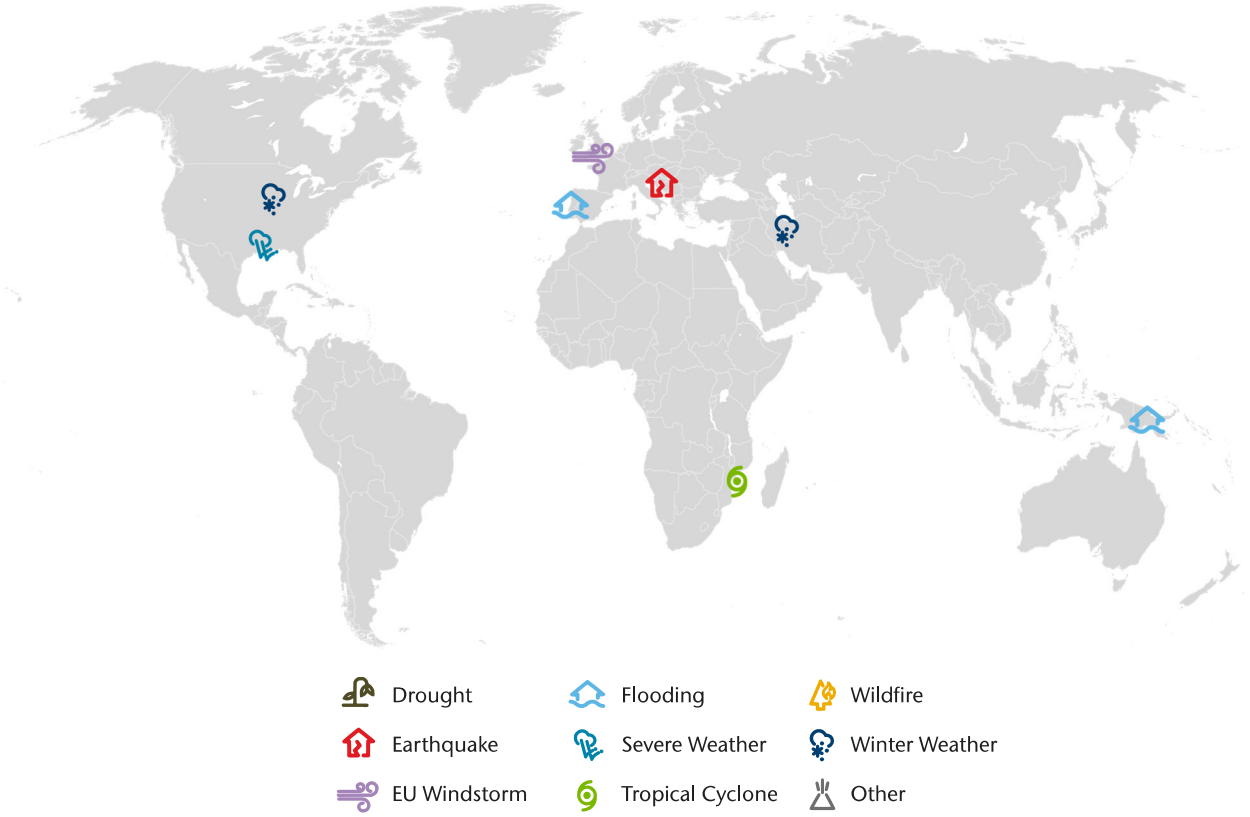
Weekly Cat Report

January 1, 2021

This Week's Natural Disaster Events



Event	Impacted Areas	Fatalities	Damaged Structures and/or Filed Claims	Preliminary Economic Loss (USD)*	Page
Earthquake	Croatia	7+	Thousands	100s of Millions+	3
Windstorm Bella	Western & Central Europe	0	Thousands	100s of Millions	6
Winter Weather	United States	0	Hundreds	Millions	7
Flooding	Portugal	0	Dozens	20+ million	8
Winter Weather	Iran	12+	Unknown	Unknown	8
Flooding	Papua New Guinea	15+	Unknown	Unknown	8
Cyclone Chalane	Madagascar, Mozambique	0	Hundreds	Unknown	8

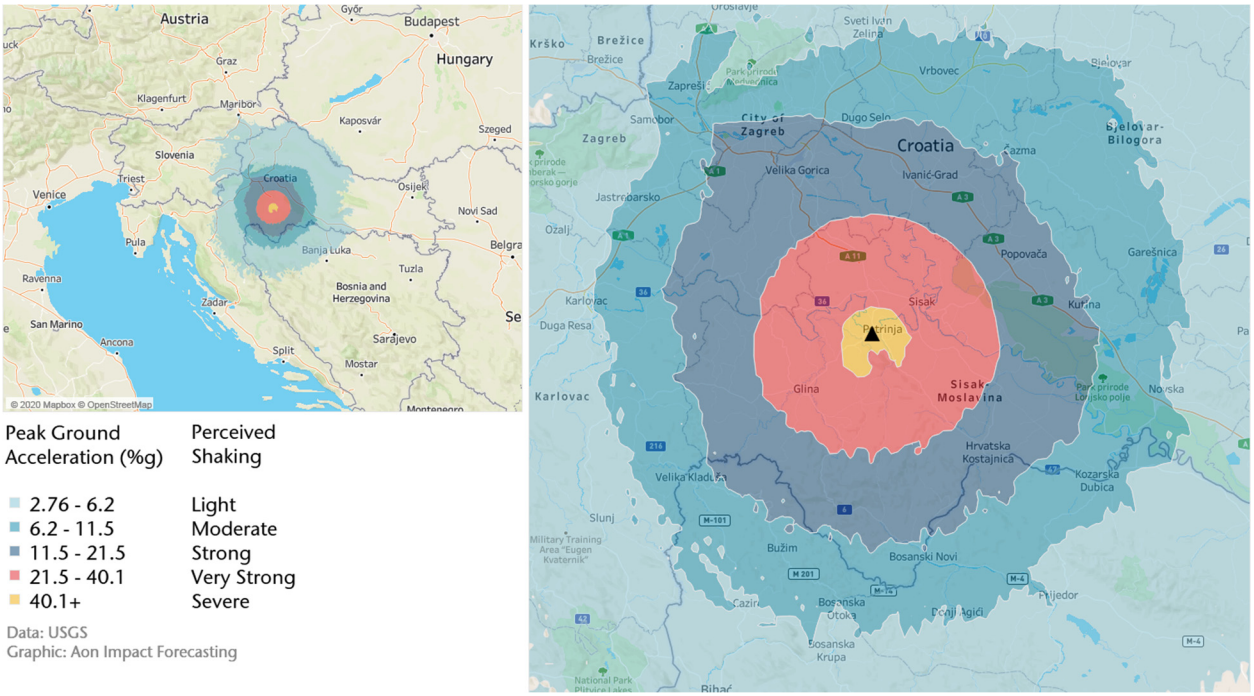
**Please note that these estimates are preliminary and subject to change. In some instances, initial estimates may be significantly adjusted as losses develop over time. This data is provided as an initial view of the potential financial impact from a recently completed or ongoing event based on early available assessments.*

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

M6.4 tremor strikes Croatia; strongest in modern record

Central Croatia was struck by a very strong, USGS-registered magnitude-6.4 earthquake on December 29. The event resulted in at least seven deaths, dozens of injuries, and widespread structural damage. The most significant impacts were felt in the town of Petrinja near the epicenter and Sislak-Moslavina County, and shaking was felt widely in neighboring countries. Initial, preliminary estimations suggest that economic losses might reach into the hundreds of millions EUR; likely even higher. This was the strongest earthquake to strike this part of the world since 1880.

Seismological Recap



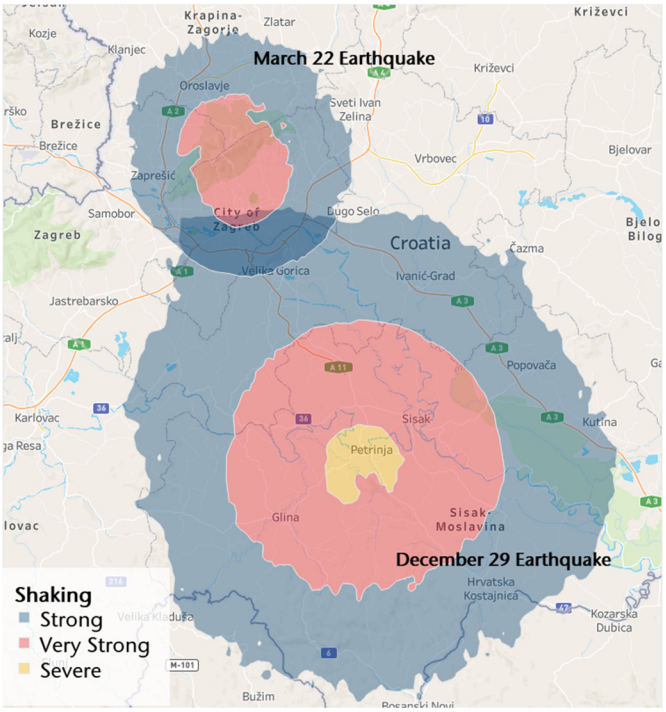
The United States Geological Survey provided the following tectonic summary of the event:

"The December 29, 2020 earthquake near Petrinja, Croatia, occurred as a result of shallow strike-slip faulting within the Eurasia Plate. Focal mechanism solutions for the event indicate that rupture occurred on a nearly vertical fault striking either to the southeast or southwest. The location and depth of the event indicate that this was an intraplate earthquake occurring within the Eurasia plate as opposed to along a major tectonic boundary. Tectonics of the Mediterranean Sea, in the convergent boundary region between Africa and Eurasia, are complex, and involve the motions of numerous microplates and regional-scale structures. The Adriatic block immediately west of today's earthquake is thought to move somewhat independently to Eurasia and Africa, driving surrounding faulting in Italy and along the eastern Adriatic coast from Croatia to Albania. This is the largest earthquake to occur in Croatia since the advent of modern seismic instrumentation. It was preceded by two sizeable foreshocks, a magnitude 4.7 and a magnitude 5.2 on December 28. About one in twenty earthquakes have foreshocks. An earthquake of similar size to the recent M6.4 occurred in 1880 near Zagreb and there have been three magnitude 6 and larger earthquakes within 200 km of the December 29, 2020 earthquake since 1900. Recently a M5.6 earthquake occurred on November 27, 1990, 175 km to the southeast which injured 10 people."

Event Details

The **largest earthquake in the modern instrumental record** with a moment magnitude of 6.4 (USGS) struck Croatia on December 29 at 12:20PM local time (11:20UTC). Its epicenter was located near Petrinja in Sislak-Moslavina County in a shallow depth of approximately 10 kilometers (6.2 miles). The main tremor was preceded by a notable magnitude-5.2 foreshock on the day before. Shaking was felt widely across the region, with registered observations from as far as southwestern Slovakia, southeastern Germany or northeastern Italy.

The event claimed at least seven lives (five in Majske Poljane, one in Žažina and one in Petrinja), while 26 people were injured. The most notable destruction occurred in the town of Petrinja, a town of roughly 25,000 inhabitants near the epicenter, and in the surrounding area. Numerous buildings in the town were destroyed, with initial reports suggesting some degree of damage to nearly all buildings in the area. Widespread structural damage occurred on roofs and chimneys, further damage was caused by falling debris. Notable destruction also occurred in nearby towns of Sisak and Glina. Some structural damage and power outages were also reported from Zagreb, which lies approximately 50 kilometers (31 miles) from the epicenter and was devastated by the tremor earlier this year.



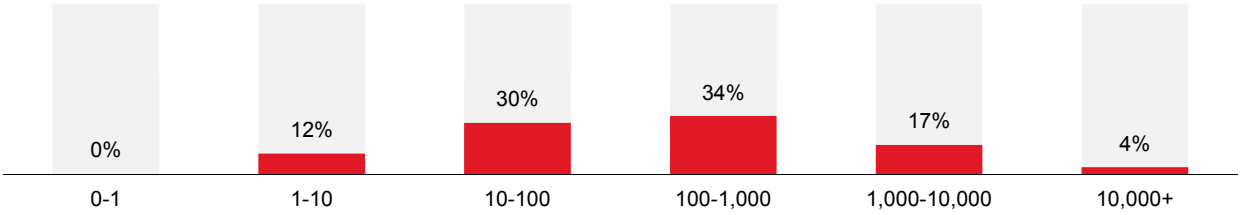
Comparison between the March and December tremors is noteworthy. Petrinja tremor's effects were more extensive; USGS's PAGER methodology suggests that 1.15 million people might have been affected by intensity of VI or higher (strong shaking) on the Modified Mercalli Intensity Scale (MMI) during the Petrinja tremor, compared to 0.89 million from the Zagreb earthquake. Yet very strong shaking (VII on MMI) was experienced by approximately 285 thousand people in March, but only 98 thousand in December. This shows that the strongest shaking in March occurred in densely populated areas of the capital city, with extensive building stock of high architectural and historical value, whereas the most significant effects of the Petrinja tremor were largely located in the rural areas of Central Croatia. Reconstruction costs due to the Zagreb tremor were estimated at several billions EUR.

Significant structural damage outside of Croatia was reported from parts of Bosnia and Herzegovina, namely Una-Sana Canton and the northwestern part of Republika Srpska. Damage was reported from Bihać, Cazin, Kozarska Dubica, Kostajnica and elsewhere.

Financial Loss

Assessments of damage from the Petrinja earthquake will take place in the coming weeks and months and it is still early to provide any definitive loss estimates, yet initial damage reports and comparison with the Zagreb earthquake form earlier this year suggests that eventual toll might reach into the hundreds of millions EUR, or likely even higher. The United States Geological Survey published an early look at possible impact through the PAGER methodology:

Probability of Economic Losses (million USD)
based on PAGER methodology by United States Geological Survey



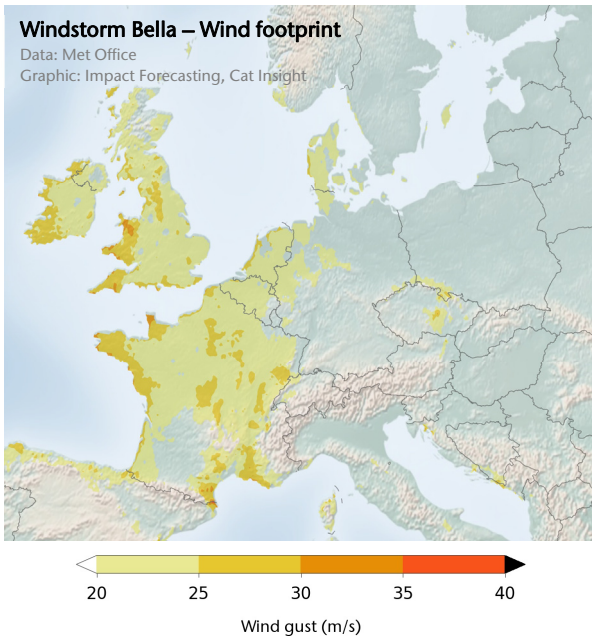
Windstorm Bella causes moderate damage in Europe

Parts of Western and Central Europe were affected by strong gusts and heavy precipitation on December 26-28, caused by Windstorm Bella. The event resulted in moderate damage across France, UK, Ireland, Belgium and the Netherlands, with minor effects also felt in other countries. Total economic damage was expected to reach into the hundreds of millions EUR.

Meteorological Recap

Parts of Western Europe were affected by a large winter storm that brought gusty winds, locally heavy precipitation and heavy snowfall in the montane areas on December 26-28. The event was named “Bella” by the UK Met Office and Met Éireann; it was also known as “Hermine” in German-speaking countries. The storm started affecting the British Isles on December 26, and gusts peaked at the Isle of Wight with 106 mph (171 kph). Bella later affected much of France, Benelux and parts of Germany and Denmark.

Highest values of meteorological parameters measured in France, as provided by Meteofrance:



Highest wind gusts	kph
Cagnano	167.8
Cap Sagro	166.3
Ouessant-Stiff	143.3
Cap-Gris-Nez	142.6
Pointe du Raz	142.6

Highest snow accumulations – Puy de Dome	cm
Super Besse	94
Chastreix	90
Vernins	50
St-Sulpice	34
St-Anthème	22

Highest precipitation	mm
Begaar	109.4
Dax	95.8
Bidache	88.2
Capbreton	87.4
Tulle	76.0

Event Details

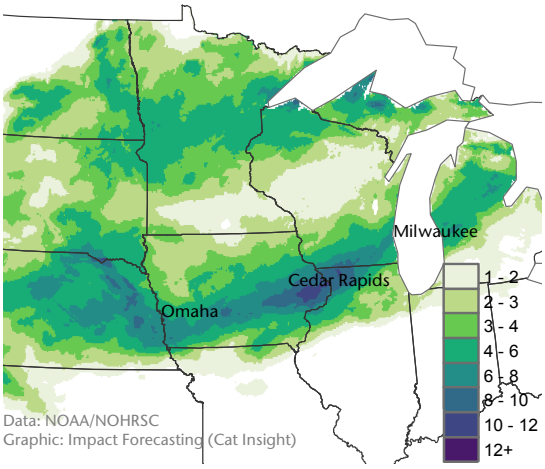
Windstorm Bella caused moderate wind-related damage across the affected countries, with highest impacts in France. Insurers were expected to register tens of thousands of claims from the event. Minor impacts were felt in Germany, Denmark and the Czech Republic. Notable flooding impacts were reported from England; particularly from Norfolk, Cambridgeshire, Bedfordshire, Northamptonshire, Oxfordshire and Worcestershire. Initial reports suggested hundreds of flooded homes, with 1,300 evacuated on Christmas Day in Bedfordshire alone.

Pair of winter storms impact U.S. into the new year

A pair of powerful storm systems impacted much of the central and eastern United States between December 28 – January 1. The disturbances were related to a split flow pattern and active storm track across the country. Overall, the two low pressure centers spread accumulating snowfall from the Rockies into the Upper Midwest, in addition to regions of the Southern and Central Plains. Heavy rainfall and isolated severe weather occurred along the Gulf Coast. Total economic and insured losses were each anticipated to reach into the millions (USD).

Meteorological Recap

Estimated 48-hour snowfall accumulation (inches)
December 28 12:00 UTC – December 30 12:00 UTC



The first storm system and associated upper level trough resulted in accumulating snowfall and notable ice accretions spanning from the Central Rockies into the Plains and Midwest between December 28-30. The storm produced a swath of 6 to 12 inches (20 to 30 centimeters) of snow accumulation across portions of eastern Nebraska, southern Iowa, northern Illinois, and southern Wisconsin. Southerly flow ahead of a cold frontal boundary advected Gulf moisture northward, generating heavy rainfall and thunderstorms across portions of the Southern Plains, and Mississippi Valley.

The second disturbance was related to a highly amplified southern upper level trough anchored over northern Mexico on December 30. This generated a closed low pressure system which pivoted eastward toward the southern Plains by December 31. The system prompted the National Weather Service (NWS) to issue winter storm warnings and advisories across regions of the Central and Southern Plains – particularly Western Texas. Southerly winds on the east side of the disturbance ushered warm and humid air northward, aiding in the development of severe weather along the Gulf Coast. The Storm Prediction Center (SPC) highlighted a region extending from southeast Texas through the western Florida Panhandle where the threat of severe weather was the greatest.

Event Details

Notable transportation and power impacts occurred between December 28-30 as snow, ice, and freezing rain rapidly coated roadways and utility lines across the most impacted localities. In **Colorado**, a multi-vehicle crash closed a portion of Interstate 25 on December 28. In **Iowa**, State Patrol responded to no less than 91 calls regarding vehicle crashes, and 84 for property damage on December 29. At least 7 injuries were reported. In **Wisconsin**, the State Patrol responded to 47 crash investigation, and 52 calls for vehicles which slid off the road, resulting in no less than 9 injuries. A snow emergency was declared for the City of Milwaukee.

As of this writing on December 31, widespread severe thunderstorm activity was beginning to unfold in parts of **Texas** and **Louisiana**. The greatest risk included damage from tornadoes, damaging winds, and heavy rainfall capable of prompting flash floods.

Natural Catastrophes: In Brief

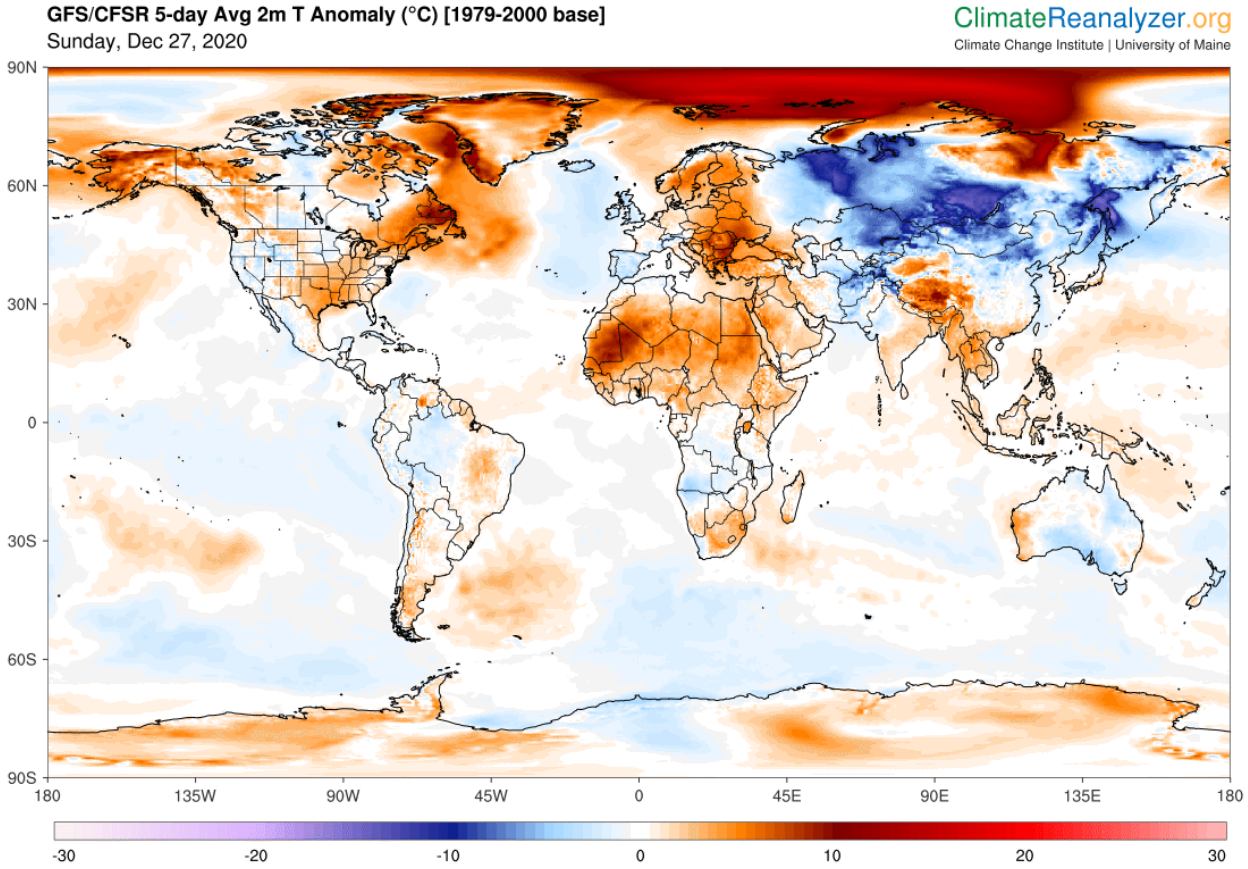
Flooding (Portugal)
Heavy rains and strong winds affected the Portuguese island of Madeira on December 25, causing floods and landslides. At least two homes were destroyed, dozens of people were evacuated, and a notable damage was reported on local infrastructure. Among the worst affected were Sao Vicente and Ponta Delgada. Expenses due to damaged road network alone were estimated at EUR16.9 million (USD21 million).

Winter Weather (Iran)
At least 12 climbers were killed in the Alborz mountains in northern Iran on December 25 after a period of unfavorable wintry weather. Dozens of settlements were isolated across the montane regions of the country due to heavy snowfall and blizzard conditions.

Flooding (Papua New Guinea)
On December 29, heavy precipitation prompted a landslide in Saki village of Goilala district in Papua New Guinea. According to local media reports, at least fifteen people were killed in the incident.

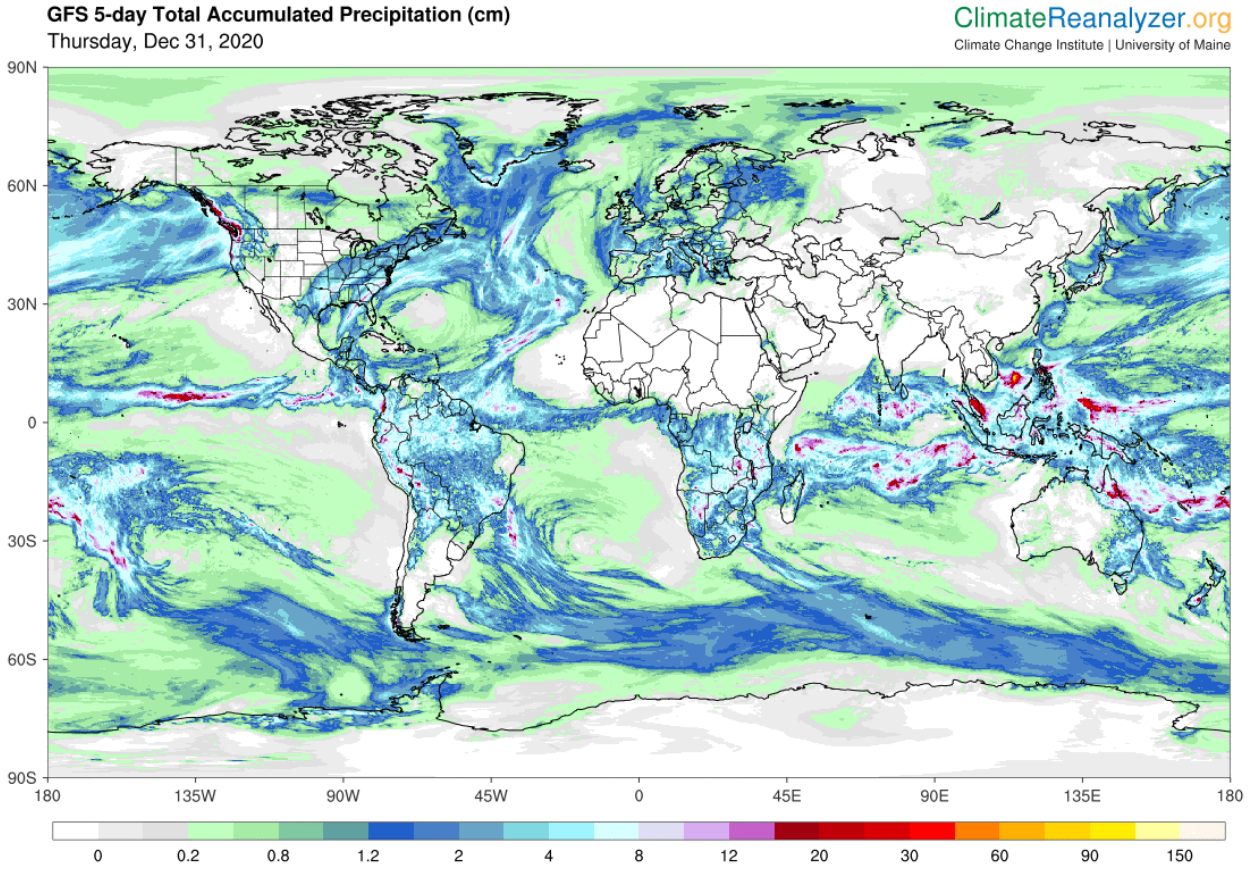
Tropical Cyclone Chalane (Madagascar, Mozambique)
Chalane became the 3rd named storm and 2nd severe cyclonic storm of the 2020/21 Southwest Indian Ocean Cyclone Season. The system formed as a disturbed low-pressure area located approximately 830 kilometers (515 miles) southwest of Diego Garcia Island on December 19 and the Joint Typhoon Warning Center (JTWC) began monitoring it. Chalane generally tracked west, became better organized, before eventually landfall near Madagascar's Mahavelona town on December 26 at 18:00 UTC, bringing heavy rains and strong winds there. Dozens of residents were evacuated from the vulnerable low-lying areas and ports along the east coast. According to the preliminary reports of UN-OCHA, the storm had caused minor flood- and wind-related damage in Madagascar. Later on, Chalane re-emerged as a tropical depression in Mozambique Channel and gained severe tropical storm status with 110 kph (70 mph) winds (1-minute average sustained), shortly before making landfall near Beira in Mozambique December 30. Hurricane-force winds associated with Chalane damaged dozens of utility poles and homes in Mozambique. Notable losses were inflicted on the local infrastructure.

Global Temperature Anomaly Forecast



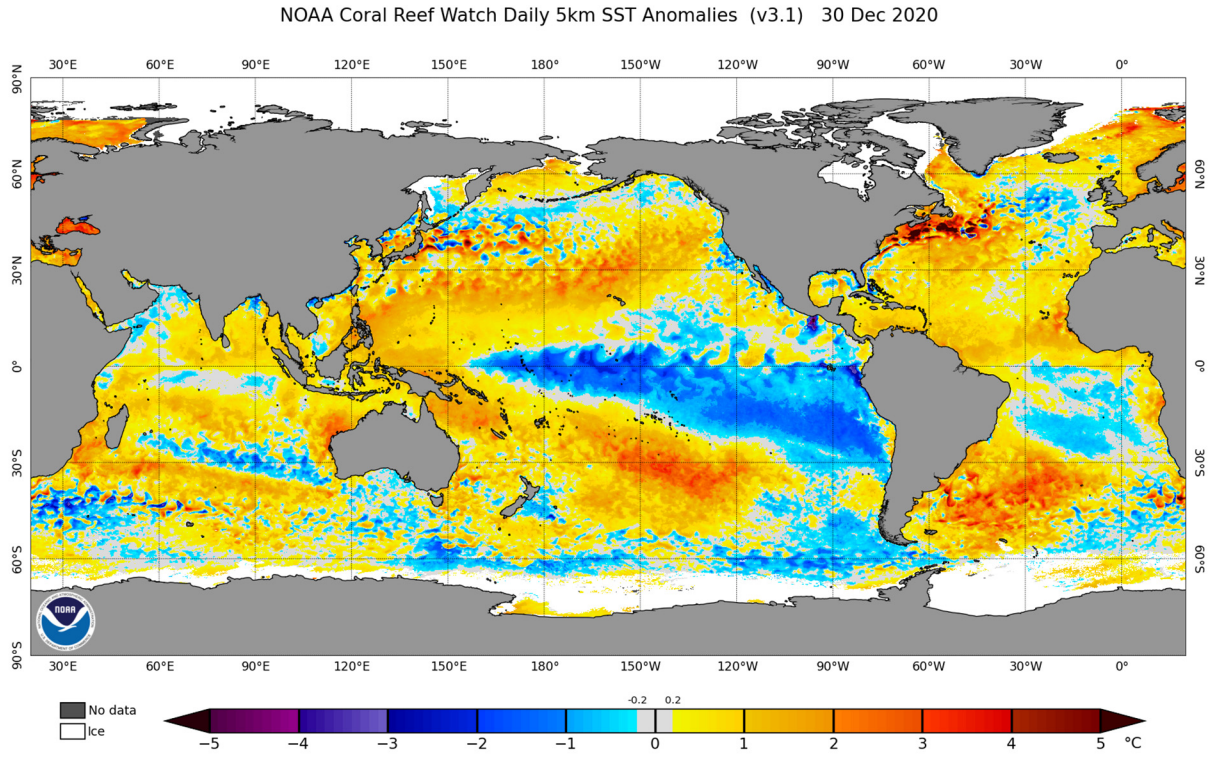
Source: Climate Reanalyzer, Climate Change Institute, University of Maine, USA

Global Precipitation Forecast



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

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



The SST anomalies are produced by subtracting the long-term mean SST (for that location in that time of year) from the current value. This product with a spatial resolution of 0.5 degree (50 kilometers) is based on NOAA/NESDIS operational daily global 5 kilometer Geo-polar Blended Night-only SST Analysis. The analysis uses satellite data produced by AVHRR radiometer.

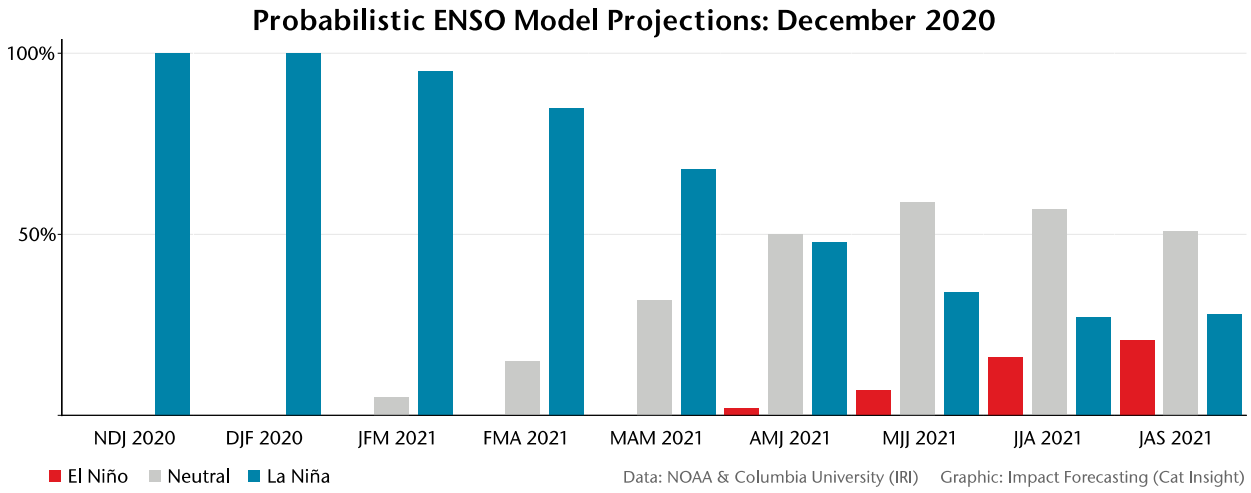
Select Current Global SSTs and Anomalies

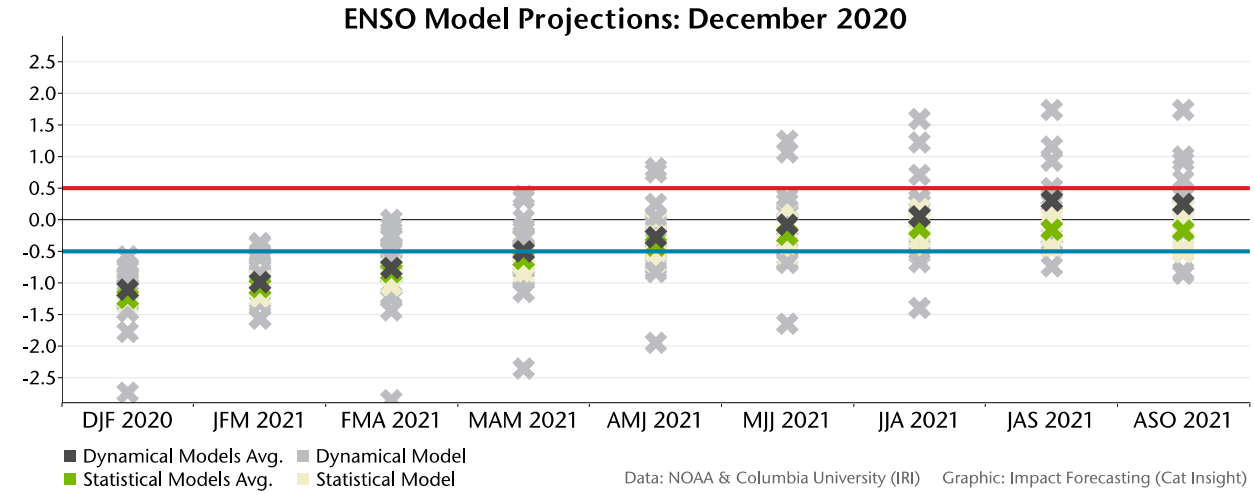
Location of Buoy	Temp (°C)	Departure from Last Year (°C)
Eastern Pacific Ocean (1,020 miles SW of San Salvador, El Salvador)	25.8	-0.8
Niño3.4 region (2°N latitude, 155°W longitude)	23.9	-3.6
Western Pacific Ocean (700 miles NNW of Honiara, Solomon Islands)	29.4	-1.0

Sources: ESRL, NOAA, NEIS, National Data Buoy Center

El Niño-Southern Oscillation (ENSO)

La Niña conditions are currently present, though NOAA has officially issued a **La Niña Advisory**. NOAA notes a 95 percent chance that La Niña conditions will persist through boreal (Northern Hemisphere) winter of 2020 / 2021, and a 50 percent chance that these conditions will linger into the spring months.





El Niño *refers to the above-average sea-surface temperatures (+0.5°C) that periodically develop across the east-central equatorial Pacific. It represents the warm phase of the ENSO cycle.*

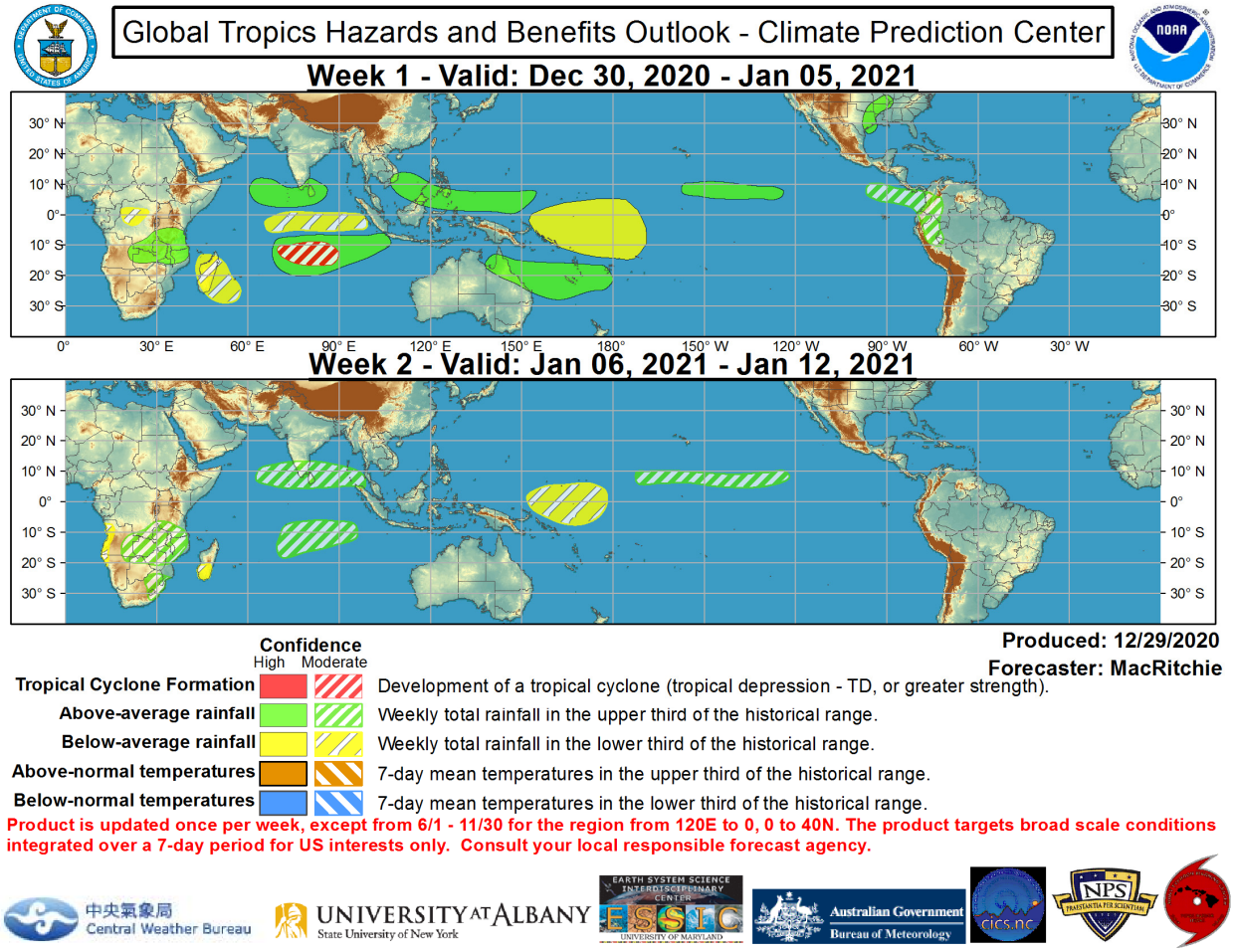
La Niña *refers to the periodic cooling of sea-surface temperatures (-0.5°C) across the east-central equatorial Pacific. It represents the cold phase of the ENSO cycle.*

El Niño and La Niña episodes typically last nine to 12 months, but some prolonged events may last for years. While their frequency can be quite irregular, El Niño and La Niña events occur on average every two to seven years. Typically, El Niño occurs more frequently than La Niña.

ENSO-neutral *refers to those periods when neither El Niño nor La Niña conditions are present. These periods often coincide with the transition between El Niño and La Niña events. During ENSO-neutral periods the ocean temperatures, tropical rainfall patterns, and atmospheric winds over the equatorial Pacific Ocean are near the long-term average.*

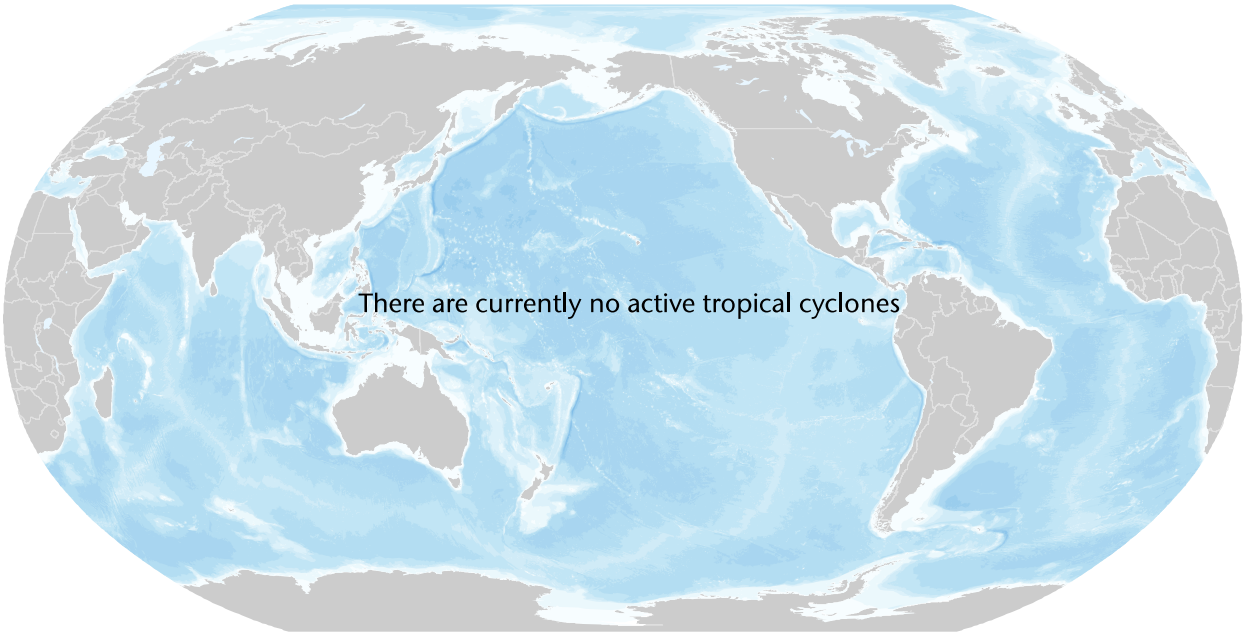
El Niño (La Niña) is a phenomenon in the equatorial Pacific Ocean characterized by a five consecutive 3-month running mean of sea surface temperature (SST) anomalies in the Niño 3.4 region that is above the threshold of +0.5°C (-0.5°C). This is known as the Oceanic Niño Index (ONI).

Global Tropics Outlook



Source: Climate Prediction Center

Current Tropical Systems



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

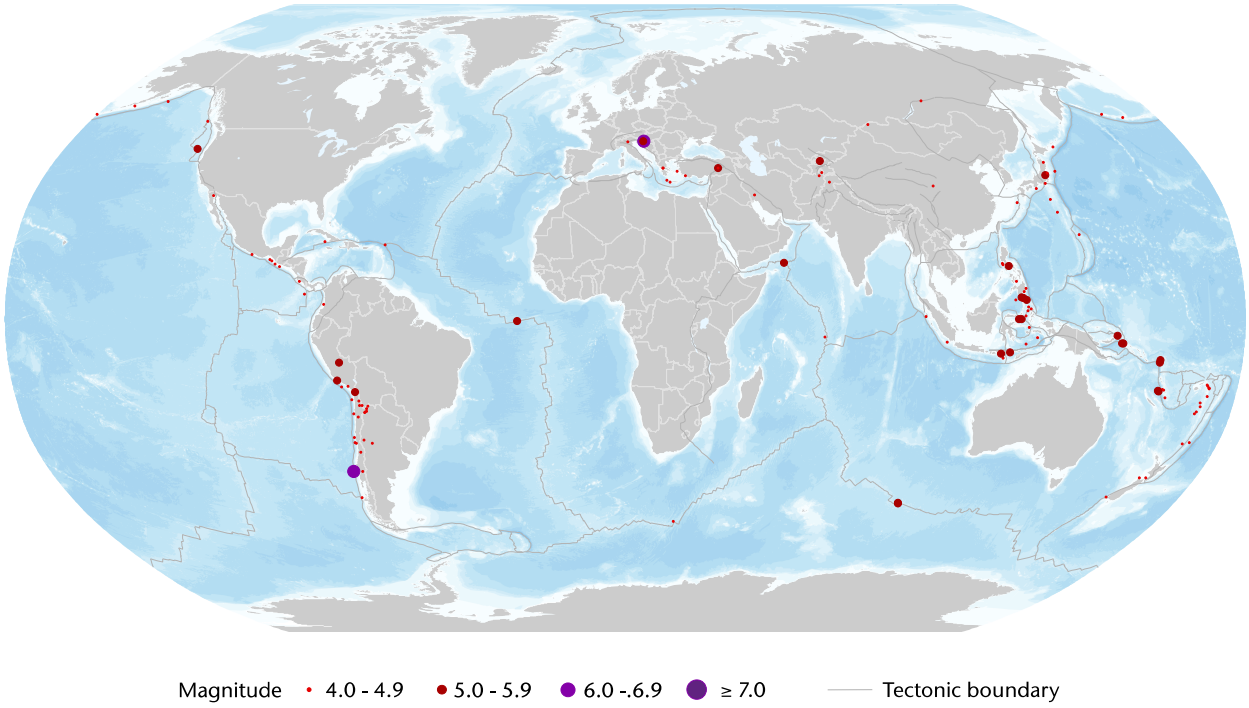
Location and Intensity Information

Name*	Location	Winds	Storm Reference from Land	Motion**

* TD = Tropical Depression, TS = Tropical Storm, HU = Hurricane, TY = Typhoon, STY = Super Typhoon, CY = Cyclone
** N = North, S = South, E = East, W = West, NW = Northwest, NE = Northeast, SE = Southeast, SW = Southwest

Sources: National Hurricane Center, Joint Typhoon Warning Center, Central Pacific Hurricane Center

Global Earthquake Activity (≥M4.0): December 25 – 31

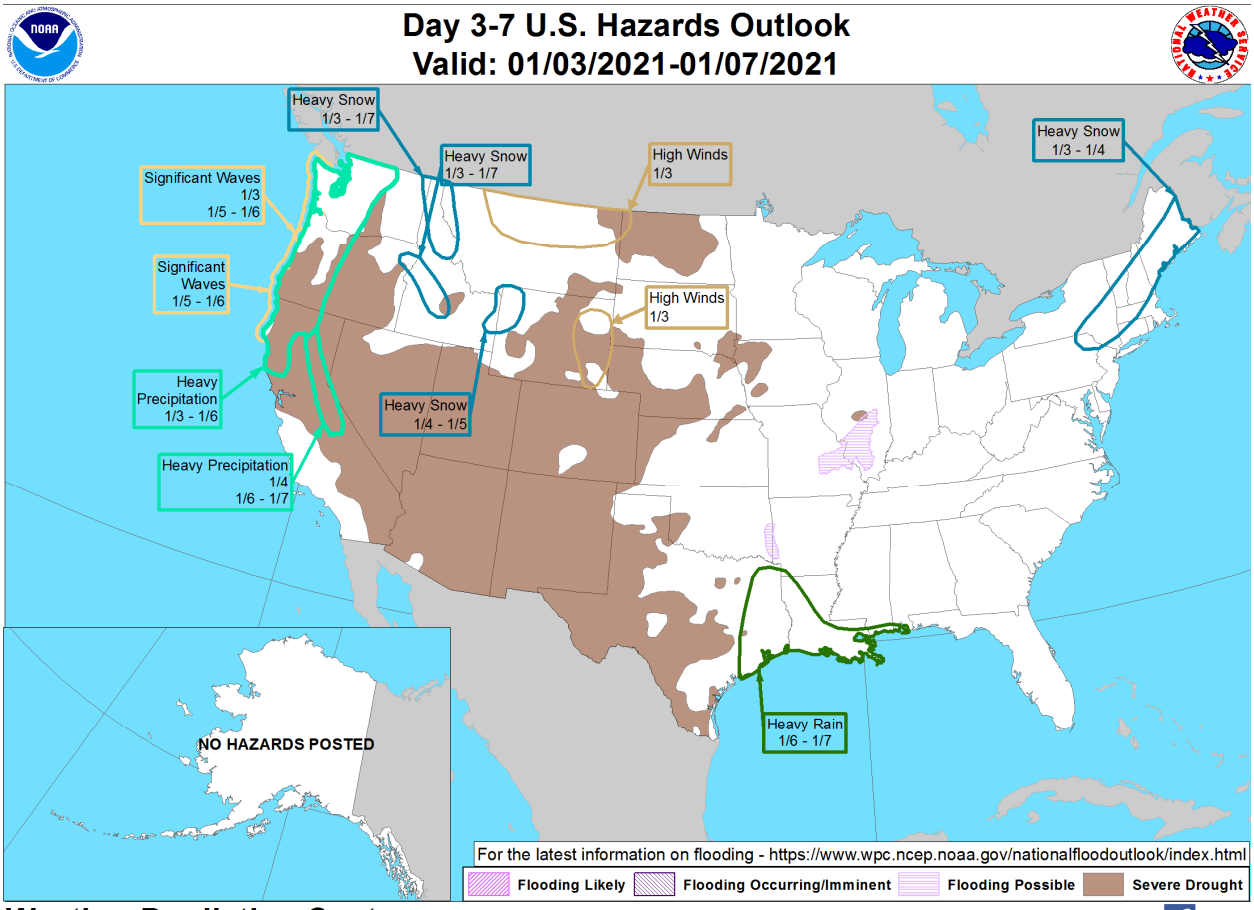


Significant EQ Location and Magnitude (≥M6.0) Information

Date (UTC)	Location	Magnitude	Depth	Epicenter
12/27/2020	39.34S, 74.99W	6.7	10 km	14 kilometers (9 miles) WNW of Corral, Chile
12/29/2020	45.42N, 16.26E	6.4	10 km	3 kilometers (2 miles) WSW of Petrinja, Croatia

Source: United States Geological Survey

U.S. Weather Threat Outlook



Potential Threats

- Multiple storm systems are expected to reach the Pacific Northwest and spread widespread precipitation (Cascadia and Sierra Nevada mountain snow and rain near the surface) through the first week of 2021. Moisture from these systems will also spawn snow across the Rockies. Elsewhere, a quick-moving front may bring accumulating snow to New England.

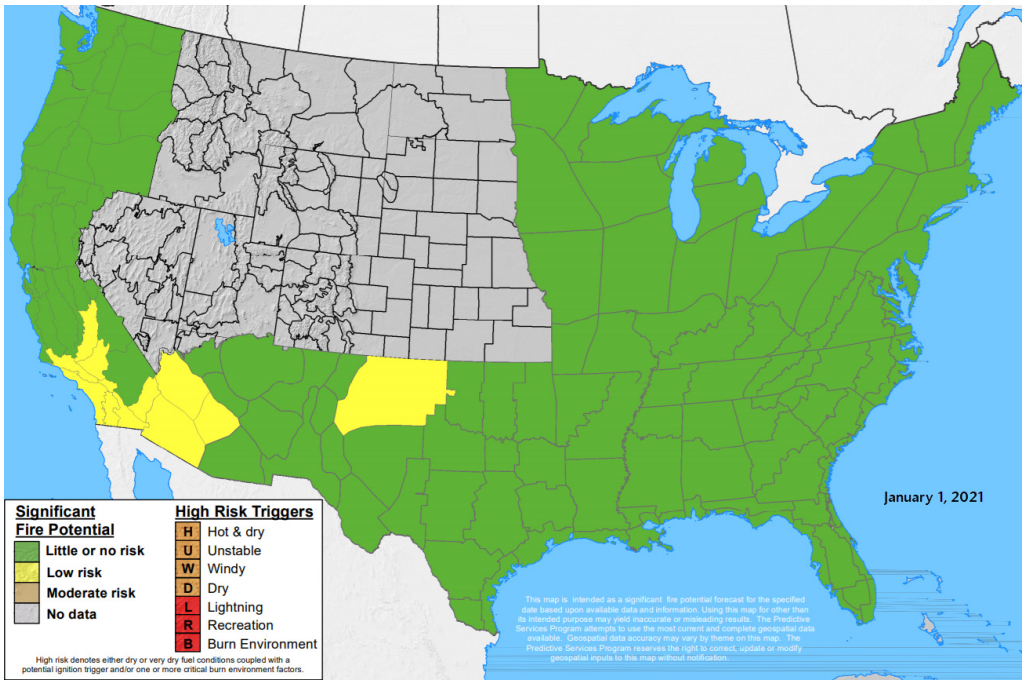
- A developing mid-week storm system may bring heavy rains to parts of Texas and the Gulf Coast.

- Recent heavy precipitation has left soils saturated and river levels elevated in portions of the Mississippi Valley and ArkLaTex.

- Severe drought conditions persist across much of the West and Plains. Some of these areas are seeing their deepest drought in multiple years.

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

The National Interagency Fire Center has highlighted a limited volume of potential fire risk across much of the country during the next week. The arrival of more seasonal precipitation and temperatures should minimize fire chances for the foreseeable future.



Annual YTD Wildfire Comparison: December 31*, 2020

Year	Number of Fires	Acres Burned	Acres Burned Per Fire
2016	62,946	5,437,875	86.39
2017	65,127	9,563,128	146.84
2018	55,911	8,582,609	153.50
2019	49,492	4,576,827	92.48
2020	58,258	10,274,679	176.37
10-Year Average (2010-2019)	**62,882**	**6,789,149**	**107.97**

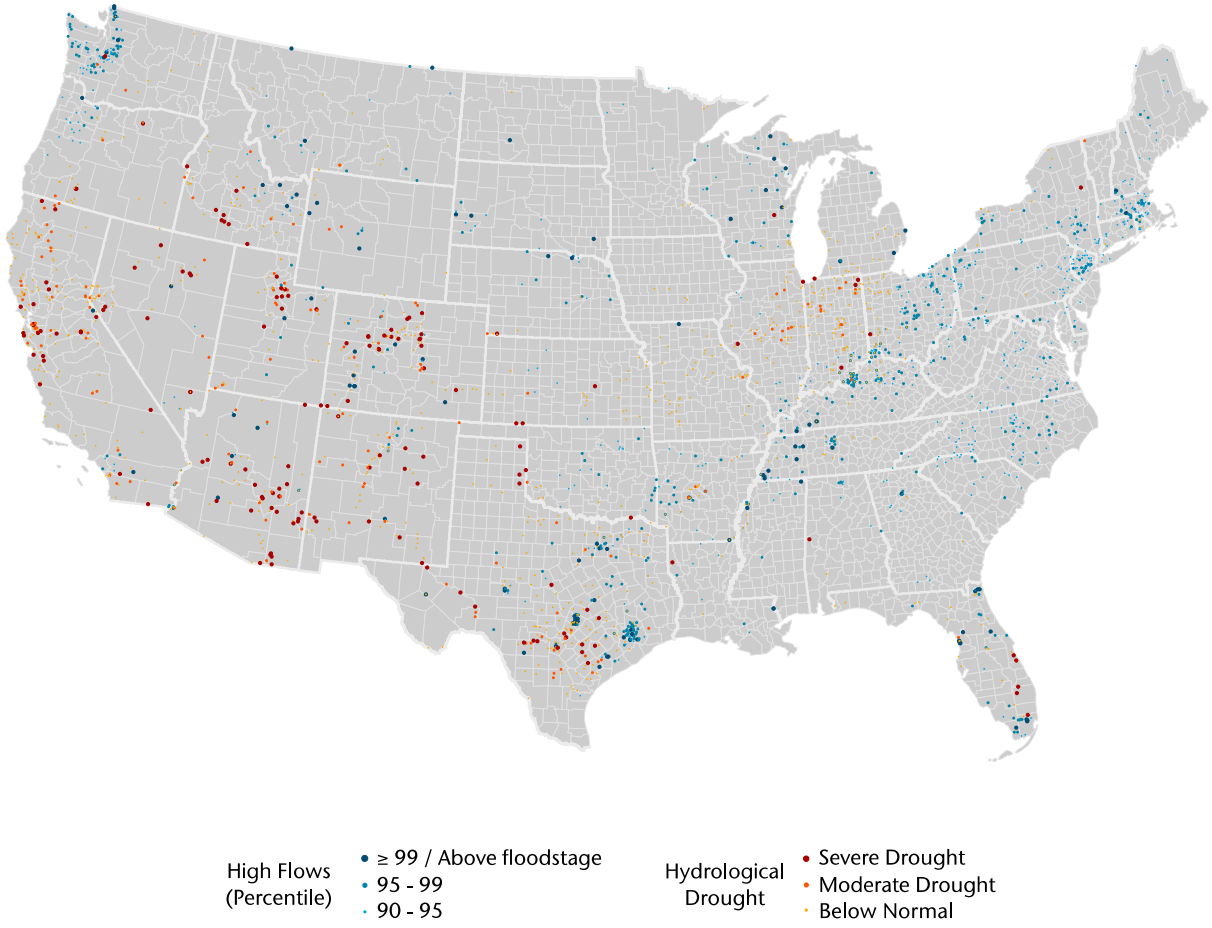
Source: National Interagency Fire Center

Top 5 Most Acres Burned by State: December 31, 2020

State	Number of Fires	Acres Burned	Acres Burned Per Fire
California	10,309	4,207,171	408.11
Washington	1,655	1,007,309	608.65
Arizona	2,519	978,520	388.46
Oregon	2,132	874,423	410.14
Colorado	1,078	625,356	580.11

Source: National Interagency Fire Center

Current U.S. Streamflow Status



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 Currently Nearing or Exceeding Flood Stage

Location	Current Stage (ft)	Flood Percentile
Red Lake River at Crookston, Minnesota	8.05	99.16
Weber River near Oakley, Utah	6.15	99.15
Oconto River near Gillett, Wisconsin	3.51	99.09
Taylor River at Almont, Colorado	2.63	99.09
Dolores River at Dolores, Colorado	2.77	99.09

Source: United States Geological Survey

Source Information

Croatia struck by largest earthquake in modern record

Directorate of Civil Protection of the Ministry of the Interior of the Republic of Croatia
United States Geological Survey

Windstorm Bella causes moderate damage in Europe

Meteofrance
Met Office

Pair of winter storms impact U.S. into the new year

U.S. National Weather Service
U.S. Storm Prediction Center
Iowa State Patrol
Wisconsin State Patrol
Northern Colorado snow recap, The Coloradoan

Natural Catastrophes: In Brief

Madeira Government authorizes direct adjustment for reconstruction in parishes affected by bad weather, Observador
Five bodies recovered from remote Papua New Guinea landslide site, ABC News
Iran Red Crescent Society
Joint Typhoon Warning Center (JTWC)
UN Office for the Coordination of Humanitarian Affairs (UN-OCHA)
Floodlist

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