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Catastrophe and Climate

Actuarial Weather Extremes: October 2021

Extreme Precipitation in the Western U.S., Impact on U.S. Drought, La Nina, October Tornadoes

November 2021

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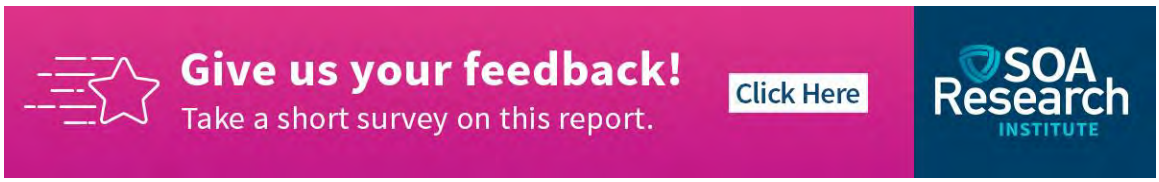

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Overview

This report examines weather conditions for precipitation, drought conditions, and tornadoes that are extreme in an historical context.

Extreme Precipitation in the Western U.S. and then Across the U.S. in Late October: Using Global Historical Climatology Network (GHCN) data back to 1960, many stations recorded record precipitation amounts both for the month of October and for individual days during the period October 24-27, 2021. The heaviest amounts for the month were in Northern California. Streamflow amounts for October vs historical values were above the 90th percentile in areas which just the month before were below the 10th percentile.

Drought Continues; mostly in the Western U.S.: In the Western U.S., the drought has diminished somewhat in terms of land area under the most extremes states of drought conditions. For the Continental U.S. overall however, the drought has expanded to cover more land area, generally in an eastward direction.

La Nina: According to the National Oceanic and Atmospheric Administration (NOAA) Climate.gov, and as reported October 14, La Nina conditions have materialized. The impact from La Nina over the winter would be to be drier and warmer across the southern U.S., cooler in the northern U.S. and Canada, and parts of the Midwest tend to see above average rain and snow. [1] The southwestern portions of the U.S., which are in severe drought conditions, would see a drier winter, which would be detrimental to drought recovery.

October Tornado Activity: During a period of eight consecutive days (October 9-16), tornado sightings, 95 in total, were reported in the U.S. Figure 7 shows the pattern of where tornadoes were sighted over the period, generally in the Central states, Ohio Valley, and into Pennsylvania.

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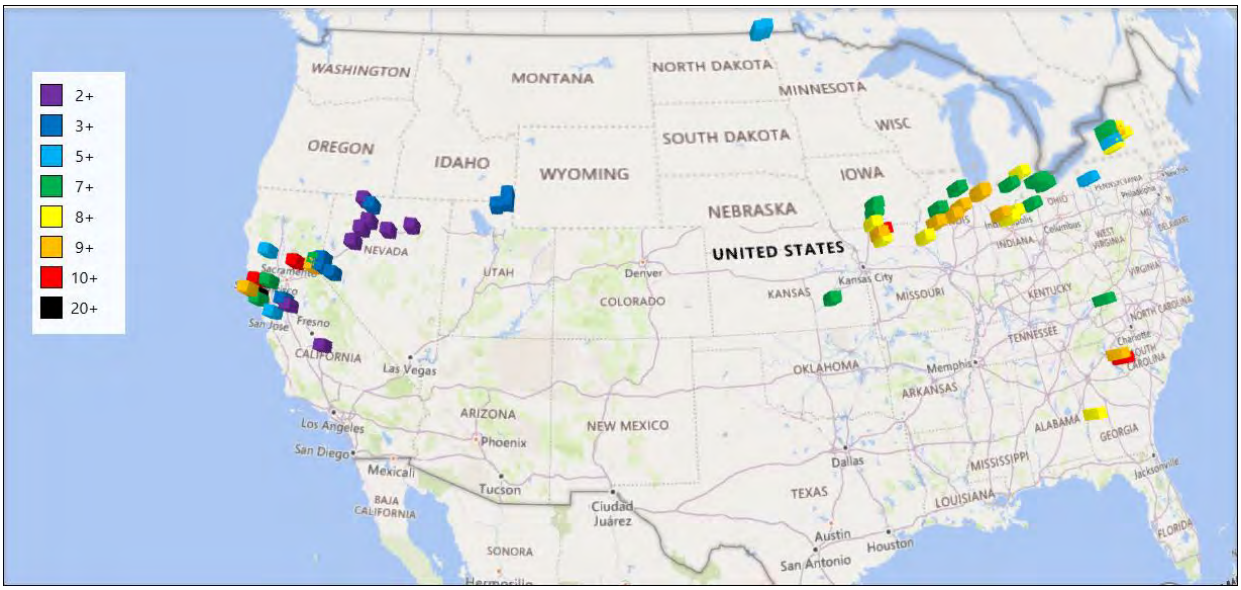
[1] Climate.gov October 14, 2021. October 2021 ENSO update: La Niña is here! | NOAA Climate.gov

Record October Precipitation

As seen in Figure 1, many stations had record October monthly precipitation amounts and largely make a path across the Northern U.S. with particularly high amounts in California, and also several records set in Nevada. Figure 2 shows similar areas and tracks the period of October 24 through October 27 showing GHCN stations which had record daily precipitation of 3+ inches.

Figure 1

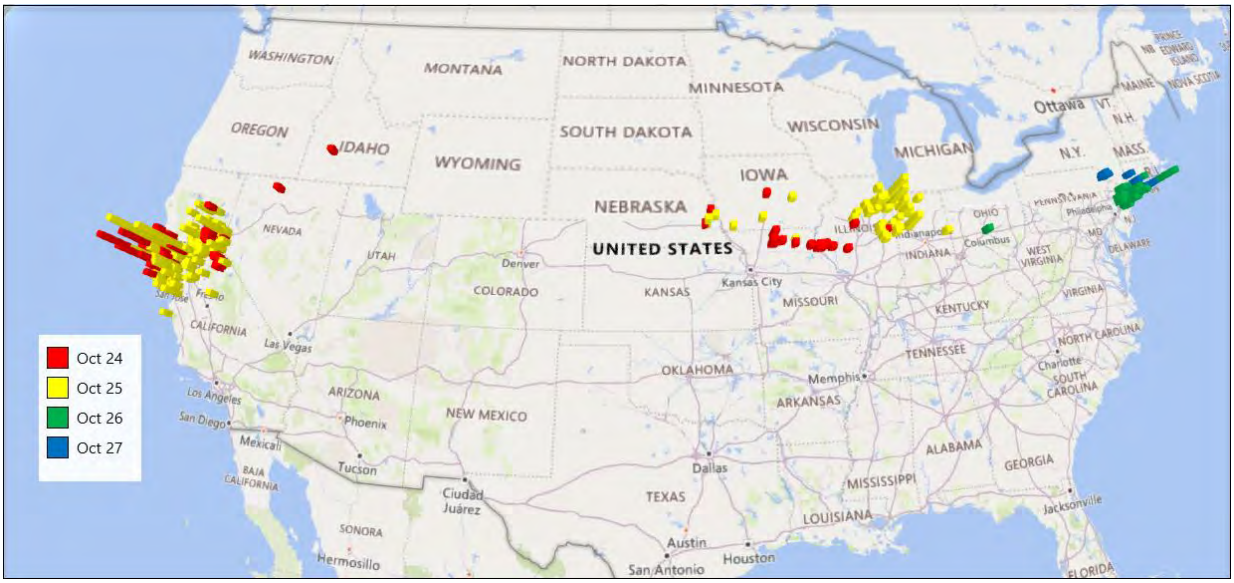
MONTHLY PRECIPITATION TOTALS IN INCHES AT STATIONS WHICH HAD RECORD OCTOBER AMOUNTS IN 2021 VS OCTOBER TOTALS BACK TO 1960



Source: GHCN station data (Accessed November 5, 2021). https://www1.ncdc.noaa.gov/pub/data/ghcn/daily/

Figure 2

DAILY STATION DATA FOR OCTOBER 24 – OCTOBER 27, 2021 FOR STATIONS WHICH HAD A RECORD DAILY PRECIPITATION AMOUNT BACK TO 1960 WHICH WAS AT LEAST 3 INCHES



Source: GHCN station data (Accessed November 5, 2021). https://www1.ncdc.noaa.gov/pub/data/ghcn/daily/

Drought Continues Mostly in the Western U.S. But With Heavy Precipitation

As seen in Figure 3, the areas that are under varying levels of drought conditions from Abnormally Dry to Exceptional Drought in the Western U.S. generally look to have receded in severity a bit. This coincides with record precipitation amounts for the month of October in the areas noted by stations in Figure 1.

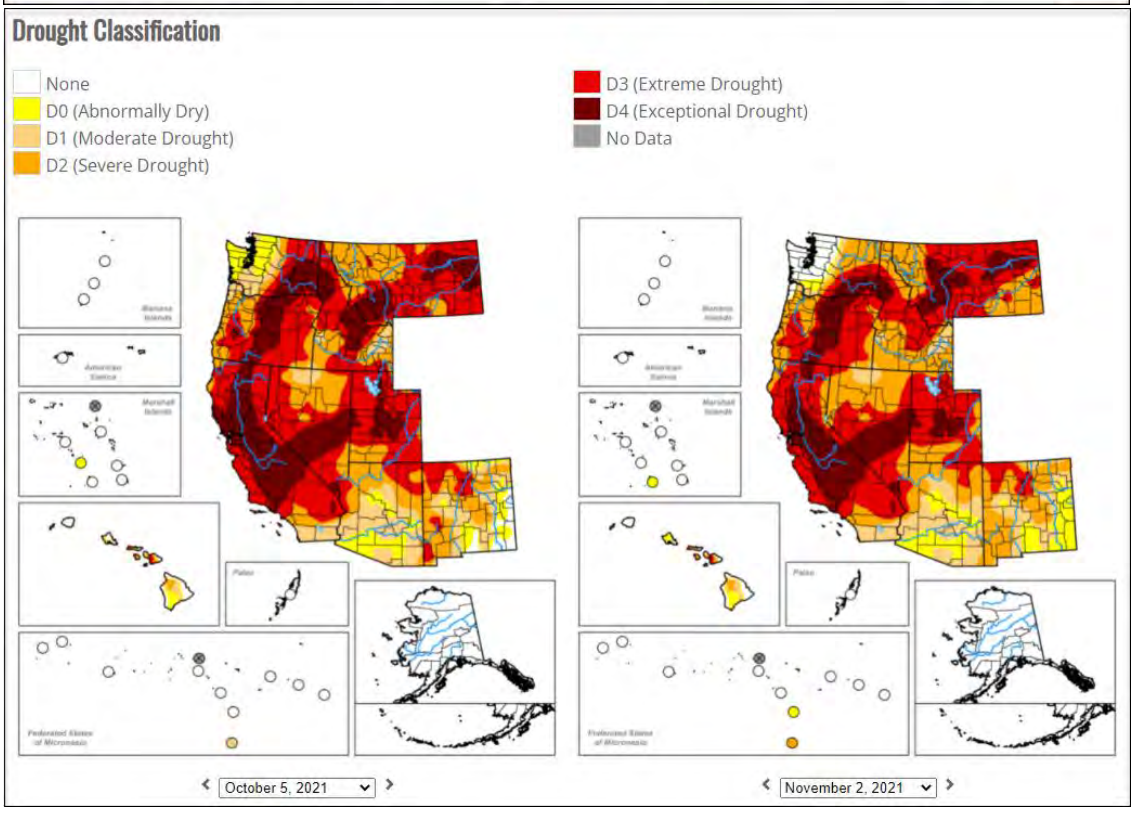
When looking at the full Continental U.S., the area under drought conditions expanded, mostly in an eastward movement. See Figure 4.

Figure 5 shows United States Geological Survey (USGS) stream gage data streamflow for the month vs station data for stations with at least 30 years of data. In October 2021, stream flows were above the 90th percentile in parts of Northern California where in September these same areas had stream flows below the 10th percentile. These metrics are also consistent with the precipitation data shown earlier.

Figure 3

COMPARISON OF DROUGHT CONDITIONS IN THE WESTERN U.S. OVER OCTOBER 2021

Week	None	D0-D4	D1-D4	D2-D4	D3-D4	D4	DSCI
2021-10-05	37.98	62.02	58.25	50.78	36.82	13.37	221
2021-11-02	38.74	61.26	57.52	50.39	32.19	10.98	212
Change	0.76	-0.76	-0.73	-0.39	-4.63	-2.39	-9

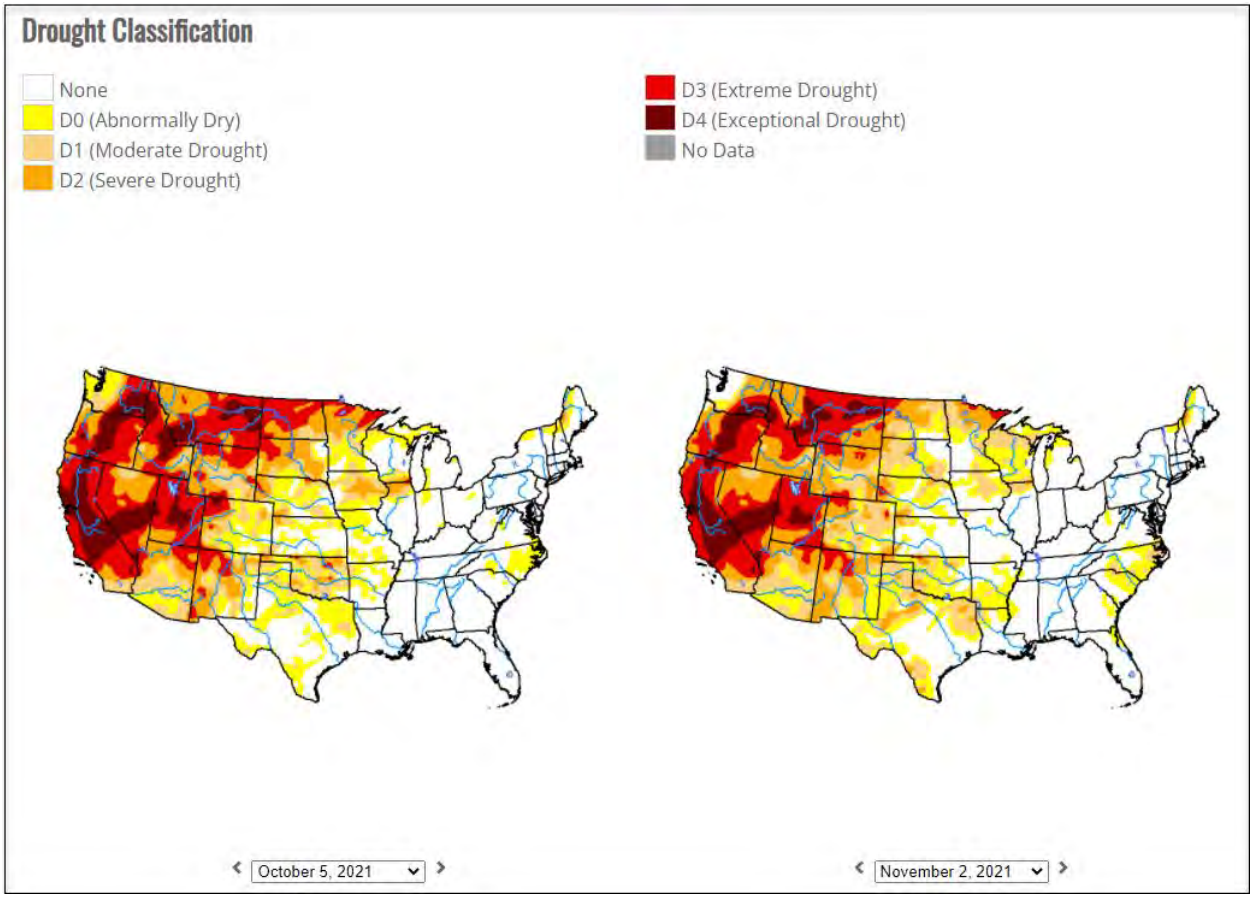


Source (Accessed November 17, 2021): https://droughtmonitor.unl.edu/Maps/CompareTwoWeeks.aspx The U.S. Drought Monitor is jointly produced by the National Drought Mitigation Center at the University of Nebraska Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. Map courtesy of NDMC.

Figure 4

COMPARISON OF DROUGHT CONDITIONS IN THE CONTINENTAL U.S. OVER OCTOBER 2021

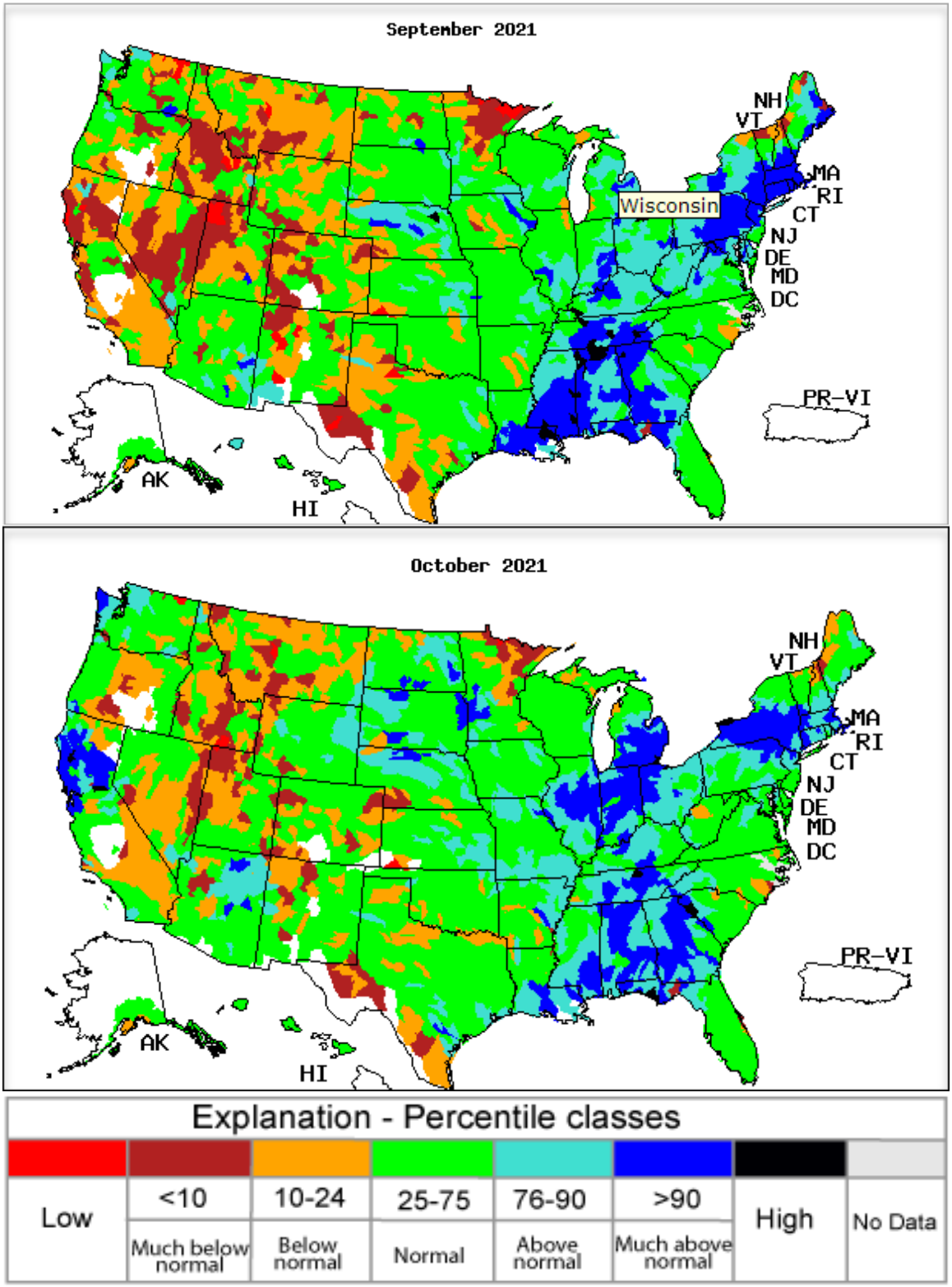
Week	None	D0-D4	D1-D4	D2-D4	D3-D4	D4	DSCI
2021-10-05	37.64	62.36	47.45	36.47	23.09	7.07	176
2021-11-02	37.22	62.78	47.81	32.93	17.98	5.74	167
Change	-0.42	0.42	0.36	-3.54	-5.11	-1.33	-9



Source (Accessed November 17, 2021): https://droughtmonitor.unl.edu/Maps/CompareTwoWeeks.aspx The U.S. Drought Monitor is jointly produced by the National Drought Mitigation Center at the University of Nebraska Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. Map courtesy of NDMC.

Figure 5

UNITED STATES GEOLOGICAL SURVEY (USGS) STREAMFLOW IN SEPTEMBER 2021 AND THEN IN OCTOBER 2021 VS HISTORICAL DATA PERCENTILE CLASSES USING STREAMGAGES WITH AT LEAST 30 YEARS OF DATA



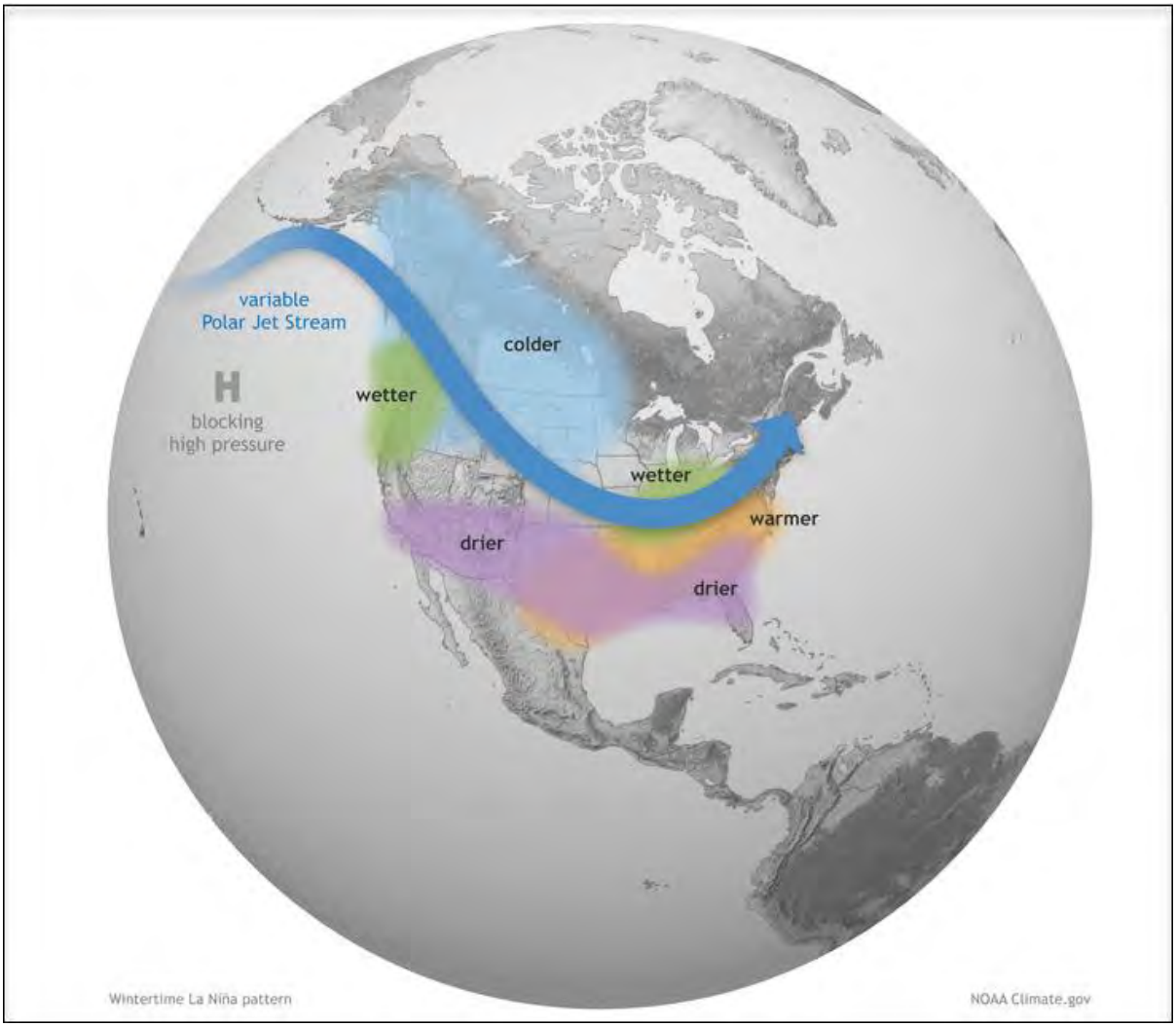
Source: United States Geological Survey (USGS) USGS WaterWatch -- Streamflow conditions Date Accessed: 10/22/21 and 11/17/21

Impact of La Nina Ocean Atmosphere Pattern

According to NOAA Climate.gov, reported October 14, La Nina has materialized. The impact from La Nina over the winter would be to be drier and warmer across the southern U.S., cooler in the northern U.S. and Canada, and parts of the Midwest tend to see above average rain and snow. [2] The southwestern portions of the U.S., which are in severe drought conditions, would see a drier winter, which would be detrimental to drought recovery. Figure 6 shows the impact during winter of a La Nina pattern.

Figure 6

DEPICTION OF LA NINA WINTERTIME PATTERN



Source: October 2021 ENSO update: La Niña is here! | NOAA Climate.gov

[2] Climate.gov October 14, 2021. October 2021 ENSO update: La Niña is here! | NOAA Climate.gov

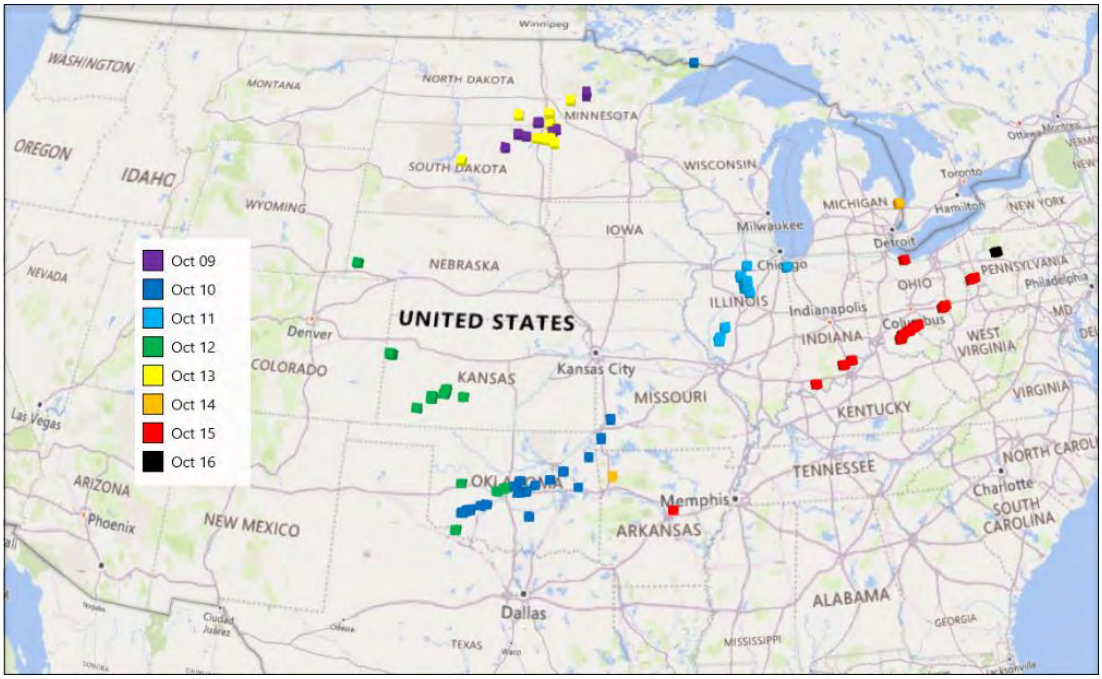
October Tornadoes

Mid-October 2021 was a busy time for tornado activity with 95 tornadoes sightings occurring over an 8-consecutive day span from October 9-16. Figure 7 shows the pattern of where tornadoes were sighted over the period, generally in the Central states, Ohio Valley, and into Pennsylvania.

For the full month of October 2021, there were also an unusually high number of Tornado reports, with 146 total and 1 death. [3] There were two EF-3 tornadoes in Missouri on October 24, 2021, which is unusual for this time of year in Missouri. [4] Since 1955, there have been 3 EF-2 tornadoes and 8 EF-3 tornadoes in Missouri in October, with the last EF-3 occurring in 1984 (See Table 1).

Figure 7

SPC DATA FOR U.S. OCTOBER 9-16 TORNADO SIGHTING LOCATIONS BY DAY



Source: SPC: https://www.spc.noaa.gov/climo/reports/211001_rpts.html Date Accessed: 10/7/2021

Table 1

HISTORIC STORM DATABASE FOR MISSOURI SINCE 1955

State	Year	EF-2	EF-3
MO	1958	0	3
MO	1966	0	1
MO	1967	0	2
MO	1984	0	2
MO	2007	2	0
MO	2013	1	0

Source: NOAA National Center for Environmental Information: https://www.ncdc.noaa.gov/stormevents/ Date Accessed: 10/7/2021

[3] NOAA Storm Prediction Center. November 7, 2021. https://www.spc.noaa.gov/climo/online/monthly/newm.html

[4] National Weather Service. https://www.weather.gov/lsx/10_24_2021

Data

Temperature data and **Precipitation data** used in this report was obtained from the **Global Historical Climatology Network** ("GHCN") weather database, which provides daily weather observations from over 100,000 weather stations worldwide, covering over 180 countries. The database is publicly available through the National Oceanic and Atmospheric Administration (NOAA) via the following FTP site:

Source: https://www1.ncdc.noaa.gov/pub/data/ghcn/daily/

Filename: ghcnd_all.tar.gz

National Weather Service Storm Prediction Center Reports
SPC: https://www.spc.noaa.gov/climo/reports/211001_rpts.html
This page will show all Tornado, Wind, and Hail reports for 10/1/2021
Select the "210802 Reports" button at the top to move to the next day

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