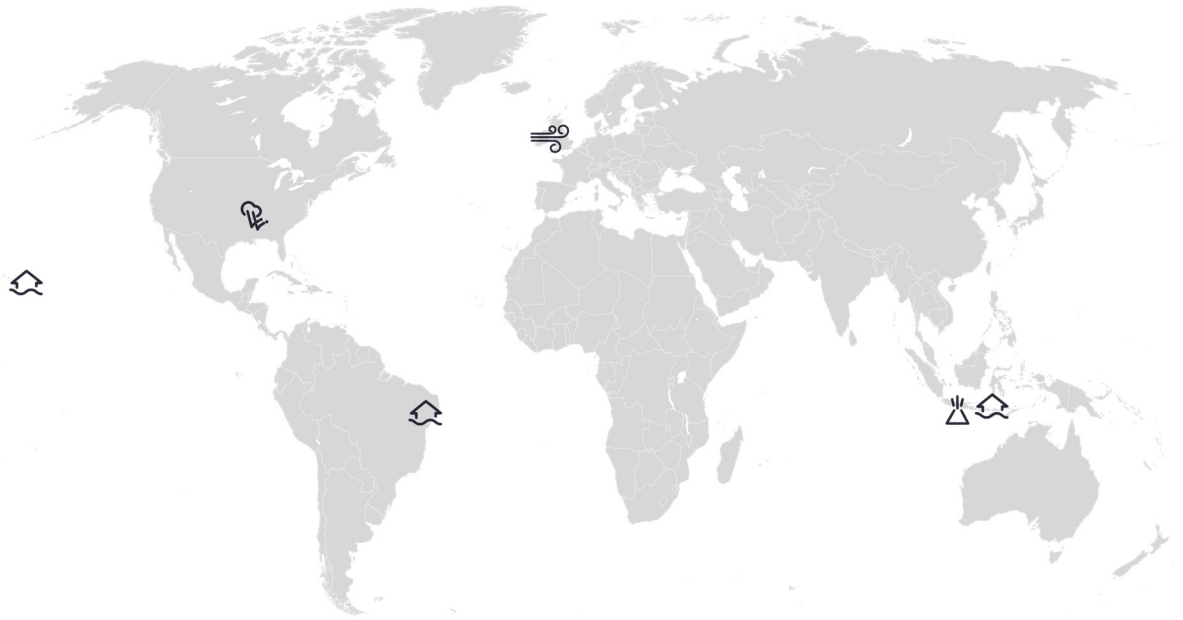
Weekly Cat Report

December 10, 2021

Executive Summary



Event	Affected Region(s)	Fatalities	Economic Loss (USD)	Page
Volcano	Indonesia	43+	20+ million	3
Flooding	United States	0	Millions	5
Windstorm Barra	Ireland, UK	0	Millions	7
Severe Weather	United States	0	Millions	8
Flooding	Indonesia	6+	Unknown	8
Flooding	Brazil	5+	Unknown	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.

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

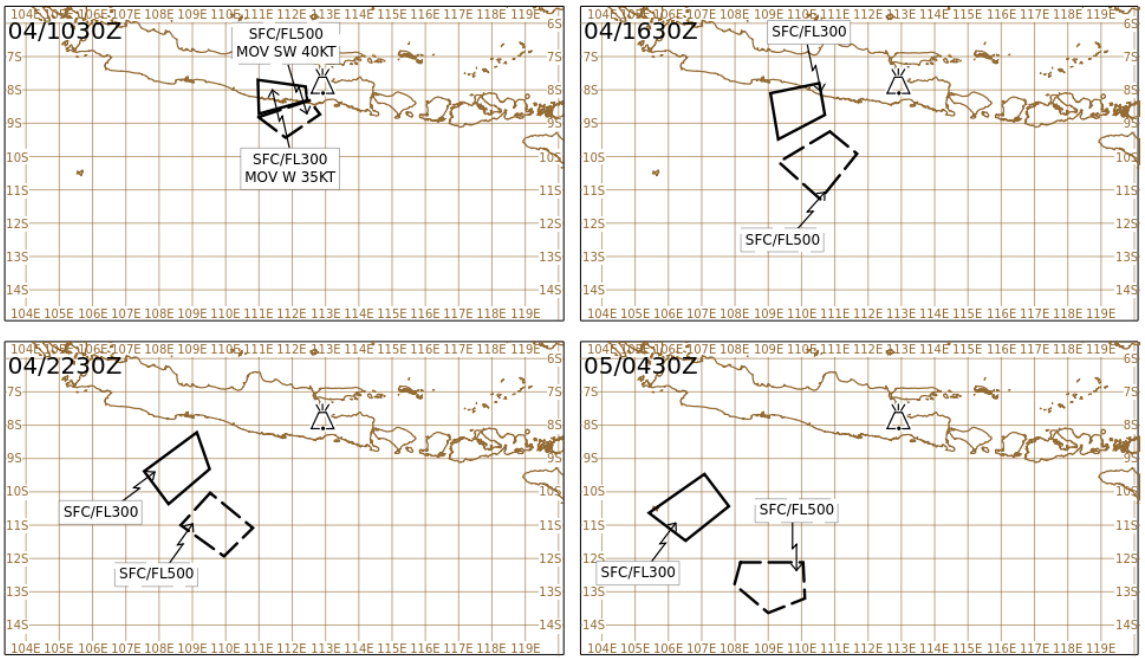
Indonesia: Volcano

Overview

Mount Semeru, about 93 kilometers (58 miles) south-southeast of Surabaya, Indonesia, erupted in the late afternoon on December 4, with the volcanic ash plume reaching up to 15 kilometers (9.3 miles) above sea level. The eruption killed at least 43 people and injured hundreds on East Java. No less than 6,000 people were evacuated. Total economic losses were expected to be at least USD20 million.

Volcanological Recap

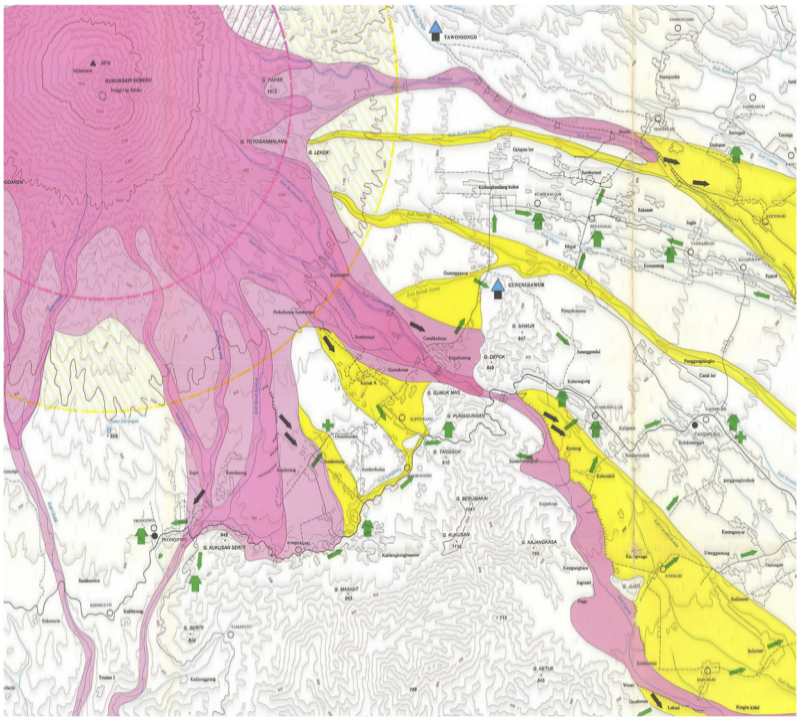
A high-level volcanic eruption occurred over Mount Semeru in the late afternoon on December 4. Mount Semeru, sitting at above 3,600 meters (11,810 feet), is Java's highest volcano and straddles along the "Pacific Ring of Fire". Heavy rain in the region eroded and partly collapsed a lava dome, causing pressure that had been building to be released and triggering the eruption. According to an advisory report from Darwin Volcanic Ash Advisory Centre (VAAC), two volcanic ash plumes reaching up to 9 kilometers (6 miles) and 15 kilometers (9 miles) above sea level were observed blowing to the west or southwest of the volcano.



Movement of volcanic ash clouds from Darwin volcanic ash dispersion model

Source: Darwin VAAC

Hot ash clouds blanketed nearby villages in Lumajang and Malang Regency, and pyroclastic lava had been recorded 800 meters (2,625 feet) from the volcano. The eruption was classified as a Strombolian eruption by the Volcanology Survey of Indonesia (PVMBG), with the main volcanic activity on the southeast flank of the volcano. Indonesian authorities maintained the ground hazard Alert Level at Level 2 (the third-highest Alert Level) and an exclusion zone of 5 kilometers (3.1 miles) was in effect.



Possible extent of pyroclastic flow (pink) and lahar (yellow)
Source: PVMBG

Event Details

Two districts in Lumajang were covered with pyroclastic materials and eight districts in Malang were covered with volcanic ash. Some villages were covered in ash and sand up to 4 meters (13 feet) tall. Thick mud formed from a mixture of debris, lava and rainfall destroyed at least 3,000 houses and many building structures, including a main bridge connecting Lumajang and Malang. At least 43 villagers died, and no fewer than 100 suffered burn injuries. A dozen people were still missing. No less than 6,000 survivors were evacuated to temporary relief shelters. Rescue efforts were hampered due to recurrent volcanic activities and rainy weather. There were no major disruptions to flight operations.

Semeru spewing ash into the air as seen from Lumajang
Source: BNPB

Financial Loss

The Indonesia National Alms Agency (Baznas) released a preliminary economic loss estimate due to damage from the Mount Semeru eruption at IDR310 billion (USD20 million).

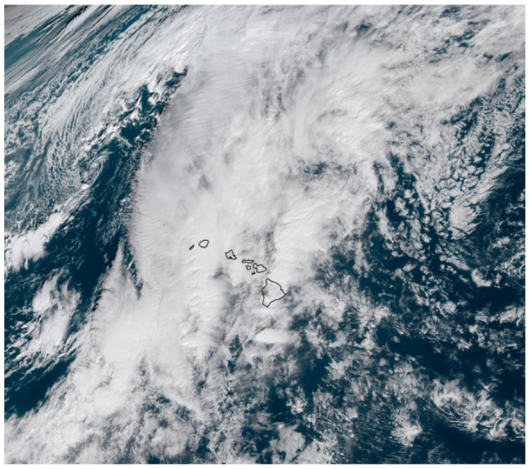
Flooding: Hawaii (United States)

Overview

A stalled Kona low generated torrential rainfall and strong winds across the Hawaiian Islands between December 3-8. Widespread flooding and flash flooding led to closed roads, damaged homes and property, and significant power interruptions. Big Island, Maui, Molokai, and Oahu were among the most impacted islands. Total economic losses were anticipated to reach well into the millions (USD).

Meteorological Recap

A stalled 'Kona Low' generated a period of unsettled weather across the Hawaiian Islands between December 3-8. Kona lows are seasonal cyclones which commonly impact the archipelago during the winter months, and are known for bringing high winds, rough seas, incessant rainfall, and severe weather. The name 'kona' is derived from a word meaning 'leeward', which refers to the west or southwest directional shift in winds associated with such storms. These humid west and southwesterly winds are a reversal of the Islands prevailing easterly trade winds, and subsequently enhance precipitation along the typically drier south and west, or leeward, slopes of the islands.



Visible satellite image on December 6 at 20:00 UTC
Source: NOAA/RAMMB

During this period, flood warnings went into effect for the entire island chain, accompanied by flash flood warnings which included parts of Maui, Molokai, and Oahu. According to the National Weather Service (NWS) the most robust bands of precipitation produced rainfall rates which exceeded 2 inches per hour (50 millimeters per hour). Radar derived storm total rainfall reached and exceeded 10 to 15 inches (250 to 380 millimetres) in multiple locations as the system pulled deep tropical moisture northward toward the islands. A single day December rainfall record was set at the Honolulu Airport on December 6, with 7.92 inches (201 millimetres). This beat the previous record established in 1987. Higher elevation peaks on Hawaii's Big Island, particularly Mauna Kea and Mauna Loa, recorded accumulating snowfall and blizzard conditions.

The table below highlights 2-day rainfall totals ending December 7 (local time) provided by the NWS:

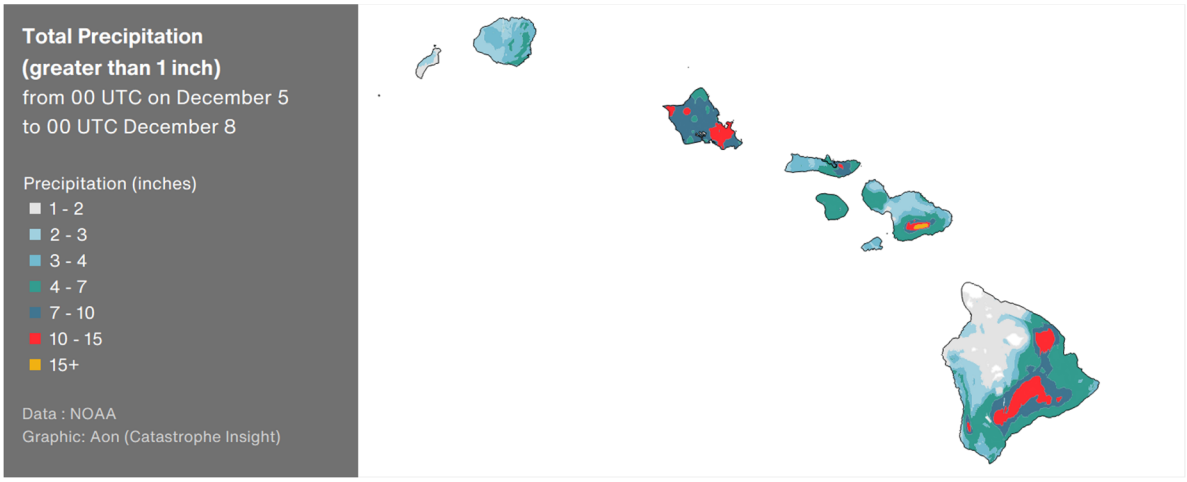
Location	Rainfall (in)
Nene Cabin, Big Island	14.26
Keaumo, Big Island	13.42
Kula, Maui	12.86
Nuuanu Upper, Oahu	11.68
Stephens Seminary, Oahu	11.65

Location	Rainfall (in)
Maunawill, Oahu	11.46
Lyon Arboretum, Oahu	11.34
Pali, Big Island	11.32
Kulani, Big Island	11.13
Luluku, Oahu	10.89

Event Details

The Governor declared a **State of Emergency** in Hawaii on December 6 due to ongoing and significant impacts to infrastructure, property, and transportation caused by the stalled Kona low. The most significant impacts were incurred in parts of the **Big Island**, **Maui**, **Molokai**, and **Oahu** – including the City of Honolulu. The incessant rainfall and high winds resulted in impassable roadways, damaged vehicles, downed trees and power lines, and flooded homes.

On the **Big Island**, Hawaii Emergency Management officials reported multiple road closures caused by rising floodwaters, downed trees, and debris. Closures included a section of Highway 11 near Kawa Flats. At the peak of the event, more than 20,000 customers on the Big Island were without power. On **Maui**, extensive flooding in the Maui Meadows subdivision damaged homes and washed away several vehicles. On December 5, a power outage at the Kahului Airport rendered the runway inoperable and temporarily halted air traffic. On **Oahu**, a damaged power substation cut electricity services to downtown Honolulu residents and businesses. The Honolulu Fire Department responded to no less than 90 storm-related incidents between December 6-7. Road closures due to flooding included a portion of the Kamehameha Highway from Waiahole to Waikane.



Financial Loss

Total economic losses to infrastructure and property were anticipated to reach well into the millions of dollars (USD) across the main Hawaiian Islands alone. It will take weeks to take full stock of impacts incurred on all the islands. Given low flood insurance take-up on the islands, and the noted damage to infrastructure, most of the economic losses were anticipated to be uninsured.

Windstorm Barra: Ireland, United Kingdom

Overview

Barra became the second notable windstorm to affect the British Isles within the last two weeks. It primarily affected Ireland on December 7-8 with strong gusts peaking at 135 kph (84 mph). As a result, relatively minor property damage occurred throughout western and southern counties, along with additional losses caused by coastal flooding.

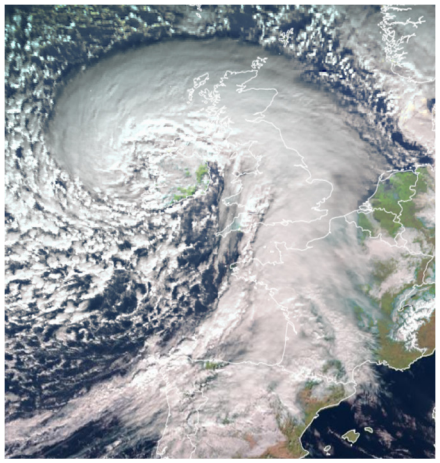
Meteorological Recap

Windstorm Barra became the second storm system to be named by the group of meteorological agencies of Ireland, United Kingdom and the Netherlands during the current season of 2021/22. It underwent a remarkable rapid cyclogenesis, as its central pressure fell by 54 millibars within a 24-hour period. The system travelled rapidly eastward through the northern Atlantic, roughly along the 50th parallel towards Ireland on December 7 and later lost its intensity and dissipated over the North Sea on December 9. Highest gusts associated with the storm were measured at the exposed Sherkin Island with 135 kph (84 mph), and average 10-minute winds at the same location reached 111 kph (69 mph).

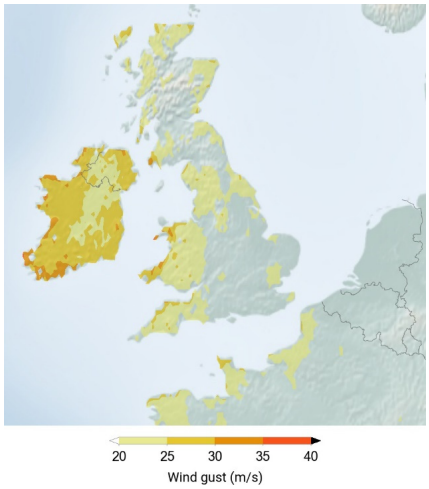
Highest gusts in Ireland
Source: Met Éireann

Station	Gust (kph)
Sherkin Island	135
Mace Head	133
Valentia	130
Newport Furnace	120
Roches Point	120
Cork Airport	119
Malin Head	119
Shannon Airport	113
Knock Airport	106
Belmullet	102

Storm Barra on a visible satellite image
Source: EUMETSAT



Modelled wind footprint
Source: Impact Forecasting



Event Details

A relatively rare red wind warning was issued for southwestern Cork, Kerry and Clare counties, with the rest of the country under lower degrees of vigilance. During the course of the storm, approximately 59,000 homes were left without power in Ireland, while 68,000 properties suffered from water supply disruption. Some property damage occurred, notably in western and southern counties. Additionally, coastal flooding occurred, particularly in Bantry, where dozens of businesses were affected.

The overall impact from Windstorm Barra in Ireland and the United Kingdom was expected to be relatively minor, with local insurance entities likely to sustain losses in the millions EUR.

Natural Catastrophes: In Brief

Severe Weather (United States)

Moisture pooling along a cold frontal boundary aided in producing heavy rainfall and severe weather which progressed from the ArkLaTex region into the Ohio and Tennessee River Valleys on December 5-6. The storms produced numerous reports of large hail, damaging straight line winds – with gusts topping 60 to 70 mph (96 to 112 kph), and isolated tornadoes. Regions of Kentucky and middle Tennessee were most affected. Impacts included power outages, downed and toppled trees, blocked roadways, and notable damage to property and homes. An EF1 tornado which touched down near Stamping Ground, Kentucky caused extensive damage to a trailer park and injured at least two people. Total economic losses were expected to reach well into the millions (USD).

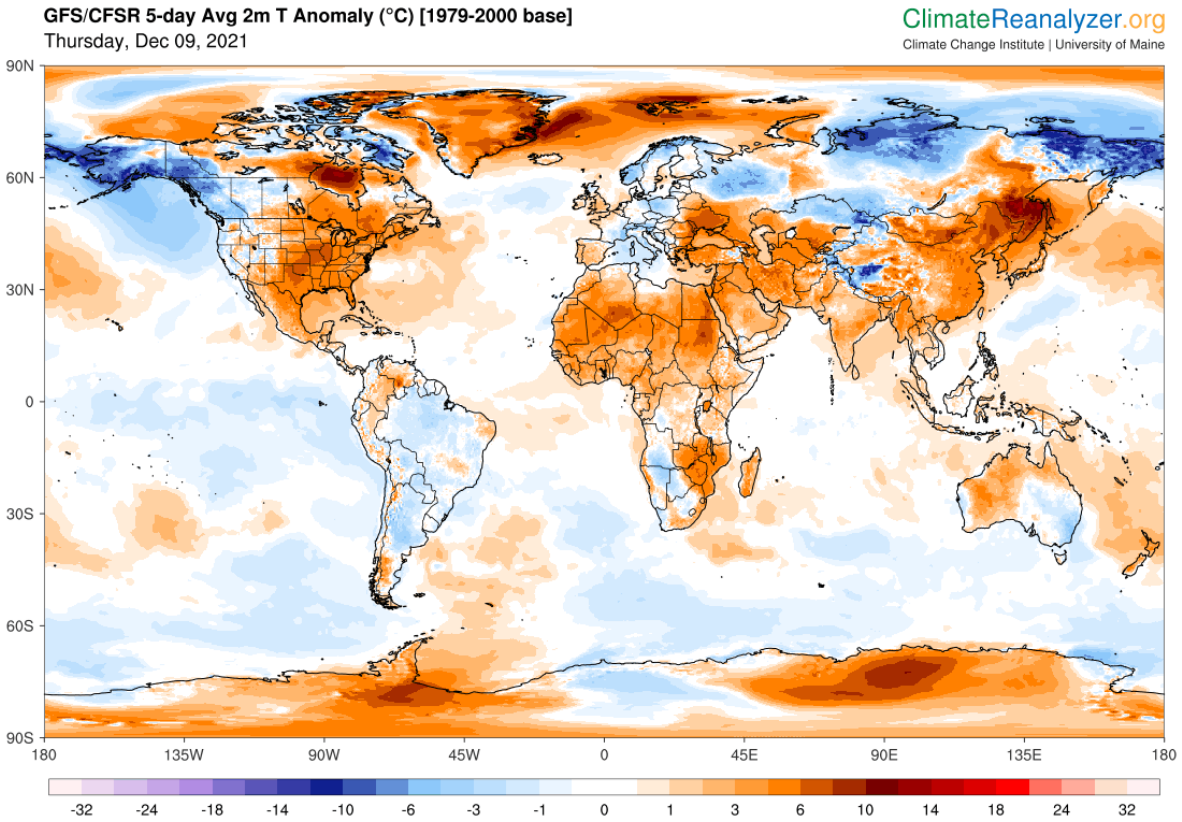
Flooding (Indonesia)

The tropical rain-belt currently over Indonesia continued to bring heavy shower activities over Java and the Lesser Sunda Islands. The water level situation was aggravated by high tides and clogged drainages, which caused serious flooding - particularly over West Nusa Tenggara where 5 fatalities and 8 injuries were recorded on December 5-6. Floodwaters in some districts reached as high as 1.3 meters (4.3 feet). More than 8,600 homes were inundated, and no less than 6,500 people were displaced. Flooding also hit South Sulawesi, a province just north of West Nusa Tenggara, with at least 1 death. No less than 4,800 villagers were displaced, and 1,600 houses were damaged on December 6-7.

Flooding (Brazil)

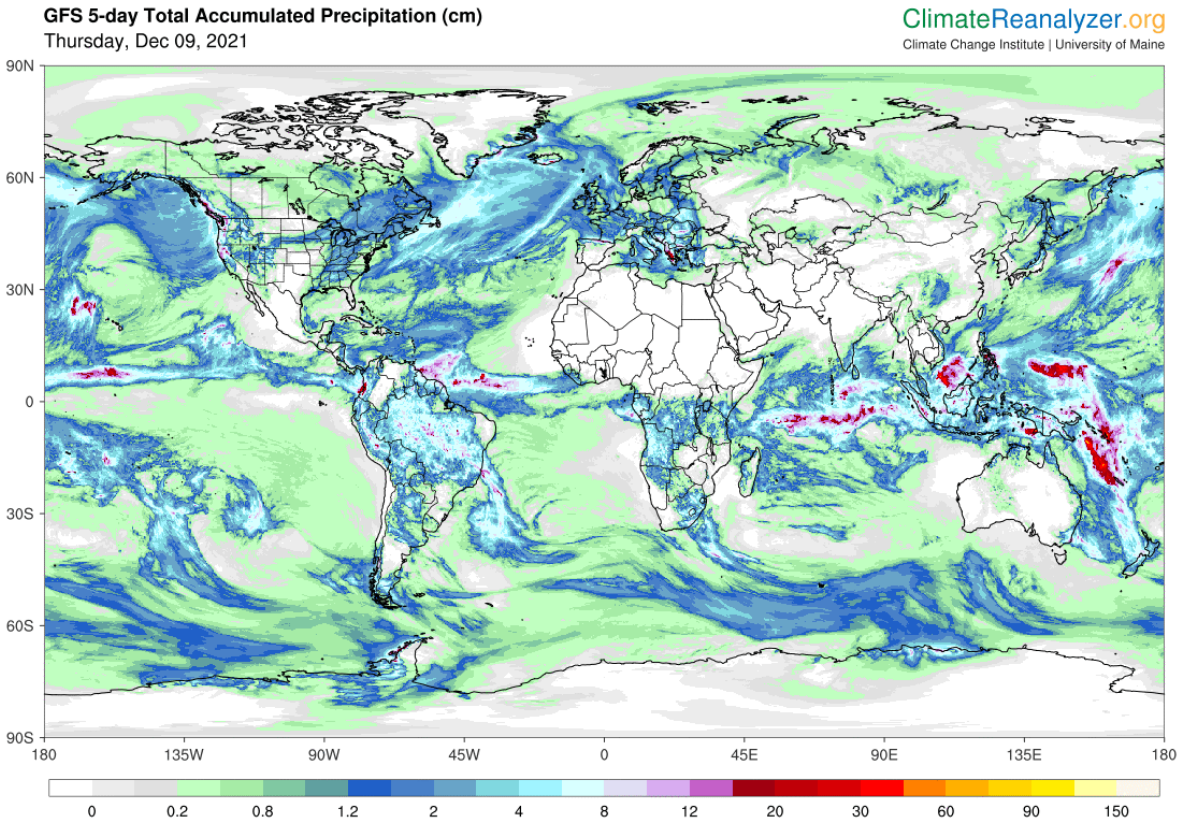
Heavy rains, which have affected northern Brazil's Bahia State since November, continued to enhance flooding impacts during the first week of December. Local State of Emergences were declared for the Itaberaba, Itamaraju and Porto Seguro municipalities. Hundreds of homes were damaged or destroyed, and multiple roads were cut off by floodwaters and debris. At least five people were killed in flood-related incidents, which also left 5,000 residents in Cumuruxatiba isolated on December 7. Damage assessments remained ongoing at the time of this writing.

Global Temperature Anomaly Forecast



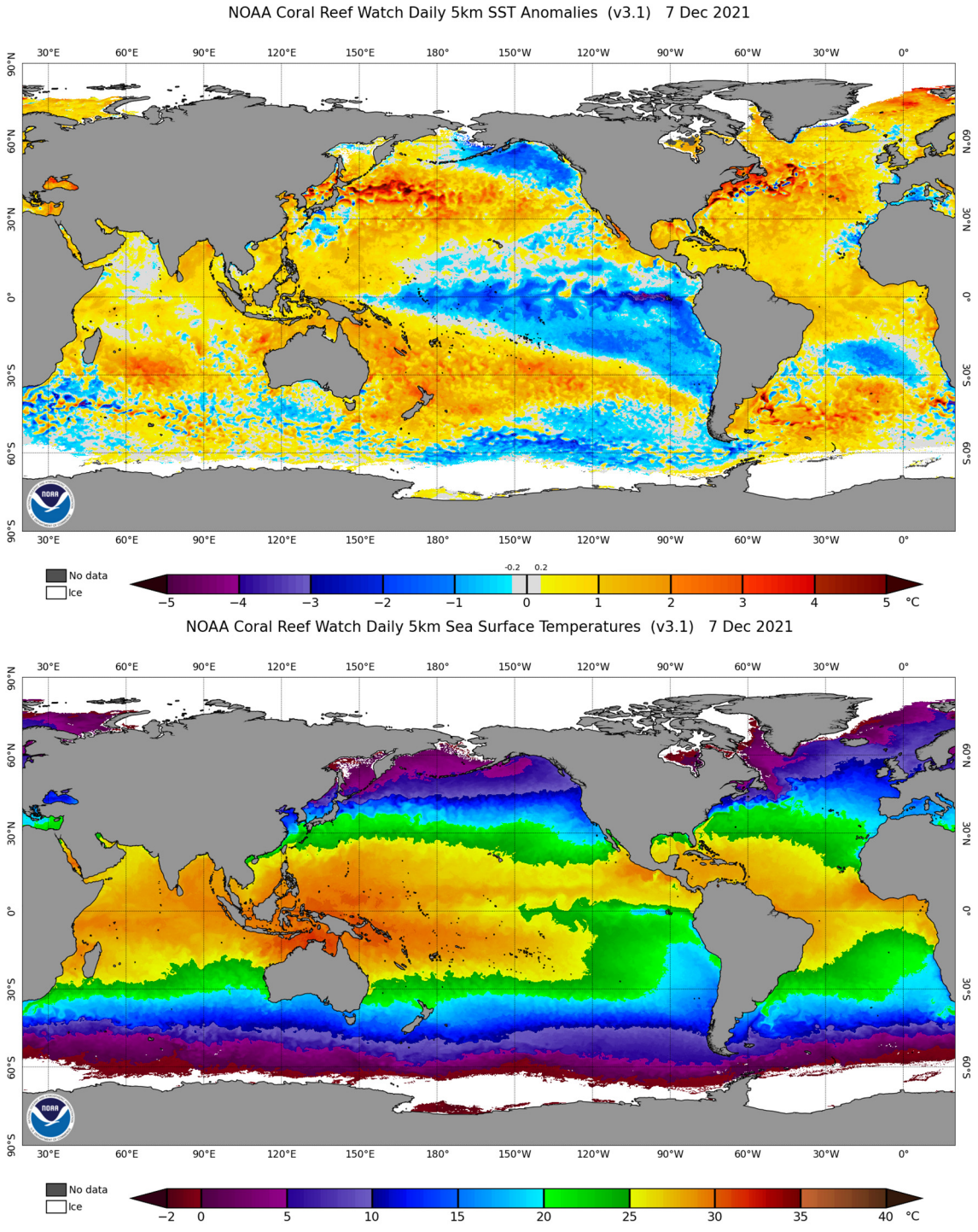
Source: Climate Reanalyzer, Climate Change Institute, University of Maine, USA

Global Precipitation Anomaly Forecast



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

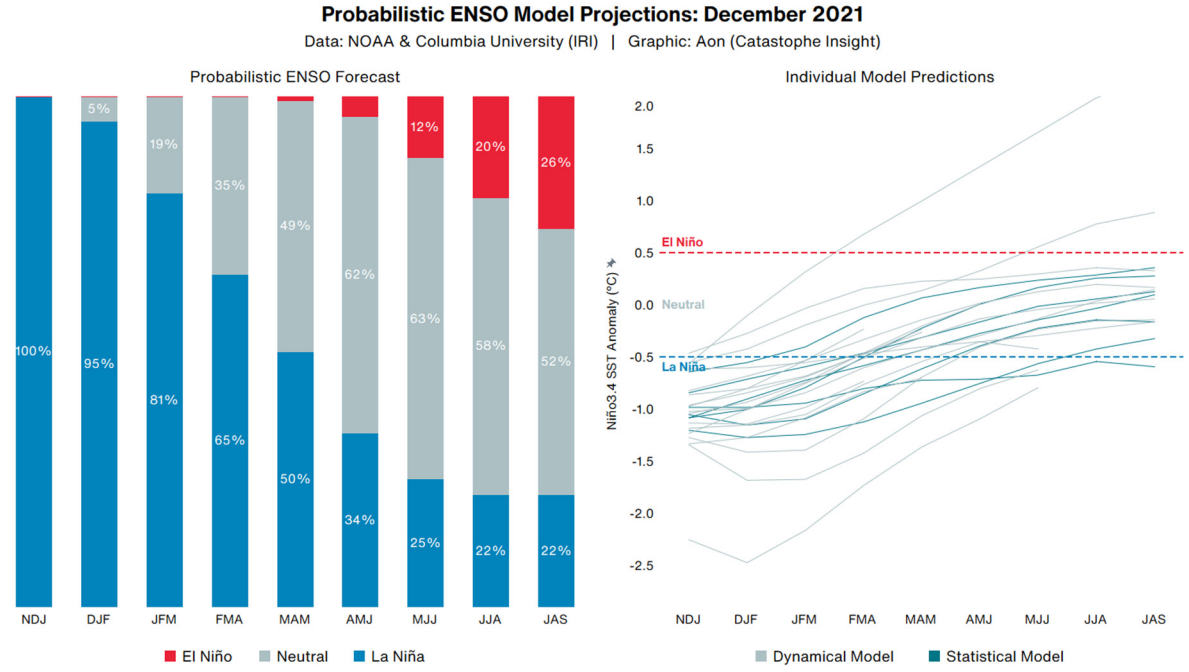
Weekly Sea Surface Temperature (SST) Maps (°C)



El Niño-Southern Oscillation (ENSO)

Overview

La Niña conditions have returned in the Central and Eastern Pacific Ocean, and NOAA has issued a “La Niña Advisory”. NOAA cites a 95 percent chance of La Niña conditions persisting through the Northern Hemisphere winter months, and a 60 percent chance of lasting through the spring (April to June). The agency also anticipates the possibility of a moderate strength La Niña at its peak before transitioning back to ENSO-neutral conditions by the Northern Hemisphere Spring of 2022.



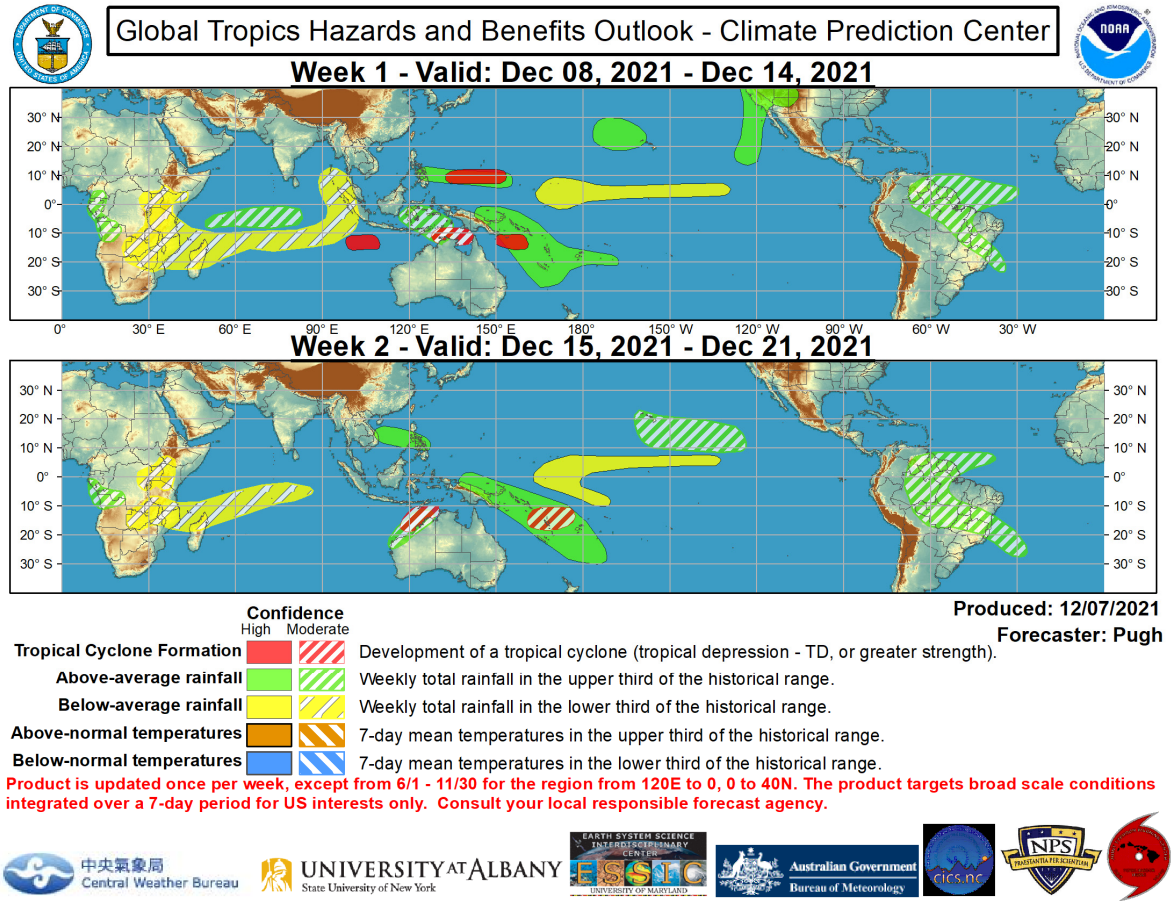
El Niño: *Warm phase of an ENSO cycle. Sea surface temperatures of +0.5°C occur across the east-central equatorial Pacific.*

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.*

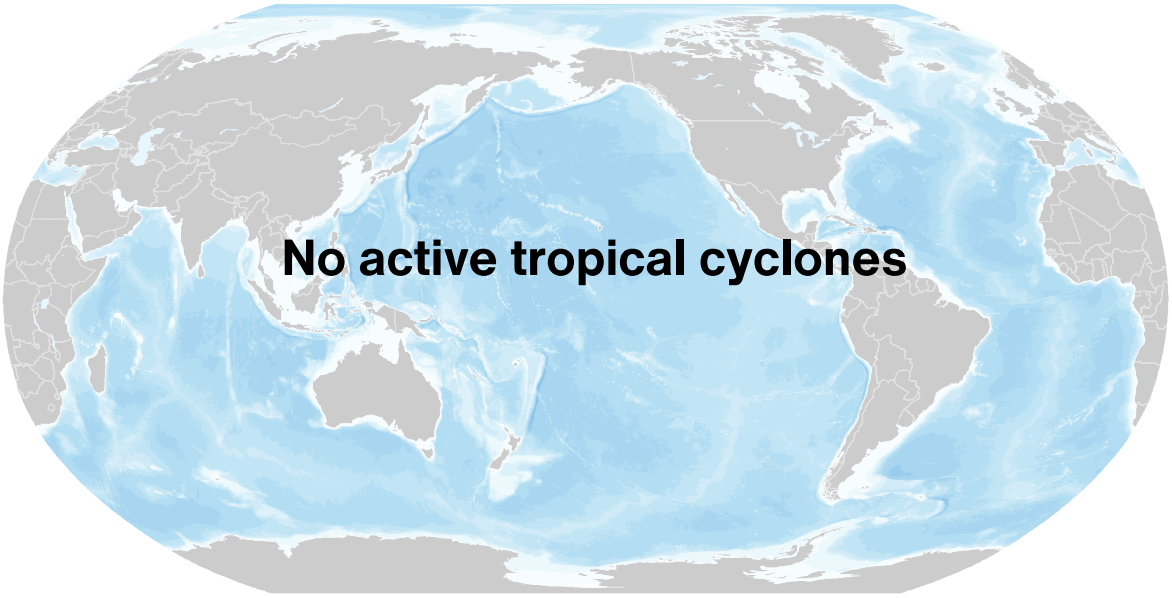
El Niño (La Niña) is a phenomenon in the equatorial Pacific Ocean characterized by a five consecutive 3-month running mean of sea surface temperature (SST) anomalies in the Niño 3.4 region that is above the threshold of +0.5°C (-0.5°C). This is known as the Oceanic Niño Index (ONI).

Global Tropics Outlook



Source: Climate Prediction Center (NOAA)

Current Tropical Cyclone Activity



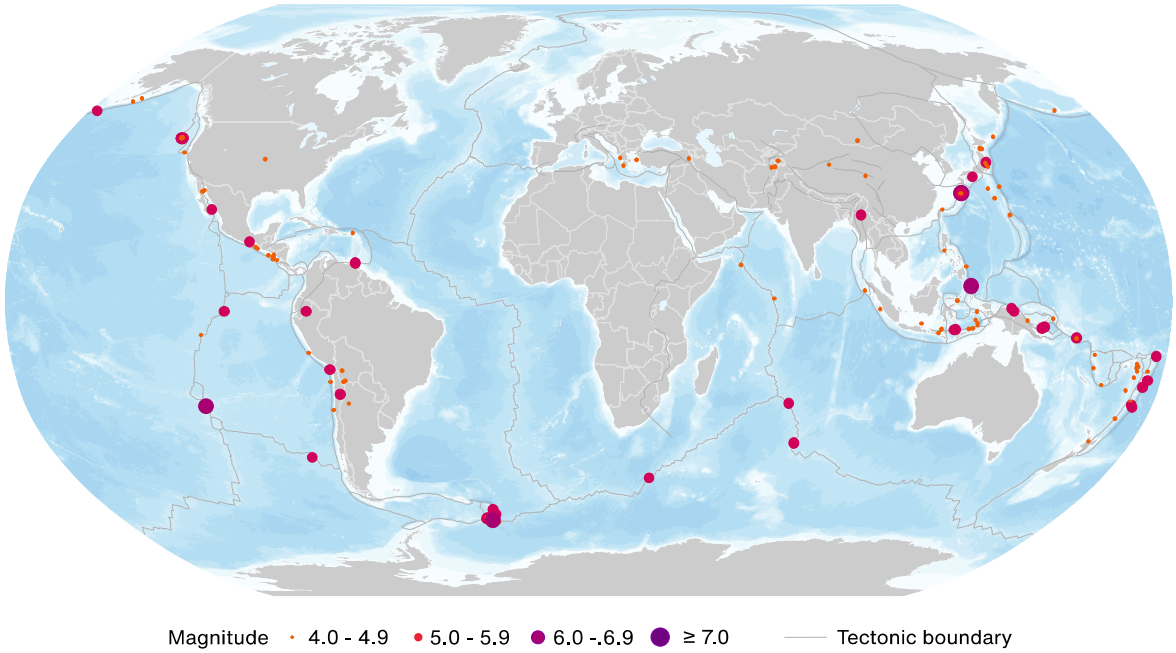
Tropical Depression Tropical Storm Category 1 Category 2 Category 3 Category 4 Category 5

Storm Name	Location	Winds	Location from Nearest Land Area

* 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)

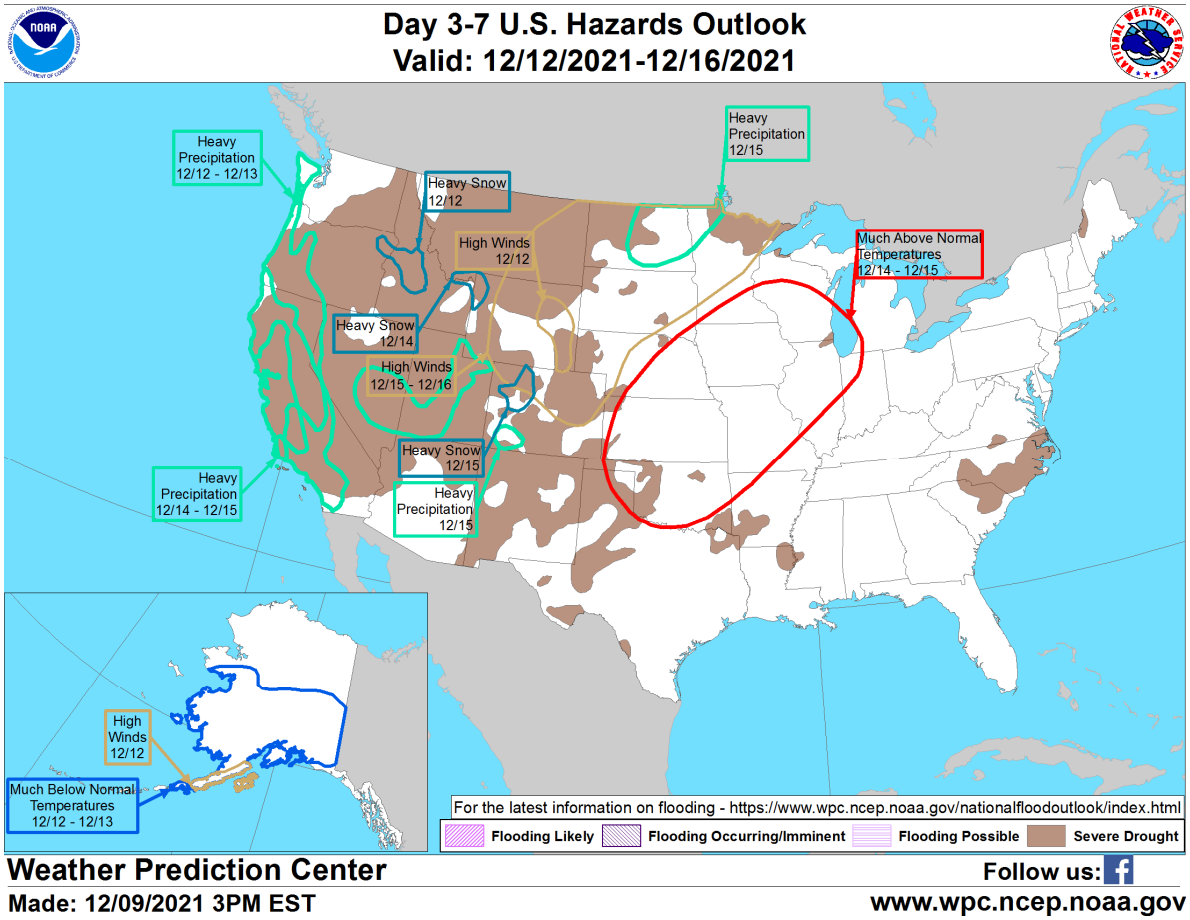
Global Earthquake Activity (≥M4.0): December 3-9



Date (UTC)	Location	Magnitude	Epicenter
12/03/2021	28.63S, 112.26W	6.2	Easter Island region
12/03/2021	60.46S, 27.11W	6.0	South Sandwich Islands region
12/04/2021	4.07N, 128.14E	6.0	25 km (16 mi) N of Tobelo, Indonesia
12/09/2021	29.44N, 129.42E	6.0	11 km (7 mi) N of Naze, Japan

Source: United States Geological Survey

U.S. Hazard Outlook



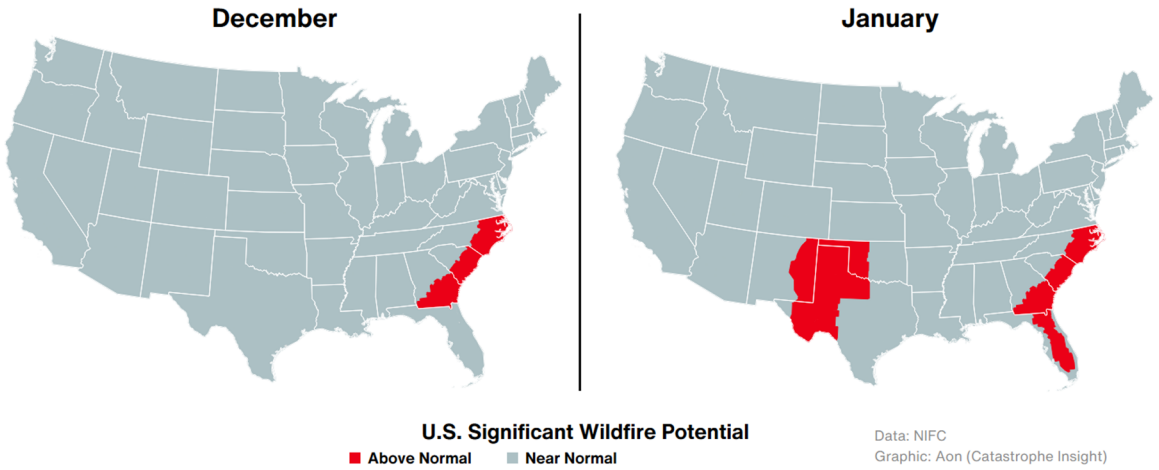
- A highly amplified upper-level pattern and frontal system will generate heavy precipitation in the Pacific Northwest and California between December 12-14. Accumulating snowfall totals are likely at higher elevations. As the trough moves onshore, heavy precipitation will impact parts of the Great Basin and Central and Northern Rockies through December 15.

- An emerging low-pressure system will result in a period of high winds in the Central and Northern Plains between December 15-16, while heavy precipitation is likely in the Northern Plains on December 15.

- Much above normal temperatures are expected across parts of the Plains and Midwest December 14-15, due to an anomalous ridge of high pressure building in the mid-section of the country.

Source: Weather Prediction Center (NOAA)

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



Annual YTD Wildfire Comparison: December 3*

Year	Number of Fires	Acres Burned	Acres Burned Per Fire
2017	57,449	9,246,118	160.94
2018	52,603	8,490,149	161.40
2019	47,703	4,682,157	98.15
2020	52,934	9,539,554	180.22
2021	54,350	6,802,729	125.17
10-Year Average (2011-2020)	**54,485**	**7,228,178**	**132.66**

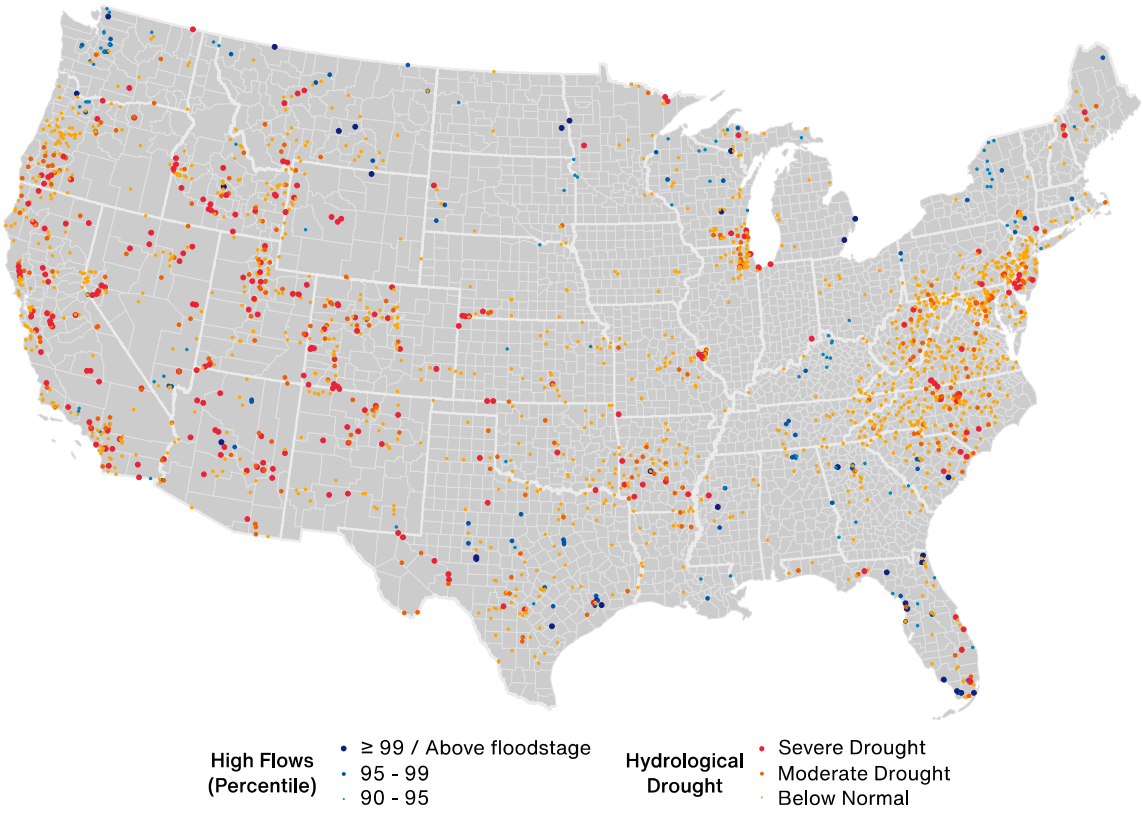
Top 5 Most Acres Burned by State: December 9

State	Number of Fires	Acres Burned	Acres Burned Per Fire
California	9,113	2,965,578	325.42
Oregon	1,776	831,307	468.08
Montana	2,524	747,989	296.35
Washington	1,851	643,991	347.92
Arizona	1,722	532,265	309.10

*Most recent NIFC update

Source: National Interagency Fire Center

U.S. Current Riverine Flood Risk



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 steam 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.

Top 5 Rivers / Creeks: Highest Percentile for Water Height

Location	Current Stage (ft)	Percentile
St. Croix River near Danbury, Wisconsin	2.93	99.04
Embarrass River near Embarrass, Wisconsin	3.93	98.94
Eau Claire River at Kelly, Wisconsin	1.87	98.94
Simikameen River near Nighthawk, Washington	6.50	98.92
Okanogan River near Tonasket, Washington	8.55	98.91

Source: United States Geological Survey

Source Information

Volcano, Indonesia
Australia Bureau of Meteorology (BoM)
Indonesia National Disaster Management Authority (BNPB)
Volcanological Survey of Indonesia (PVMBG)
Indonesia National Alms Agency (BAZNAS)

Flooding: Hawaii (United States)
U.S. National Weather Service
Storm-Related Power Outages Impact Upwards of 20K on Big Island, *Big Island Now*
State of emergency declared in Hawaii as storm leaves hundreds without power, *NBC News*

Windstorm Barra: Ireland, United Kingdom
Met Éireann
Storm Barra: Schools to reopen tomorrow as winds ease, *The Irish TImes*

Natural Catastrophes: In Brief
Tragedy After Bus Swept Away by Floods in Kitui County, *Floodlist*
U.S. Storm Prediction Center
ASEAN Disaster Information Network
Deadly Floods and Landslides in Bahia After Heavy Rain, *Floodlist*

Contacts

Steve Bowen
Managing Director
Head of Catastrophe Insight
steven.bowen@aon.com

Brian Kerschner
Senior Catastrophe Analyst
brian.kerschner@aon.com

Michal Lörinc
Senior Catastrophe Analyst
michal.lorinc@aon.com

About Aon

Aon plc (NYSE:AON) is a leading global professional services firm providing a broad range of risk, retirement and health solutions. Our 50,000 colleagues in 120 countries empower results for clients by using proprietary data and analytics to deliver insights that reduce volatility and improve performance.