States	US	275+	–
	Feb. 7	United States	US	285+	–
	Feb. 15–17	United States	US	260+	–
Southern Plains Derecho	Feb. 26–28	United States	US	810+	1
Early March SCS and Wind	Mar. 1–3	United States	US	6,430+	13
Dallas/Fort Worth Hail	Mar. 16–17	United States	US	945	–
Mississippi Tornado and SCS	Mar. 23–28	United States	US	2,990+	24
Central US Outbreak	Mar. 30–Apri 1	United States	US	6,100+	33
Southern Plains Hail	Apr. 2	United States	US	150+	–
Early April US Outbreak	Apr. 3–5	United States	US	2,920+	6
Missouri Tornadoes and SCS	Apr. 14–16	United States	US	1,385+	–
Oklahoma Tornadoes and SCS	Apr. 18–22	United States	US	3,270+	3
Southern US Hail and SCS	Apr. 23–27	United States	US	1,410+	–
Late April Outbreak	Apr. 28–May 1	United States	US	1,300+	–

Severe Convective Storm (continued)

Event Name	Date	Region	Countries	Economic Loss	Fatalities
Early May Outbreak	May 2–9	United States	US	2,240+	1
Front Range and Midwest Hail	Mar. 9–16	United States	US	3,880+	1
Texas Hail and SE SCS	May 17–20	United States	US	1,790+	–
	May 22–26	United States	US	735+	2
	May 23–25	United States	US	150+	–
	May 31–Jun. 4	United States	US	220+	–
	Jun. 5–8	United States	US	590+	–
Texas Hail and Southern SCS	Jun. 9–14	United States	US	4,020+	4
Early Summer Outbreak	Jun. 15–19	United States	US	3,835+	–
Great Lakes June SCS	Jun. 15–16	United States	US	685+	–
CO and TX Outbreak and SCS	Jun. 21–26	United States	US	5,530+	7
Midwest Derecho and SCS	Jun. 28–Jul. 4	United States	US	1,610+	–
	Jul. 3–9	United States	US	730+	–
Northeast SCS and Floods	Jul. 5–10	United States	US	2,125+	–
IL Tornadoes and Central SCS	Jul. 9–12	United States	US	1,570+	–
Mid–July SCS and NC Tornado	Jul. 15–19	United States	US	990+	–
MN Hail and Eastern SCS	Jul. 19–21	United States	US	1,745+	1
Colorado July Outbreak	Jul. 19–20	United States	US	255+	–
Central and Eastern Outbreaks	Jul. 25–31	United States	US	1,265+	–
Arizona Dust Storm and SCS	Jul. 25–30	United States	US	175+	–
August Extended Outbreak	Aug. 4–8	United States	US	1,300+	2
Minneapolis Hail	Aug. 10–11	United States	US	1,200+	–
Mid–August Outbreak	Aug. 12–15	United States	US	345+	1
Great Lakes SCS	Aug. 22–24	United States	US	650+	5
Phoenix SCS and Floods	Aug. 31–Sep 2	United States	US	215+	–
Eastern SCS and Floods	Sep. 9–11	United States	US	535+	–
	Sep. 12–14	United States	US	200+	–
Southern Plains Hail	Sep. 23–24	United States	US	1,300	–
	Sep. 26-27	United States	US	315+	2

Tropical Cyclone

Event Name	Date	Region	Countries	Economic Loss	Fatalities
Tropical Storm Cheneso	Jan. 18–25	Africa	MG	20+	33
Cyclone Freddy	Feb. 21–Mar 5	Africa	MG, MU, MW, MZ, and ZW	900+	1,434
Cyclone Mocha	May 14–15	Asia	MM, BD, and IN	2,243+	463
Typhoon Mawar	May 23–Jun 2	Asia	GU, PH, TW, and JP	1,020+	9
Cyclone Biparjoy	June 15–17	Asia	PK and IN	250+	16
Typhoon Talim	Jul. 17–18	Asia	PH, HK, and CN	373+	2
Typhoon Doksuri	Jul. 24–31	Asia	PH, TW, and CN	20,000+	111
Typhoon Khanun	Aug. 2–11	Asia	JP, TW, KR, and RU	230+	10
Typhoon Lan	Aug. 14–16	Asia	JP	150+	–
Typhoon Saola	Aug. 27–Se.p 2	Asia	PH, CN, and HK	580+	2
Typhoon Haikui	Sep. 2–8	Asia	CN, HK, and TW	4,670+	14
Tropical Storm Yun Yueng	Sep. 8–9	Asia	JP	160+	3
Hurricane Lee	Sep. 15–17	North America	CA and US	150+	2
Cyclone Gabrielle	Feb. 11–17	Oceania	NZ	1,800+	11
Hurricane Hilary	Aug. 19–22	United States	MX and US	1,025+	2
Hurricane Idalia	Aug. 29–31	United States	CU and US	2,425+	2
Tropical Storm Ophelia	Sep. 23–26	United States	US	375+	2

Wildfire

Event Name	Date	Region	Countries	Economic Loss	Fatalities
	Jul. 23–26	Africa	GZ	–	34
Kazakhstan Wildfires	Jun. 8–15	Asia	KZ	–	15
Asturias Spring Wildfires	Mar. 20–Apr 13	Europe	ES	100+	–
Kurgan Region Wildfires	May. 6–11	Europe	RU	–	21
Spain Q3 Wildfires	Jul. 1–Sep. 1	Europe	ES	710+	–
Greece Summer Wildfires	Jul. 13–Sep. 1	Europe	GR	1,720+	23
Chile Wildfires	Jan. 30–Feb. 18	Latin America	CL	505+	26
Tantallon Fire	May 28–Jun 4	North America	CA	200+	–
Kelowna Area Wildfires	Aug. 15–Sep. 21	North America	CA	600+	–

Bush Creek East Fire	Aug. 18–Sep. 1	North America	CA	400+	–
Lahaina Fire	Aug. 18–24	United States	US	5,500+	98
Gray Fire	Aug. 18–24	United States	US	450+	1

Winter Weather

Event Name	Date	Region	Countries	Economic Loss	Fatalities
	Jan. 5–10	Asia	IN	Millions	25
Afghanistan Cold Spell	Jan. 10–27	Asia	AF	–	166
Nyinchi Avalanche	Jan. 17–23	Asia	CN	40+	28
Tajik Avalanche	Feb. 15–16	Asia	TJ	Millions	20
	Apr. 20–24	Asia	CN	113+	1
	May 27	Asia	PK	–	11
	Feb. 4–5	Europe	AT, IT, and CH	–	11
Eastern Canada Freeze	Feb. 3–5	North America	CA	177+	–
Canada Spring Ice Storm	April 5–6	North America	CA	450+	–
Southern Plains Ice Storm	Jan. 30–Feb 2	North America	US	360+	10
Northeast Freeze	Feb. 2–5	North America	US	2,120+	–
Upper Midwest Blizzard	Feb. 21–23	North America	US	270+	3
March Nor'easter	Mar. 13–15	North America	US	220+	–

Other

Event Name	Date	Region	Countries	Economic Loss	Fatalities
Japan Seasonal Heatwave	May 1–Sep 30	Asia	JP	–	106
South Korea Heatwave	June 16–30	Asia	KR	–	32
India June Heatwave	June 17–19	Asia	IN	–	264+
Pakistan June Heatwave	Jun. 23–26	Asia	PK	–	22
Europe June Heatwave	Jun. 1–30	Europe	–	–	3,500+
Europe July Heatwave	Jul. 1–31	Europe	–	–	1,900+
Mexico Heatwaves	Mar. 19–Sep 30	North America	MX	–	387+
US June Heatwave	June 17–30	United States	US	–	14

Country Abbreviations

Country Name	Abbreviation
Afghanistan	AF
Aland Islands	AX
Albania	AL
Algeria	DZ
American Samoa	AS
Andorra	AD
Angola	AO
Anguilla	AI
Antarctica	AQ
Antigua and Barbuda	AG
Argentina	AR
Armenia	AM
Aruba	AW
Australia	AU
Austria	AT
Azerbaijan	AZ
Bahamas	BS
Bahrain	BH
Bangladesh	BD
Barbados	BB
Belarus	BY
Belgium	BE
Belize	BZ
Benin	BJ
Bermuda	BM
Bhutan	BT
Bolivia	BO
Bonaire, Sint Eustatius and Saba	BQ
Bosnia and Herzegovina	BA
Botswana	BW
Bouvet Island	BV
Brazil	BR
British Indian Ocean Territory	IO
Virgin Islands (UK)	VG
Brunei	BN
Bulgaria	BG
Burkina Faso	BF
Burundi	BI
Cambodia	KH
Cameroon	CM
Canada	CA
Cape Verde	CV
Cayman Islands	KY
Central African Republic	CF
Chad	TD
Chile	CL
China	CN

Country Name	Abbreviation
Christmas Island	CX
Cocos Islands	CC
Colombia	CO
Comoros	KM
Cook Islands	CK
Costa Rica	CR
Croatia	HR
Cuba	CU
Curacao	CW
Cyprus	CY
Czech Republic	CZ
Democratic Republic of the Congo	CD
Denmark	DK
Djibouti	DJ
Dominica	DM
Dominican Republic	DO
East Timor	TL
Ecuador	EC
Egypt	EG
El Salvador	SV
Equatorial Guinea	GQ
Eritrea	ER
Estonia	EE
Ethiopia	ET
Falkland Islands	FK
Faroe Islands	FO
Fiji	FJ
Finland	FI
France	FR
French Guiana	GF
French Polynesia	PF
French Southern Territories	TF
Gabon	GA
Gambia	GM
Georgia	GE
Germany	DE
Ghana	GH
Gibraltar	GI
Greece	GR
Greenland	GL
Grenada	GD
Guadeloupe	GP
Guam	GU
Guatemala	GT
Guernsey	GG
Guinea	GN
Guinea-Bissau	GW

Country Name	Abbreviation
Guyana	GY
Haiti	HT
Heard Island and McDonald Islands	HM
Honduras	HN
Hong Kong	HK
Hungary	HU
Iceland	IS
India	IN
Indonesia	ID
Iran	IR
Iraq	IQ
Ireland	IE
Isle of Man	IM
Israel	IL
Italy	IT
Ivory Coast	CI
Jamaica	JM
Japan	JP
Jersey	JE
Jordan	JO
Kazakhstan	KZ
Kenya	KE
Kiribati	KI
Kosovo	XK
Kuwait	KW
Kyrgyzstan	KG
Laos	LA
Latvia	LV
Lebanon	LB
Lesotho	LS
Liberia	LR
Libya	LY
Liechtenstein	LI
Lithuania	LT
Luxembourg	LU
Macao	MO
Macau	MO
Macedonia	MK
Madagascar	MG
Malawi	MW
Macedonia	MK

Country Abbreviations

Country Name	Abbreviation
Malaysia	MY
Maldives	MV
Mali	ML
Malta	MT
Marshall Islands	MH
Martinique	MQ
Mauritania	MR
Mauritius	MU
Mayotte	YT
Mexico	MX
Micronesia	FM
Moldova	MD
Monaco	MC
Mongolia	MN
Montenegro	ME
Montserrat	MS
Morocco	MA
Mozambique	MZ
Myanmar	MM
Namibia	NA
Nauru	NR
Nepal	NP
Netherlands	NL
Netherlands Antilles	AN
New Caledonia	NC
New Zealand	NZ
Nicaragua	NI
Niger	NE
Nigeria	NG
Niue	NU
Norfolk Island	NF
North Korea	KP
Northern Mariana Islands	MP
Norway	NO
Oman	OM
Pakistan	PK
Palau	PW
Palestinian Territory	PS
Panama	PA
Papua New Guinea	PG
Paraguay	PY
Peru	PE
Philippines	PH
Pitcairn	PN
Poland	PL
Portugal	PT

Country Name	Abbreviation
Puerto Rico	PR
Qatar	QA
Republic of the Congo	CG
Reunion	RE
Romania	RO
Russia	RU
Saint Kitts and Nevis	KN
Saint Lucia	LC
Saint Martin	MF
Saint Pierre and Miquelon	PM
Saint Vincent and the Grenadines	VC
Samoa	WS
San Marino	SM
Sao Tome and Principe	ST
Saudi Arabia	SA
Senegal	SN
Serbia	RS
Serbia and Montenegro	CS
Seychelles	SC
Sierra Leone	SL
Singapore	SG
Sint Maarten	SX
Slovakia	SK
Slovenia	SI
Solomon Islands	SB
Somalia	SO
South Africa	ZA
South Georgia and the South Sandwich Islands	GS
South Korea	KR
South Sudan	SS
Spain	ES
Sri Lanka	LK
Sudan	SD
Suriname	SR
Svalbard and Jan Mayen	SJ
Swaziland	SZ
Sweden	SE
Switzerland	CH
Syria	SY
Taiwan	TW
Tajikistan	TJ
Tanzania	TZ
Thailand	TH
Togo	TG
Tokelau	TK

Country Name	Abbreviation
Tonga	TO
Trinidad and Tobago	TT
Tunisia	TN
Turkey	TR
Turkmenistan	TM
Turks and Caicos Islands	TC
Tuvalu	TV
Virgin Islands (US.)	VI
Uganda	UG
Ukraine	UA
United Arab Emirates	AE
United Kingdom	GB
United States	US
Uruguay	UY
Uzbekistan	UZ
Vanuatu	VU
Vatican	VA
Venezuela	VE
Vietnam	VN
Wallis and Futuna	WF
Western Sahara	EH
Yemen	YE
Zambia	ZM
Zimbabwe	ZW

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