

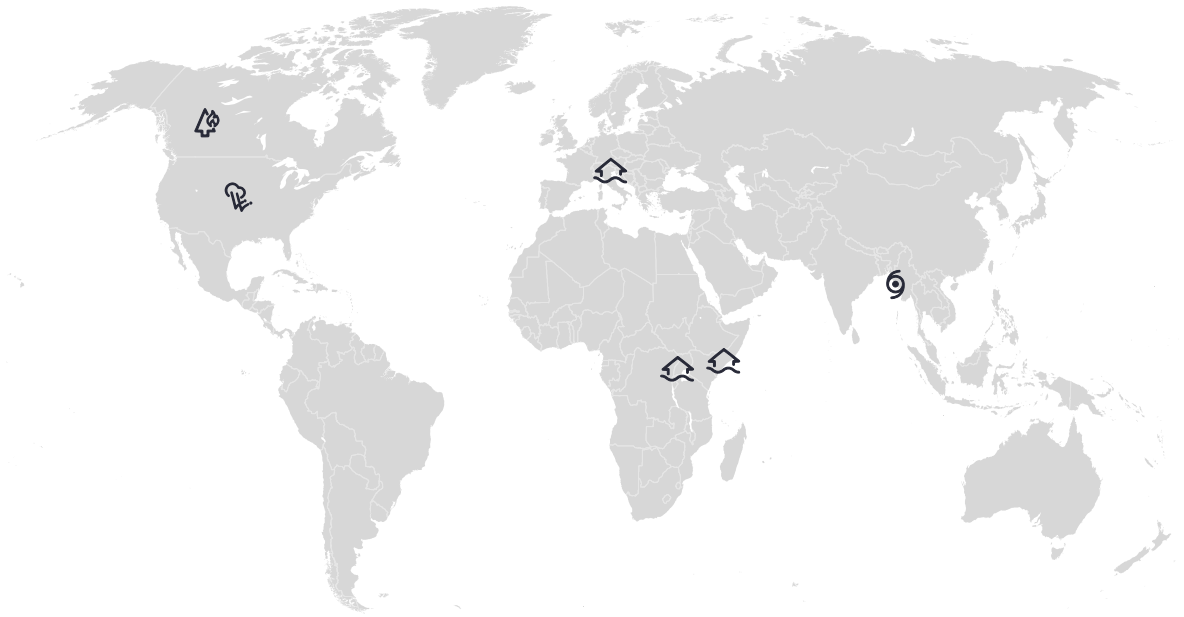


Weekly Cat Report

May 19, 2023



Executive Summary



| Event | Affected Region(s) | Fatalities | Economic Loss (\$) | Page |
|--------------------------------|----------------------------|------------|--------------------|------|
| Flooding | Southern & Central Europe | 14 | Billions | 3 |
| Cyclone Mocha | Myanmar, Bangladesh, India | 463+ | 10s of millions | 7 |
| Wildfire & Heatwave | Canada | 0 | 100s of millions | 10 |
| Flooding | Somalia | 22+ | Unknown | 12 |
| Flooding | Uganda | 23+ | Unknown | 12 |
| Severe Convective Storm | United States | 1 | 10s of millions | 12 |

Please note that any financial loss estimate is preliminary and subject to change. These estimates are provided as an initial view of the potential financial impact from a recently completed or ongoing event based on early available assessments. Significant adjustments may inevitably occur. All losses in US dollars (\$) unless noted otherwise.

Along with this report, we continue to welcome users to access current and historical natural catastrophe data and event analysis on Impact Forecasting's Catastrophe Insight website: <http://catastropheinsight.aon.com>

Southern & Central Europe: Flooding

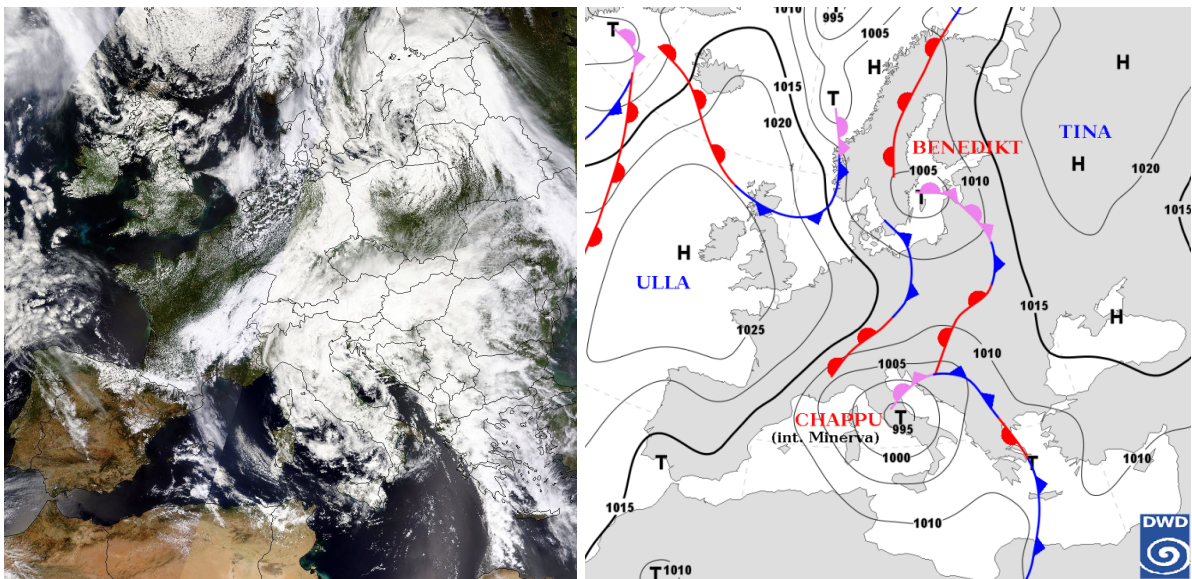
Overview

Severe flooding episode triggered by heavy rainfall affected Italy and several other countries in Southern and Central Europe on May 14-17. Emilia-Romagna Region in Italy was particularly impacted, with at least 14 fatalities reported and considerable damage on property, vehicles, infrastructure, and agriculture. This event comes two weeks after the first round of flooding that impacted the region. According to regional governments, total economic losses were initially anticipated to reach into the billions of EUR.

Meteorological and Hydrological Recap

Heavy rainfall and localized thunderstorms started to affect the region on May 13-14, as the first low-pressure system **Benedikt** (named by the FU Berlin) brought favourable conditions for storm development and intense precipitation. A new round of downpours associated with another low **Chappu** followed on May 15-17. This storm acquired an international name **Minerva**.

Note: The Free University of Berlin names all low-pressure systems that affect the European continent and these names are widely used in German-speaking countries. However, groups of national meteorological agencies across Europe have separate naming systems for significant extratropical cyclones; in particular, Minerva was officially named by the Operational Center for Meteorology of the Italian Air Force, on behalf of the group of Central Mediterranean countries (Slovenia, Croatia, Montenegro, Albania and Malta).

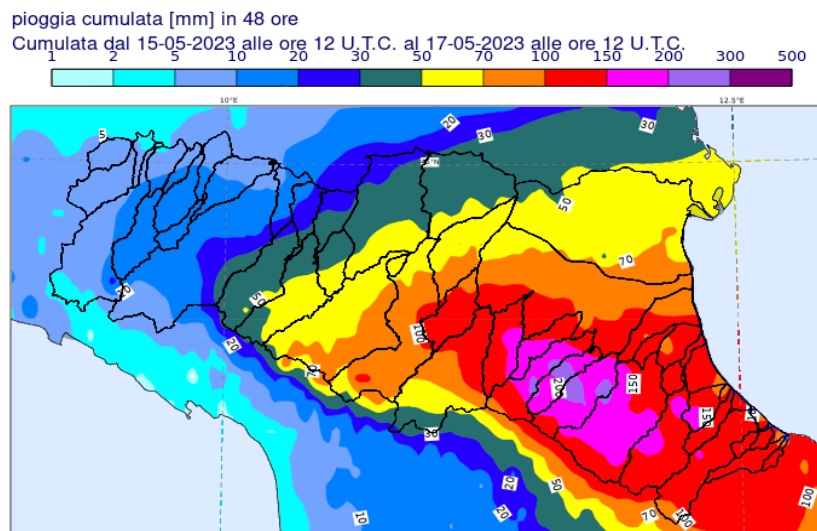


Minerva (Chappu) on a satellite image, and a surface analysis chart on May 16

Source: NASA, DWD

The low persisted over the region for several days, bringing torrential rain, particularly in Emilia-Romagna region, central-northern Italy. 48-hour rainfall totals exceeded 200 mm (7.9 inches) at multiple locations (see Table below).

This rainy episode followed intense rainfall that hit the same area in early May. These two notable events resulted in extreme rainfall totals. Several stations in the provinces of Forlì-Cesena, Ravenna and Bologna have **already surpassed 500 mm (19.7 inches) of rain since the beginning of May**, according to data provided by the local meteorological service (Arpae-SIMS).



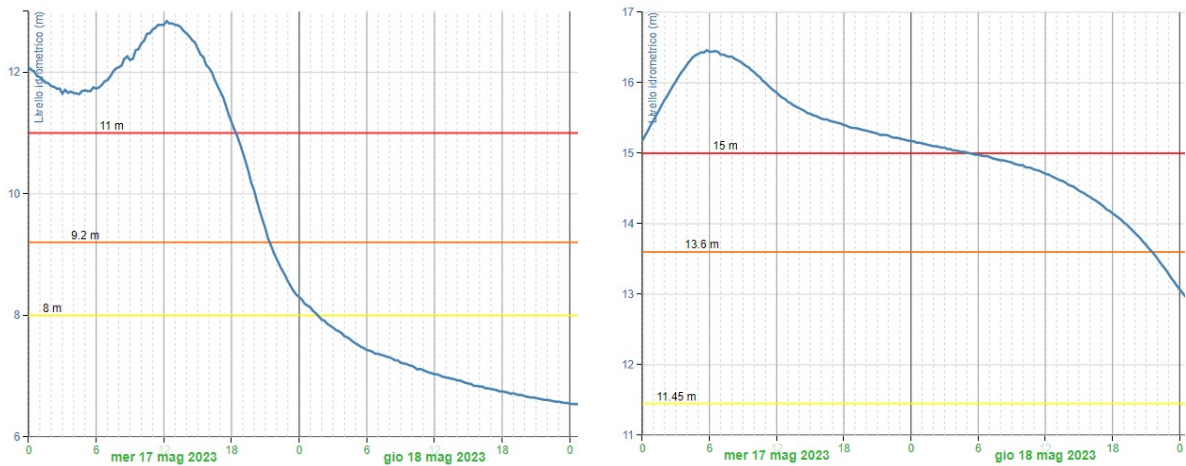
48-hour rainfall accumulation on May 16-17
Source: Arpae Emilia-Romagna

48-hour rainfall totals at selected stations, May 16-17

Source: Arpae-SIMC

| Station, Province | Rainfall total (mm) | Station, Province | Rainfall total (mm) |
|---------------------------------|---------------------|----------------------------|---------------------|
| Monte Albano, Ravenna | 261 (10.3 in) | Monte Romano, Ravenna | 237 (9.3 in) |
| Trebbio, Forlì-Cesena | 255 (10.0 in) | Castel del Rio, Bologna | 226 (8.9 in) |
| S. Cassiano sul Lamone, Ravenna | 255 (10.0 in) | Monte Grosso, Forlì-Cesena | 220 (8.7 in) |
| Casola Valsenio, Ravenna | 243 (9.6 in) | Tredozio, Forlì-Cesena | 215 (8.5 in) |
| Le Taverne, Bologna | 238 (9.4 in) | Casoni di Romagna | 200 (7.9 in) |

Flood risk across the region was exacerbated due to significant soil saturation after heavy rains from early May. During the recent event peak, 23 rivers and streams overflowed their banks. Red (highest) or orange alerts for flooding was issued for the provinces of Bologna, Ferrara, Forlì-Cesena, Modena, Parma, Ravenna, Reggio Emilia, and Rimini, starting to be valid on May 14.



Water levels at Castenaso gauging station, Idice River (left), and at Cotignola gauging station, Senio River (right), exceeding the third flood level (red line), which denotes an “exceptional flood”.

Source: Meteo Alert Emilia-Romagna

Heavy rainfall additionally triggered more than 280 landslide events in the Apennine range, with 120 landslides noted as significant, affecting no fewer than 58 municipalities.

Lows Benedikt and Minerva (Chappu) also brought heavy rain into the widespread area in the southern and central Europe, including Croatia, Bosnia and Herzegovina, Austria and the Czech Republic. Many locations recorded monthly rainfall totals just during this short rainy period. For instance, the Gračac station in Croatia recorded 425 mm (16.7 inches) of rain during 5-day period, well above the monthly average rainfall total for the region.

Event Details

In **Italy**, the regions of **Emilia-Romagna** and **Marche** were the worst affected by torrential rainfall and flooding. As of May 19, 14 fatalities were confirmed in the provinces of Forlì-Cesena and Ravenna, while several people remained missing at the time of this writing, and more than 10,000 were forced to leave their homes, particularly in the provinces of Bologna, Forlì-Cesena, and Ravenna. More than 1,000 firefighters conducted emergency missions due to flooding, intervening more than 2,175 times between May 15-19.



Source: Emilia-Romagna Region

Flooding caused closures on about 400 roads, and at least 50,000 power outages. Notable agricultural losses were incurred on tens of thousands of hectares of crop land. According to the local agricultural associations, more than 5,000 farms were inundated by floodwaters.

Emilia-Romagna region is still recovering from the severe flooding that hit the region earlier this month and resulted in two fatalities and notable property and infrastructure damage (see previous Weekly Cat Report).

Heavy rains since May 13 have triggered flooding also in **Croatia**, where dozens of buildings were submerged, and power outages occurred. Additional flooding was reported from Una and Sana River basins in **Bosnia and Herzegovina**. Minor material damage, along with hundreds of flood-related interventions conducted by the emergency services, were also reported from **Austria** and the **Czech Republic**, particularly due to flooded cellars.

Financial Loss

Damage assessments remain ongoing as multiple water courses still exceed flood stages. Additional rainfall is also expected in the coming days and the situation thus remains critical and more evacuations were announced on May 19. However, given the extensive scale of the disaster, local authorities are already anticipating economic losses in the billions of EUR. As a significant protection gap for flood coverage remains in place, impact on the insurance industry was expected to be a smaller percentage of the total cost.

Myanmar, Bangladesh, India: Cyclone Mocha

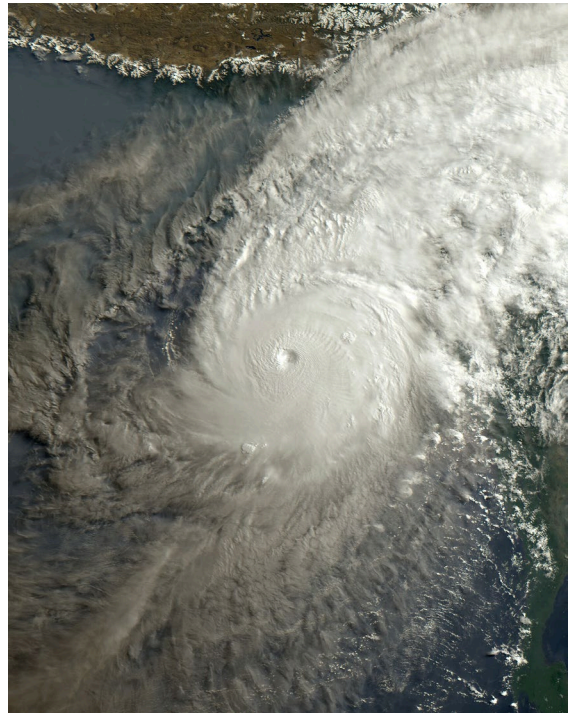
Overview

Tropical Cyclone Mocha became the first cyclone of the 2023 North Indian Ocean cyclone season. The deadly storm affected millions of people and caused material damage and evacuations in Myanmar, Bangladesh, and India, making landfall as a Category 4-equivalent storm in Myanmar's Rakhine State on May 14. As of this writing, at least 463 people were killed, and hundreds of others suffered injuries across the region.

Meteorological Recap

Mocha originated from a low-pressure area that the India Meteorological Department (IMD) started to monitor on May 8. Over the following days, very warm sea surface temperatures enhanced conditions for cyclone development. The system intensified into a cyclonic storm on May 11 and was named **Mocha** by the IMD.

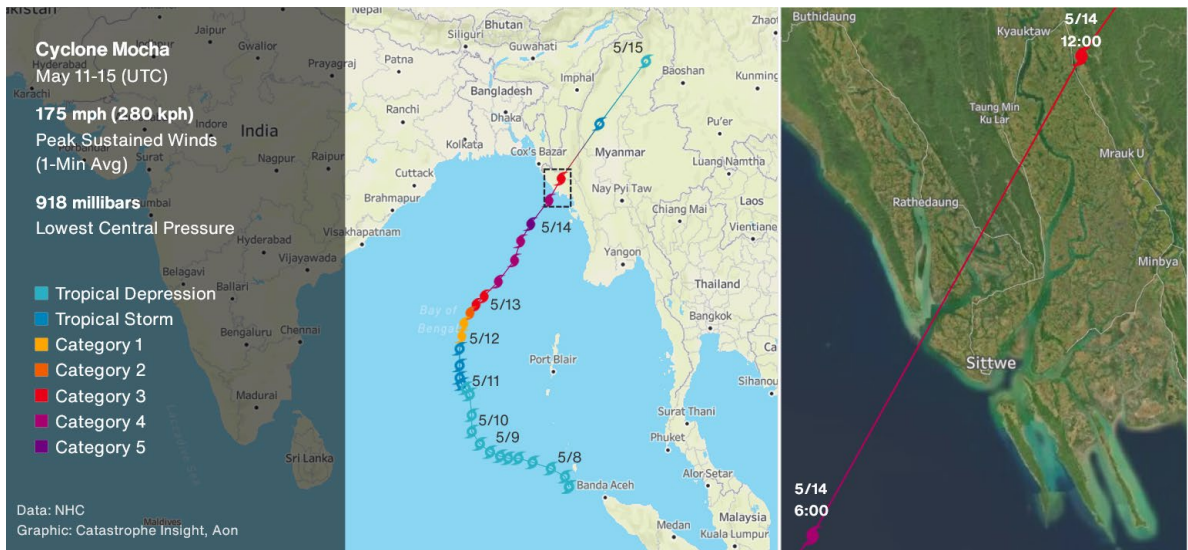
The storm tracked north-north-westward over the Bay of Bengal on May 11-14, rapidly strengthening, and peaking at intensity equivalent to **Category 5** on the Saffir-Simpson hurricane wind scale on May 14, with 1-minute sustained winds of 175 mph (280 kph). In terms of sustained winds, Mocha tied with Cyclone Fani, which occurred in 2019, as the strongest storm on record in the north Indian Ocean. Mocha slightly weakened into a Category 4-equivalent storm before making landfall on May 14 near Sittwe in Myanmar, reaching a sustained wind speed of 155 mph (250 kph). After its landfall Mocha rapidly weakened inland and dissipated on May 15.



Satellite view on cyclone, May 14

Source: JMA, Himawari 9

Affected areas experienced strong winds and heavy rainfall with event rainfall totals locally exceeding 400 mm (15.7 inches) at exposed locations. Coastal areas were affected by storm surge up to 3.5 metres (11.5 ft), which flooded a widespread area.



Event Details

More than 2.6 million people were exposed to hurricane-force winds in total. **Myanmar** was the worst hit by Mocha, with damage reported particularly in Rakhine State, including the hardest-hit towns of Sittwe, Mrauk-U, Kyauktaw, or Minbya. A large number of structures in coastal communities were flooded by storm surge. High winds downed trees and caused disruptions in communication networks. Property damage on thousands of structures was incurred across the country, with a majority located in the states of Rakhine and Chin. As of May 18, authorities confirmed 460 deaths and no fewer than 700 injured people in cyclone-related accidents. However, total death toll is expected to be even higher, as many more people remain missing and reliable information from the disaster area remained limited.

Cox's Bazar in **Bangladesh** was one of the hardest hit by the storm's passage. High winds and heavy rainfall caused notable agricultural losses and property damage to nearly 13,000 houses in Cox's Bazar and St. Martin Island alone, according to authorities. An initial estimate of agricultural losses in Cox's Bazar District accounted for BDT115 million (\$1 million), with regional total likely to increase significantly. As of this writing, three people died and at least 12 people were injured.

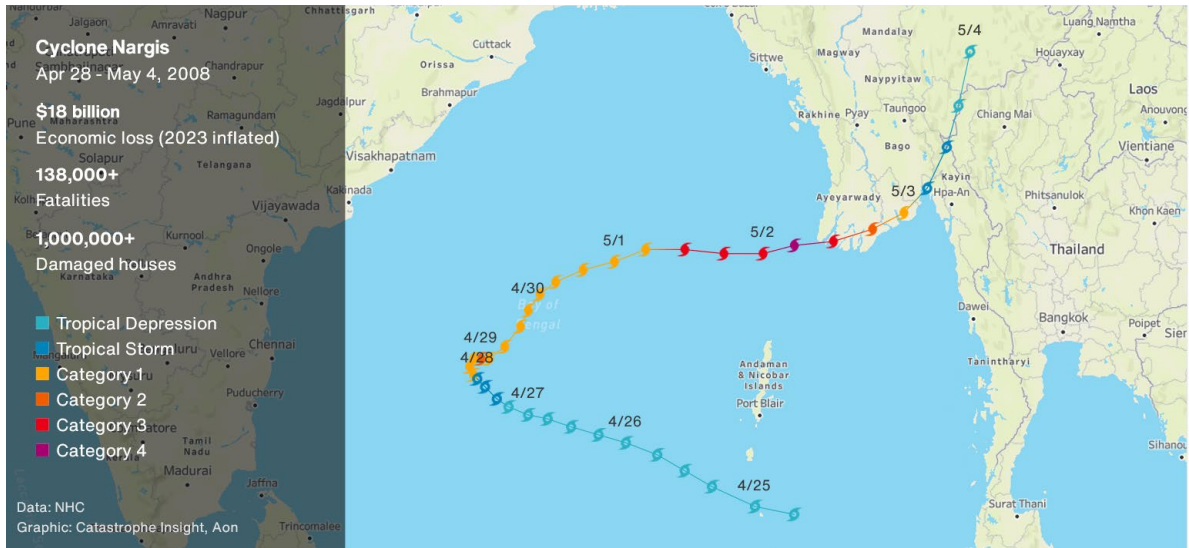
States of Mizoram, Tripura, and Manipur in **India** were also affected by the storm. Local authorities reported more than 200 damaged houses.

Historical Context

Mocha's impact will likely be much lower than the catastrophic damage and human toll caused by Cyclone Nargis in 2008, which resulted in approximately 138,000 fatalities in Myanmar. Unlike Mocha, the storm that hit 15 years ago affected much more densely populated areas in southern parts of the country in the delta of the Irrawaddy River.

Nevertheless, the humanitarian impact of Mocha is expected to be substantial. Partly because it impacted areas affected by internal conflicts with a large number of refugees housed in large-scale refugee camps. At the same time, the ability of south and southeast Asia nations to better prepare for upcoming disasters has shown signs of improvement over the years, which shows on the scale of

evacuations conducted during significant events. The situation in Myanmar remains difficult, however, mainly because of the conflict in the country.



Financial Loss

Determination of economic impact of Cyclone Mocha will likely take at least several weeks or months, as reliable information from the worst-affected area remains limited. However, it is likely that total aggregated losses in all countries will reach at least into the hundreds of millions USD. Impact on the insurance sector will likely be limited.

Canada: Wildfire & Heatwave

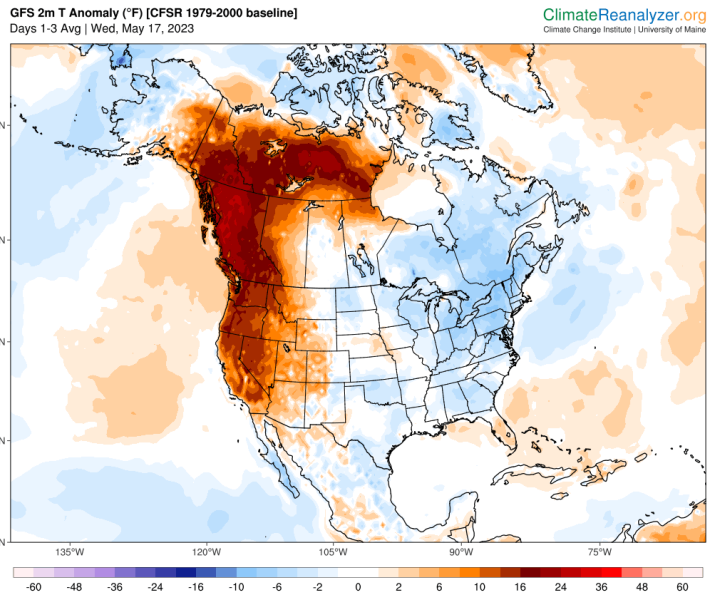
Overview

Parts of Canada, particularly Alberta and British Columbia, were affected by extreme heat over the past week. The ongoing precipitation deficit and very warm weather worsened conditions favorable for wildfire development. Year-to-date, dozens of wildfires have already burned an area of more than 764,000 hectares (1.89 million acres).

Meteorological Recap

Widespread area in Western North America experienced temperatures running 15 – 25°C (up to 45°F) above normal during several consecutive days, as a result of an extensive high-pressure area over western part of the continent. Many monthly temperature records were broken and some of them exceeded previous records by several degrees. Numerous high-latitude stations saw extreme temperatures for this part of the year (see Table below).

Prolonged period with dry and warm weather enhanced conditions for wildfire development and spreading.



| Station, Province | Temperature (°C) | Detail |
|---------------------------------|----------------------|--|
| Lytton, British Columbia | 36.5 (97.7°F) | Monthly record |
| Pemberton, British Columbia | 35.9 (96.6°F) | Monthly record |
| Port Alberni, British Columbia | 34.3 (93.7°F) | Monthly record |
| Jasper, Alberta | 30.8 (87.4°F) | Monthly record; altitude: 1,020 m (3,346 ft) |
| Willow Creek, Alberta | 29.4 (84.9°F) | Monthly record; altitude: 1,402 m (4,600 ft) |
| Henderickson, Alberta | 28.6 (83.5°F) | Monthly record; altitude: 1,542 m (5,059 ft) |
| Arviat, Nunavut | 21.2 (70.2°F) | Station monthly record broken by 6.7°C (12.1°F) |
| Lupin, Nunavut | 20.0 (68.0°F) | Monthly record; latitude: 65° 45' |

Event Details

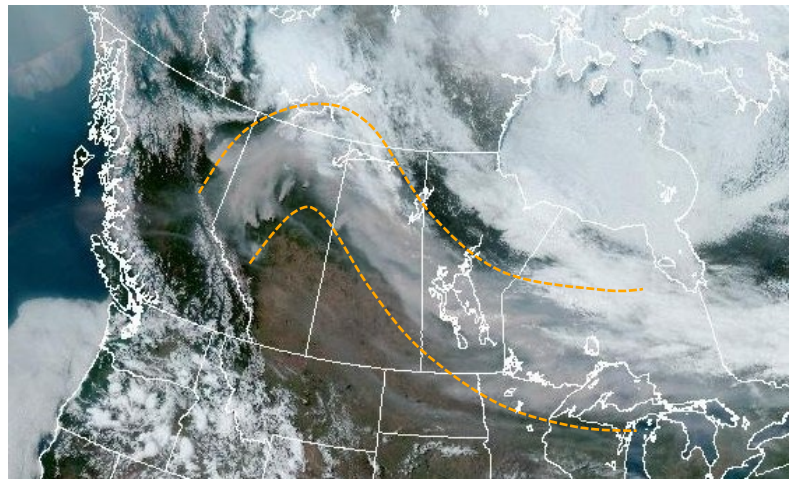
Provinces of **Alberta**, **British Columbia** and **Saskatchewan** have been particularly affected by severe wildfires. To date, wildfires have burned more than 764,000 hectares (1.89 million acres) of land in Alberta alone, including 488 individual fires, 93 reported as active, as of May 18. The largest fires affected forest areas of Edson, Grande Prairie, High Level, Rocky Mountain House, Slave Lake, and Whitecourt. According to authorities, at least 100 homes have been destroyed due to fire in the Fox Lake community.



Aerial view on wildfires in Alberta, causing air pollution

Source: Alberta Wildfire Service

Wildfires prompted preemptive evacuation of multiple communities – in total, approximately 29,000 people were forced to leave their homes. The smoke from the wildfires resulted in air pollution and travelled long distances across the North American continent. Notable disruption was noted in the regional oil production industry, as several oil drilling companies were forced to operatively shut down some operations in the affected area.



Wildfire smoke spread, May 15

Source: NOAA, GOES-East

Financial Loss

As the event remains ongoing, it is difficult to determine total economic and insured impact and the total effects of the fires will depend on weather conditions in the next period. The fires have also resulted in notable business interruption costs, particularly to the oil & gas industry.

Natural Catastrophes: In Brief

Flooding (Somalia)

Flash flooding triggered by heavy rains in recent days killed at least 22 people and affected nearly 500,000 individuals in the states of Hirshabelle and Jubaland in Somalia. Floodwaters inundated dozens of homes and caused widespread agricultural damage.

Flooding (Uganda)

Heavy rains, flooding and landslides have continued to impact several districts across Uganda since the beginning of May. According to the National Environment Management Authority (NEMA), no fewer than 23 people died, and 16 were injured due to landslides and floods in the districts of Kigezi and Ntokoro.

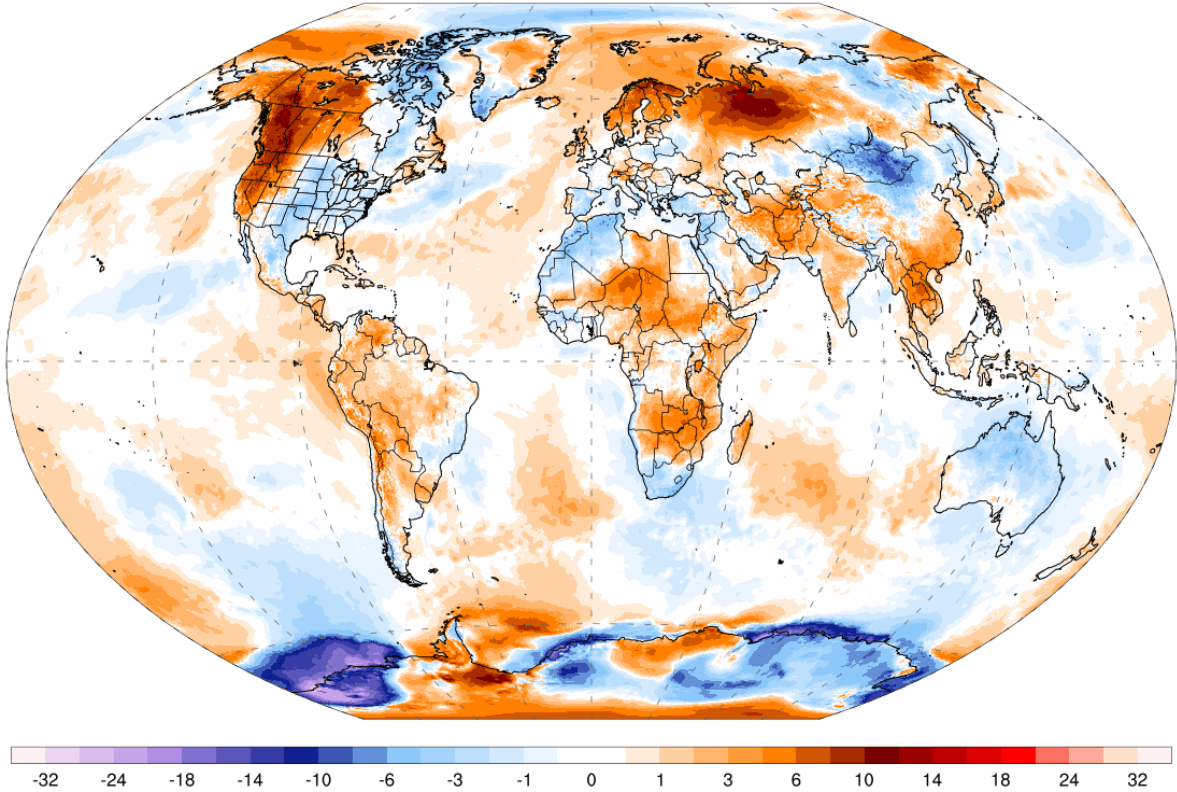
Severe Convective Storm (United States)

Severe weather related to a slow-moving low-pressure area and associated frontal system affected parts of the Great Plains and Midwest on May 12-13 and resulted in some material damage. On May 12, EF2-intensity tornado (on Enhanced Fujita scale) injured two people and caused notable damage in Burt County, Nebraska. On the following day, tornado of EF1 intensity killed one person, caused multiple injuries and property damage in Cameron County, Texas. Some material damage due to storms was incurred also in Iowa and Illinois. Storm activity shifted further east on the following days. Notably, wind-related damage was reported from Kentucky, Tennessee, North Carolina, and Virginia on May 16.

Global Temperature Anomaly Forecast

GFS 2m T Anomaly (°C) [CFSR 1979-2000 baseline]
Days 1-3 Avg | Fri, May 19, 2023

ClimateReanalyzer.org
Climate Change Institute | University of Maine

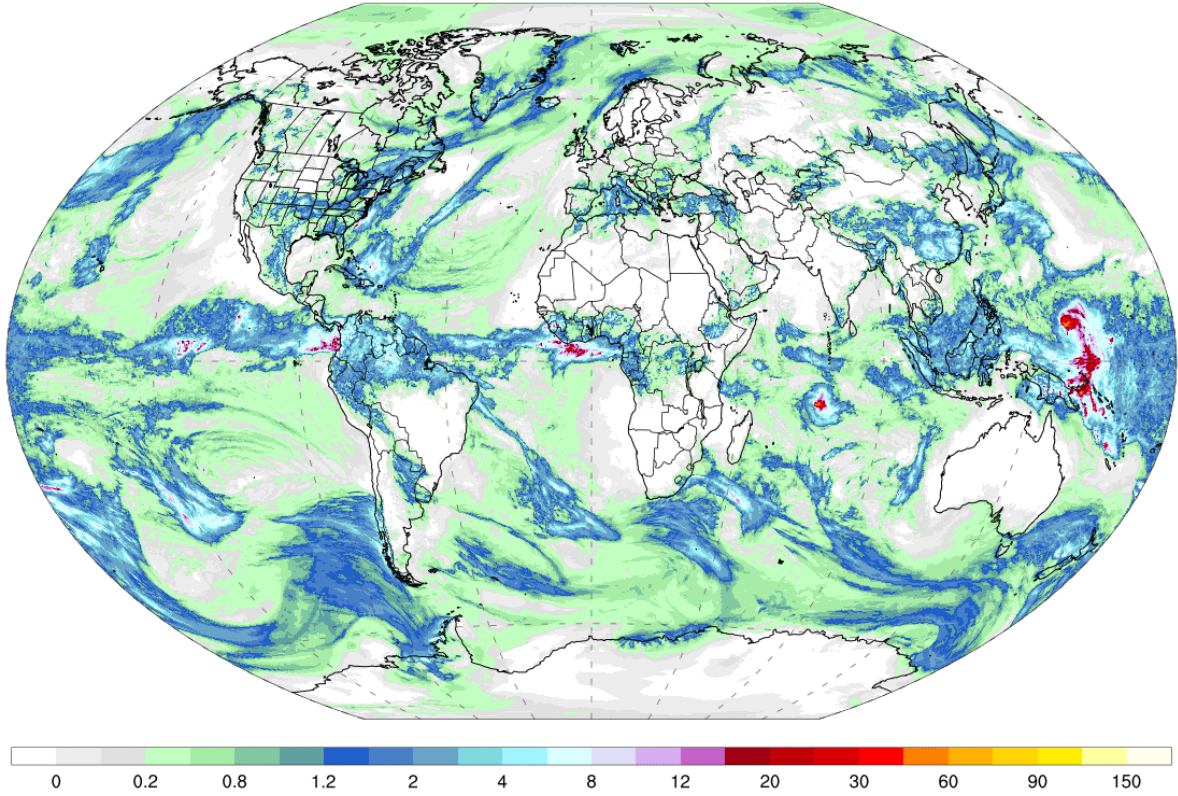


Source: Climate Reanalyzer, Climate Change Institute, University of Maine, USA

Global Precipitation Forecast

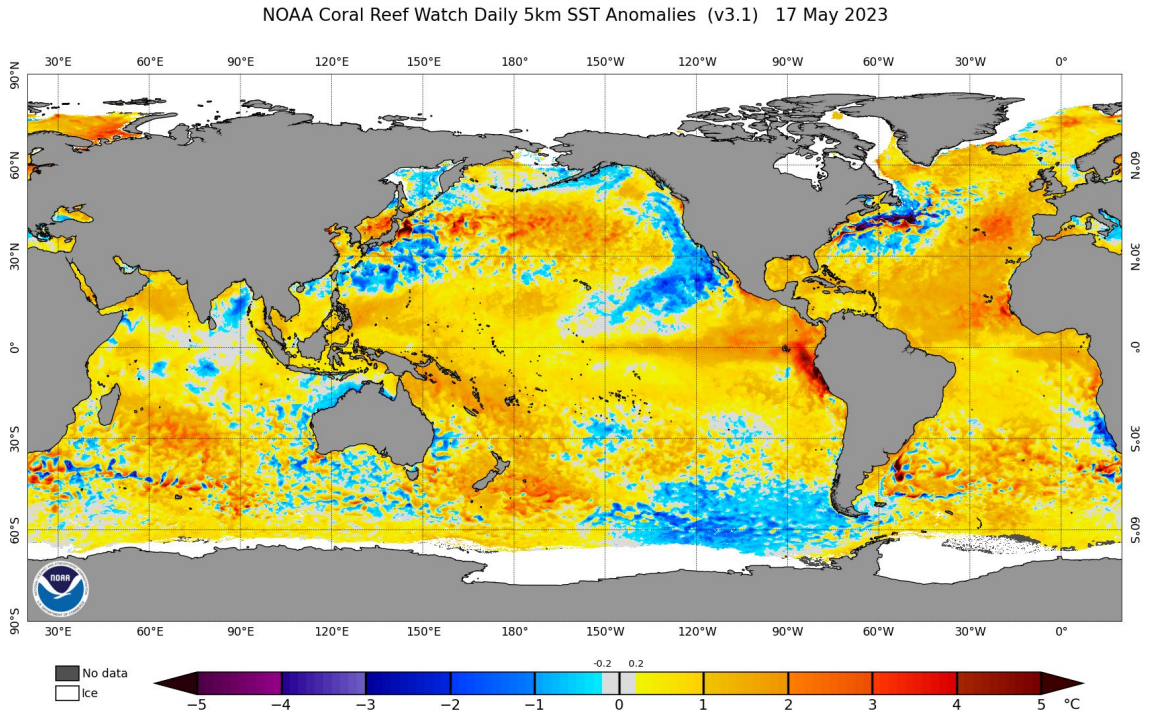
GFS Accumulated Precipitation (cm)
Days 1-3 Total | Fri, May 19, 2023

ClimateReanalyzer.org
Climate Change Institute | University of Maine



Source: Climate Reanalyzer, Climate Change Institute, University of Maine, USA

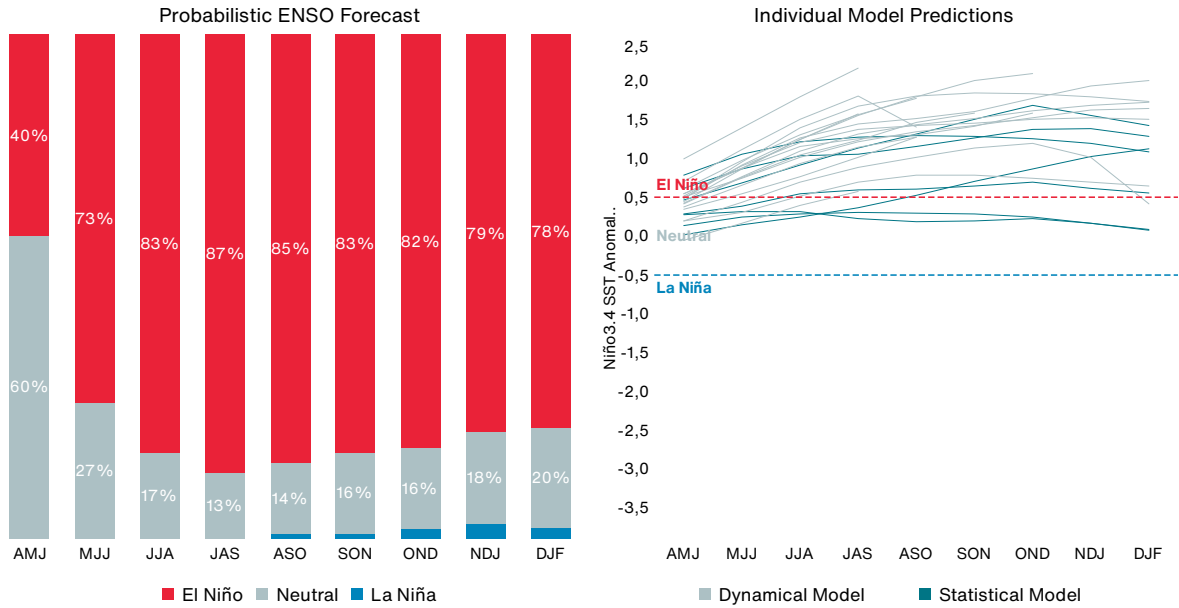
Weekly Sea Surface Temperature (SST) Maps (°C)



El Niño-Southern Oscillation (ENSO)

Probabilistic ENSO Model Projections: Mid-April 2023

Data: NOAA & Columbia University (IRI) | Graphic: Catastrophe Insight, Aon



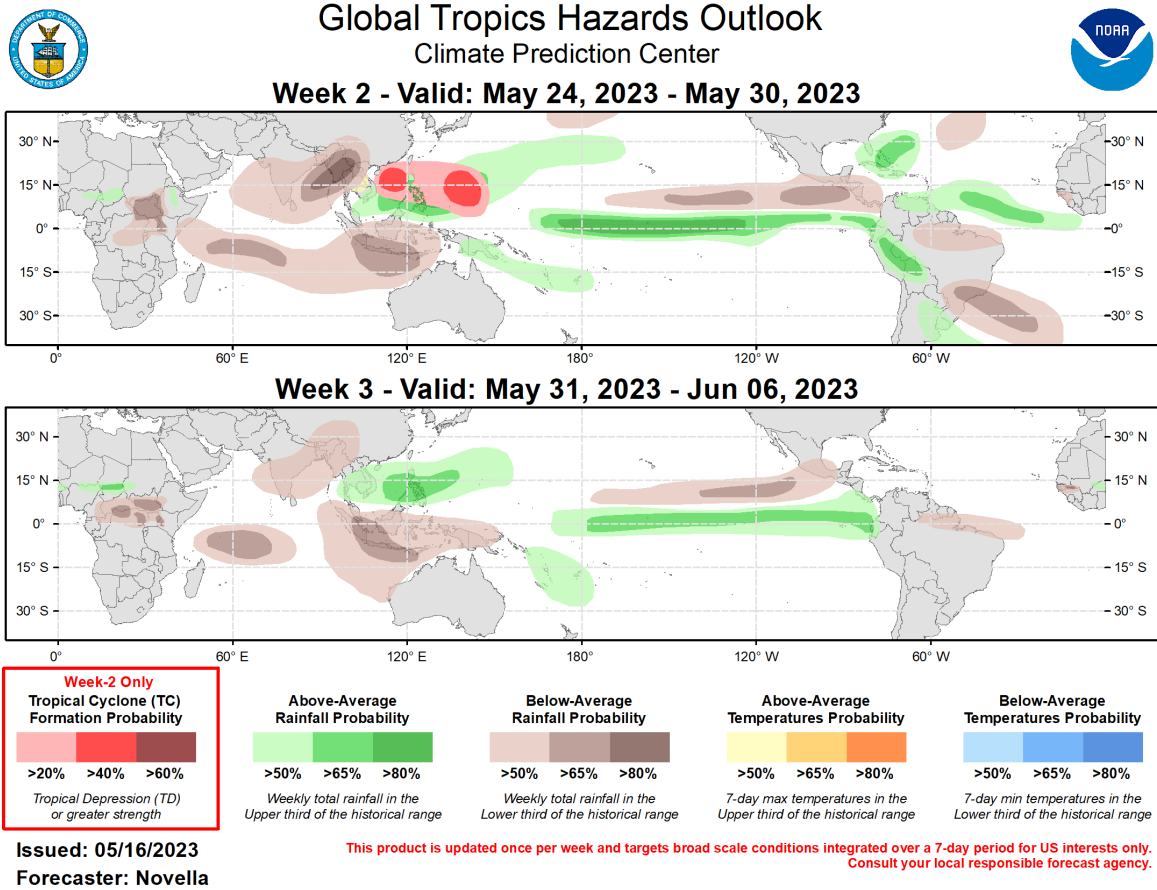
El Niño: Warm phase of an ENSO cycle. Sea surface temperatures of +0.5°C occur across the east-central equatorial Pacific.

La Niña: Cool phase of an ENSO cycle. Sea surface temperatures of -0.5°C occur across the east-central equatorial Pacific.

Neutral: A period when neither El Niño nor La Niña conditions are present.

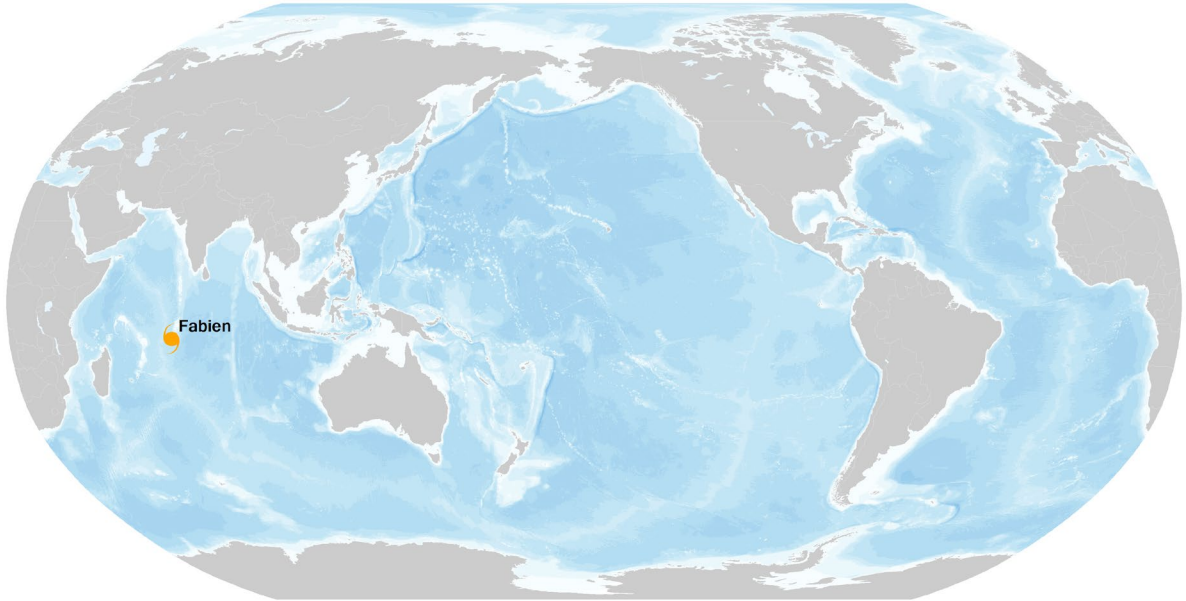
El Niño (La Niña) is a phenomenon in the equatorial Pacific Ocean characterized by a five consecutive 3-month running mean of sea surface temperature (SST) anomalies in the Niño 3.4 region that is above the threshold of +0.5°C (-0.5°C). This is known as the Oceanic Niño Index (ONI).

Global Tropics Outlook



Source: Climate Prediction Center (NOAA)

Current Tropical Cyclone Activity



● Tropical Depression
 ● Tropical Storm
 ● Category 1
 ● Category 2
 ● Category 3
 ● Category 4
 ● Category 5

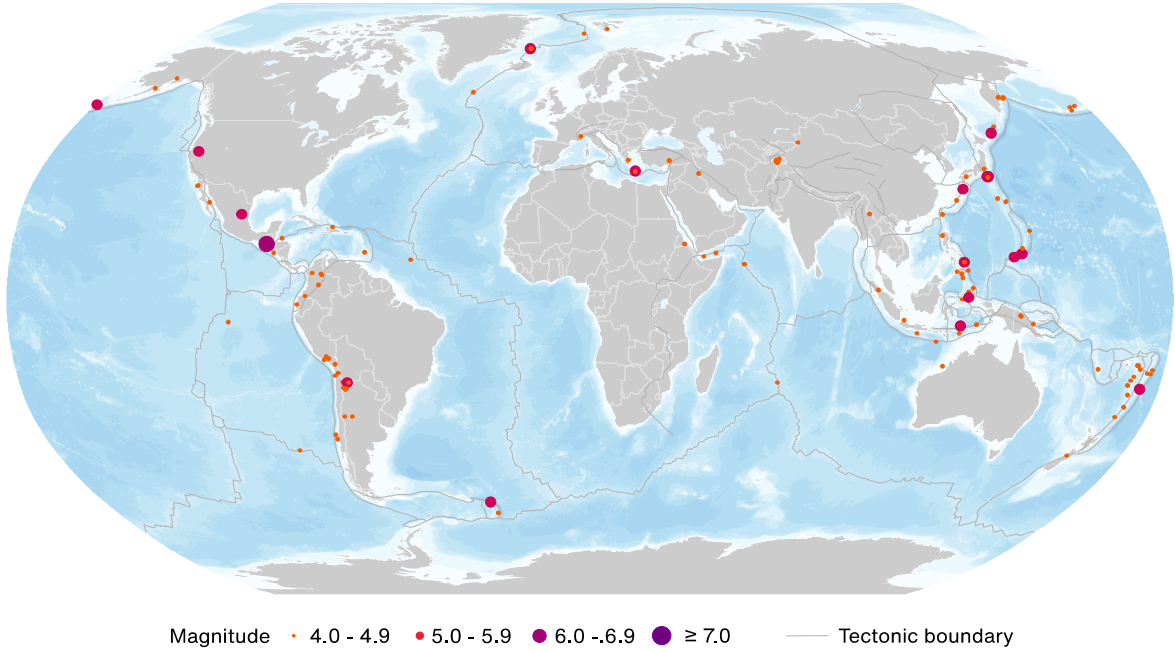
| Storm Name | Location | Winds | Location from Nearest Land Area |
|------------|-------------|-------|---|
| CY Fabien | 9.9S, 70.0E | 50 | 995 mi (1,605 km) S from Male, Maldives |

* TD: Tropical Depression, TS: Tropical Storm, HU: Hurricane, TY: Typhoon, CY: Cyclone

** N: North, S: South, E: East, W: West, NW: Northwest, NE: Northeast, SE: Southeast, SW: Southwest

Source: National Hurricane Center, Joint Typhoon Warning Center, Central Pacific Hurricane Center (NOAA)

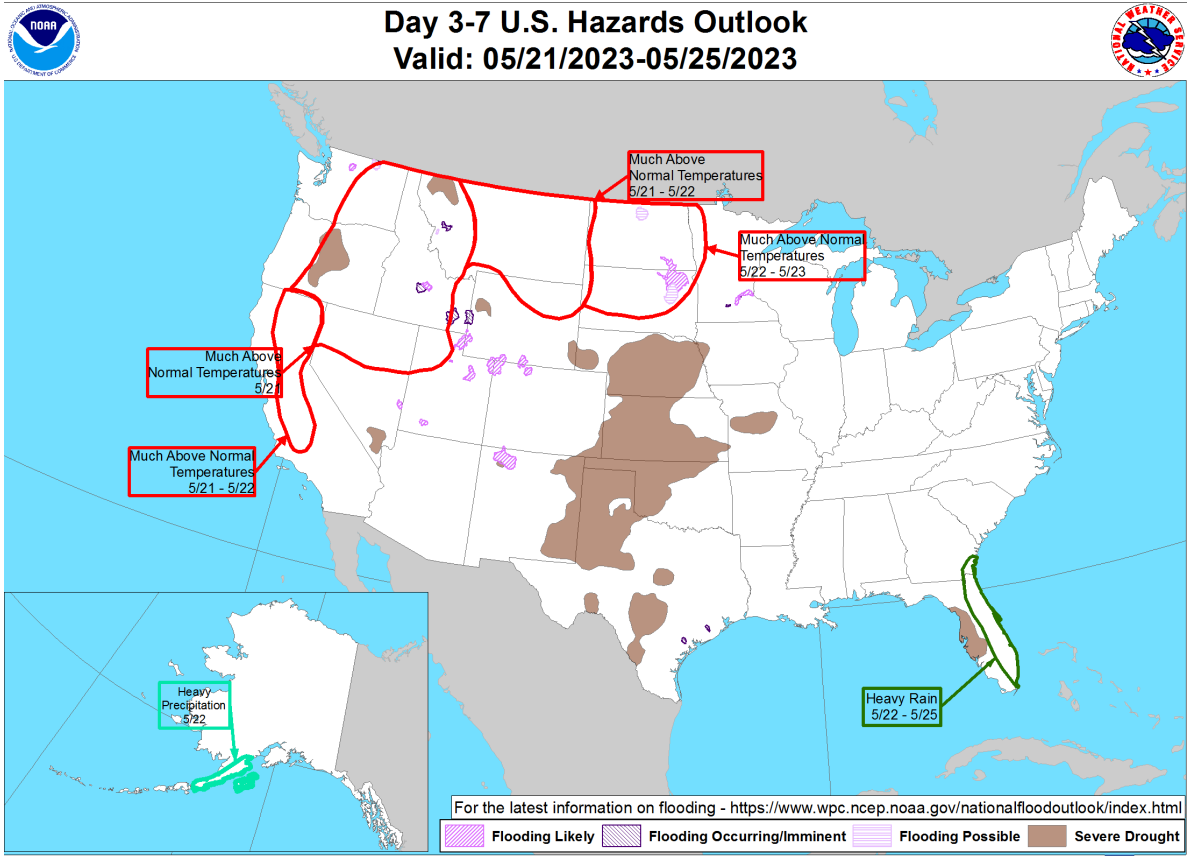
Global Earthquake Activity ($\geq M4.0$): May 12-18



| Date (UTC) | Location | Magnitude | Epicenter |
|------------|----------------|-----------|--------------------------------------|
| 5/17/2023 | 15.15N, 90.84W | 6.4 | 2 km (1 mi) SE of Canillá, Guatemala |

Source: United States Geological Survey

U.S. Hazard Outlook



Weather Prediction Center

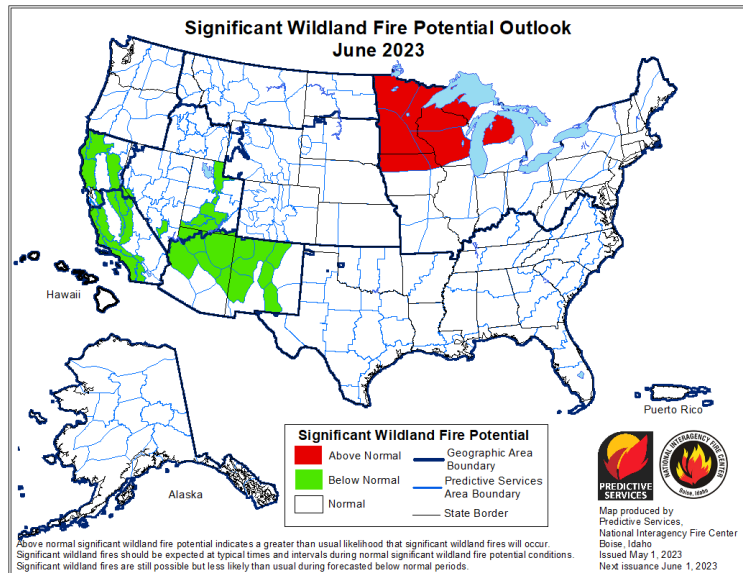
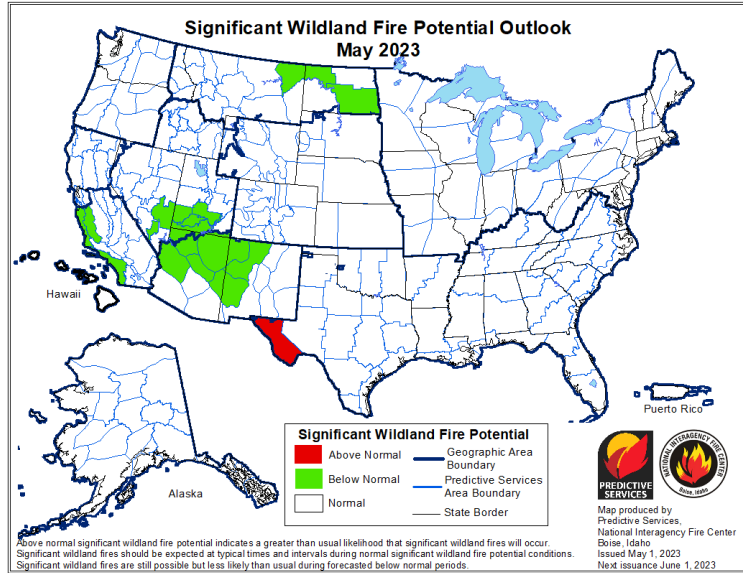
Made: 05/18/2023 3PM EDT

Source: Climate Prediction Center (NOAA)

Follow us: 

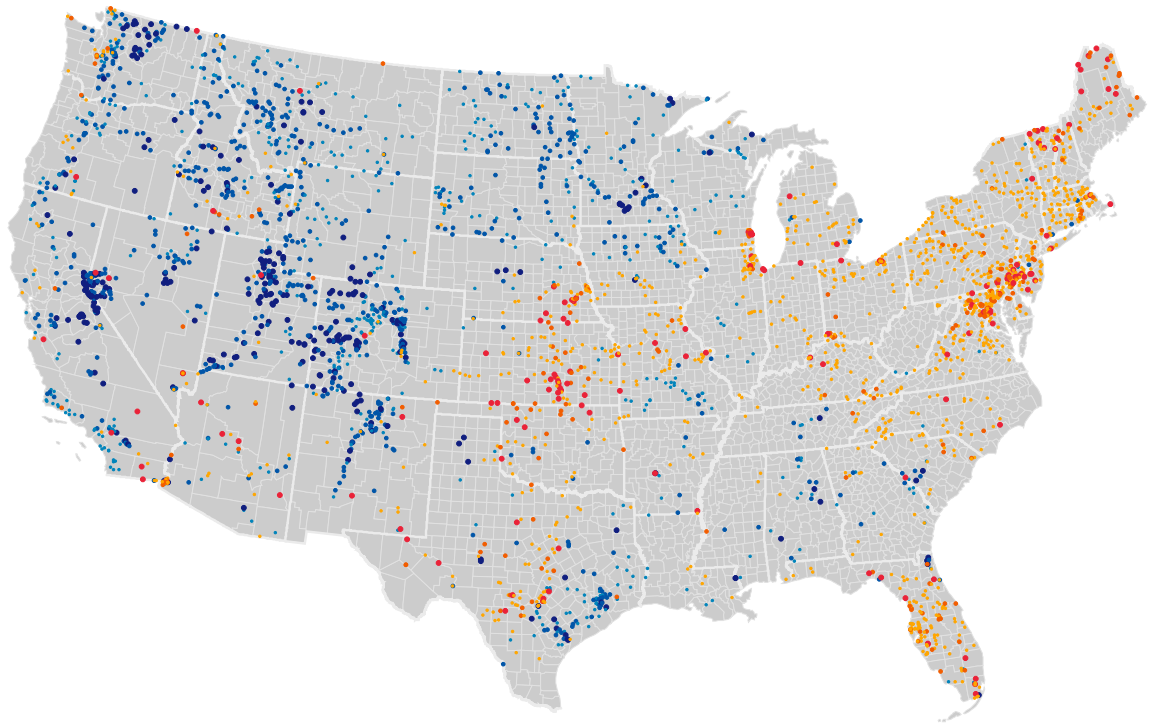
www.wpc.ncep.noaa.gov

U.S. Wildfire: Significant Fire Risk Outlook & Activity



Source: NIFC

U.S. Current Riverine Flood Risk



| | | | |
|----------------------------|--------------------------------|-------------------------|--------------------|
| High Flows (Percentile) | • ≥ 99 / Above floodstage | Hydrological Drought | • Severe Drought |
| | • 95 - 99 | | • Moderate Drought |
| | • 90 - 95 | | • Below Normal |

A $\geq 99^{\text{th}}$ percentile indicates that estimated streamflow is greater than the 99th percentile for all days of the year. This methodology also applies for the other two categories. A stream in a state of severe drought has 7-day average streamflow of less than or equal to the 5th percentile for this day of the year. Moderate drought indicates that estimated 7-day streamflow is between the 6th and 9th percentile for this day of the year and 'below normal' state is between 10th and 24th percentile.

Source: United States Geological Survey

Source Information

Southern & Central Europe: Flooding

The Agency for Territorial Security and Civil Protection

The Agricultural Association Coldiretti

Bonaccini: "Damage for billions, we need a commissioner", *Agenzia Italia*

Meteo Alert Emilia-Romagna

The European Severe Weather Database (ESWD)

Myanmar, Bangladesh, India: Cyclone Mocha

The India Meteorological Department (IDM)

The Japan Meteorological Agency (JMA)

St Martin's islanders struggle to rebuild after Mocha, *The Business Standard*

Two and a half thousand houses were completely destroyed in Cox's Bazar: District Administration, *The Daily Star*

Canada: Wildfire & Heatwave

Alberta Wildfire Government Service

Record-breaking heat scorches the western US and Canada as wildfires continue to rage, *CNN*

Natural Catastrophes: In Brief

The National Environment Management Authority (NEMA)

The Storm Prediction Center (SPC)

Contacts

Michal Lörinc

Head of Catastrophe Insight

michal.lorinc@aon.com

Ondřej Hotový

Catastrophe Analyst

ondrej.hotovy@aon.com

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