

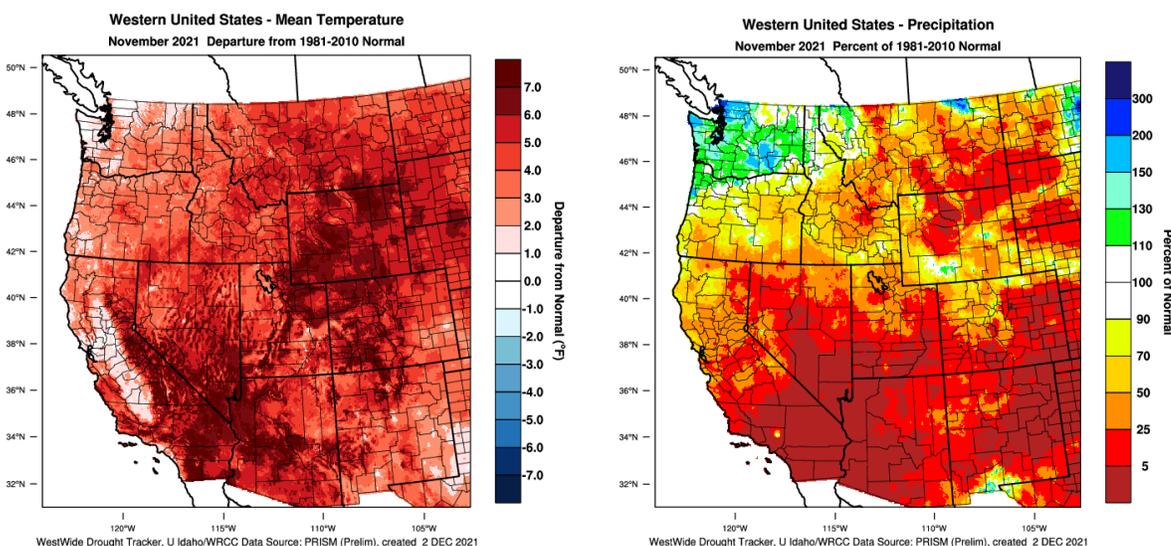
# Weather and Climate Summary and Forecast December 2021 Report

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## Summary:

- A warmer than average<sup>1</sup> November was experienced over much of the west, with portions of western Washington and western valleys south into California seeing closer to average temperatures.
- After the deluge in California from an atmospheric river in October, the storm axis moved north bringing another extreme atmospheric river event that inundated Washington and British Columbia. Otherwise, the west experienced a very dry November.
- Drought conditions have improved in the PNW but remains in place for over 95% of the western US. The winter forecast points to continued improvement for the PNW across the northern Rockies but little change elsewhere.
- The December forecast favors a continuation of the cooler than average to average conditions seen in late November. The storm track also continues to be more northerly, keeping the PNW wetter than average and California likely closer to average or below average.
- La Niña conditions continue in the Tropical Pacific with models pointing to the conditions staying in place through mid-spring, then transitioning back to neutral in late spring to early summer. With La Niña conditions in place, the overall forecast is bolstered to the PNW likely continuing to experience a cooler/wetter winter, while California is more likely to be drier with near-average temperatures during the winter. The transition line is the unknown, but it appears that northern California is the likely pivot point.

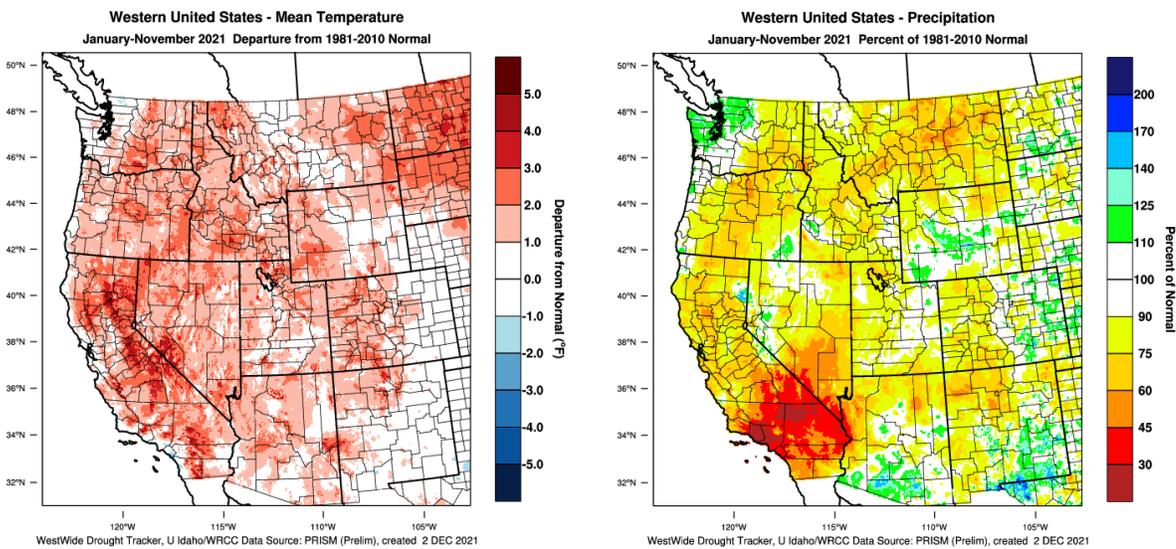
November was a relatively mild month with temperatures largely above normal across the western US, with areas of the Rockies and southwest 5-7° above average (Figure 1). Temperatures were closer to average in the Olympics and northern Cascades of Washington, areas in southern Oregon, and throughout the central valley of California. Precipitation during the month clearly shows the northerly storm track with 110-300% or greater amounts in Washington and extending into British Columbia (not shown in Figure 1). The rain in these regions came largely from one atmospheric river event that brought record amounts to many locations but left the rest of the west extremely dry for the month. While the west was warm, the east was moderately cool with the south and mid-Atlantic seeing temperatures 3-7°F below average for the month. In terms of precipitation, most of the rest of the country was drier than average with only a small area of the northern Plains, southern Texas, and Florida seeing above-average rainfall during the month (not shown).



**Figure 1** – Western US November 2021 temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

<sup>1</sup> Note that all references to normal or averages in this report are to the 1981-2010 climate normal for each weather/climate parameter unless stated otherwise. Also, note that the 1991-2020 climate normals are starting to become available across reporting agencies and will be used in this report when possible.

Year-to-date the western US is running largely above average (Figure 2), although coastal zones, portions of the Great Basin and Rockies, and the northern Cascades remain closer to average. The Front Range of the Rockies south into the southern Plains and Texas continue near average to cooler than average year-to-date (Figure 2), while the southeast has been near average and Florida, New England, the northern Plains, and the Great Lakes have been warmer than average (not shown). Year-to-date precipitation amounts in the western US show that a substantial area has seen 90% or less of average which has added to the broader drought conditions in the west (see Drought Watch). Isolated areas scattered across the Olympics, northern Cascades, coastal zones in Oregon, the Rockies, and the southwest have experienced a near-average to roughly 120% of normal precipitation for the year. For the rest of the country, year-to-date drier than average conditions continue across the northern Plains, portions of the Great Lakes, and into extreme northern New England, while the central portion of the country, Gulf Coast, and southeast has largely been near average to wetter than average for the year (not shown).



**Figure 2** – Western US year to date (January-November 2021) temperature departure from normal (left) and percent of normal precipitation (right; images from WestWide Drought Tracker, Western Region Climate Center; University of Idaho).

**Drought Watch** – North Pacific weather systems dropped upwards of 5 inches of precipitation on northwest Oregon and western Washington with even more in British Columbia. Some precipitation also occurred in the northern Rockies, otherwise most of the west experienced a very dry November. Unfortunately, the precipitation came to areas that were already seeing drought improvement and did not help much elsewhere as the long-term drought conditions in the west continue (Figure 3). As of the latest Drought Monitor update, over 97% of the western US remains in some level of drought with even the most extreme drought conditions (extreme and exceptional) continuing to hover near 50%. Drought zones also extend into the Rockies, much of the Plains, most of Texas, and the western Great Lakes, with even portions of US east of the Mississippi River showing some short-term drought. Short- and long-term drought indicators from the seasonal outlook (Figure 3, right panel) point to the PNW across to portions of the northern Rockies seeing continued improvement through the first half of the winter. However, the outlook continues to show the long-term drought in California, into the southwest, and up into the Rockies, while also indicating the likelihood of drought developing further in Texas and the southern Plains. From the Mississippi River eastward the coastal zones of the mid-Atlantic are forecast to see drought conditions develop (Figure 3).

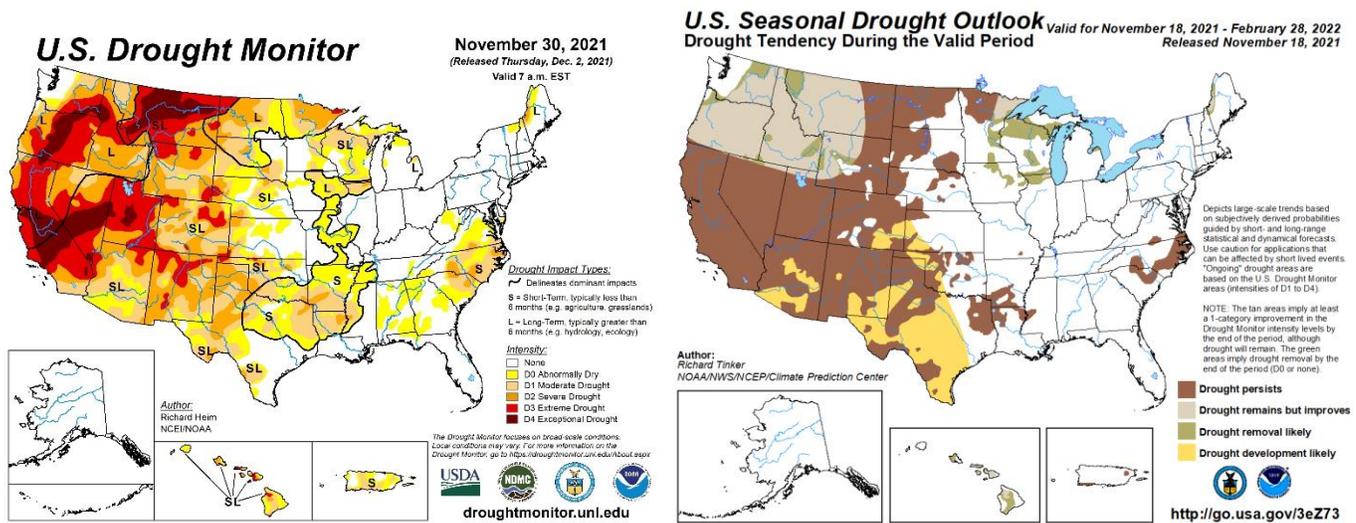


Figure 3 – Current US Drought Monitor and seasonal drought outlook.

**ENSO Watch** – The tropical Pacific has remained in La Niña conditions with SSTs in the central-eastern equatorial Pacific  $-0.8^{\circ}\text{C}$  below average as of mid-November were (Figure 4). Following from these cool SSTs, the evolution of other key oceanic and atmospheric variables is consistent with La Niña conditions. As such the Climate Prediction Center (CPC) is continuing the La Niña Advisory. Modeling efforts also continue to predict SSTs remaining during winter, and then returning to ENSO-neutral levels during late spring to early summer. The official outlook from numerous agencies confirms this forecast with the outlook calling for La Niña continuing with high probability during December through April. La Niña conditions are adding to the model forecasts and applied research that point to the PNW likely seeing a cooler/wetter winter, while California has high odds to be drier during the upcoming winter and near average for temperatures (see the 90-day forecast below).

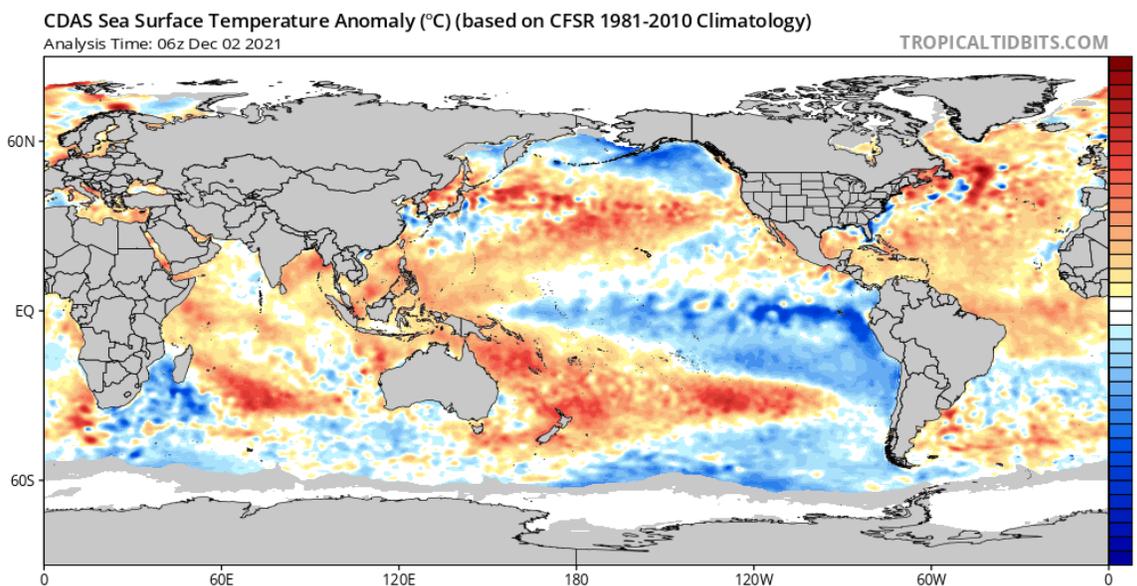


Figure 4 – Global sea surface temperatures ( $^{\circ}\text{C}$ ) for the period ending December 2, 2021 (image from TropicalTibbits.com).

**North Pacific Watch** – The pattern in North Pacific SSTs has remained spatially consistent over the last month (Figure 4). A large area in the Gulf of Alaska continues cooler than average with circulation over the region helping to mix cooler waters to the surface. Warm SSTs still exist over a large area in the central North Pacific, and cooler SSTs are occurring southwest from California and across the ENSO zone showing a classic La Niña pattern in tropical SSTs (see above). These conditions have the Pacific Decadal Oscillation on moving between neutral to a negative phase. This type of pattern in cooler North Pacific SSTs supports the seasonal forecast showing the tendency for a cooler/wetter PNW, transitioning to

cool and near average precipitation in northern California and to slightly cool and dry overall during the winter in most of California.

#### **Forecast Periods:**

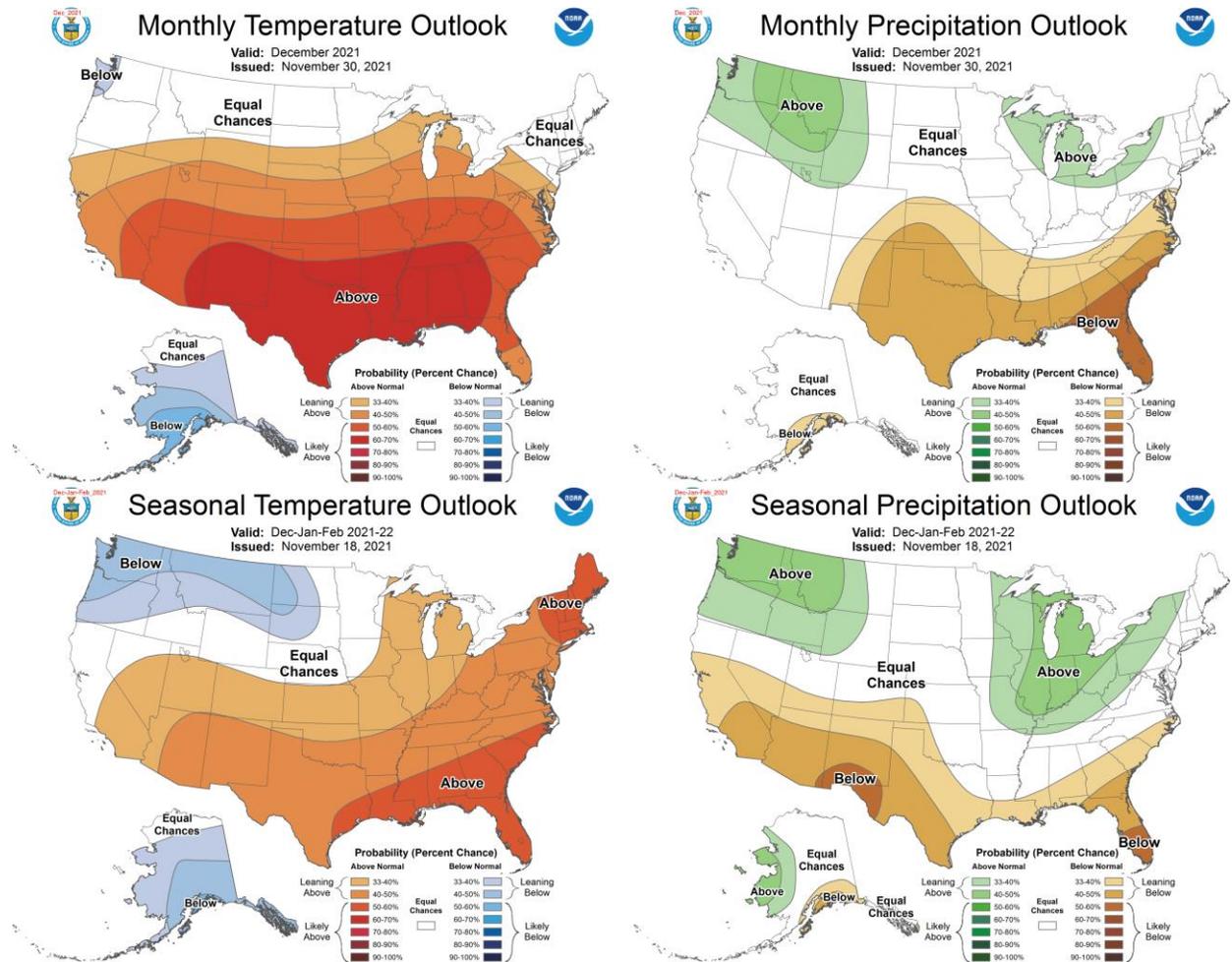
**Next 5 Days:** Seasonably cool over the next five days up and down the west coast. Rain chances off and on over the next few days, with most coming to areas north of the California-Oregon border. Temperatures in the PNW will be cold enough for low-level snow in many areas. Conditions in California will likely bring daily fog across much of the central valley until rain chances increase entering the next forecast period.

**6-10 Day (valid December 8-12):** Continued colder than average temperatures over the PNW, while California and the Rockies are forecast to near average for this time of year. Precipitation during this forecast period is expected to be near to above average for most of the western US with the PNW and central Great Basin having the greatest chance. While the west is seasonably cool or cooler than average, the rest of the country is forecast to see a warmer than average period, especially across the Gulf Coast and the southeastern US. Shifting eastward, below-average precipitation is forecast in Texas and south Florida, while the eastern seaboard is forecast to see above-average precipitation.

**8-14 Day (valid December 10-16):** Overall pattern continues from the last forecast period into mid-month with cold conditions likely in the PNW and closer to normal temperatures in California and the Great Basin. Precipitation amounts are forecast to be generally above-average over the west, with the greatest chance remaining in the PNW and Great Basin, but California should get some precipitation during this period. The general temperature pattern remains in the east with above-normal conditions forecast with the bullseye being in the southeast. Precipitation patterns also hold through mid-month with Texas likely remaining dry, below-average conditions expanding from Florida into the southeast and above-average precipitation across the rest of the eastern US.

**30 Day (valid December 1-31):** Both the December forecast and the December-January-February (Figure 5) are showing what most are pointing to ... a classic La Niña pattern for temperatures and precipitation. For December the forecast points to the PNW across the northern tier of states all the way to New England likely staying below average to average in terms of temperatures, while the middle to southern states from California across to the mid-Atlantic are likely to experience a warmer than average month. For precipitation, the forecast for the month is calling above average amounts in the PNW across into the northern Rockies. California across into the Great Basin, the southwest, and up into the northern Plains and Mississippi river valley are forecast to see near average precipitation for the month. Dry conditions are forecast for Texas, across the Gulf Coast, and into the southeast (Figure 5).

**90 Day (valid December-January-February):** As mentioned above, the seasonal forecast for winter continues to hold from previous forecasts and reflects the expected influences of La Niña on precipitation and temperatures (Figure 5). The PNW across to the northern Plains are expected to see below-average temperatures, while just southward of these areas near average temperatures are forecast, which then gives way to the rest of the country likely experiencing a warmer than average DJF period (Figure 5). For precipitation, the pattern of a drier southern tier of states, then equal chances of slightly above to slightly below for the central zone of the country, then above average for the PNW and Great Lakes to New England holds from December through to February (Figure 5).



**Figure 5** – Temperature (left panel) and precipitation (right panel) outlooks for the month of December (top panel) and December, January, and February (bottom panel) (Climate Prediction Center, climate.gov).