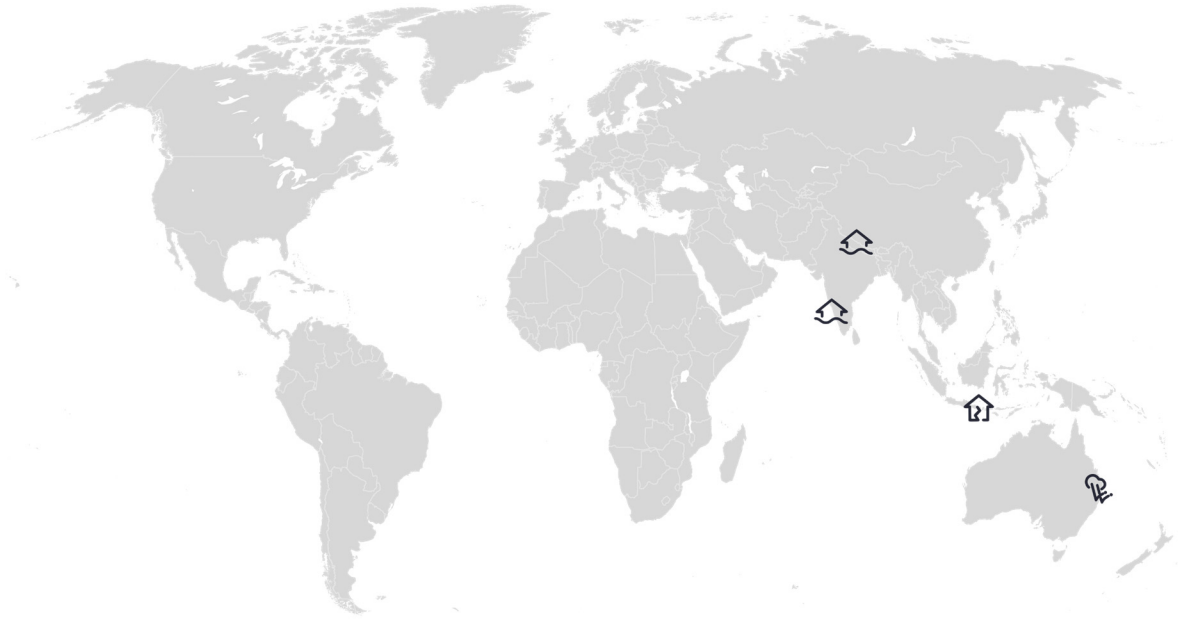


Weekly Cat Report

October 22, 2021



Executive Summary



Event	Affected Region(s)	Fatalities	Economic Loss (USD)	Page
Severe Weather	Australia	0	Millions	3
Flooding	India	141+	Millions	5
Earthquake	Indonesia	3+	Millions	6
Flooding	Nepal	88+	Millions	6

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>

Australia: Severe Weather

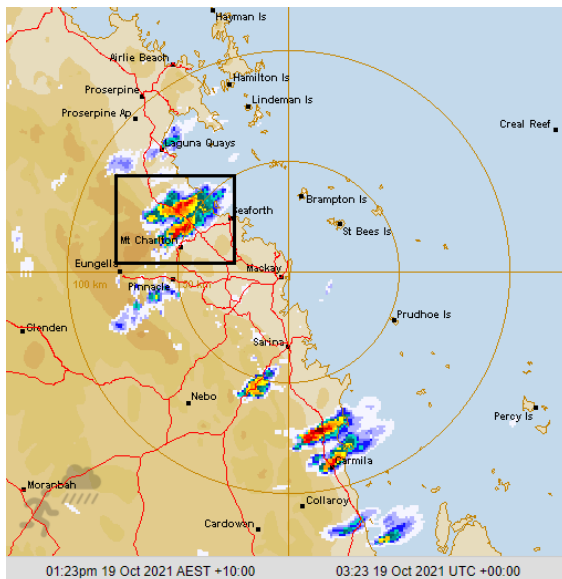
Overview

An upper-level disturbance brought several rounds of severe storms to parts of Queensland and New South Wales between October 18-20. An Australian record-breaking hailstone measuring at least 16 centimeters (6.3 inches) fell in Queensland, near Yalboroo, on October 19. The active stretch of weather generated widespread reports of hail damage, gusty winds, and flooding rainfall. Total economic losses were expected to reach well into the millions (USD).

Meteorological Recap

Severe storms and supercells that evolved in parts of New South Wales and Queensland between October 18-20 were aided by warm temperatures and rich low-level moisture. These conditions, in combination with an approaching upper-level disturbance and strong winds aloft further enhanced atmospheric instability. The storms generated flooding rainfall, damaging winds, isolated tornadoes, and instances of large hail across broad areas of central and southern Queensland and northern New South Wales.

On October 18, storms evolved across southeast Queensland where severe thunderstorm warnings were issued by the Bureau of Meteorology (BoM). At least two tornadoes near Gladstone and Toowoomba were confirmed, while hailstorms impacted Darling Downs and Highfields. A weather station near South Burnett received 69 millimeters (2.7 inches) of rainfall in a 30-minute period during the event.



Mackay, Australia radar on October 19, 2021

Source: Bureau of Meteorology

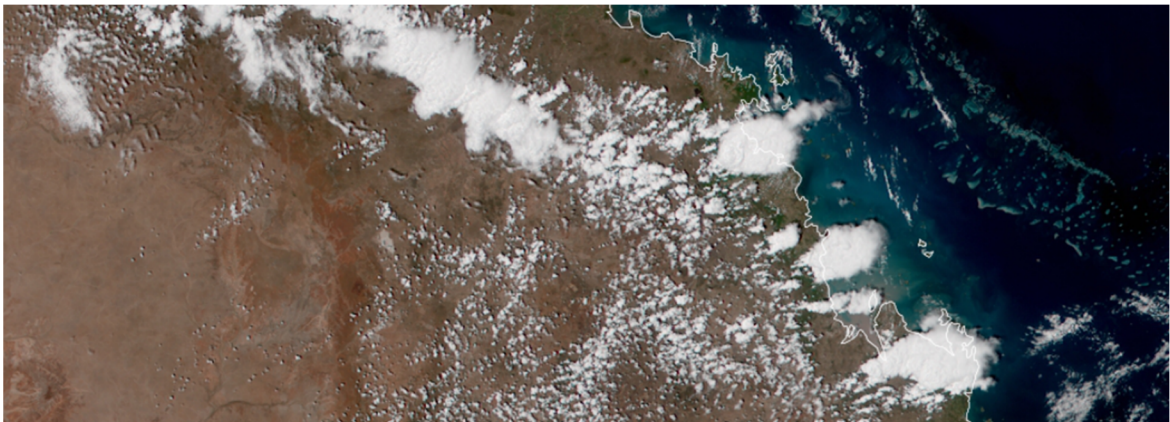
In Queensland, a storm with a robust updraft generated gargantuan and record-breaking hail in Yalboroo, north of Mackay on October 19. The BoM indicated a hailstone approaching 16 centimeters (6.3 inches) was measured. This set a new Australian record, surpassing the previous record from 2020 when hail of approximately 14 centimeters (5.5 inches) fell in New South Wales. As the upper-level trough lingered near the coast, severe storms and notable hail continued to impact portions of New South Wales and Queensland on October 20.

This latest severe outbreak continued an active stretch of weather for Australia's eastern states, as peak thunderstorm season approaches. The previous week, a destructive tornado touched down near Armidale in northern New South Wales on October 14. The tornado damaged multiple homes.

Event Details

In **Queensland**, the supercell which produced record-breaking hail on October 19 resulted in widespread damage to vehicles, structures, and vegetation particularly near Yalboroo and Bloomsbury. Media reports indicated that impacts included broken windows and windshields, dented roofs and solar panels, and exterior property damage. Power outages and localized flash flooding occurred across the most affected communities. Storms on October 20 generated straight-line wind gusts which approached 120 kph (75 mph) near the Mackay airport. Several small planes incurred hail damage during the event. Downed power lines left at least 10,000 customers without electricity.

In **New South Wales**, a supercell generated widespread impacts near Coffs Harbor on October 20. The State Emergency Service (SES) responded to at least 800 calls for assistance, many of which were related to water inundation, as well as damaged roofs and windows. Nearby, customers were evacuated from the Toormina Gardens Shopping Centre after the storm caused a portion of roofing to collapse. Additional damage was reported at area nursing homes and childcare centers. In several localities, hail accumulations reached 30 centimeters (12 inches). Heavy rains prompted the closure of several roadways.



Satellite imagery of severe storms in eastern Queensland on October 19 (3:20 UTC)

Source: NOAA/RAMMB

Financial Loss

A preliminary assessment by a local member of parliament (MP) from Coffs Harbour in New South Wales cited that total damage will be “in the tens of millions, if not the hundreds of millions of dollars (AUD)”. Damage in Queensland to the north of Mackay was also likely to reach into the millions (AUD). As of this writing, the Insurance Council of Australia (ICA) had yet to declare an insurance catastrophe for the multiple days of storms.

India: Floods

Overview

In the midst of a transitional withdrawal period of the seasonal summer monsoon, torrential rains affected southern India from October 11-20. Subsequent heavy rainfall led to at least 46 fatalities in the state of Kerala alone. Further rain and landslide-related incidents elsewhere in the country led to a further 95 fatalities. The floods swept away hundreds of homes and caused major damage to infrastructure and agricultural interests. Total economic losses were estimated into the millions (USD).

Meteorological Recap

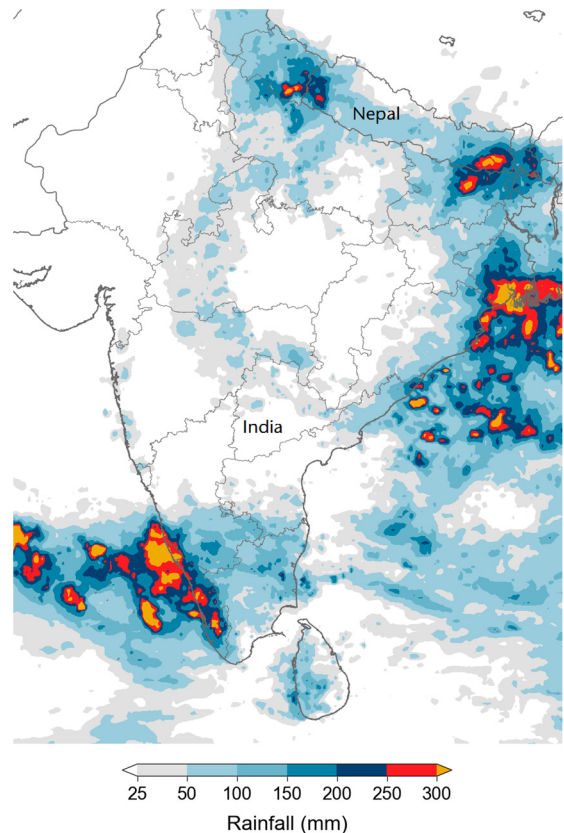
The India Meteorological Department (IMD) announced on October 6 that the seasonal southwest monsoon was starting to withdraw across India. This marked a 19-day delay from the typical start of a withdrawal on September 17. 2021 also became the fifth consecutive year with a delayed end to the monsoon season. Climatology has shown that by mid-October, the seasonal wind flow shifts from the southwest to the northeast.

The slow delay of the monsoon allowed a continuation of heavy rainfall in association with the development of areas of low pressure and frontal boundaries. The rains were heaviest in Kerala, where some areas cited more than 300 millimeters (11.81 inches) of rain in a matter of days. Further rains elsewhere in India caused more landslides and river overflows. This included in the city of Delhi, which cited nearly 88 millimeters (3.46 inches) of rain in a 24-hour period ending on October 18. This marked the 4th-wettest October day on record for the capital dating to 1901.

Event Details

The most significant impacts were noted in the state of Kerala, where at least 42 people died during a stretch from October 11-20 alone. One 24-hour period ending October 12 at the city of Karipur recorded 255 millimeters (10 inches) of rainfall. Deadly landslides were enhanced by the overflow of several rivers in Kerala including the Manimala (Pathanamthitta district), Kallada (Kollam), Achankovil (Pathanamthitta), and the Karamana and Neyyar (Thiruvananthapuram).

Further riverine and landslide impacts were noted in northern sections of the country, including Uttarakhand. Major landslides in the state killed more than 30 people alone. Heavy rains left hundreds of homes inundated with many emergency high water rescue missions initiated.



Satellite derived rainfall: October 11-20 (UTC)

Source: NASA/GPM, Graphic: Aon (Cat Insight)

Natural Catastrophes: In Brief

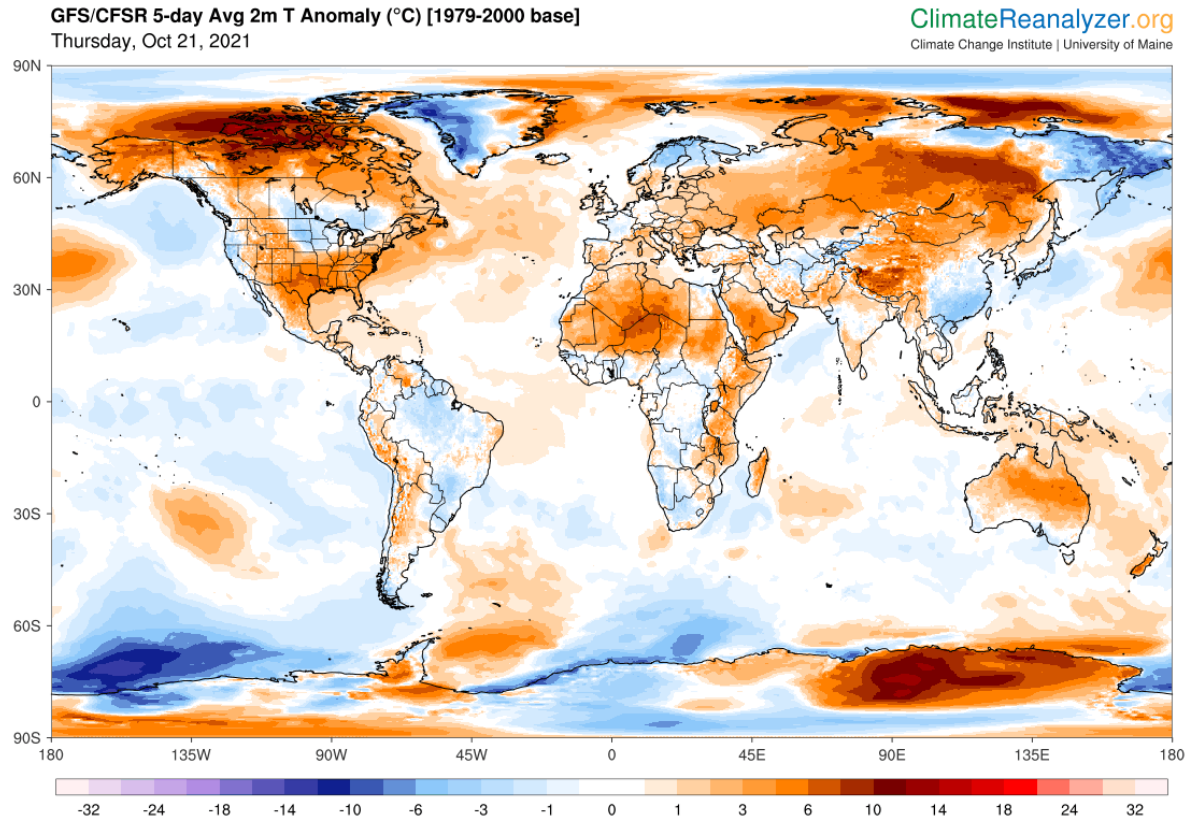
Earthquake (Indonesia)

According to the United States Geological Survey (USGS), a magnitude-5.1 earthquake struck the Indonesia island of Bali, 15 kilometers (9.3 miles) northeast of Banjar Wangsian, in the early morning hours of October 16 local time. The shallow earthquake resulted in at least three deaths and dozens of injuries. According to the Indonesian National Board for Disaster Management (BNPB), no fewer than 1,862 homes were damaged to varying degrees, of which at least 617 incurred severe damages. The Karangasem and Bangli Regencies were among the most impacted. The quake was followed by a magnitude-4.3 aftershock. Total economic damage was anticipated to be in the millions (USD).

Nepal (Flooding)

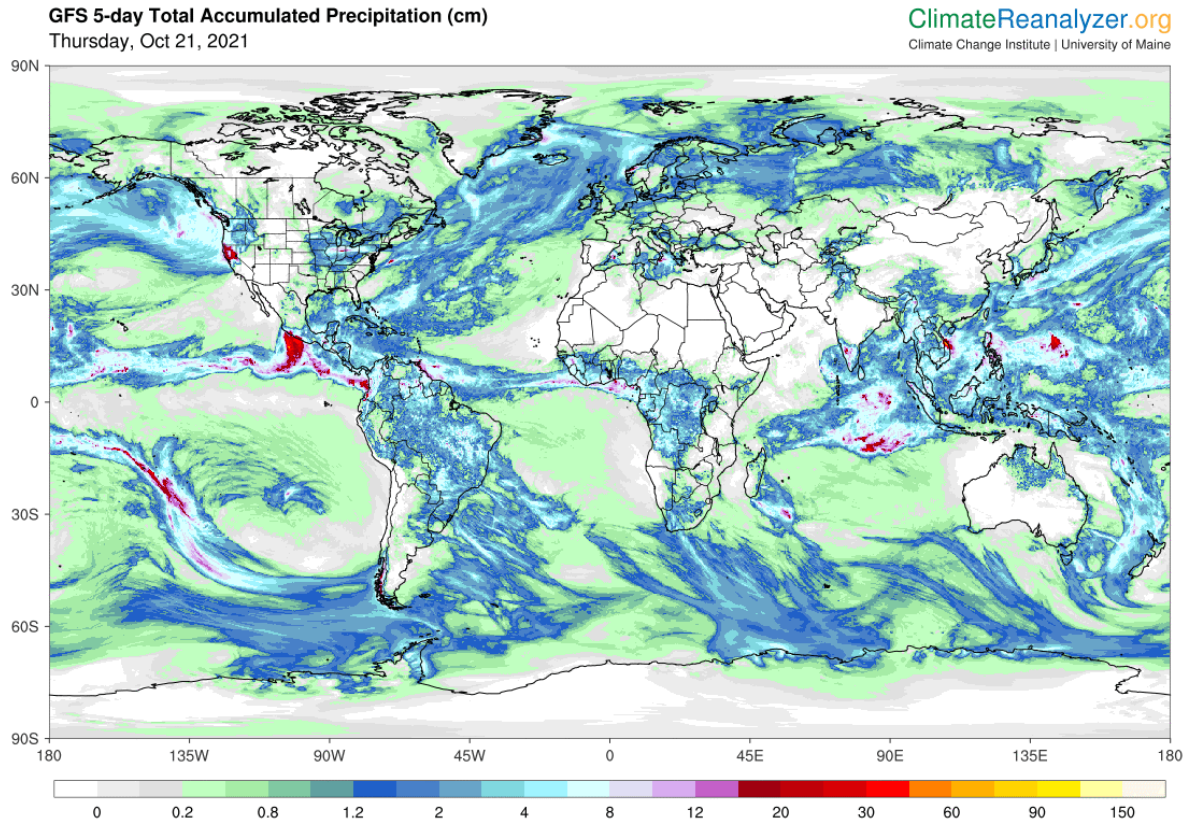
Incessant rains, aided by abundant moisture from the Bay of Bengal, resulted in deadly flooding across parts of Nepal since October 16. Districts in the western Sudurpashchim Province and eastern Province 1 were among the most affected. In total, at least 20 of the 77 districts across the country were severely impacted. As of this writing, no fewer than 88 deaths have been confirmed, while dozens remained missing. In the Dadeldhura district, a 48-hour rainfall total of 502.2 millimeters (19.8 inches) was measured through October 19. Flooding was enhanced by already saturated soils from an active monsoon season. Flash-flooding and landslides destroyed a vast area of agricultural land, blocked roadways, destroyed homes, and damaged bridges and infrastructure.

Global Temperature Anomaly Forecast



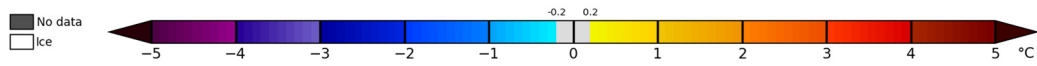
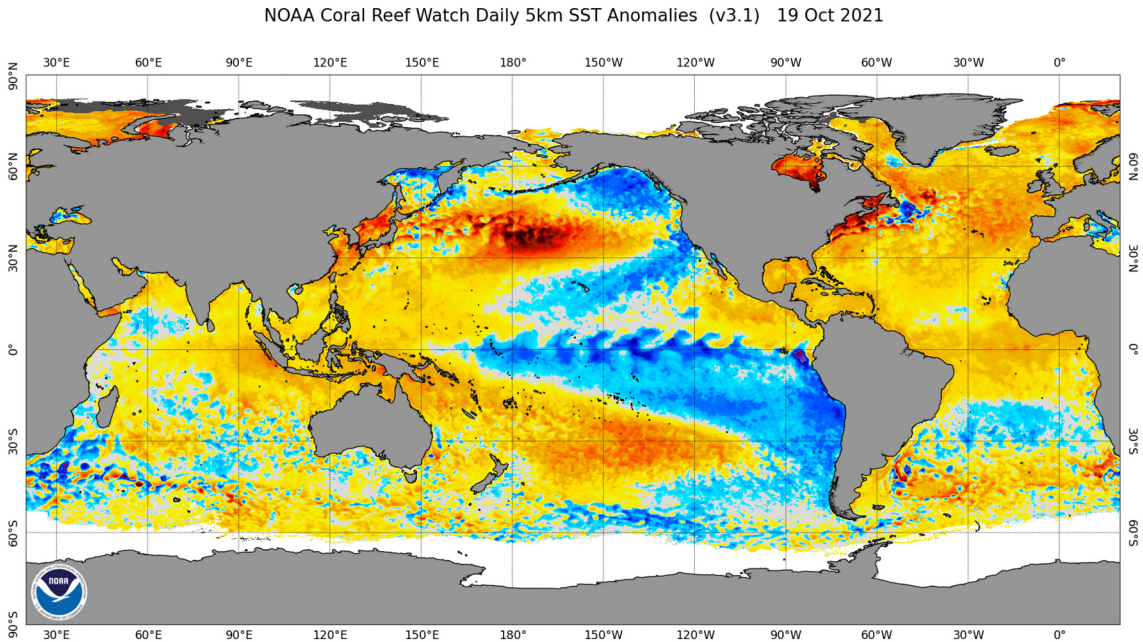
Source: Climate Reanalyzer, Climate Change Institute, University of Maine, USA

Global Precipitation Anomaly Forecast

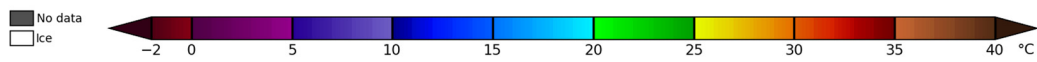
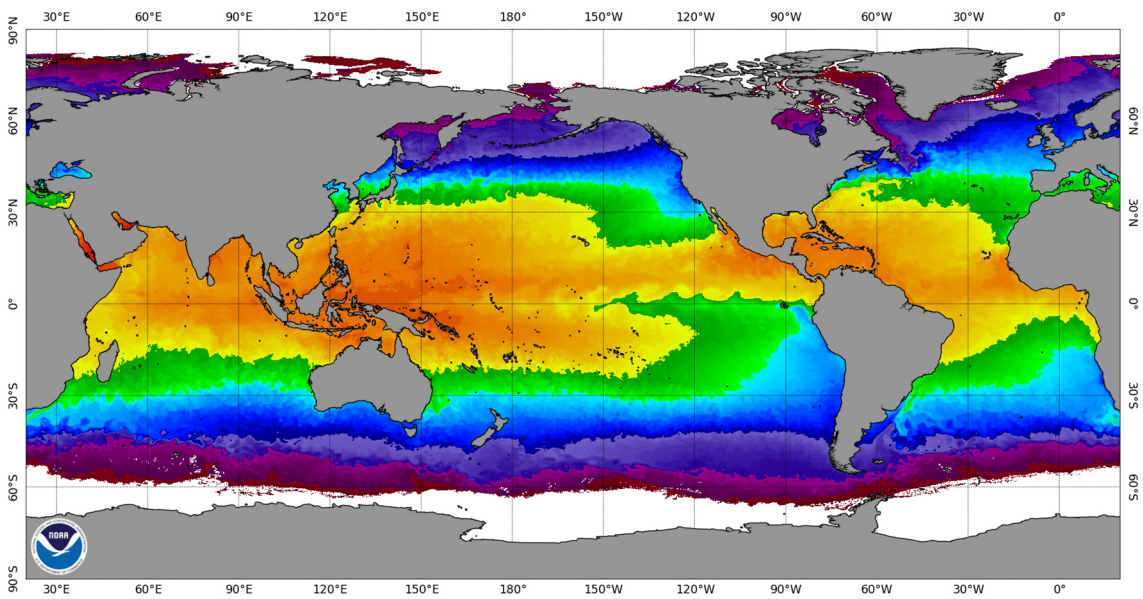


Source: Climate Reanalyzer, Climate Change Institute, University of Maine, USA

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



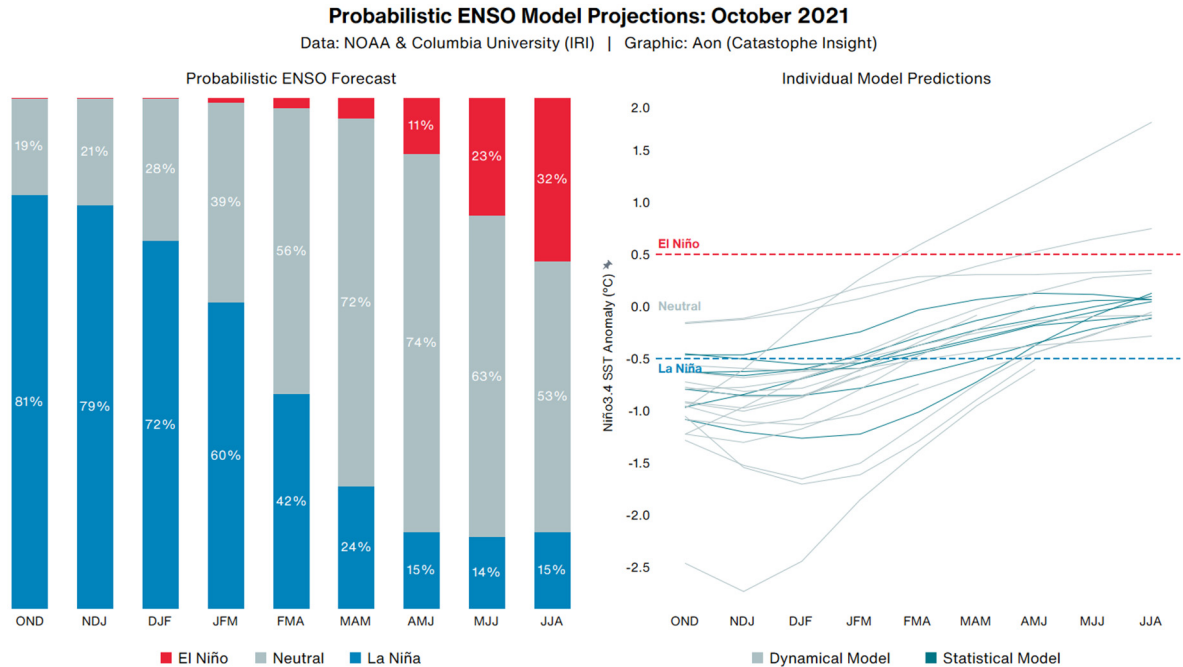
NOAA Coral Reef Watch Daily 5km Sea Surface Temperatures (v3.1) 20 Oct 2021



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 an 87% chance of La Niña conditions persisting through the December 2021 - February 2022 timeframe. The agency also anticipates a moderate strength La Niña at its peak before weakening and likely transitioning back to ENSO-neutral conditions by the Northern Hemisphere Spring of 2022.



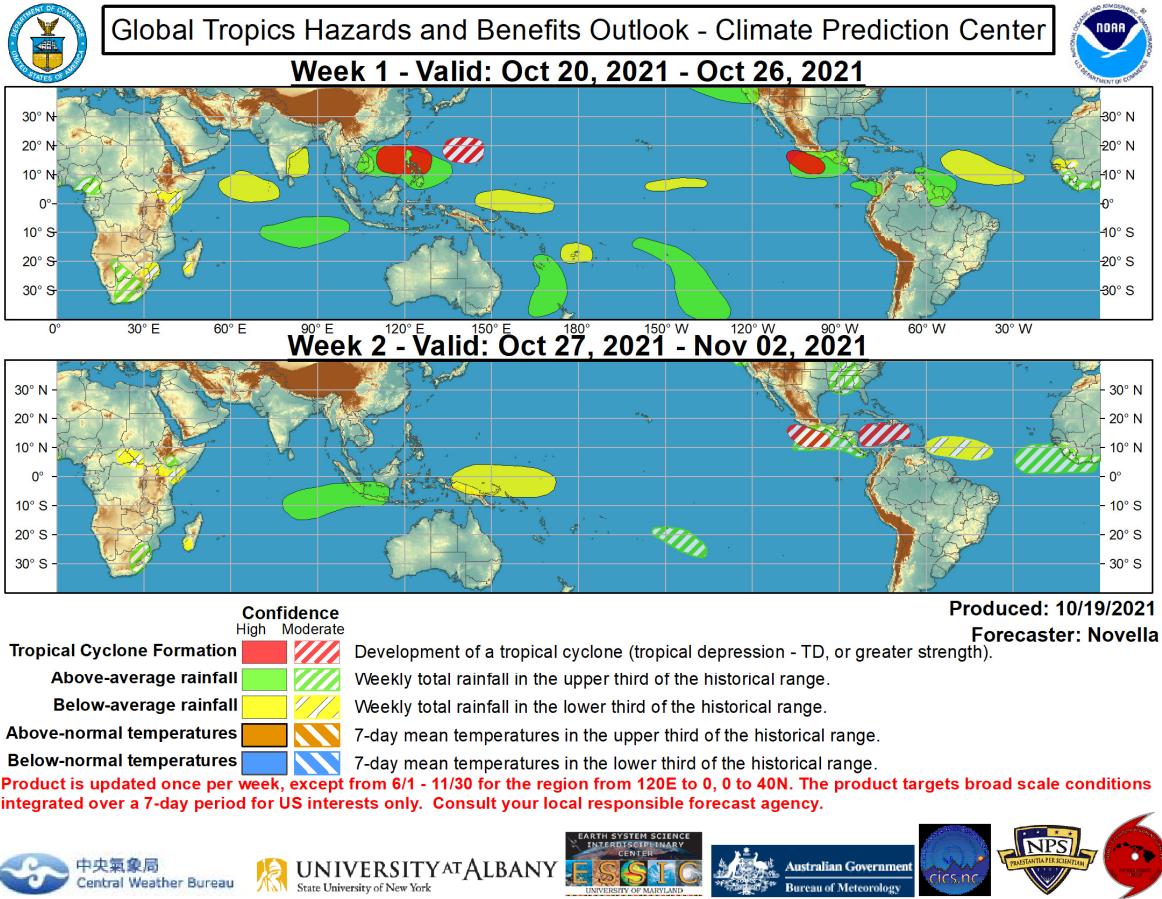
El Niño: Warm phase of an ENSO cycle. Sea surface temperatures of +0.5°C occur across the east-central equatorial Pacific.

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.

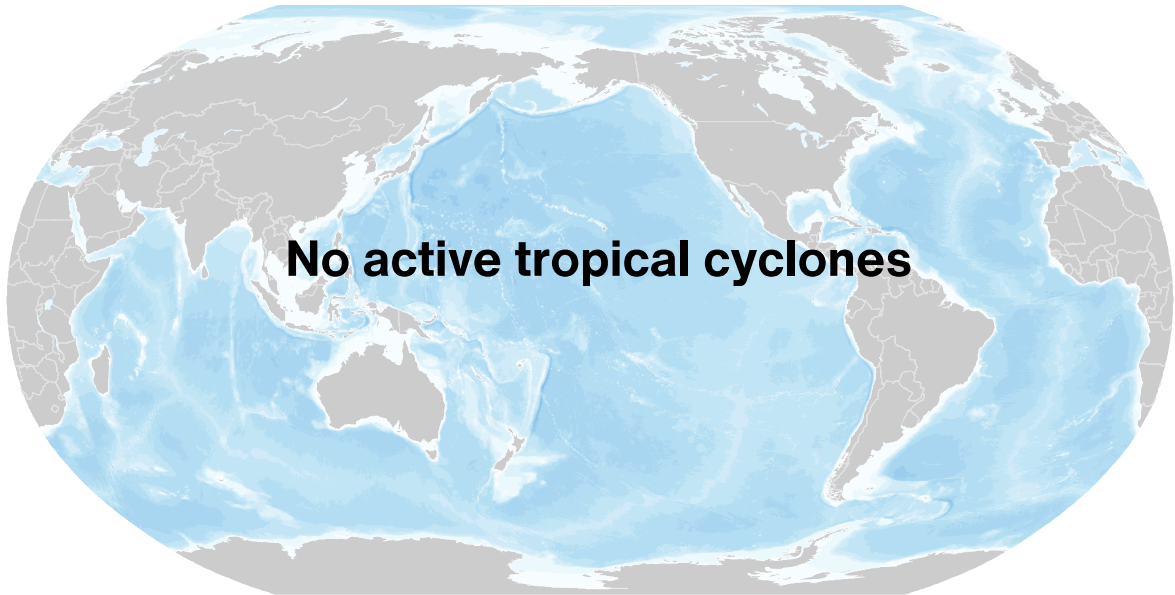
El Niño (La Niña) is a phenomenon in the equatorial Pacific Ocean characterized by a five consecutive 3-month running mean of sea surface temperature (SST) anomalies in the Niño 3.4 region that is above the threshold of +0.5°C (-0.5°C). This is known as the Oceanic Niño Index (ONI).

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

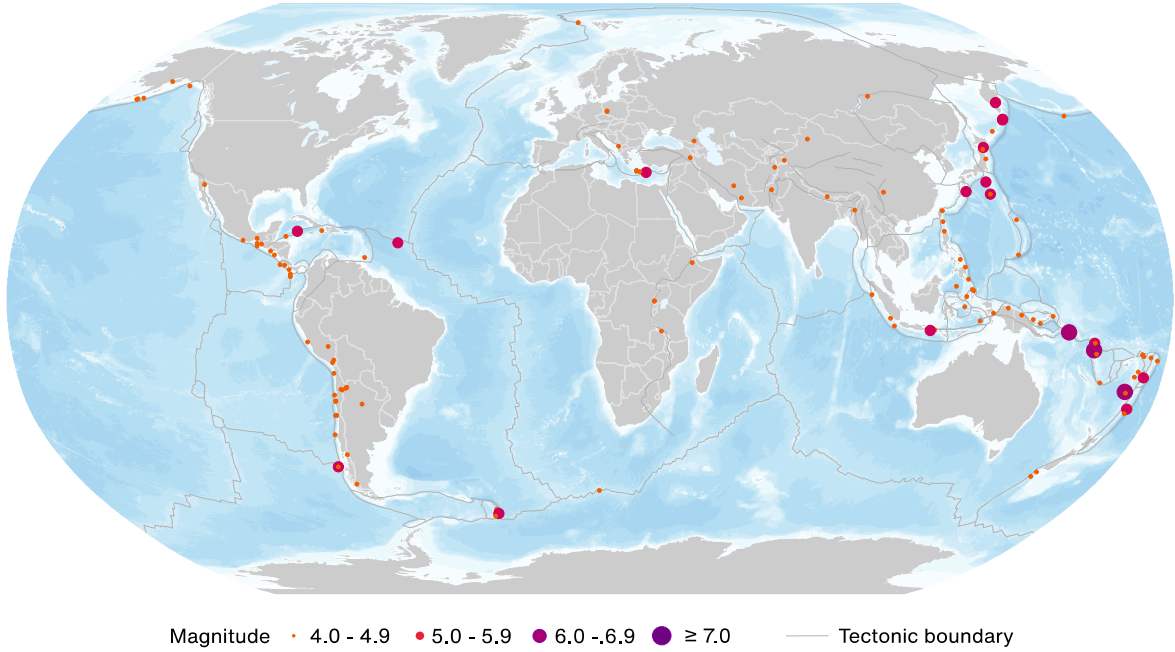
Storm Name	Location	Winds	Location from Nearest Land Area

* 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)

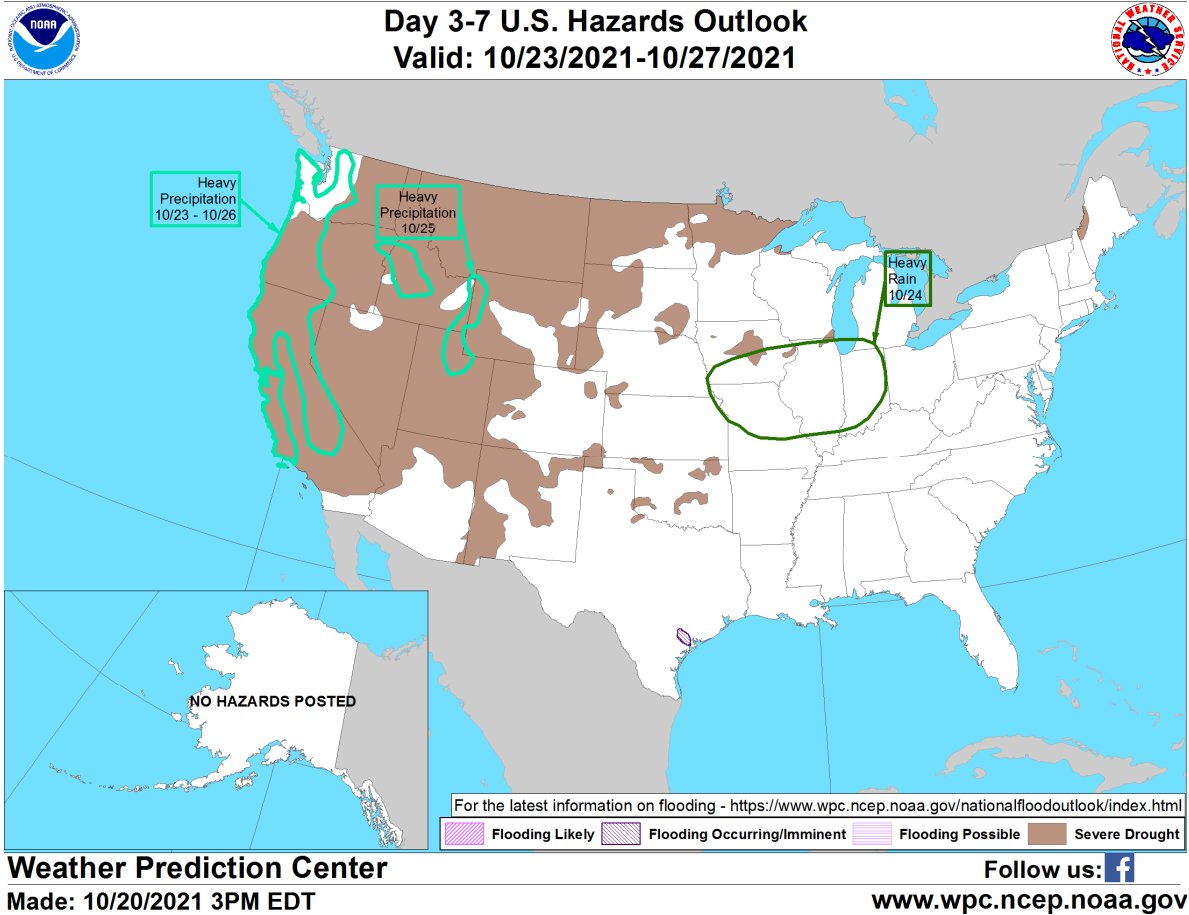
Global Earthquake Activity ($\geq M4.0$): October 15-21



Date (UTC)	Location	Magnitude	Epicenter
10/15/2021	8.88S, 158.48E	6.4	14 km (9 mi) WSW of Buala, Solomon Islands
10/18/2021	13.74S, 166.94E	6.1	67 km (42 mi) WNW of Sola, Vanuatu
10/21/2021	25.24S, 179.64E	6.0	S of the Fiji Islands

Source: United States Geological Survey

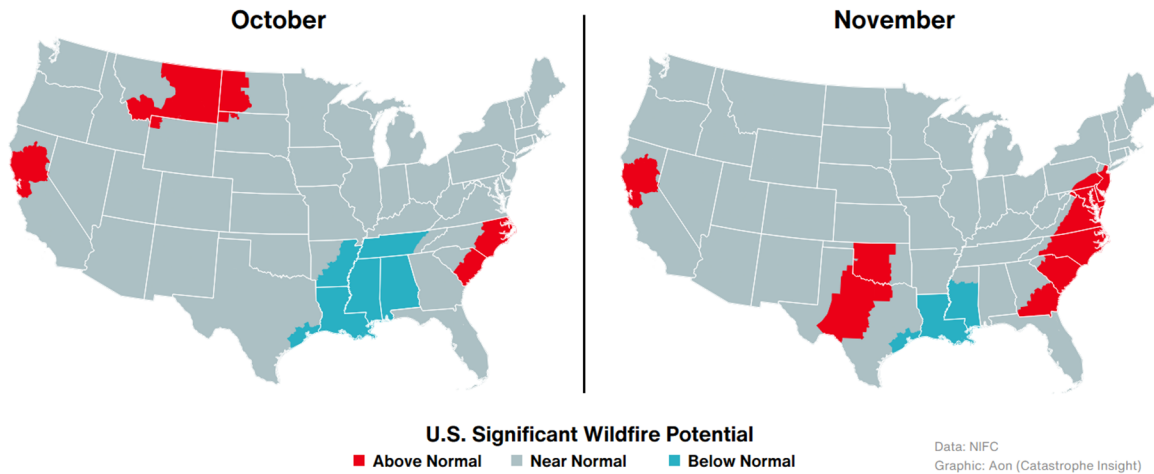
U.S. Hazard Outlook



- A series of atmospheric rivers will allow rich moisture to stream from the tropical Pacific toward the West Coast through at least October 26. During this time, periods of heavy rainfall and higher elevation snow are expected across California and the Pacific Northwest. The incessant rains will bring drought relief to many communities, while concurrently enhancing the risk for flooding and debris flows.
- Interactions between moisture streaming from the Gulf of Mexico and a frontal system will create a region of heavy precipitation in the Middle Mississippi and Ohio Valleys on October 24.
- Heavy precipitation is expected in parts of the Intermountain West and Northern Rockies as a frontal system moves inland on October 25.

Source: Weather Prediction Center (NOAA)

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



Annual YTD Wildfire Comparison: October 21

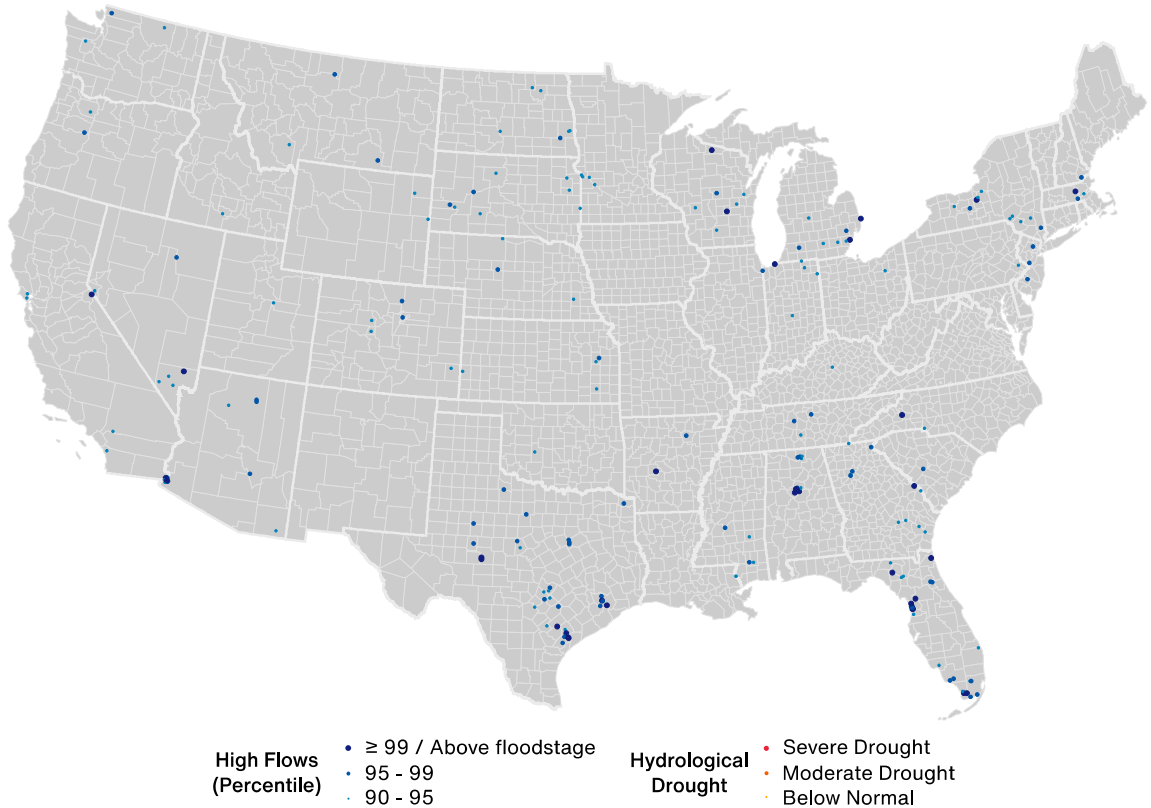
Year	Number of Fires	Acres Burned	Acres Burned Per Fire
2017	51,934	8,818,600	169.80
2018	50,181	8,159,015	162.59
2019	43,746	4,467,200	102.12
2020	46,466	8,416,452	181.13
2021	47,884	6,515,883	136.08
10-Year Average (2011-2020)	49,188	6,884,437	139.96

Top 5 Most Acres Burned by State: October 21

State	Number of Fires	Acres Burned	Acres Burned Per Fire
California	8,625	2,384,282	276.44
Montana	2,439	719,084	294.83
Oregon	1,609	672,347	417.87
Arizona	1,663	532,129	319.98
Idaho	1,299	449,275	345.86

Source: National Interagency Fire Center

U.S. Current Riverine Flood Risk



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.

Top 5 Rivers / Creeks: Highest Percentile for Water Height

Location	Current Stage (ft)	Percentile
Altamaha River at Doctortown, Georgia	11.95	98.90
Ocmulgee River at Lumber City, Georgia	11.15	98.84
Tobesofkee Creek near Macon, Georgia	3.83	98.82
White River near Kadoka, South Dakota	5.46	98.73
Novato Creek at Novato, California	3.46	98.68

Source: United States Geological Survey

Source Information

India Floods

Deadly floods, landslides bring south India monsoon death toll to 35, authorities say, *Washington Post*
India – Floods and Landslides in Kerala Leave More Than 20 Dead, *Floodlist*
Death toll passes 180 in Nepal and India floods, *BBC News*
Explained: Why has October been so rainy across India?, *The India Express*

Australia Severe Weather

Australia Bureau of Meteorology (BoM)
Wild east coast weather driven by transition between winter and summer, says BoM, *ABC Australia*
BOM says 'Australian record'-sized hailstones have fallen on North Queensland, *ABC Australia*
NSW, Queensland regions hit by powerful hail storms as Coffs Harbour cops brunt, *7 news*

Natural Catastrophes: In Brief

United States Geological Survey (USGS)
Indonesian National Board for Disaster Management (BNPB)
Nepal – Dozens of Lives Lost After Rain Heavy Rain Triggers Floods and Landslides, *Floodlist*
Nepal floods and landslides kill at least 77, *Reuters*
Floods, landslides kill 48 in Nepal, *Xinhua*

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