

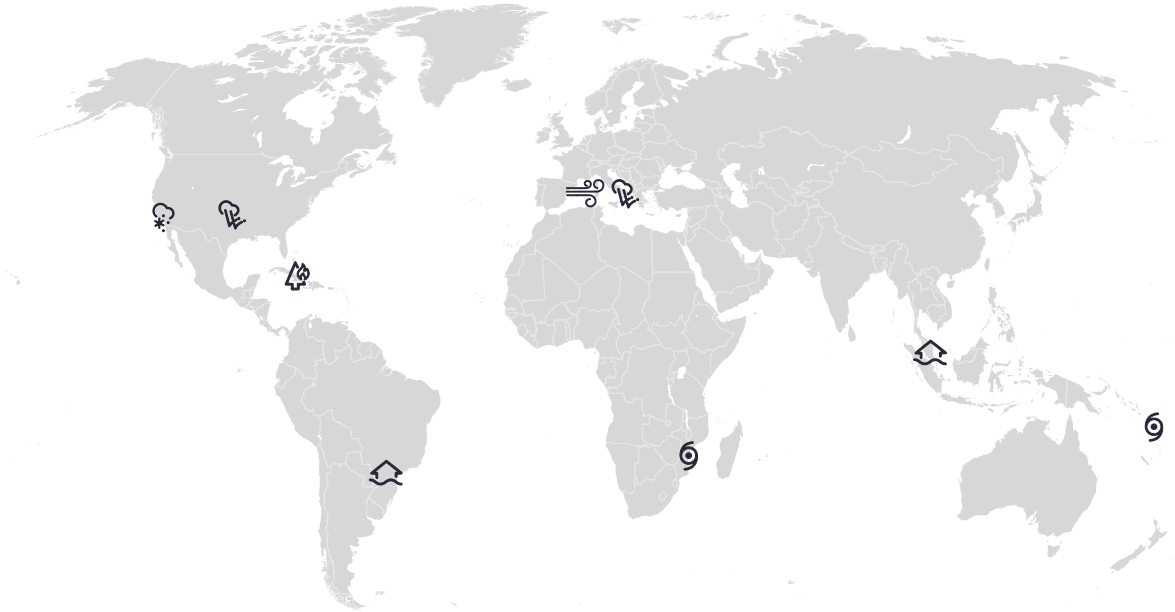
AON

Weekly Cat Report

March 3, 2023



Executive Summary



Event	Affected Region(s)	Fatalities	Economic Loss (\$)	Page
Tropical Storm Freddy	Mozambique, Zimbabwe	9+	10s of millions	3
Flooding & Winter Weather	United States	0	Millions	5
Severe Convective Storm	United States	0	Millions	7
Flooding & Landslides (Update)	Paraguay, Brazil	65+	Unknown	7
Severe Convective Storm	Italy	0	Negligible	7
Wildfires	Cuba	0	Unknown	7
Tropical Cyclone Judy	Vanuatu	0	Negligible	7
Flooding	Malaysia	1+	Millions	7
Medicane Juliette	Spain	0	Millions	8

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>

Mozambique and Zimbabwe: Tropical Storm Freddy

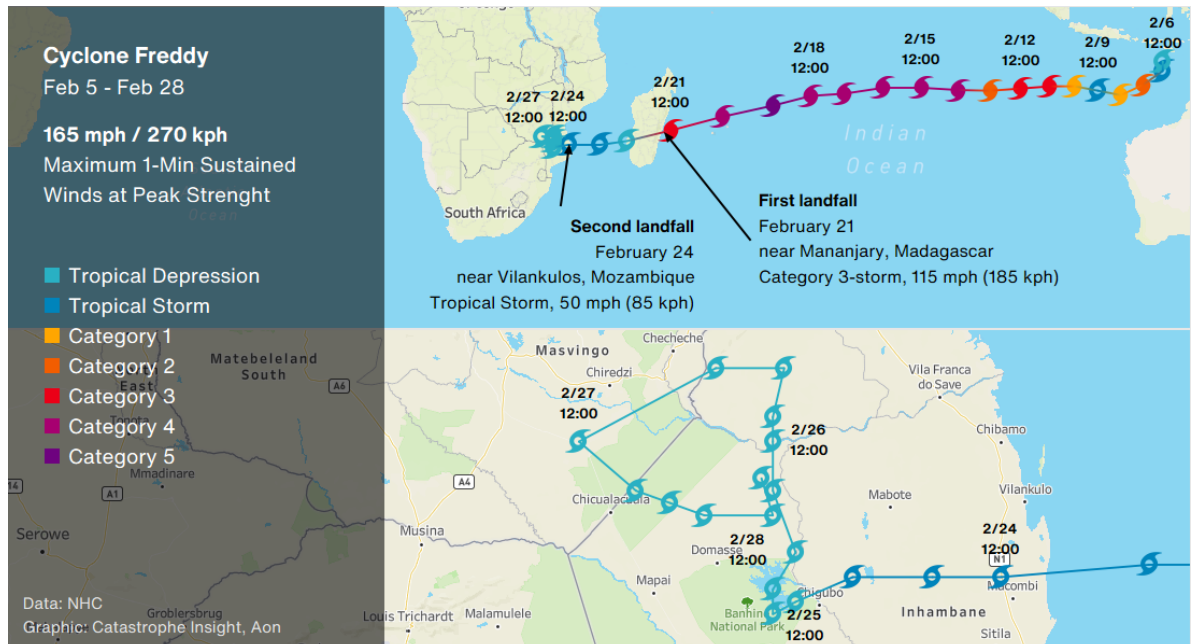
Overview

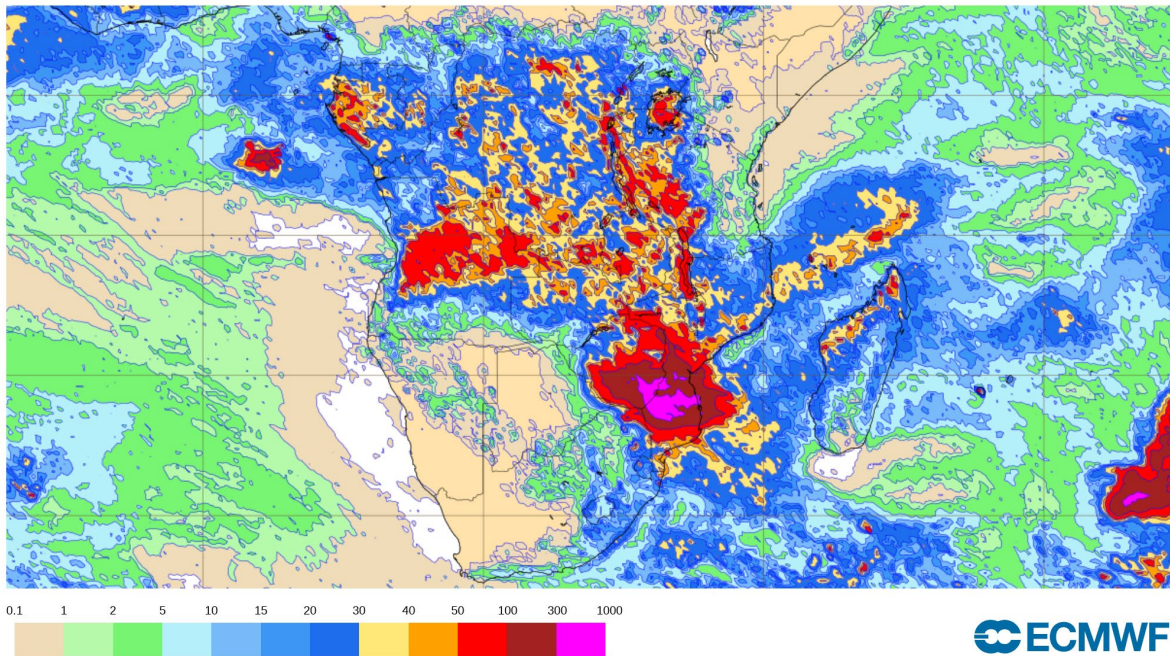
Remnants of Cyclone Freddy have affected Mozambique and Zimbabwe at Tropical Storm intensity since February 24, bringing torrential rainfall that triggered severe flooding and affected over 160,000 people in the region. Thousands of homes were damaged or destroyed, at least nine people lost their lives. Total economic losses can potentially reach into the tens of millions USD or higher.

Meteorological Recap

Between February 5-21, Cyclone Freddy became the fourth storm system that crossed the entire Indian Ocean. On February 21, Freddy made its **first landfall** in Madagascar (see previous Weekly Cat Report). After restrengthening over warmer seawaters of Mozambique Channel, storm made its **second landfall** on February 24 as a Tropical Storm in Vilankulo District, Inhambane Province, with wind gusts of up to 85 kph (50 mph). Maintaining the Tropical Storm / Tropical Depression status, the storm's centre persisted over Mozambique and Zimbabwe for next several days. Remnants of cyclone Freddy brought significant amount of rain; some localities recorded around 200 mm (7.9 in) of rain in 24-hour period. Total event rainfall exceeded 300 mm (11.8 in) over broad area (see Graphics by ECMWF below). Local river levels, particularly within the Limpopo River basin, increased rapidly, as soil has been already saturated after heavy rainfall and flooding that hit the area earlier in February.

According to an assessment of Colorado State University, cyclone Freddy set a new all-time record of 69.0 for the highest accumulated cyclone energy (ACE) of a tropical cyclone in the Southern Hemisphere. Freddy was also the first tropical cyclone in the Southern Hemisphere to undergo four separate rounds of rapid intensification.





Total rainfall accumulated between February 24-28

Source: ECMWF

Event Details

As of March 3, the storm has affected over 160,000 people across the provinces of Inhambane, Gaza and Sofala in **Mozambique**, according to authorities. At least seven people died in flood-related accidents, seven others were injured. Almost 28,000 homes were damaged or destroyed, public infrastructure and services also suffered notable damage, including 55 health centers and more than 1,000 schools. About 26,800 hectares (66,200 acres) of crops were affected. Additional rather minor material damage was incurred also in **Zimbabwe**, where two other people were killed.

Prior to reach Mozambique and Zimbabwe, storm notably impacted **Madagascar**, affected more than 220,000 people, killed at least seven people, and caused notable damage to more than 28,000 buildings.

Financial Loss

As it is still too early to assess a total damage related to Freddy's passage, total economic loss has not yet been determined. The toll can potentially reach into the tens of millions USD in Madagascar, considering a high number of destroyed buildings. Additional damage was incurred in Mozambique and Zimbabwe.

United States: Flooding & Winter Weather

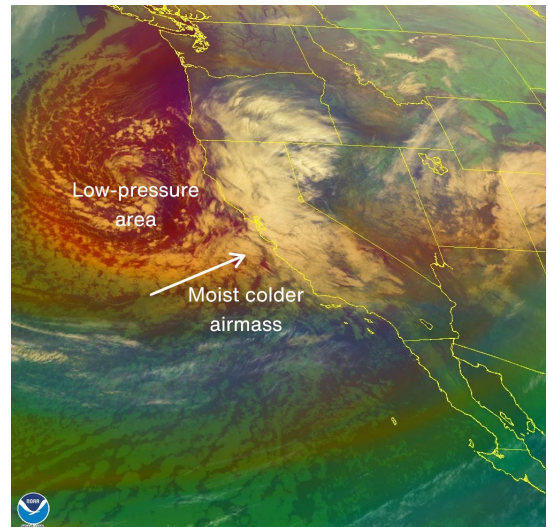
Overview

Parts of California were affected by another round of heavy precipitation on February 24-25. A low-pressure system generated localized heavy rainfall accompanied by flooding risk, torrential snowfall, and blizzard conditions at higher elevations, as well as strong wind gusts, resulting in material damage and traffic disruptions. Total economic losses were expected to reach into the millions USD.

Meteorological Recap

All hazards, primarily flooding triggered by heavy rainfall, strong winds, and heavy snowfall at higher elevations, were associated with large low-pressure area located near the western U.S. coast. The system particularly affected southern California by funnelling unusually cold air southward. The storm also generated stronger winds up to 70 mph (110 kph), passing a moist airmass towards the coast of California and bringing heavy precipitation into the region. Table below highlights the highest precipitation totals for this event, according to the National Weather Service (NWS).

Several rivers started to rise afterwards, reaching the minor or moderate flood stages. A river flood warning was issued also for the Santa Ynez River or Ventura River, which reached 19.26 ft (5.87 m) at the Foster Park station late on February 24.



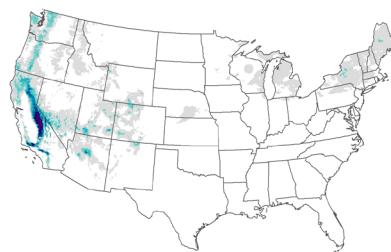
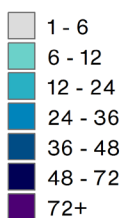
Airmass Composite on February 24

Source: NOAA, GOES-West

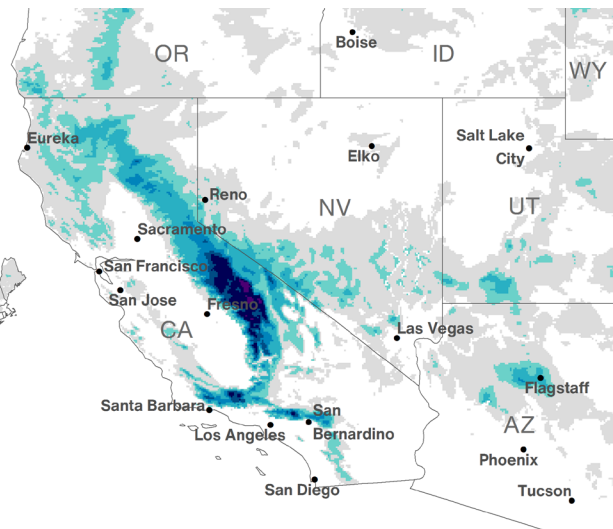
Total Snowfall (in)

(1 inch or greater)

from 00 UTC February 24
to 00 UTC February 27



Data: NOAA
Graphics: Catastrophe Insight, Aon



Higher elevations across California received substantial amount of snow during this event (see Graphics above). Mountain High in San Gabriel Mountains got 93 inches (2.4 metres) of snow between February 24-27. Rare snowfall was reported also in some low-elevated parts of California. The excessive total precipitation which felt during the first two months of the year, including heavy precipitation from atmospheric rivers from early January, will likely alleviate the severe drought conditions in the state.

Location, County	Precipitation Total (in)	Precipitation Total (mm)
Pine Mountain Inn, Ventura	11.5	292
Matilija Dam, Ventura	10.9	277
Rose Valley, Ventura	10.9	277
Woodland Hills, Los Angeles	10.8	274
Gibraltar Dam, Santa Barbara	10.8	274

Event Details

Southern **California** was the most affected by the storm. Torrential precipitation resulted in several landslide events across the state. Additional damage was incurred due to strong wind gusts, which toppled powerlines and caused power outages to more than 126,000 customers, many of them in the Los Angeles area.

In **Oregon**, a state of emergency was declared in one county. So far there have been no reports of any storm-related deaths or injuries.



Wind damage in Santa Maria, Santa Barbara County
Source: Santa Barbara Fire Department

Financial Loss

Total economic losses are estimated to be at least in the millions of USD, primarily due to strong wind that caused damages on several homes.

Natural Catastrophes: In Brief

Severe Convective Storm (United States)

A low that affected California on February 24-25 moved further eastward and caused additional material damage and several injuries in Oklahoma, Kansas, and Texas on February 26-27. The primary hazards associated with the frontal boundary passage were damaging wind gusts up to 100 mph (160 kph), including several tornadoes and derecho, and large hails with size up to 2 inches (5 cm) in diameter. More than 88,000 customers experienced power outages across all states as the storm passed. Multiple houses were damaged, at least thirteen people were injured in wind-related accidents.

Flooding & Landslides (Paraguay, Brazil) - Update

More heavy rain accompanied by widespread flooding continues to affect several departments in Paraguay. In recent days, thousands of people were forced to leave their homes in Amambay, Concepción, Alto Paraguay, and San Pedro departments, according to authorities. Notable damage on dozens of buildings and infrastructure was incurred. Meanwhile, the number of fatalities related to flooding and landslides in the state São Paulo, southeastern Brazil, rose to 65, two people remain missing, thousands have been evacuated, according to authorities and media reports.

Severe Convective Storm (Italy)

A hailstorm damaged several vehicles and caused losses on crops in Calabria region, northern Italy, on February 27. Based on the European Severe Weather Database (ESWD), hails of size between 4 and 6 cm (up to 2.4 in) were reported in Palizzi and Crotona municipalities.

Wildfires (Cuba)

Around 80 wildfires have been affecting Cuba, particularly eastern provinces of Santiago de Cuba and Holguín. Several fires spread towards the more populated areas in recent days, forcing tens of people to be evacuated. So far, more than 2,000 hectares (4,900 acres) were burned, notable agricultural damage on crops and plantations was incurred.

Tropical Cyclone Judy (Vanuatu)

Judy, a Category 4 storm equivalent on Saffir-Simpson scale, hit Vanuatu on February 28. Storm passed close to the capital city of Port Vila, resulted in minor damage on several buildings and power outages due to damaging winds. Dozens of roads were closed, all domestic and international flights were cancelled. Another storm, cyclone Kevin, is expected to impact Vanuatu on March 3.

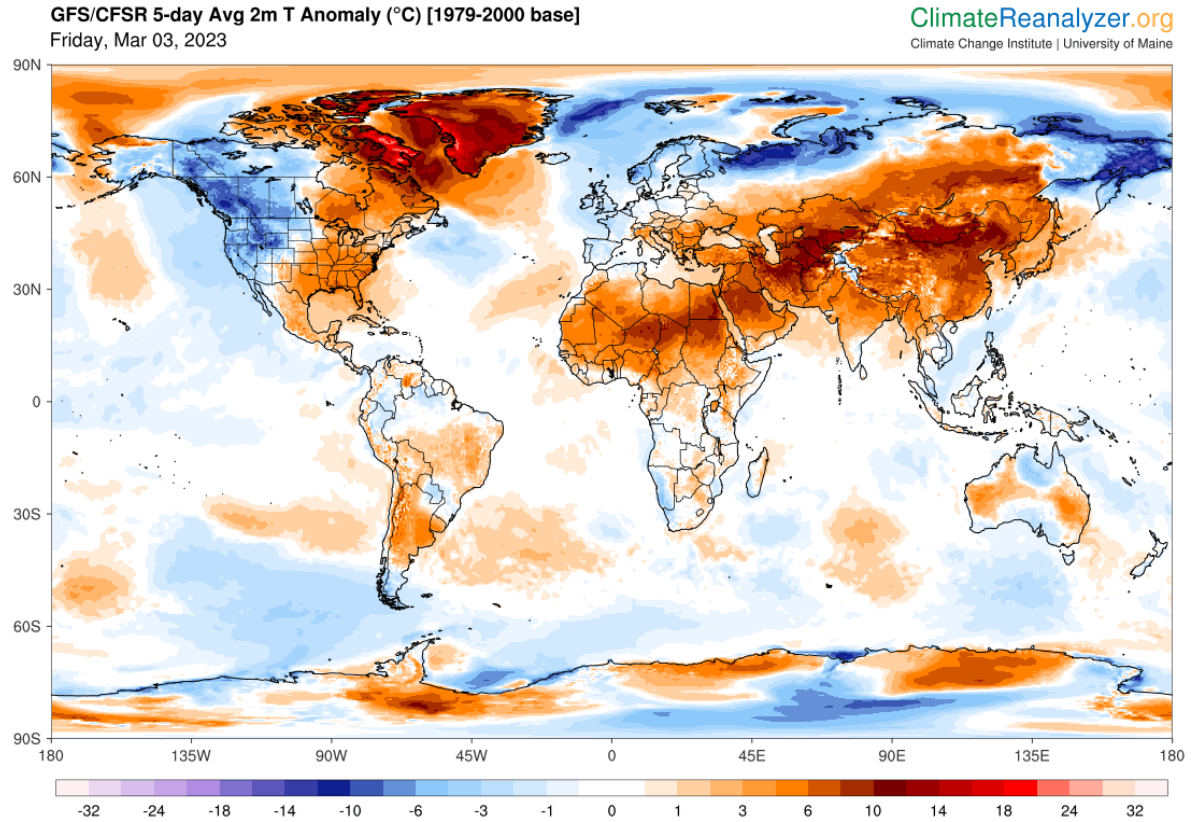
Flooding (Malaysia)

Heavy rains from recent days triggered severe flooding in Malaysia, particularly in states of Johor, Pahang, Malacca, and Negeri Sembilan. As of March 2, more than 26,000 people, 25,000 in Johor state alone, were forced to leave their inundated homes after some localities received more than 400 mm (15.7 in) of rain just in one day. Authorities reported at least one dead due to flooding.

Medicane Juliette (Spain)

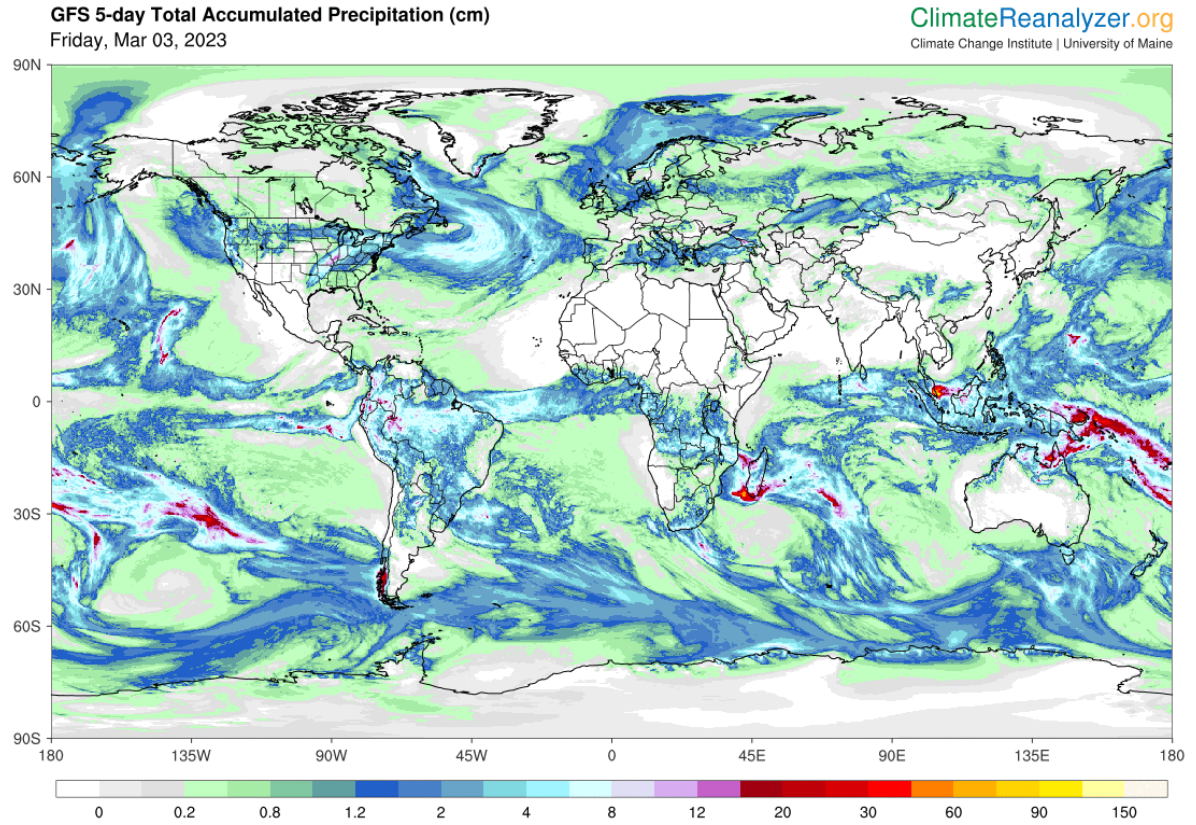
A low-pressure system, named Juliette, with a relatively well-defined structure affected the Mediterranean Balearic archipelago, eastern Spain, on February 28. The storm became the second Mediterranean Tropical-like cyclone this season, after Medicane Helios. The storm brought strong winds up to 110 kph (68 mph), rare heavy snowfall at higher elevations, along with heavy rain, exceeding 150 mm (5.9 in) in 24-hour period that resulted in localized flooding. In Mallorca, emergency services intervened more than 330 times, mostly due to fallen trees, flooded buildings, and inundated roads. Several boats were damaged due to storm and thousands of people experienced power outages. Economic losses are expected to be in the millions of EUR.

Global Temperature Anomaly Forecast



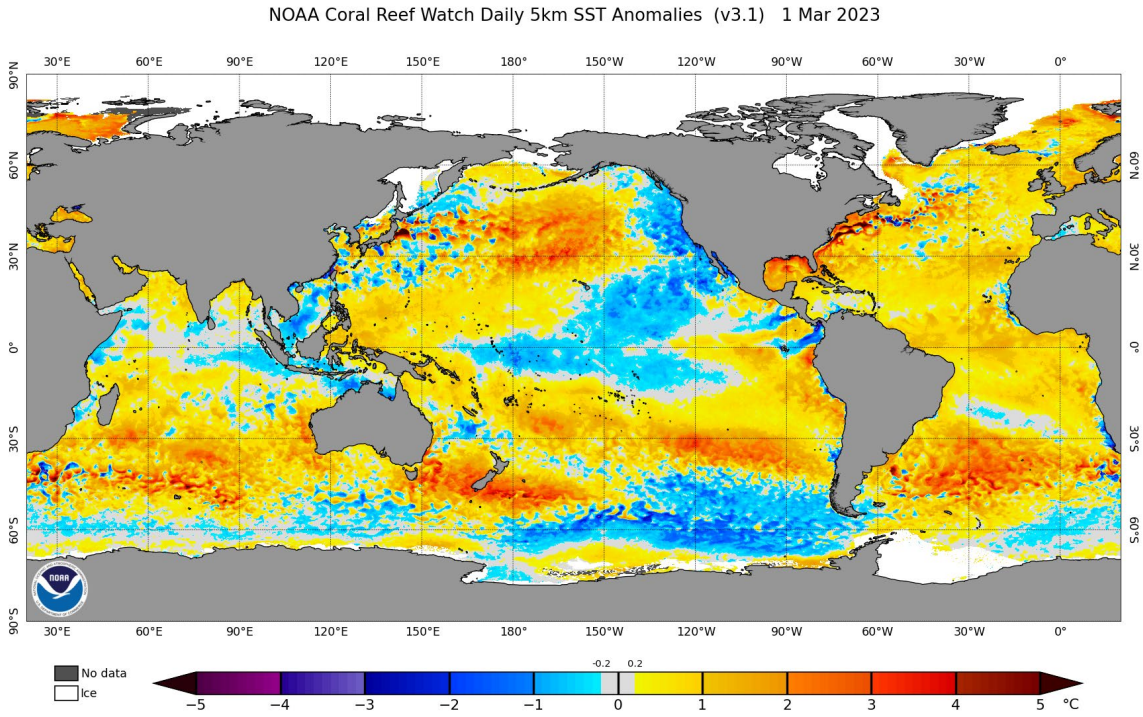
Source: Climate Reanalyzer, Climate Change Institute, University of Maine, USA

Global Precipitation Forecast



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

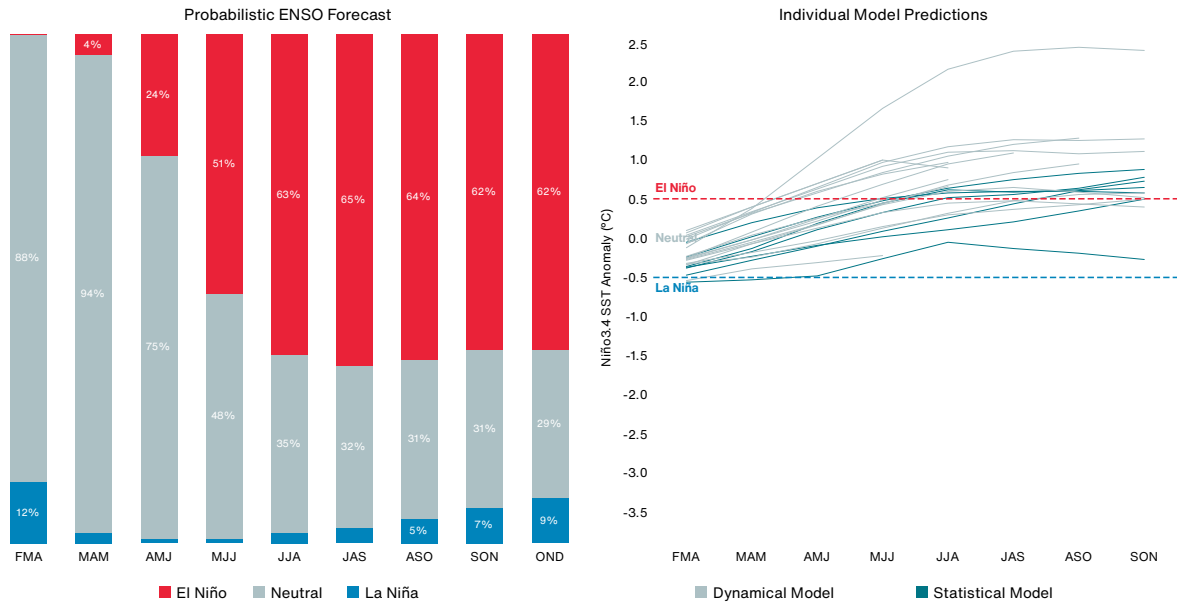
Weekly Sea Surface Temperature (SST) Maps (°C)



El Niño-Southern Oscillation (ENSO)

Probabilistic ENSO Model Projections: February 2023

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



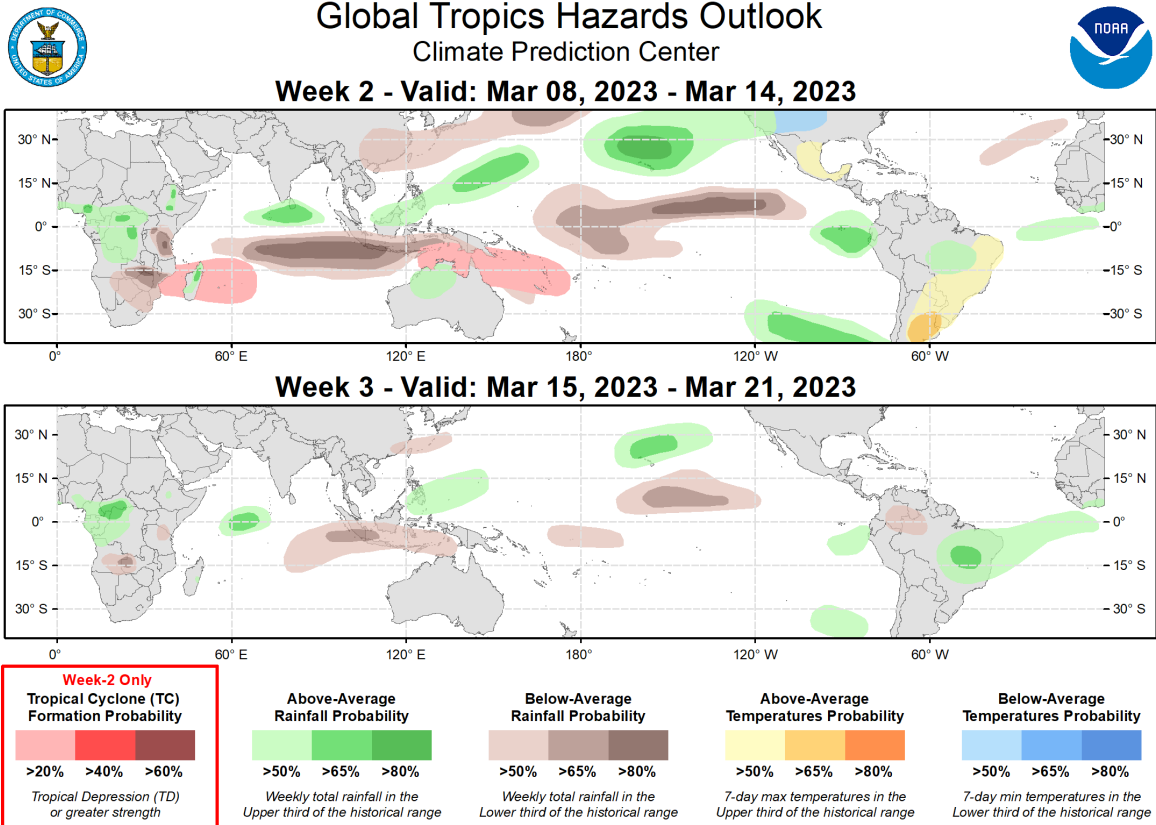
El Niño: Warm phase of an ENSO cycle. Sea surface temperatures of +0.5°C occur across the east-central equatorial Pacific.

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



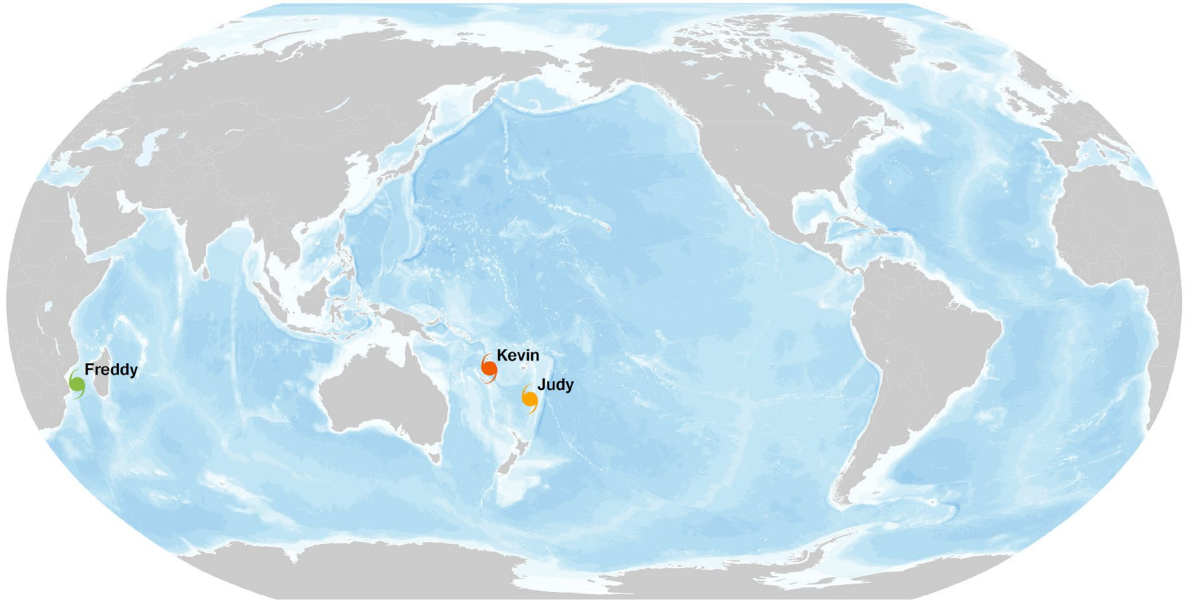
Issued: 02/28/2023

Forecaster: Barandiaran

This product is updated once per week and targets broad scale conditions integrated over a 7-day period for US interests only. Consult your local responsible forecast agency.

Source: Climate Prediction Center (NOAA)

Current Tropical Cyclone Activity



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

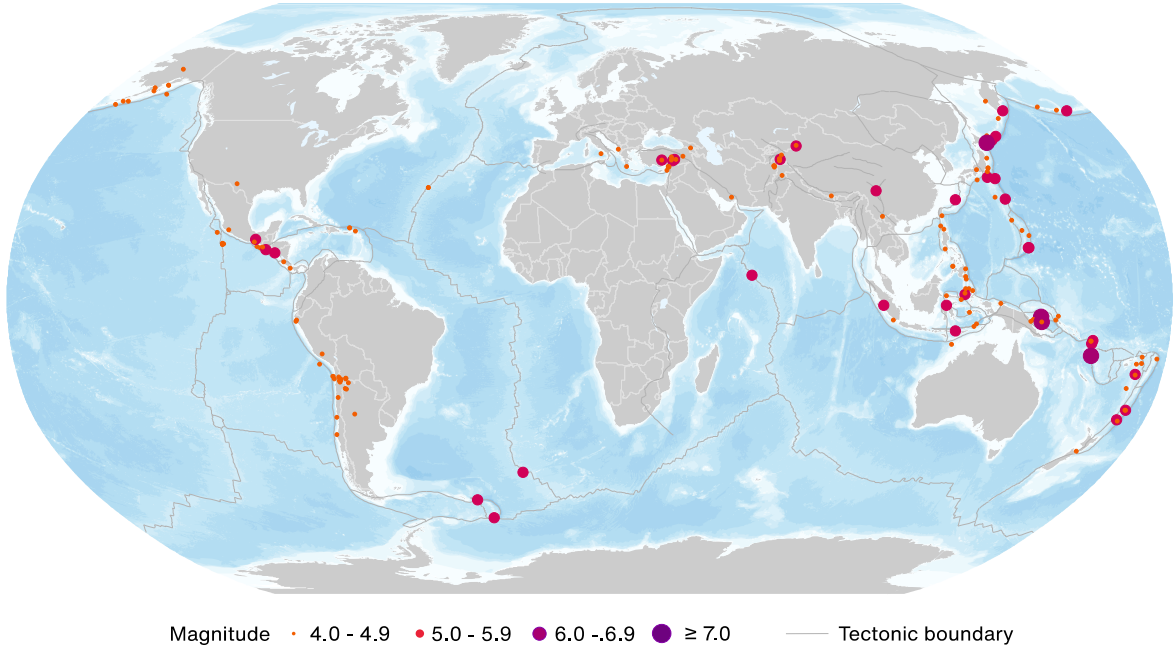
Storm Name	Location	Winds	Location from Nearest Land Area
CY Kevin	17.8S, 167.5E	95	55 mi (85 km) W from Port-Vila, Vanuatu
CY Judy	26.1S, 179.8E	70	465 mi (750 km) E from Nukualofa, Tonga
CY Freddy	22.1S, 38.3E	30	220 mi (355 km) NE from Maxixe, Mozambique

* 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)

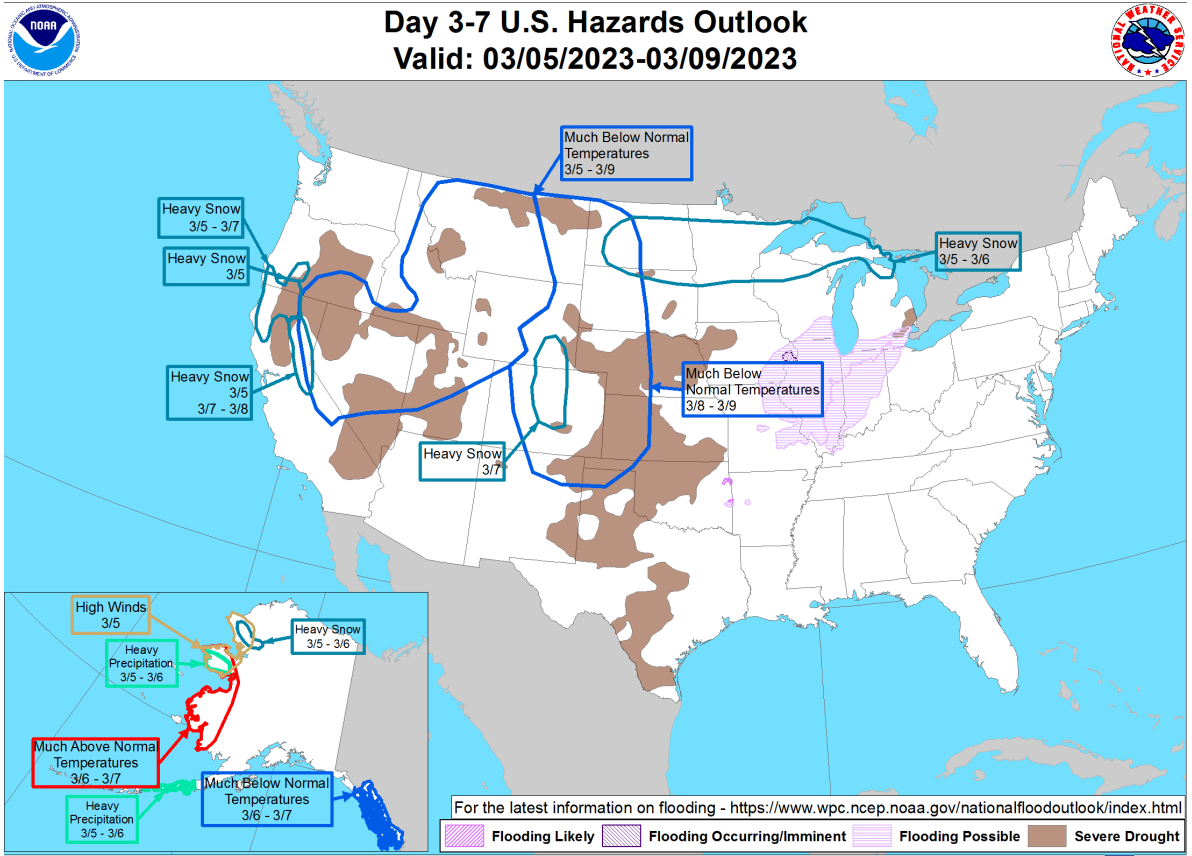
Global Earthquake Activity ($\geq M4.0$): Mar 3-Mar 9



Date (UTC)	Location	Magnitude	Epicenter
2/25/2023	42.78N, 145.07E	6.0	61 km (38 mi) ESE of Kushiro, Japan
2/25/2023	6.11S, 149.79E	6.2	29 km (18 mi) ENE of Kandrian, Papua New Guinea
3/1/2023	4.81S, 149.49E	6.5	10 km (6 mi) NW of Kimbe, Papua New Guinea
3/2/2023	15.41S, 166.37E	6.5	86 km (53 mi) WSW of Port-Olry, Vanuatu

Source: United States Geological Survey

U.S. Hazard Outlook



Weather Prediction Center

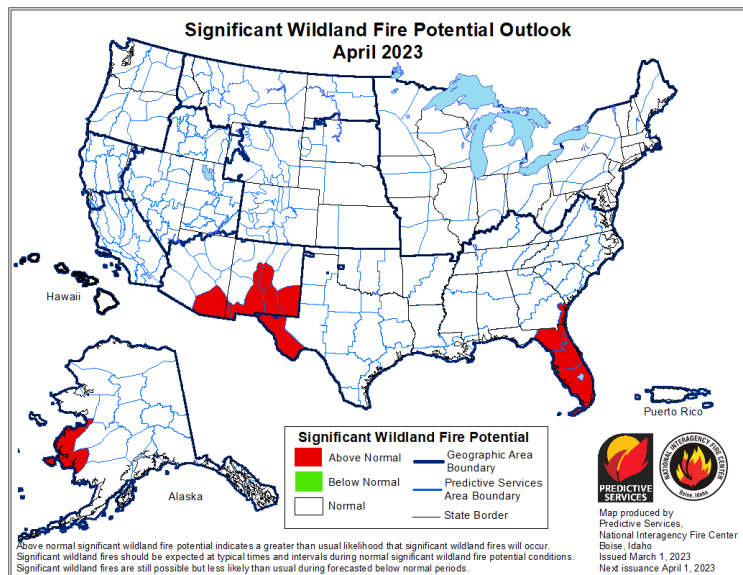
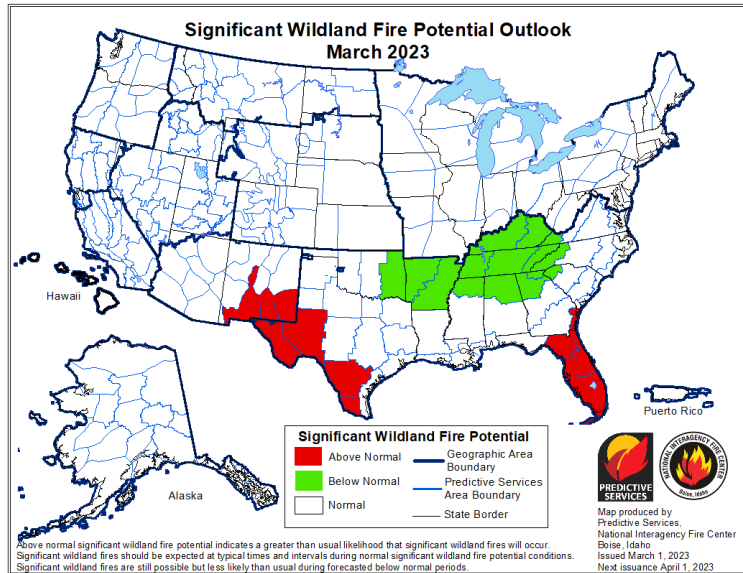
Made: 03/02/2023 3PM EST

Source: Climate Prediction Center (NOAA)

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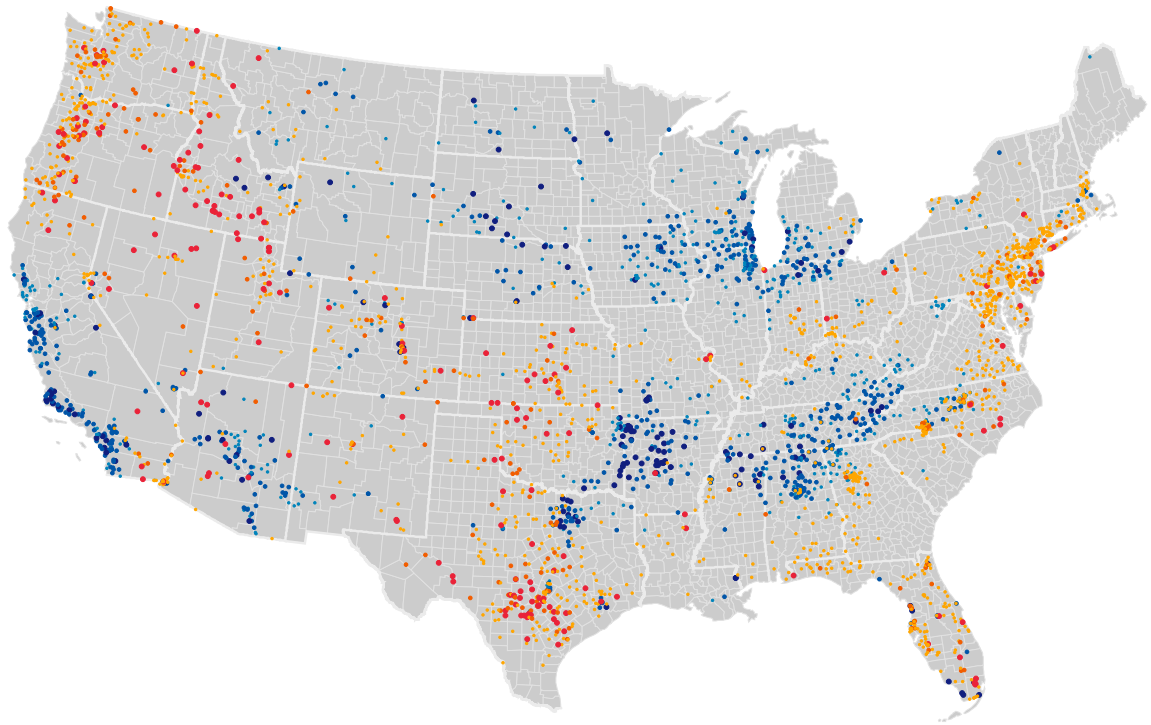
www.wpc.ncep.noaa.gov

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 ≥99th 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

Mozambique and Zimbabwe: Cyclone Freddy

European Centre for Medium-Range Weather Forecasts (ECMWF)

Thousands Displaced as Cyclone Freddy Brings Flooding Rain, *Floodlist*

Mozambique deals with flooding in aftermath of Storm Freddy, *Africa Times*

United States: Flooding & Winter Weather

The National Weather Service (NWS)

California storm brings flooding and leaves thousands without power, *BBC*

More than 126,000 without power in California as storm brings rain, heavy snow, damaging winds, *ABC News*

Natural Catastrophes: In Brief

The National Weather Service (NWS)

European Severe Database (ESWD)

Joint Typhoon Warning Centre (JTWC)

Vanuatu's Port Vila hit by strong winds and heavy rain from Cyclone Judy, *ABC Net News*

Floods Affect Thousands in Amambay, Concepción, Alto Paraguay and San Pedro, *Floodlist*

Paraguay's National Emergency Secretariat (SEN)

Massive forest fires rage on in eastern Cuba, *Reuters*

Over 26,000 evacuated as floods hit Malaysia again; 1 dead, *The Washington Post*

Storm Juliette affects eastern Spain, *CatNat.net*

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