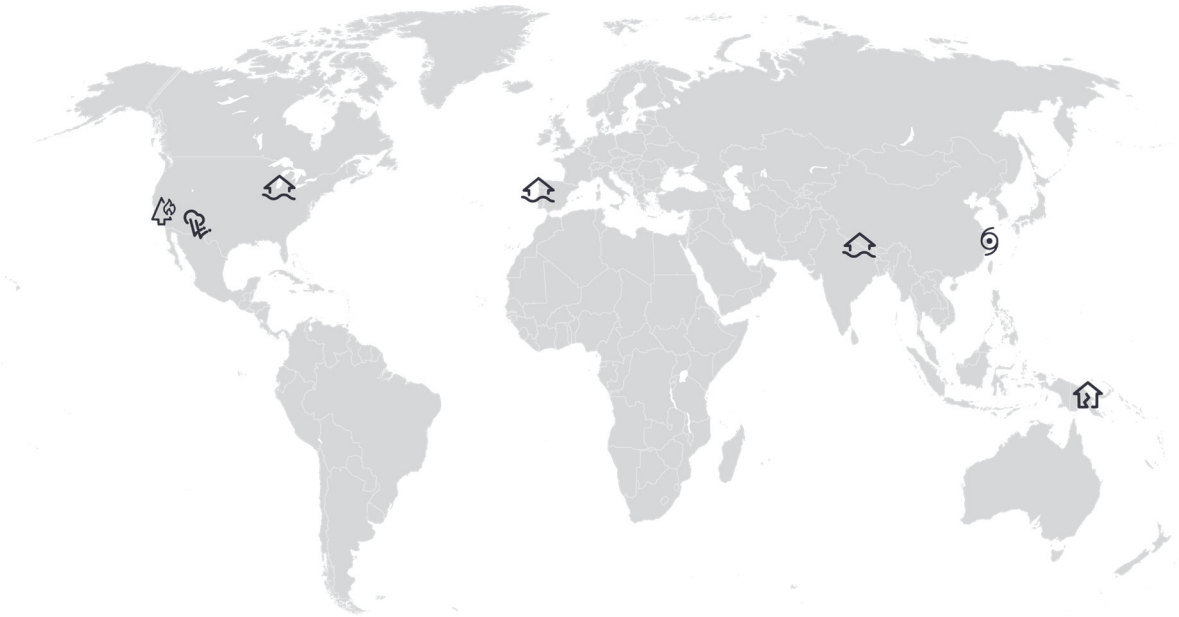
AON

Weekly Cat Report

September 16, 2022

Executive Summary



Event	Affected Region(s)	Fatalities	Economic Loss ($)	Page
Earthquake	Papua New Guinea	7+	10s of millions	3
Typhoon Muifa	China	0	10s of millions	5
Severe Convective Storm	United States	0	Millions	7
Wildfire	United States	0	Millions	7
Flooding	Nepal	5+	Unknown	7
Flooding	Portugal	0	Unknown	7
Flooding	United States	0	Unknown	7

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.

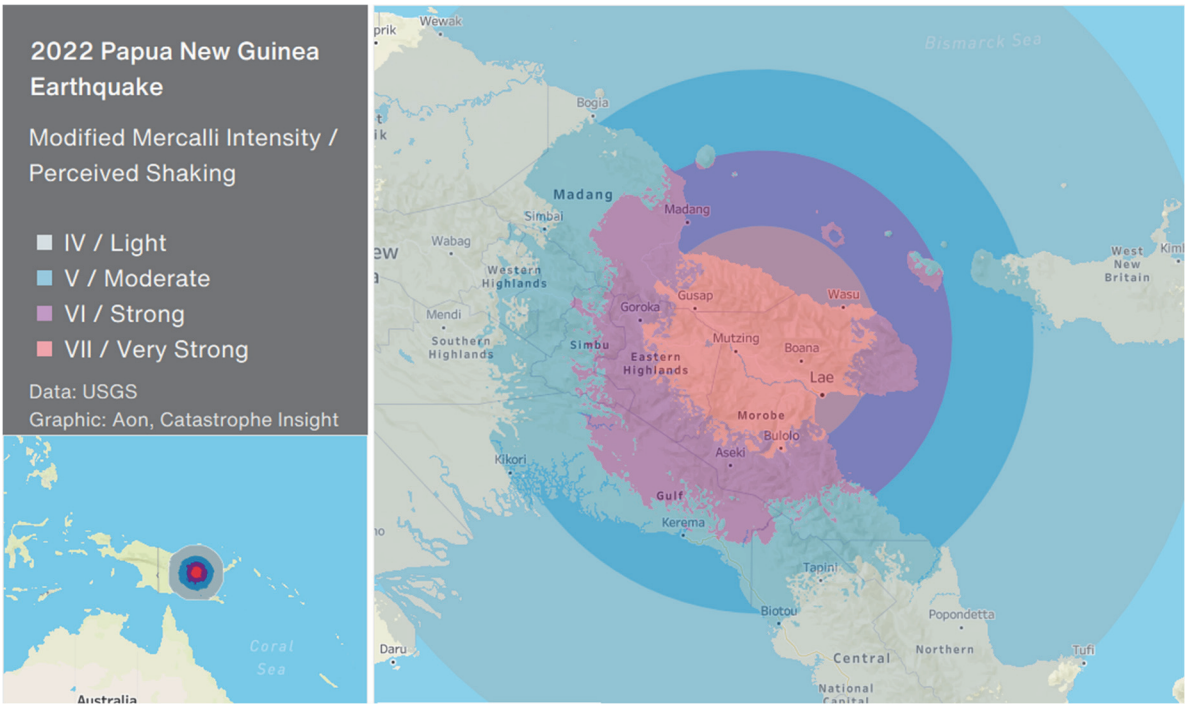
Along with this report, we continue to welcome users to access current and historical natural catastrophe data and event analysis on Impact Forecasting's Catastrophe Insight website: http://catastropheinsight.aon.com

Papua New Guinea: Earthquake

Overview

A very strong, intermediate-depth, magnitude-7.6 earthquake jolted eastern Papua New Guinea on September 10. As of this writing, at least seven fatalities and 24 injuries were reported. The earthquake resulted in notable material damage across the region. The United States Geological Survey (USGS) suggested a relatively high probability of economic losses reaching into the tens of millions, or even higher.

Seismological Recap



An initial magnitude-7.6 earthquake struck the Markham Valley, eastern New Guinea Island at 23:46 UTC on September 10. The United States Geological Survey (USGS) reported a depth of 90 km (56 mi), the epicenter was located approximately 78 km (48 mi) northwest of Lae city, Morobe Province. A further, magnitude-5.0, earthquake followed an hour later approximately 70 km (45 mi) north-west, accompanied with additional weaker tremors. According to USGS, the earthquake occurred as a result of normal faulting on the large-scale convergence zone of the Australian and Pacific plates near the northern edge of the Australian plate where it moves forward the east-north relative to the Pacific plate at a velocity of about 100 mm (3.9 in) per year. Intermediate-depth earthquakes like the September 10 event with depth of 70-300 km (43-186 mi) typically cause less damage on the surface but can be felt at greater distances from their epicenters. Moderate shaking (intensity V on the Modified Mercalli Intensity scale) was felt at least 500 km (310 mi) away in the capital of Port Moresby.

Tsunami warnings were issued for coasts within 1,000 km (620 mi) from the epicenter. Historically, there have been 22 magnitude-7.5 or greater earthquakes recorded in the New Guinea region since 1900. The previous significant earthquake occurred in February 2018 and claimed 160 fatalities and more than 50,000 damaged houses.

Event Details

An estimated 1.2 million people were affected by very strong shaking (intensity VII or higher on the MMI scale), particularly in Morobe, Madang and Eastern Highlands Provinces. Tremors triggered a series of landslides which resulted in casualties and in notable damage to homes and infrastructure.

In **Morobe Province**, at least six people died after multiple landslide events occurred in Kabwum (3), Wau (3), Bulolo and Boana districts. Material damages to homes, roads and health centers were incurred, according to local disaster authorities. The earthquake caused damage on the Muya Power Plant infrastructure resulting in supply outages. In **Madang Province**, one person died in a landslide in Rai Coast district, and at least 13 people were injured at Fox Nest House. In Madang town, no fewer than 389 houses collapsed. In **Eastern Highlands Province**, the Ramu hydropower station near Kainantu was damaged, resulting in a widespread power outage across the provinces, affecting power supply infrastructure in the urban centers of Lae and Madang. Several important highways and bridges were damaged or blocked due to landslides. At least ten students were injured by debris falling from a dormitory building at the University of Goroka.

Financial Loss

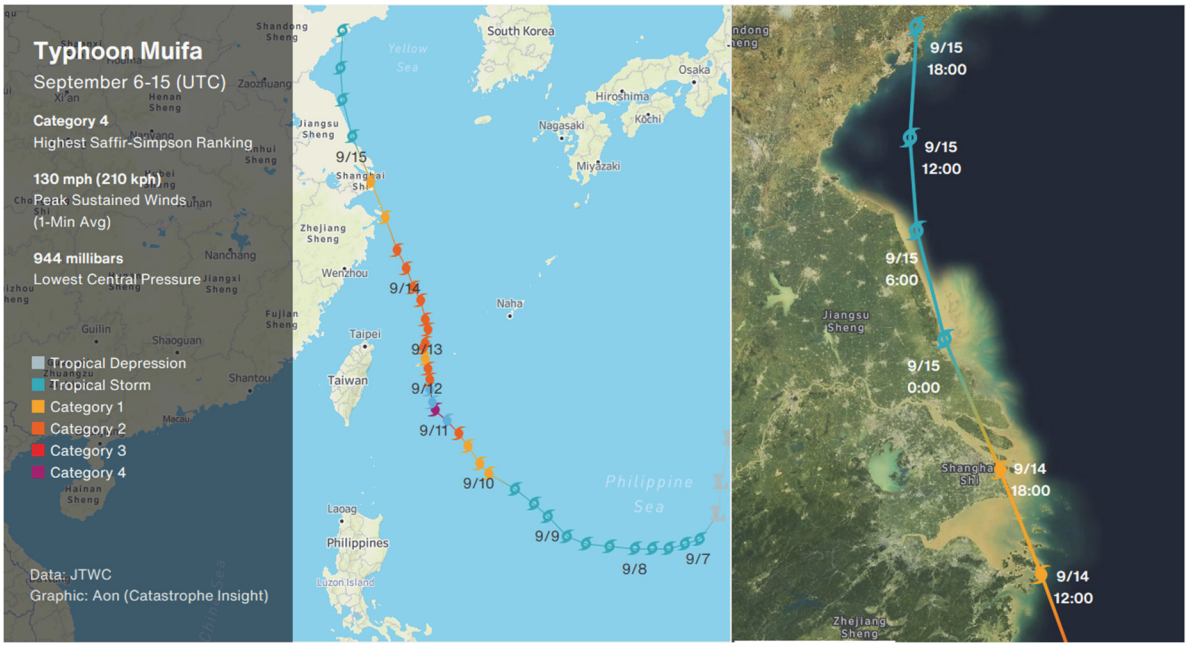
Property damages to dwellings and infrastructure in affected areas are still being assessed. On September 12, the Minister of Defense briefed the National Executive Council, seeking PGK20 million ($5.7 million) for immediate relief supplies, response and recovery activities in the three affected provinces. Based on the PAGER methodology by USGS, the earthquake has a 42 percent likelihood of economic losses exceeding the tens of millions (USD) and a 37 percent for losses in the hundreds of millions (USD).

China: Typhoon Muifa

Overview

After passing Putuo district in Zhoushan City, Typhoon Muifa made a second landfall as a Category-1 equivalent storm on the Saffir-Simpson Hurricane Wind Scale (SSHWS) in densely populated Shanghai area at 12:30 AM local time on September 15 as one of the strongest storms to strike the Shanghai metro region since at least 1949. The China Meteorological Administration (CMA) raised its typhoon alert to the highest for the first time this year; an 'orange' alert was issued for Typhoon Chaba in July. As of this writing, damage assessments were still in early stages, but economic losses can potentially reach into the tens of millions (USD), if not higher.

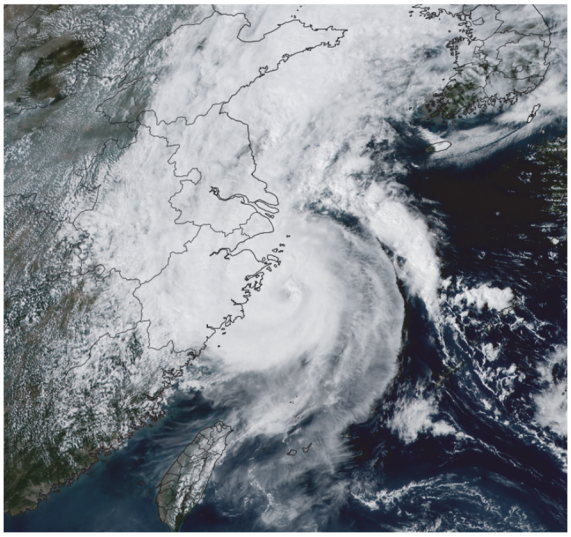
Meteorological Recap



On the afternoon of September 6, the Joint Typhoon Warning Center (JTWC) noted an area of persistent deep convection in the western Pacific, which subsequently developed into a tropical storm the day after. The storm was designated **"Muifa"** by the Japan Meteorological Agency (JMA) on September 8.

Muifa tracked slowly northward along the western periphery of a deep subtropical ridge extending from Shikoku to Shanghai, reaching typhoon strength by the early hours of September 10, and attaining 1-minute sustained wind speeds of at least 205 kph (125 mph) by the morning of September 11, equivalent to a Category-3 storm. It spent the next few days east of Taiwan in the Philippine Sea, tracking in a slower motion due to the presence of a monsoon depression to its east which weakened the steering mechanism. The Wulai district in New Taipei, Taiwan, recorded 588 mm (23.1 in) rainfall from September 11-13 through 5:00 PM local time.

Muifa crossed Ishikaji into the East China Sea around noon on September 12, briefly weakening as the storm completed an eyewall replacement cycle. Muifa underwent slight intensification in the East China Sea and tracked towards Shanghai as a Category-2 equivalent hurricane. However, cooler sea surface temperatures (SSTs) prevented further development. The cyclone made landfall in Putuo district in Zhoushan city, Zhejiang, at 8:30 PM local time on September 14. At landfall, the typhoon exhibited 1-minute averaged winds reaching 150 kph (95 mph), making it stronger than Typhoon Khanun in 2005. Muifa made another landfall in Fengxian District, Shanghai, at 12:30 AM on September 15 with weaker sustained winds of 125 kph (80 mph). The storm made its final landfall in the vicinity of Shandong overnight.



Typhoon Muifa nearing China on September 14
Source: NOAA / RAMMB

Event Details

An 'orange' alert was in place for Typhoon Muifa on September 13, which was subsequently upgraded to 'red' the next day ahead of the storm's landfall. No fewer than 2 million people in Zhejiang and Shanghai were evacuated to safety. Flights along China's east coast were cancelled, including Shanghai where all flights after 5:00 PM local time were cancelled on September 14. Port and marine operations were disrupted since September 12. Railway services in the Yangtze River Delta were affected, and classes in Ningbo, Taizhou, Shaoxing, and Zhoushan were suspended on September 14. No less than 520,000 customers in Zhejiang were affected by electricity outages.

Financial Loss

Different from Typhoon Khanun which tracked inland after landfalling in Zhejiang, Muifa took a more coastal route that would potentially minimize economic impacts to China. Damage assessments were still in the early stages, but economic losses could minimally reach into the tens of millions (USD), if not higher. For reference, Typhoon Chaba resulted in ¥3.1 billion ($460 million) losses in July this year.

Natural Catastrophes: In Brief

Severe Convective Storm (United States)

Moisture associated with Tropical Cyclone Kay in tandem with upper-level energy and ample diurnal heating resulted in notable severe convective storms (SCS) in parts of Arizona on September 11. Maximum wind gusts at Phoenix Sky Harbor Airport reached 76 mph (122 kph). Tens of thousands of customers across the region lost electricity. Wind and subsequent dust storms disrupted transportation and downed trees. Additional flooding in parts of California and Nevada damaged property and buried vehicles in mud and debris.

Wildfire (United States)

The Mosquito Fire burning in El Dorado and Placer Counties of California exhibited extreme fire behavior since it was first discovered on September 6. The fire prompted evacuation orders for no fewer than 11,000 residents near Foresthill, Volcanoville, and Georgetown. As of this writing, the fire had affected no less than 64,159 acres (25,964 ha) – to become the largest active fire currently in California. Preliminary damage surveys indicated at least 70 structures were destroyed and 10 were damaged. Total economic losses were like to reach into the millions (USD).

Flooding (Nepal)

At least five people died in floodwaters prompted by heavy rain in Darchula District, west Nepal, on September 9. As of this writing, at least ten people remain missing and eleven were injured. According to national disaster authority (NDRRMA), flooding and landslides damaged no fewer than 50 houses and several bridges and roads.

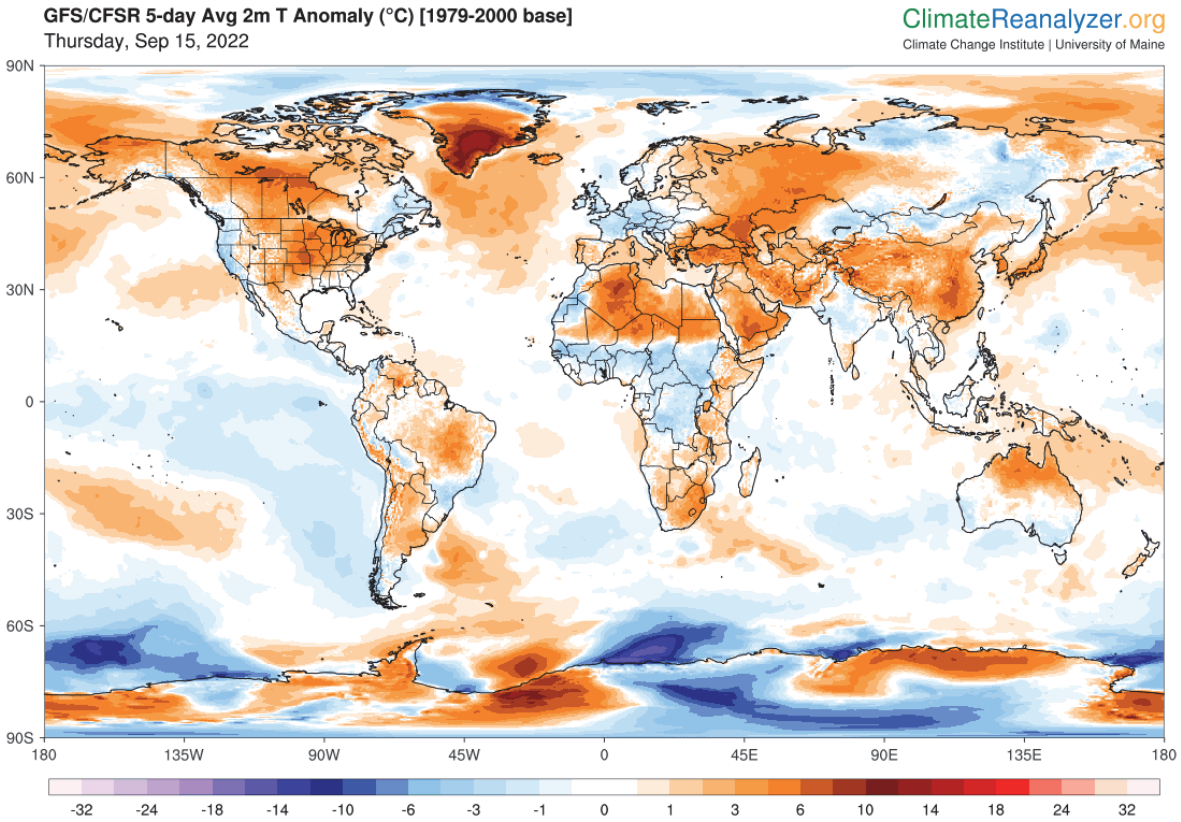
Flooding (Portugal)

An area of low pressure associated with the remnants of hurricane Danielle brought heavy rainfall into central parts of Portugal and resulted in localized flooding; notably in Manteigas Municipality in Guarda District. Intense rainfall impacted hilly and burned areas affected by summer wildfires, which resulted in flash flooding, landslides, and mudslides. According to authorities, damage to several buildings and infrastructure was incurred. Vehicles were dragged into the Zêzere river. As of this writing, no fatalities or injured people were reported. Damage on municipal infrastructure alone was at least €2.5 million ($2.5 million).

Flooding (United States)

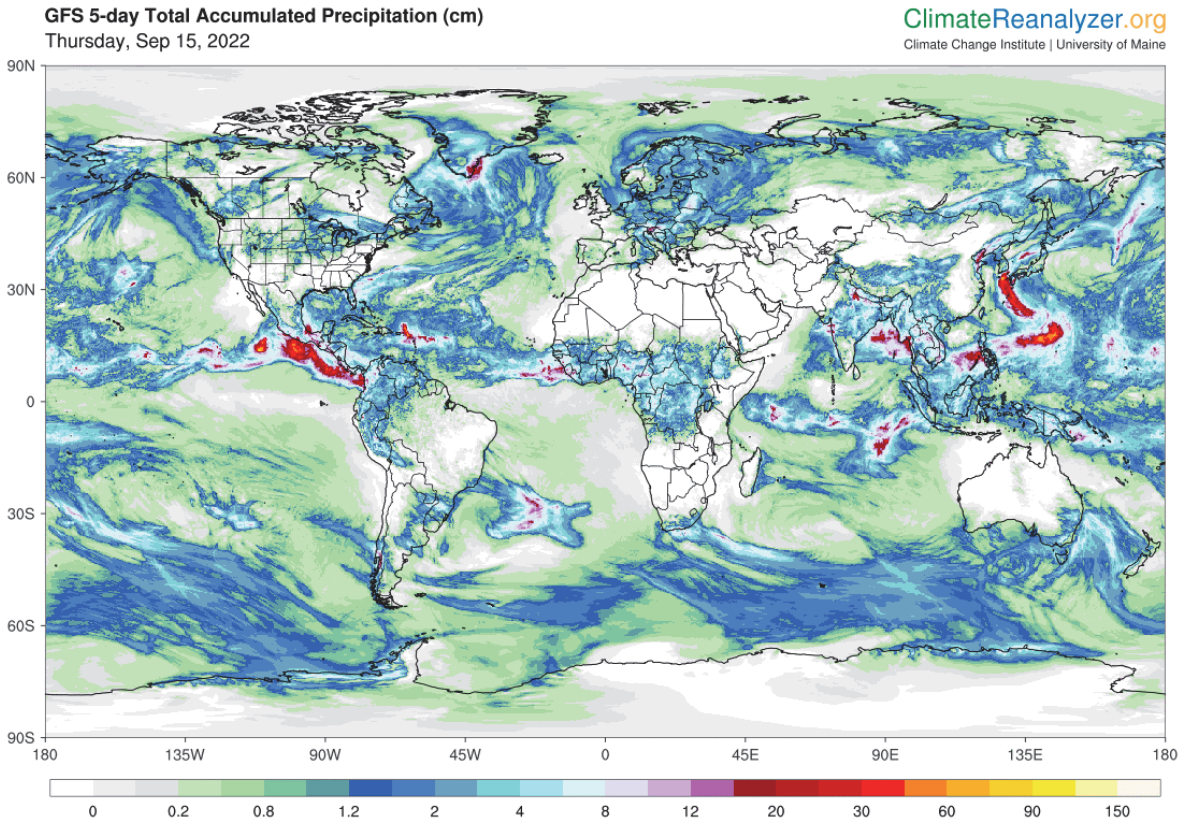
An upper level low and associated frontal boundary resulted in episodes of flooding and flash-flooding spanning from the Midwest into the Northeast between September 11-13. Rainfall was enhanced by moisture pulled northward from the Gulf of Mexico. On September 11, notable flooding impacted property and vehicles and inundated roadways in southern Wisconsin and northern Illinois – including the Chicago region. Rockford set a daily rainfall record with 4.34 in (110 mm). By September 13, flooding in the New York City metro region inundated roadways and encroached upon homes and businesses.

Global Temperature Anomaly Forecast



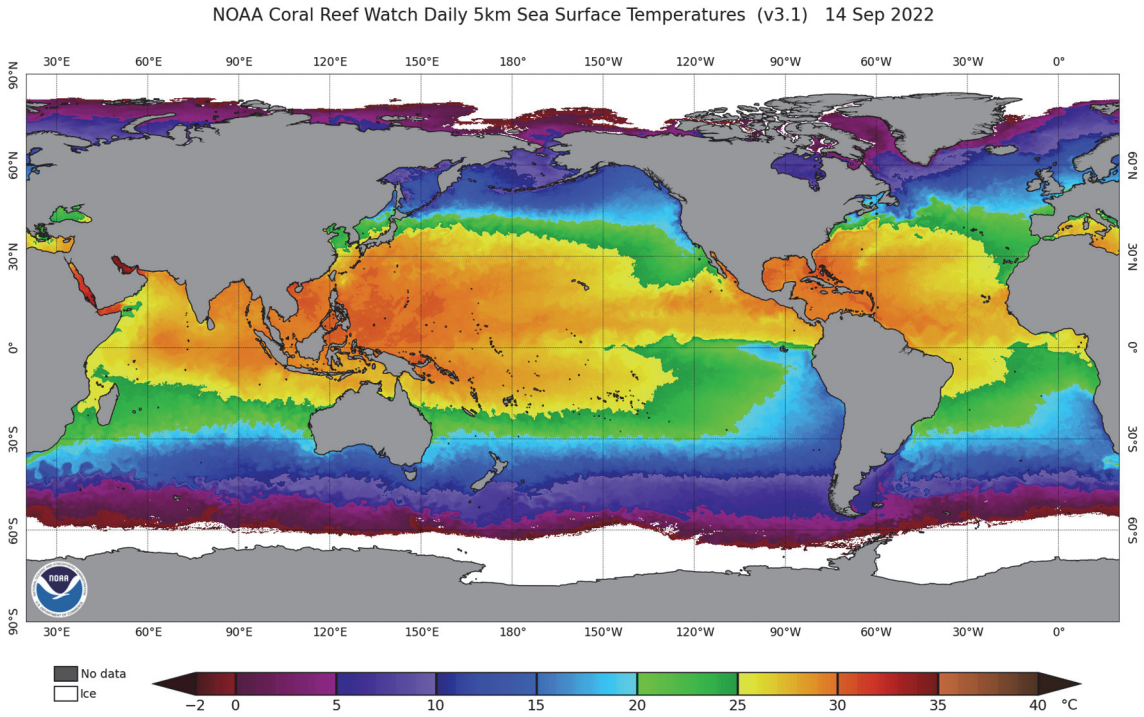
Source: Climate Reanalyzer, Climate Change Institute, University of Maine, USA

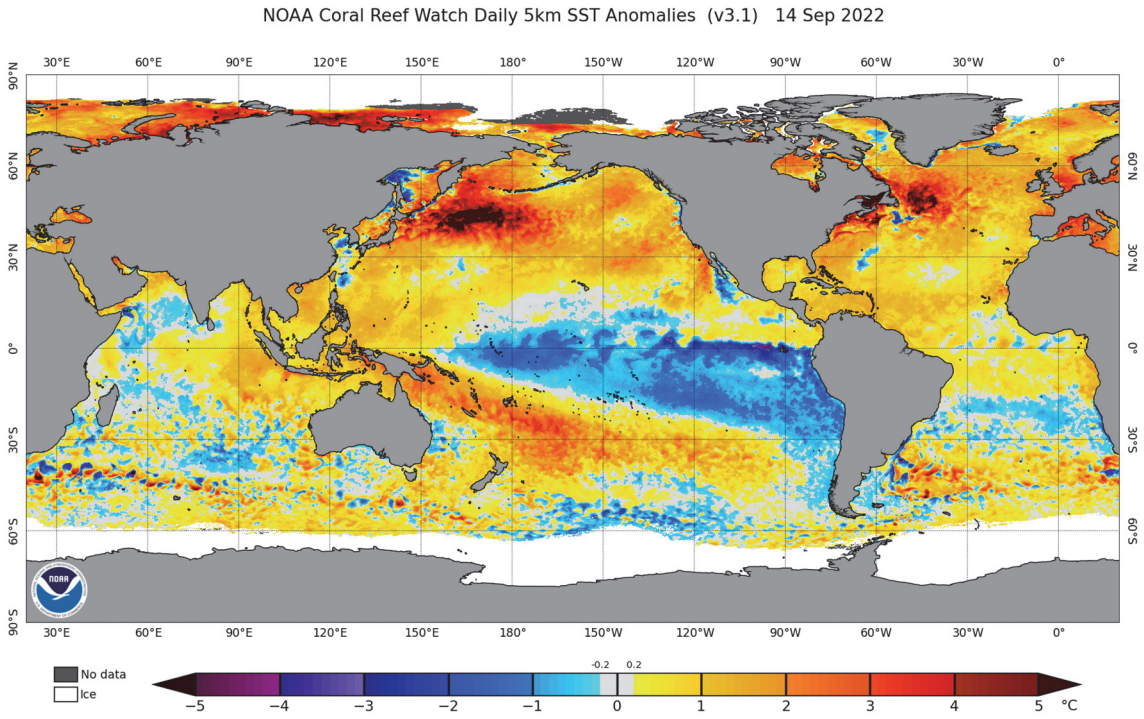
Global Precipitation Anomaly Forecast



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

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

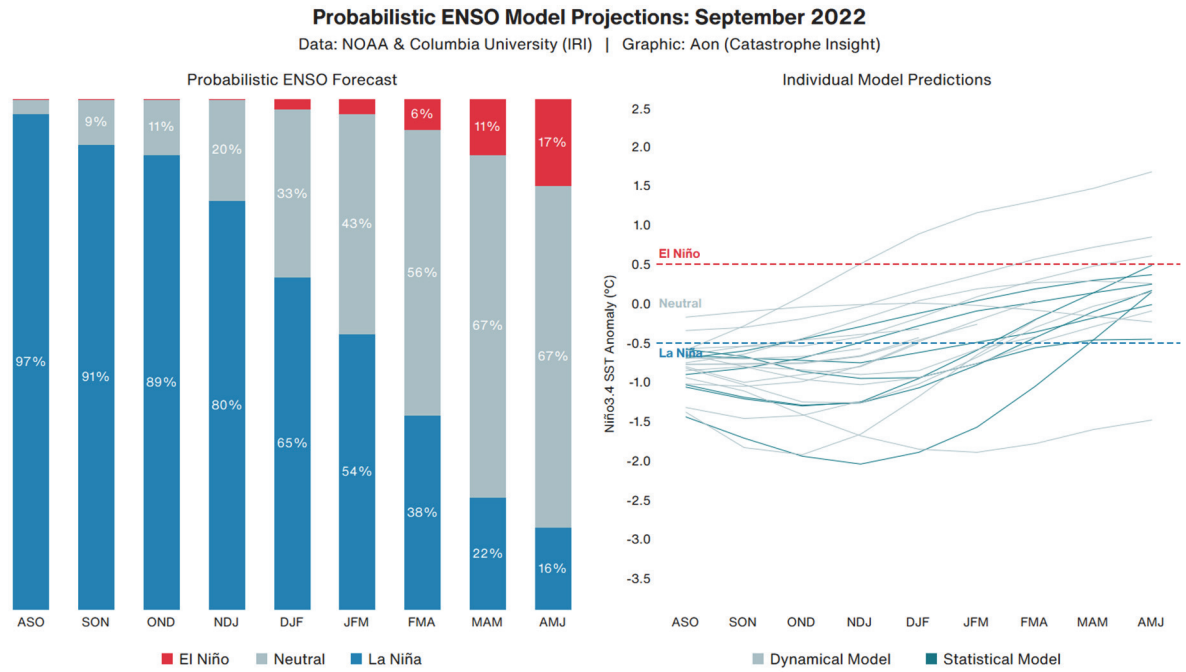




El Niño-Southern Oscillation (ENSO)

Overview

La Niña conditions are very likely to continue for the next several months. NOAA cites a 91 percent chance of La Niña conditions persisting through November, and then gradually declining to 54 percent during the boreal (northern hemisphere) winter months of January, and February.



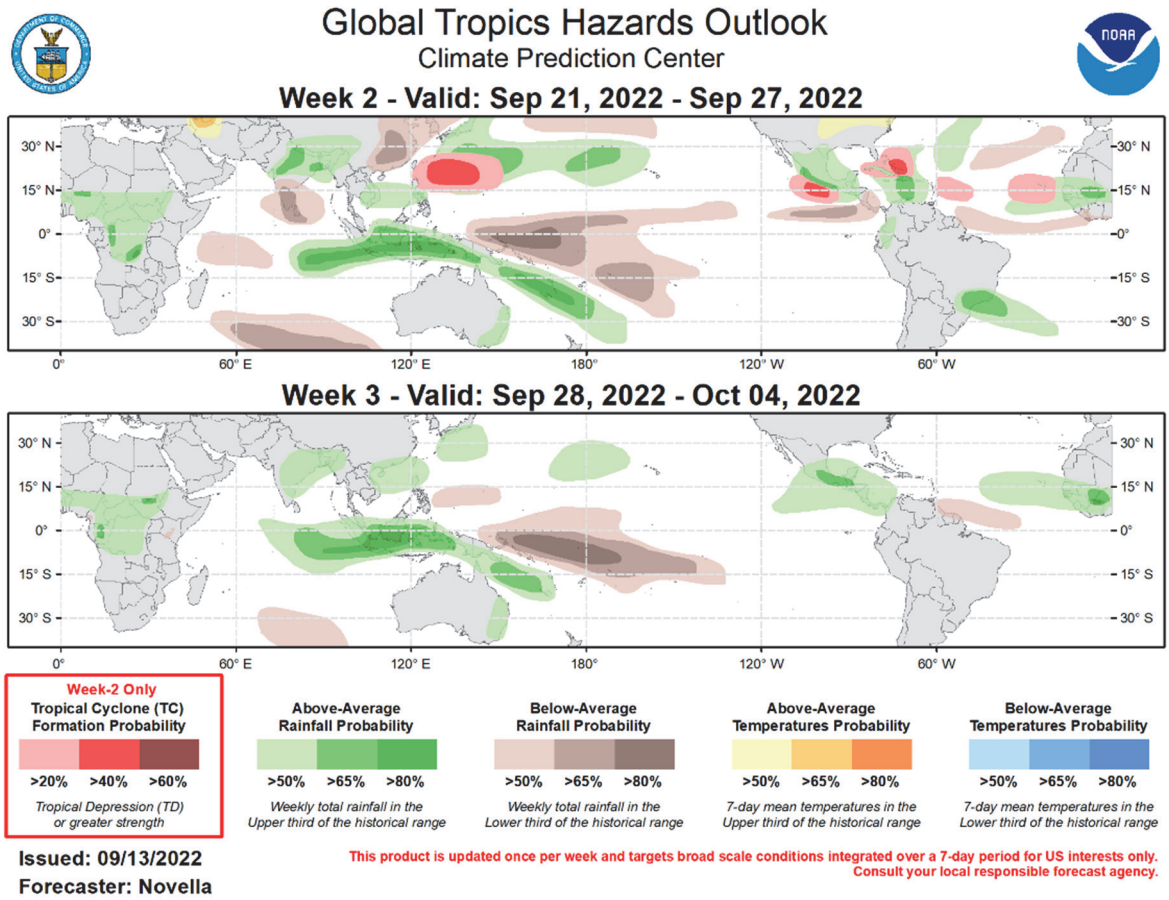
El Niño: *Warm phase of an ENSO cycle. Sea surface temperatures of +0.5°C occur across the east-central equatorial Pacific.*

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.*

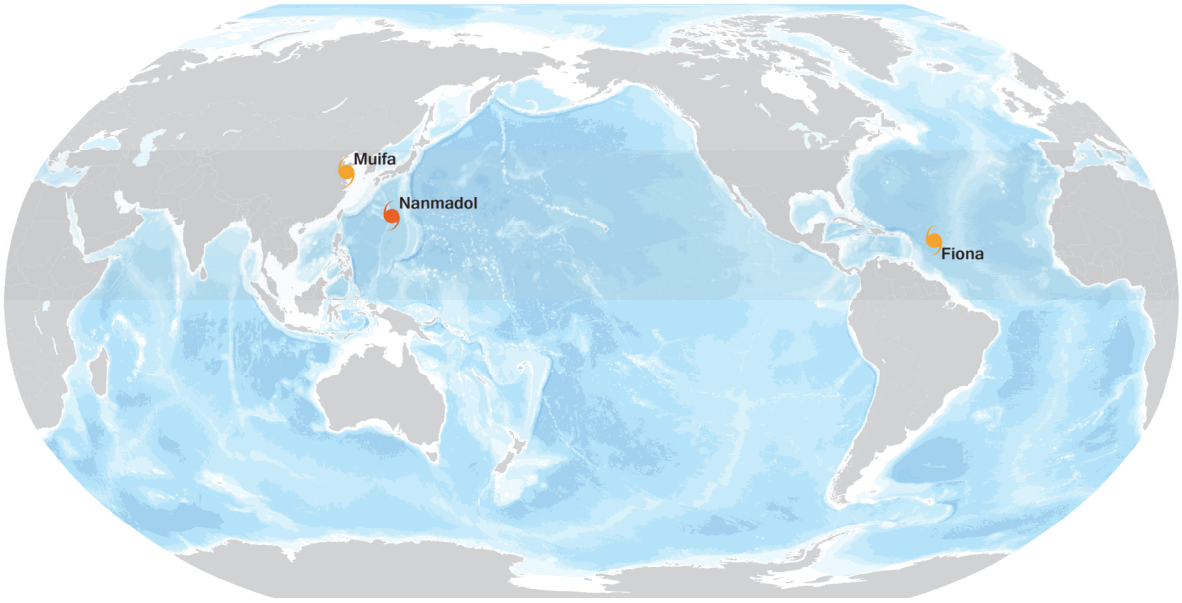
El Niño (La Niña) is a phenomenon in the equatorial Pacific Ocean characterized by a five consecutive 3-month running mean of sea surface temperature (SST) anomalies in the Niño 3.4 region that is above the threshold of +0.5°C (-0.5°C). This is known as the Oceanic Niño Index (ONI).

Global Tropics Outlook



Source: Climate Prediction Center (NOAA)

Current Tropical Cyclone Activity



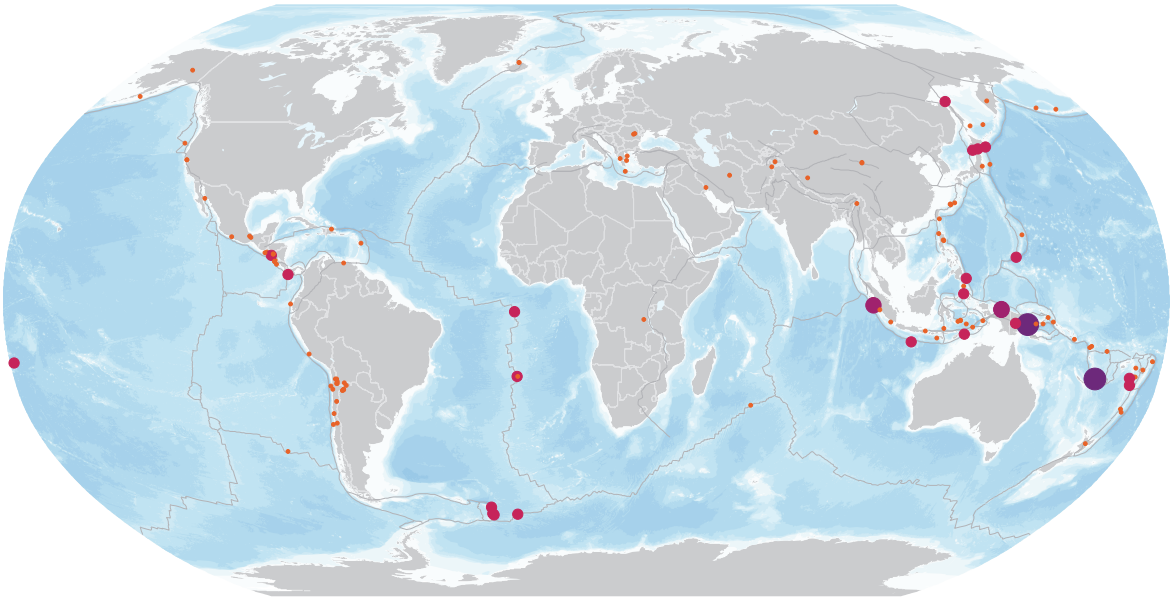
Tropical Depression Tropical Storm Category 1 Category 2 Category 3 Category 4 Category 5

Storm Name	Location	Winds	Location from Nearest Land Area
TS Fiona	16.6N, 53.7W	50	465 mi (745 km) NE from Bridgetown, Barbados
TY Nanmadol	23.4N, 137.3E	80	635 mi (1020 km) E from Naha, Japan
TS Muifa	35.2N, 120.3E	45	210 mi (340 km) SE from Jinan, China

* TD: Tropical Depression, TS: Tropical Storm, HU: Hurricane, TY: Typhoon, CY: Cyclone; PTC: Potential Tropical 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): September 9-15

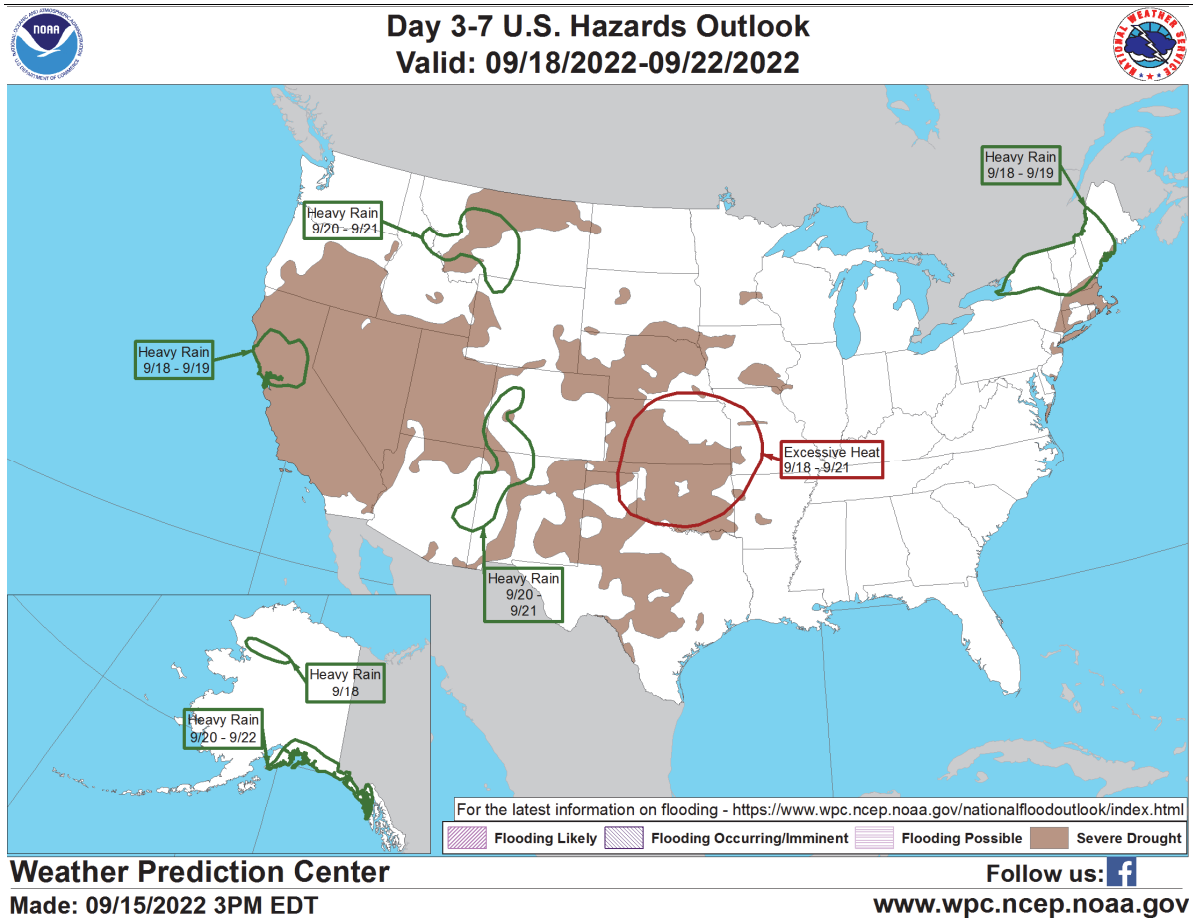


Magnitude • 4.0 - 4.9 • 5.0 - 5.9 • 6.0 -.6.9 • ≥ 7.0 — Tectonic boundary

Date (UTC)	Location	Magnitude	Epicenter
9/9/2022	2.25S, 138.20E	6.2	26 km (16 mi) ESE of Biak, Indonesia
9/10/2022	2.22S, 138.19E	6.2	Papua, Indonesia
9/10/2022	1.12S, 98.62E	6.0	17 km (11 mi) WSW of Pariaman, Indonesia
9/10/2022	6.26S, 146.47E	7.6	66 km (41 mi) E of Kainantu, Papua New Guinea
9/14/2022	21.19S, 170.24E	7.0	20 km (12 mi) SSE of Isangel, Vanuatu

Source: United States Geological Survey

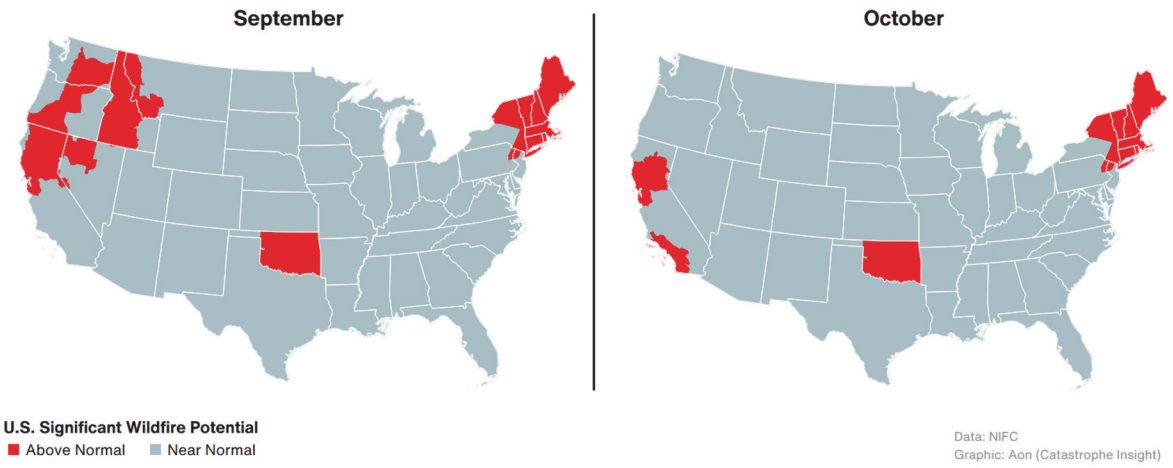
U.S. Hazard Outlook



- A meandering upper-level trough across the West will interact with moisture from the Eastern Pacific to produce heavy rainfall in northern California on September 18-19. Heavy rainfall will subsequently spread into portions of the Southwest and Northern Rockies through September 21.
- A dominant ridge across the central United States will promote a multi-day period of excessive heat. Near to record breaking daily highs are possible in portions of the Plains between September 18-21.
- A quasi-stationary frontal boundary will promote heavy rainfall across interior New England between September 18-19.
- Latest data from the United States Drought Monitor (USDM), showed 45 percent of the country, predominantly in the West, was affected by drought conditions as of September 15.

Source: Weather Prediction Center (NOAA)

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



Annual YTD Wildfire Comparison: September 15

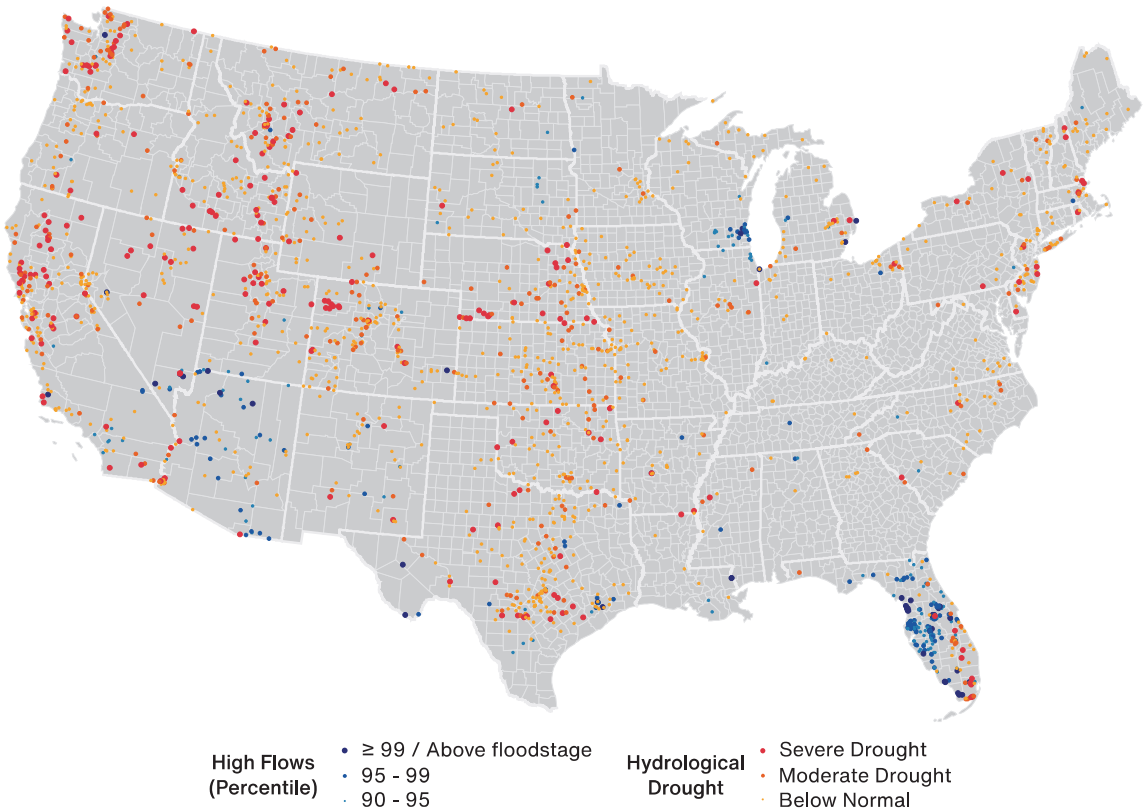
Year	Number of Fires	Acres Burned	Acres Burned Per Fire
2018	47,797	7,224,752	151.15
2019	36,848	4,292,624	116.50
2020	42,363	6,896,438	162.79
2021	44,740	5,609,865	125.39
2022	50,691	6,717,555	132.52
10-Year Average (2012-2021)	**43,087**	**6,019,333**	**139.70**

Top 5 Most Acres Burned by State: September 15

State	Number of Fires	Acres Burned	Acres Burned Per Fire
Alaska	569	3,107,227	5,460.86
New Mexico	710	858,987	1,209.84
Texas	9,668	641,119	66.31
Idaho	885	358,773	405.39
Oregon	1,322	332,295	251.36

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
South Fork Ogden River near Huntsville, Utah	2.03	99.01
Sacandaga River at Stewarts Bridge, Hadley, New York	5.53	98.91
Muddy River near Moapa, Nevada	2.33	98.81
Little Bighorn River at State Line near Wyola, Montana	2.15	98.80
Mill Creek at Walla Walla, Washington	1.95	98.78

Source: United States Geological Survey

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Source Information

Papua New Guinea: Earthquake
The United States Geological Survey (USGS)
UN OCHA
Powerful quake hits Papua New Guinea, at least 4 dead, *Reuters*
PNG 7.6 Magnitude Earthquate Updates by PNG National Command Centre, *Papua New Guinea Today*

China: Typhoon Muifa
Joint Typhoon Warning Center (JTWC)
China Meteorological Administration
Taiwan Central Weather Bureau

Natural Catastrophes: In Brief
U.S. National Weather Service
U.S Storm Prediction Center
National Interagency Fire Center (NIFC)
California Department of Forestry and Fire Protection (Cal-Fire)
5 Dead, 10 Missing After Floods in Darchula, *Floodlist*

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