2024 Fall Outlook

For Norteña & Central Nuevo México

Albuquerque
WEATHER FORECAST OFFICE
Updated 11/3/2024


Robert Pody – Magdalena Mountains


Robert Hill Cottonwood & Sandhill Cranes Bosque del Apache Wildlife Refuge


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Oscar Rafael – Hyde Park


Tom Kllroy USDA Forest Service - Fourth of July Canyon


Cita Dasheno – Hyde Park


US Forest Service -Mountainair Ranger District Cibola NF

What will a weak to moderate La Niña mean for late fall 2024 in central and northern NM?

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ENSO Alert System Status: La Niña Watch

ENSO-neutral conditions are present.*

Equatorial sea surface temperatures (SSTs) are near-to-below-average in the central and eastern Pacific Ocean.

La Niña is favored to emerge in October-November (60% chance) and is expected to persist through January-March 2025.*

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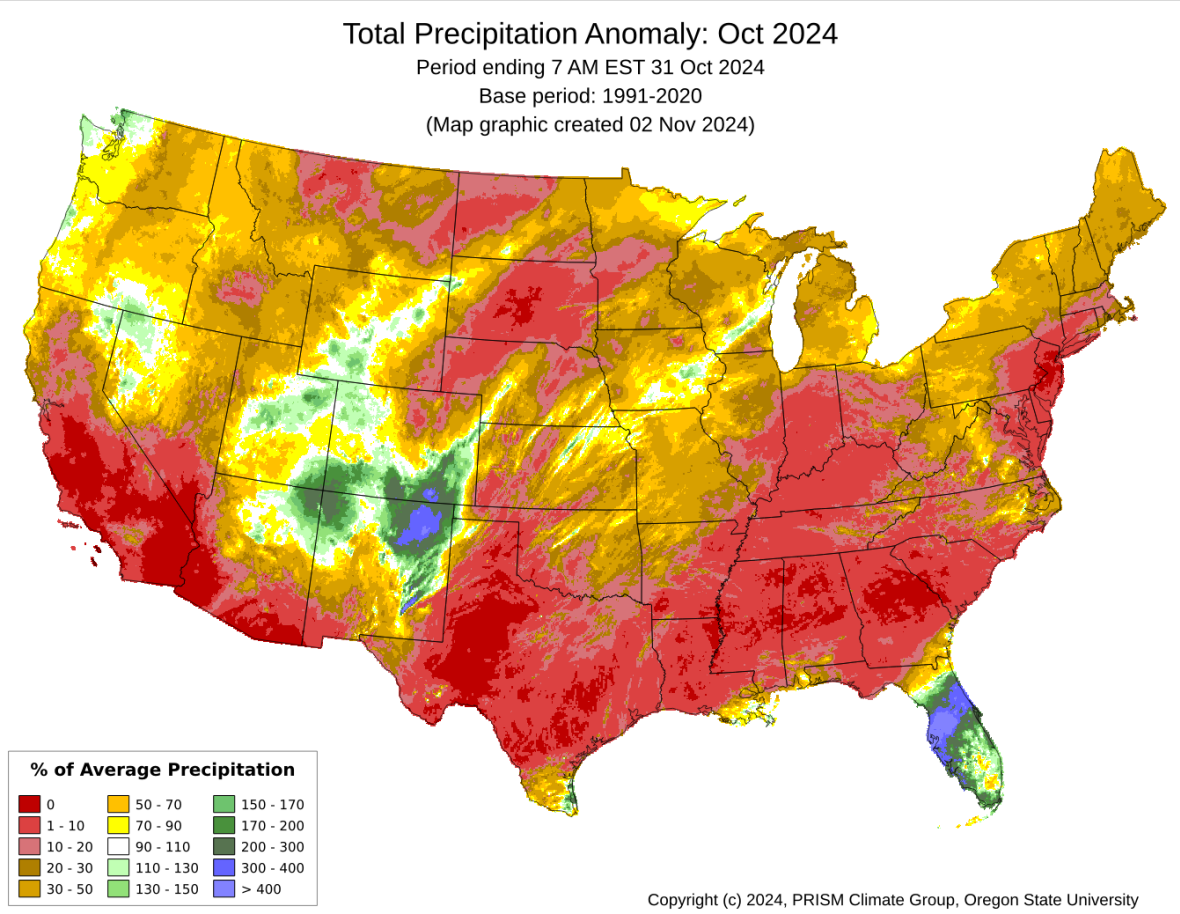

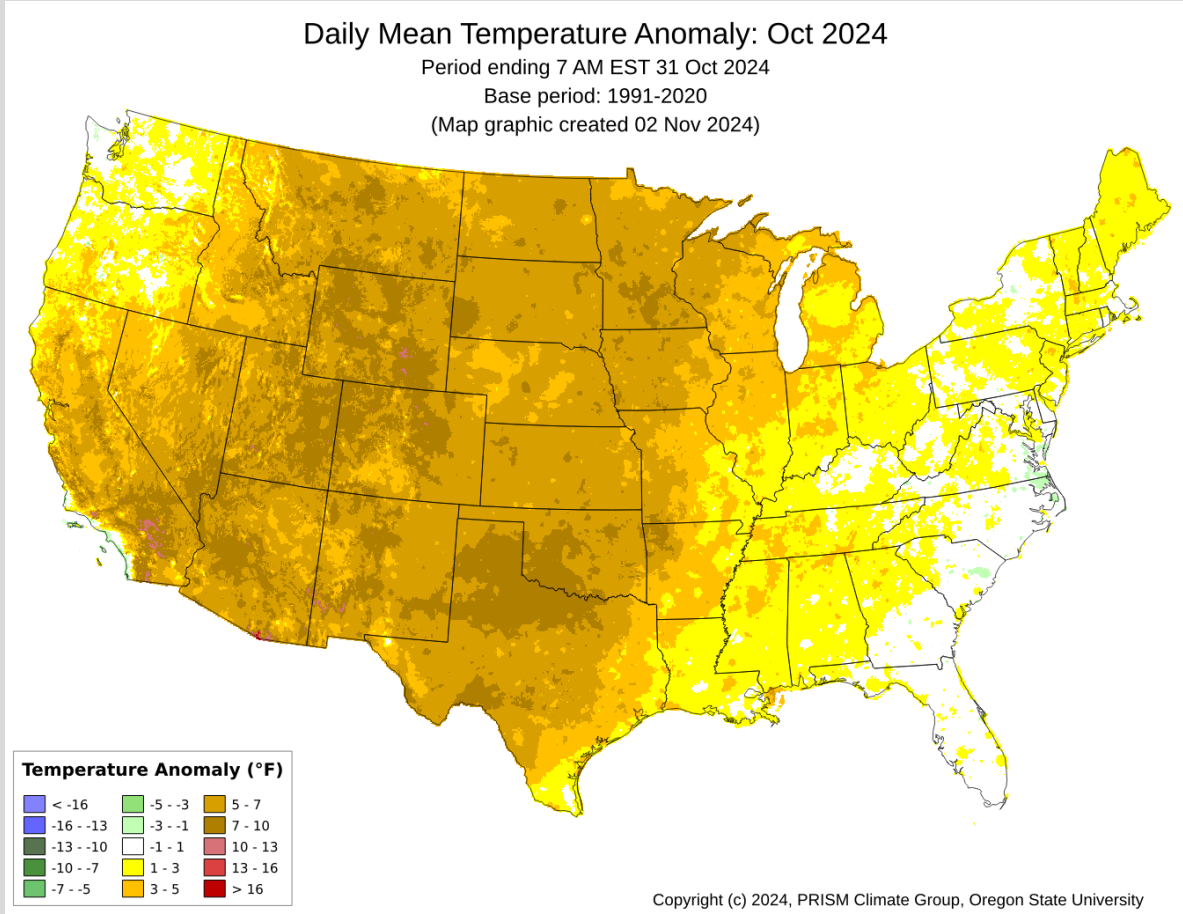

How did precipitation and temperature compare to the average calculated between 1991 and 2020? Much of northwestern and, especially, eastern New Mexico experienced significant impacts due to torrential rainfall, large hail, and emergency flash flooding, particularly in the Roswell and Hagerman areas. The next slide will illustrate that it was the wettest October on record for many parts of northeast New Mexico, including areas within the HPCC burn scar and portions of southeast Lincoln County. A large area of Chaves County, extending from Elk northeastward to the Rio Peñasco Highway and east-northeast to Roswell, Midway, and Hagerman, also experienced this all-time October record rainfall.

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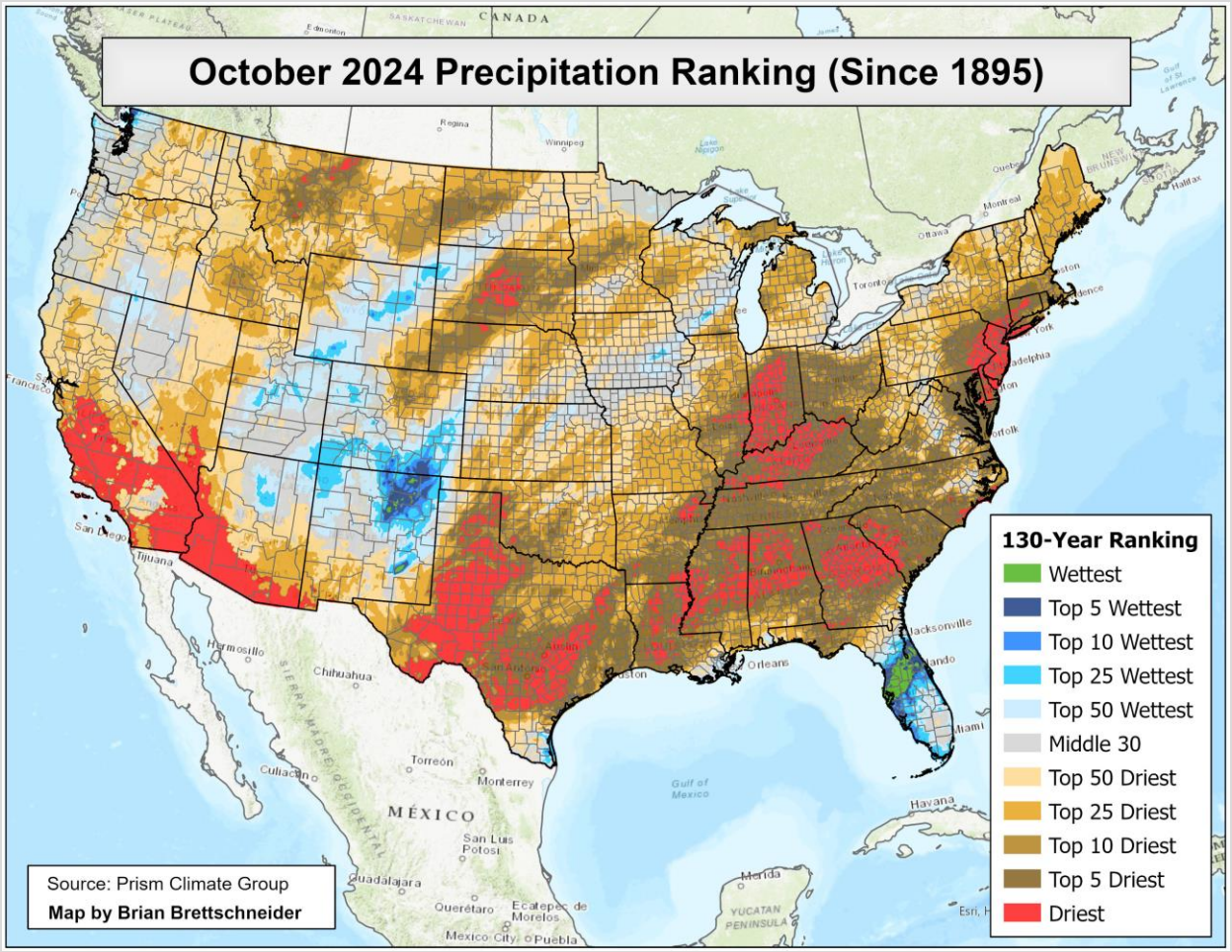

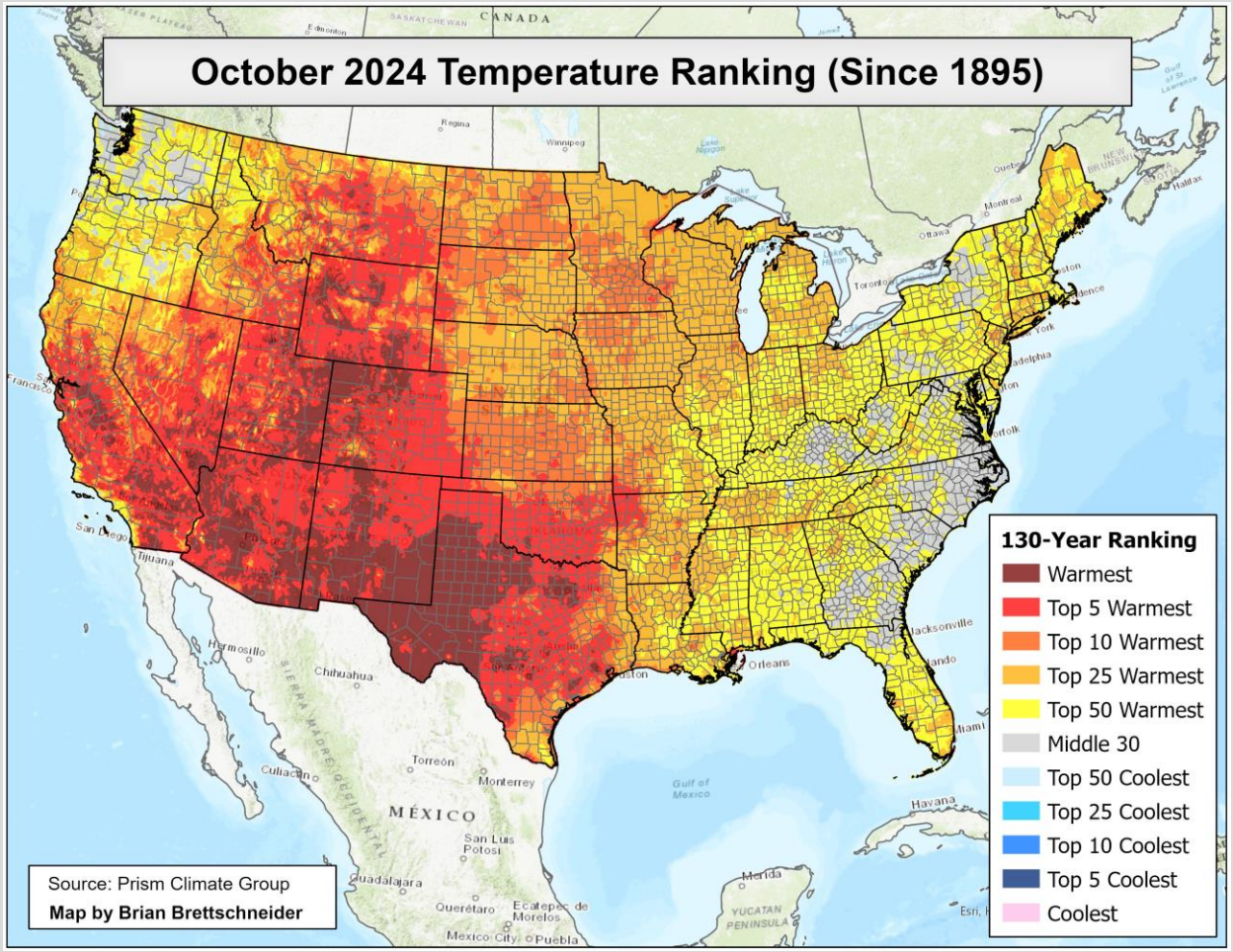

800 meter (m) (each model square is a 0.5 mile box which is considered very high for a climate like model) resolution precipitation and temperature data from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) group. In plain language, the PRISM Climate Group scientists at Oregon State University (OSU) "gather climate observations from a wide range of monitoring networks, applies sophisticated quality control measures, and develops spatial climate datasets to reveal **short- and long-term climate patterns**. The resulting datasets incorporate a variety of modeling techniques and are available at multiple spatial/temporal resolutions, covering the period from **1895 to the present**. Whenever possible, we offer these datasets to the public, either free of charge or for a fee (depending on dataset size/complexity and funding available for the activity)."

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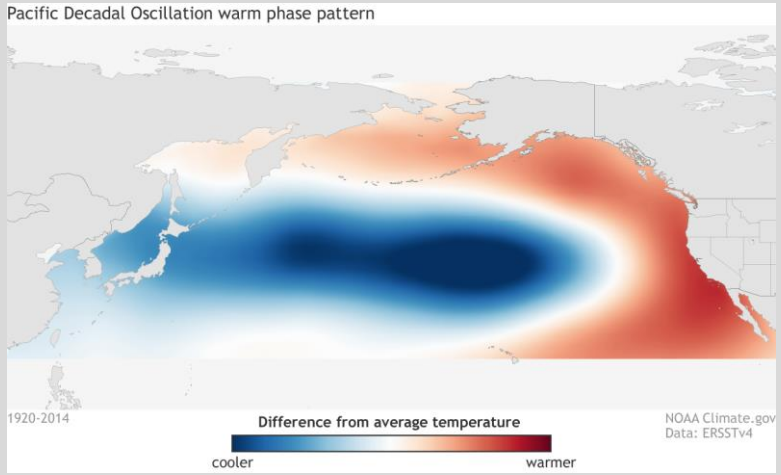

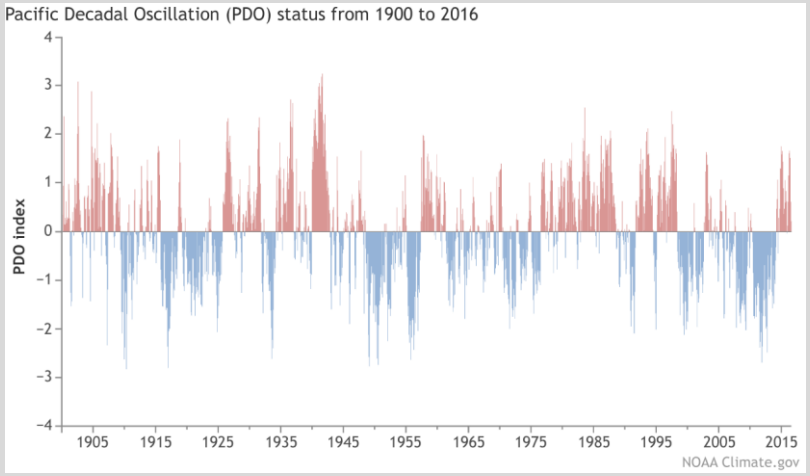

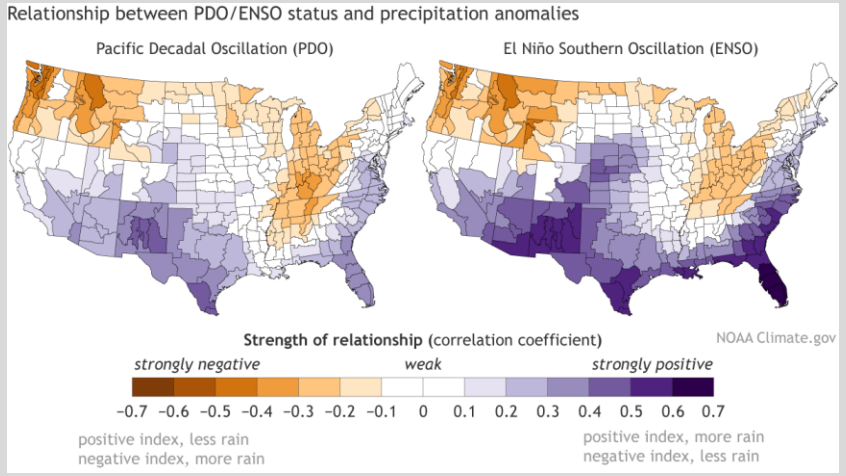

What is heck is the Pacific Decadal Oscillation (PDO)? – Tom Di Liberto at CPC/NOAA/Climate.gov sums it up perfectly using a Neapolitan ice cream analogy. "The first—our chocolate—involves the strength of a semi-permanent area of low atmospheric pressure off the Aleutian Islands, creatively called the Aleutian A major reason the PDO and ENSO impacts look similar is because ENSO is one of the three major flavors that make up the PDO Neapolitan itself! The vanilla in the PDO's climate Neapolitan is the ocean itself. SST anomalies that develop due to random weather or an El Niño/La Niña normally wind up reaching below the sea surface. Lastly, our final flavor—the strawberry—is the Gulf Stream of the North Pacific Ocean, the Kuroshio Current. Changes along the ocean current in terms of strength and location, which occur over decadal time periods, can also impact SSTs in the western half of the North Pacific. Put all three of those impacts on the ocean together and you get most of the PDO." Low. Rainfall over western North America, as seen in the images above, is better explained by ENSO than the PDO since there is a more direct physical connection." It's worth noting that climate change influences may be impacting its (PDO and ENSO) effects (Trenberth 2022) and possibly muting some of the impacts.

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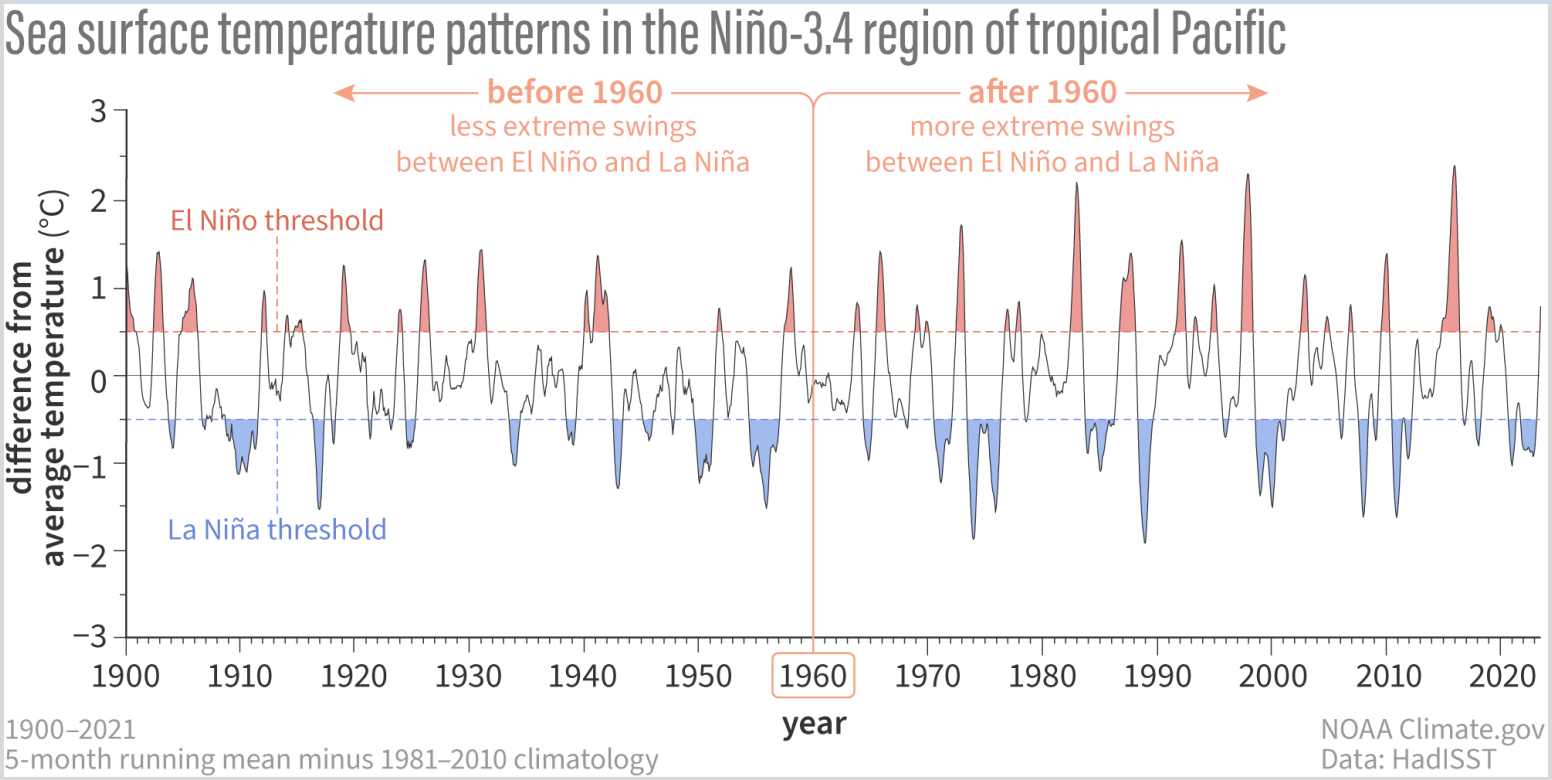
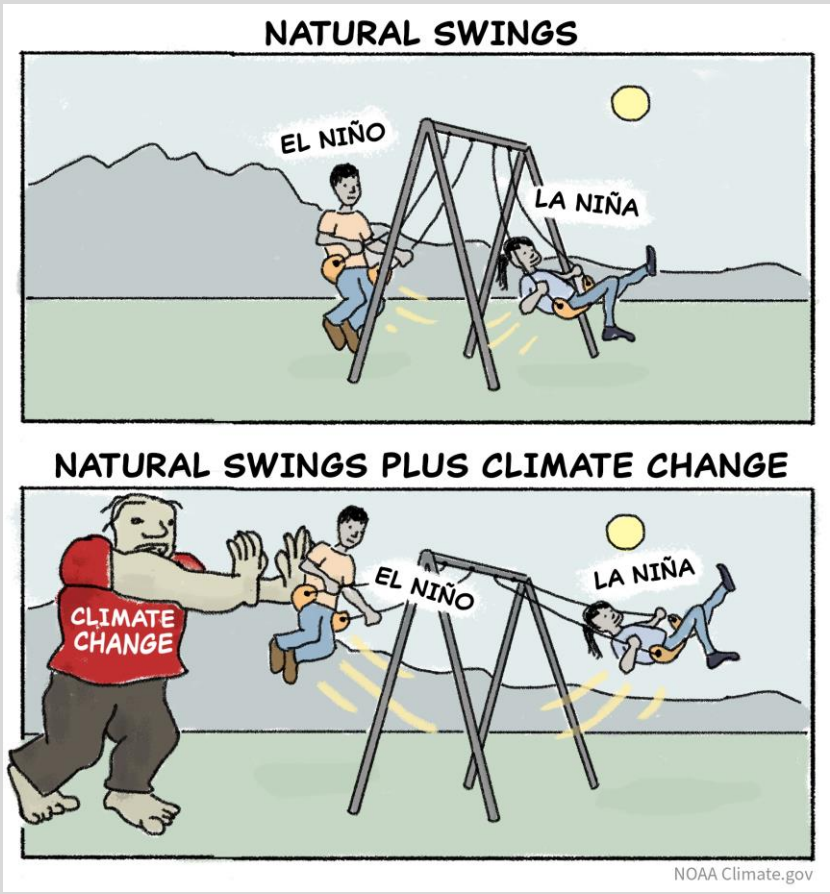


Sea surface temperature in the Niño-3.4 region of the tropical Pacific from 1900 to 2023. Monthly data have been smoothed with a 5-month running mean after removing a seasonal climatology for 1981-2010. Red peaks are El Niño events and blue troughs La Niña events. The approximate mid-point of the time series is indicated by the vertical black line in 1960. The white area between ±0.5°C signifies neutral conditions. Data is from HadISST, which uses satellites and other in situ observational data.



What about the role of climate change on ENSO and related atmospheric teleconnections like Rosby waves and the all important Pacific North American Pattern (PNA)? The graphics above are perhaps the best way to illustrate climate change's influence on ENSO. "One manifestation of this amplified cycle is that strong El Niño and La Niña events are becoming stronger and more frequent, just as we've observed in the more recent historical record. The big events pack the most punch, so even though 10% doesn't sound like much, it juices up the strongest and most societally relevant year-to-year climate fluctuation on the planet. Combined with the other ways global warming has affected ENSO impacts, this amplified cycle translates into more **extreme** and **frequent** ENSO-linked droughts, floods, heat waves, wildfires and severe storms (globally) like we observed during the recent triple dip La Niña that ended last March and the major 2015-16 El Niño a few years ago." Michael Mcphaden – NOAA PMEL And like the extreme rain events in NM in northwest third to half of the state in June and for the northwest and much of eastern NM in October. "A warmer atmosphere is a thirstier atmosphere" – (Trenberth 2022)

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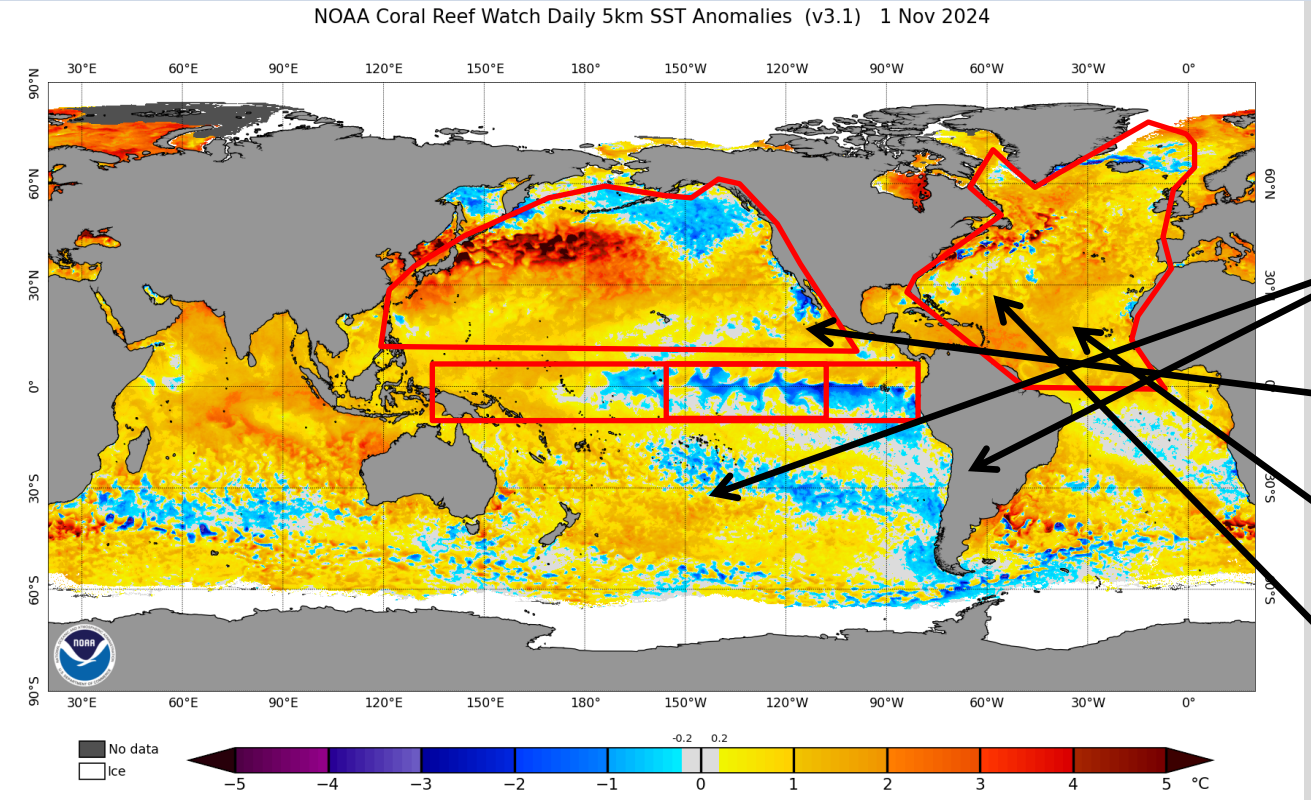

- Multivariate ENSO Index (**MEI**) for JUL-AUG 2024: **-0.7**
- Oceanic Niño Index (**ONI**) (uses Niño 3.4 region - inner rectangle) for JAS 2024: **-0.1C** (**+0.5C** = El Niño, La Niña = **-0.5C**)
- Pacific Decadal Oscillation (**PDO**) for AUG 2024: **-2.62 (trended rapidly cooler/negative in September)**
- Atlantic Multidecadal Oscillation (**AMO**) for SEP 2024: **+1.23**
- North Atlantic Oscillation (**NAO**) SEP, OCT 2024 **+0.63, -1.43C**

Latest weekly global SST anomalies showing an area of cooler than is typical temperatures in the eastern equatorial Pacific nearing La Niña territory (-0.5°C or cooler than average in Niño 3.4 region for 3 month period). Also note the large expanses of well above average SSTs in the North Pacific and North Atlantic and the cooler than average SSTs along the West Coast which is the result of a negative or cool phase of the Pacific Decadal Oscillation (PDO). A negative or cool North Atlantic Oscillation (NAO), which can mimic/align with ENSO/El Niño/La Niña, underway in the Atlantic Ocean Basin. The negative phase reflects an opposite pattern of height and pressure anomalies over these regions. Both phases of the NAO are associated with basin-wide changes in the intensity and location of the North Atlantic jet stream and storm track, and in large-scale modulations of the normal patterns of zonal and meridional heat and moisture transport (Hurrell 1995), which in turn results in changes in temperature and precipitation patterns often extending from eastern North America to western and central Europe (Walker and Bliss 1932, van Loon and Rogers 1978, Rogers and van Loon 1979). Since there is no unique way to define the spatial structure of the NAO, it follows that there is no universally accepted index to describe the temporal evolution of the phenomenon. Most modern NAO indices are derived either from the simple difference in surface pressure anomalies between various northern and southern locations, or from the PC time series of the leading (usually regional) EOF of sea level pressure (SLP). Many examples of the former exist, usually based on instrumental records from individual stations near the NAO centers of action, but sometimes from gridded SLP analyses. A major advantage of most of these indices is their extension back to the mid-19th century or earlier. (Hurrell & Phillips 2023)

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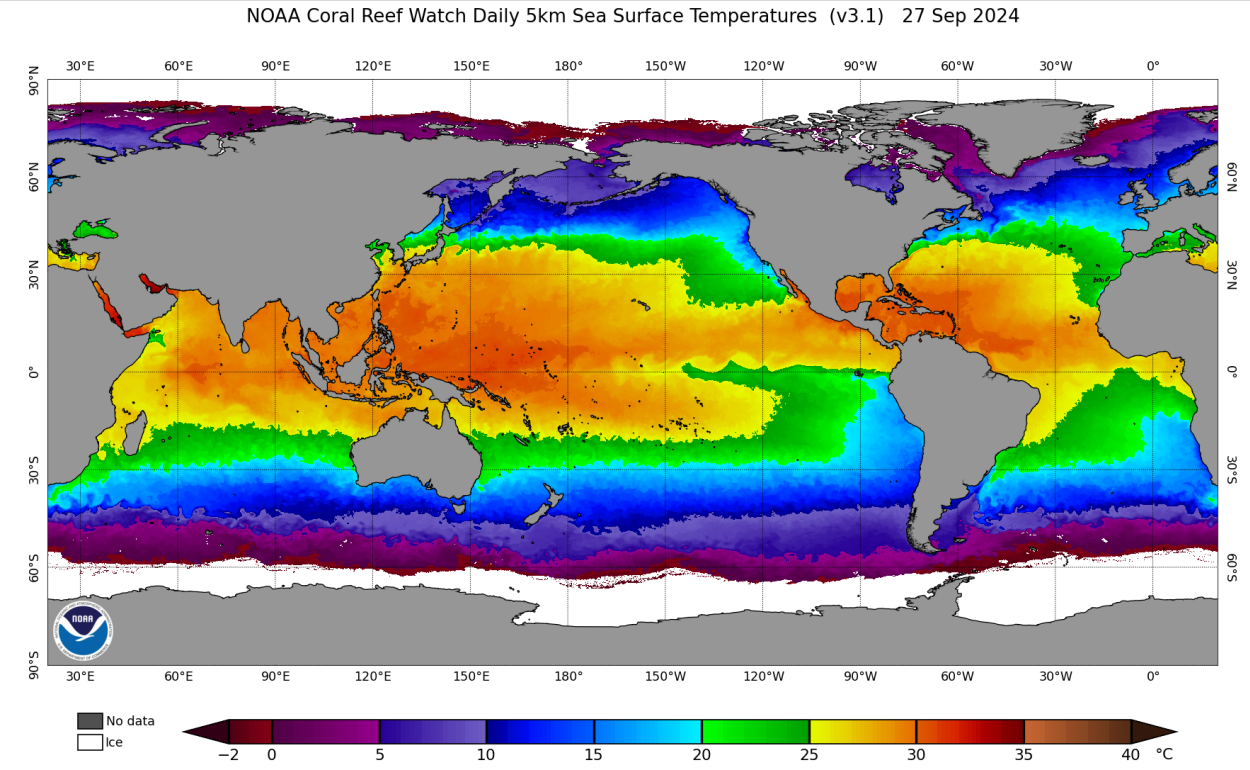

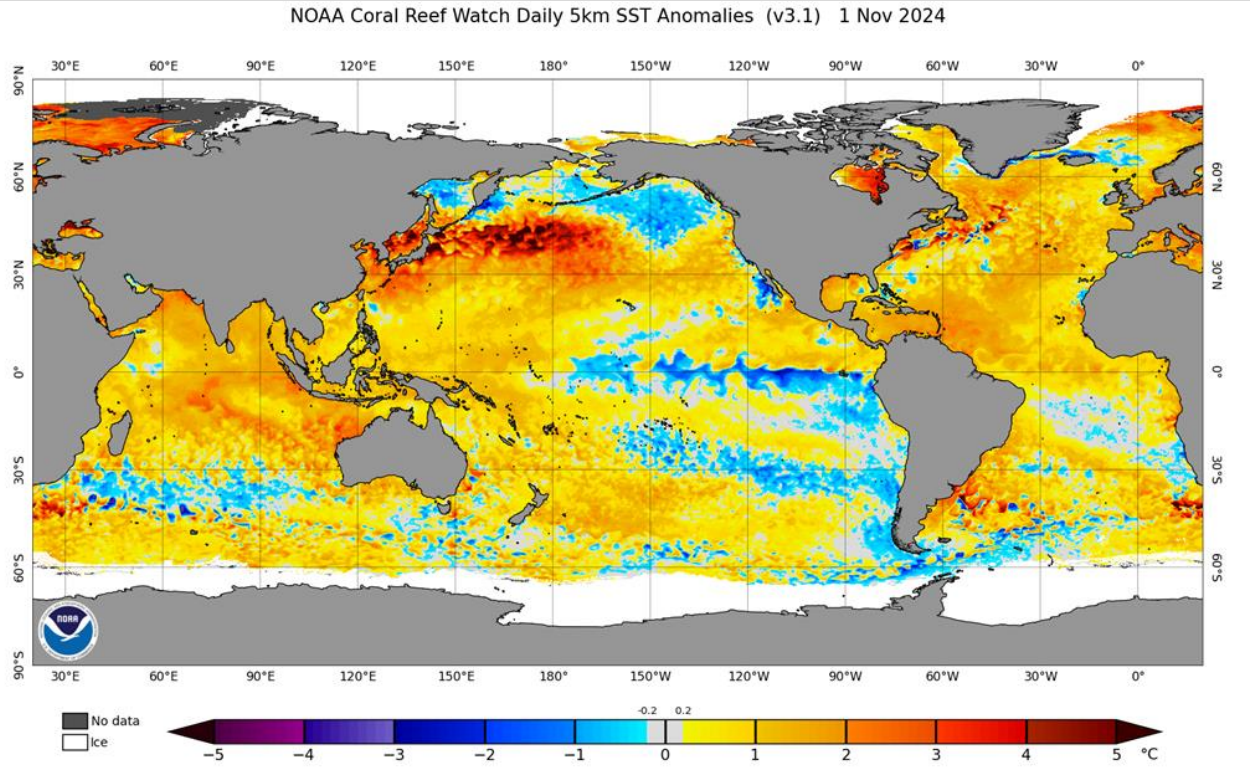

Sea surface temperatures (SSTs) on the left with difference from average SSTs on right. A La Niña transition is evident along with other areas of expansive well above average SSTs in the northern hemisphere. The "bath water" as it's often called in the northwest Pacific Ocean can be a moisture source for cool season Atmospheric Rivers (AR).

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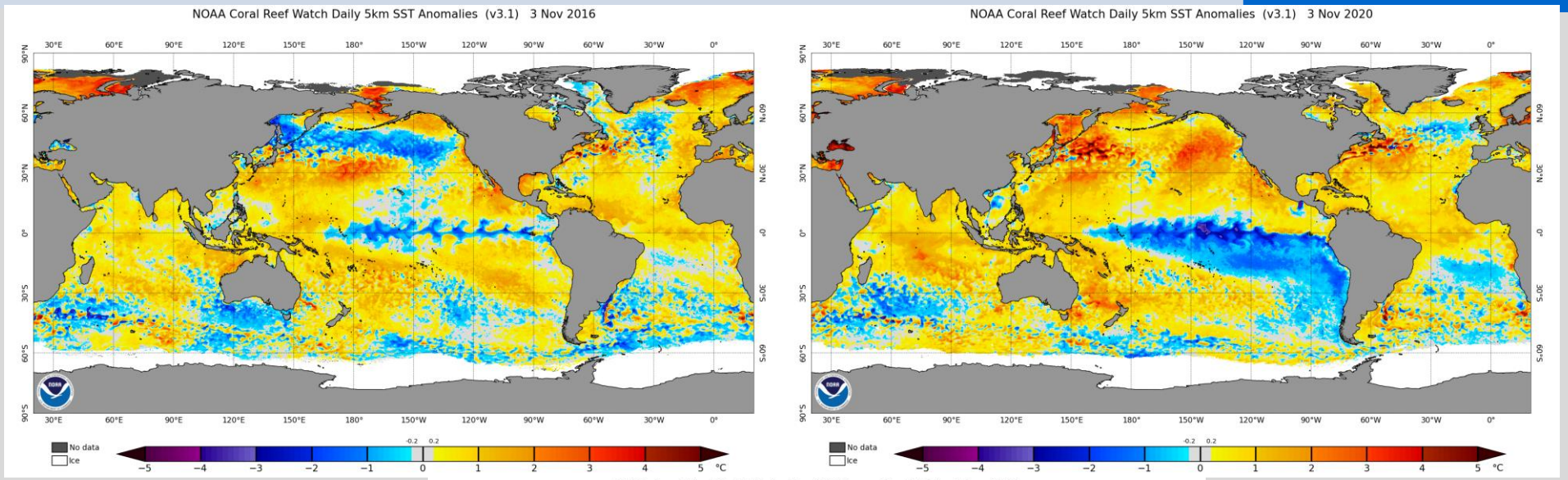

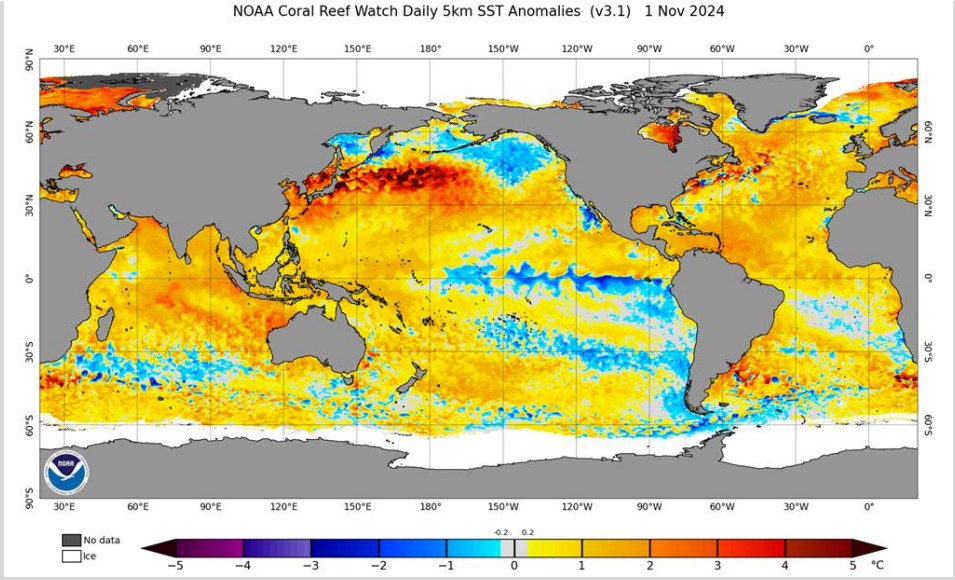

Comparing this year's cooling toward La Niña to recent events. SST gradients or difference from average are closer to 2020. In November 2016, the PDO was positive (1.24C).

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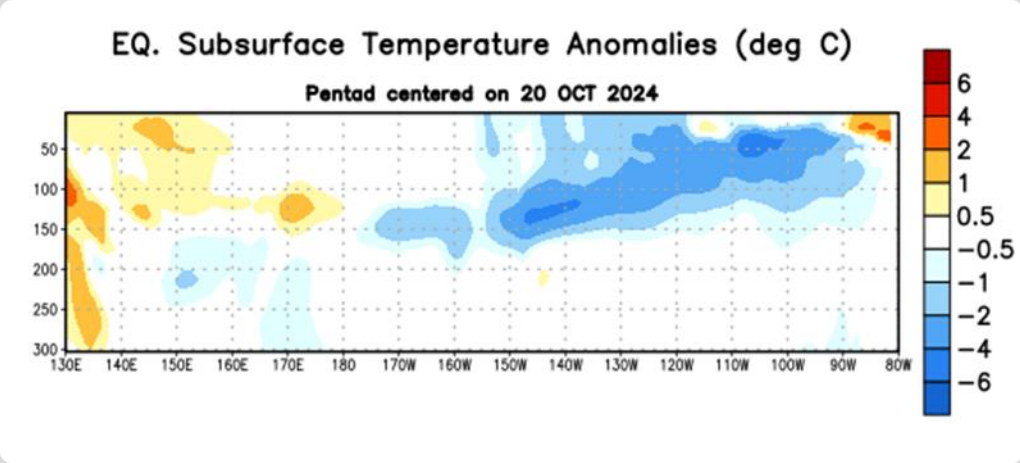

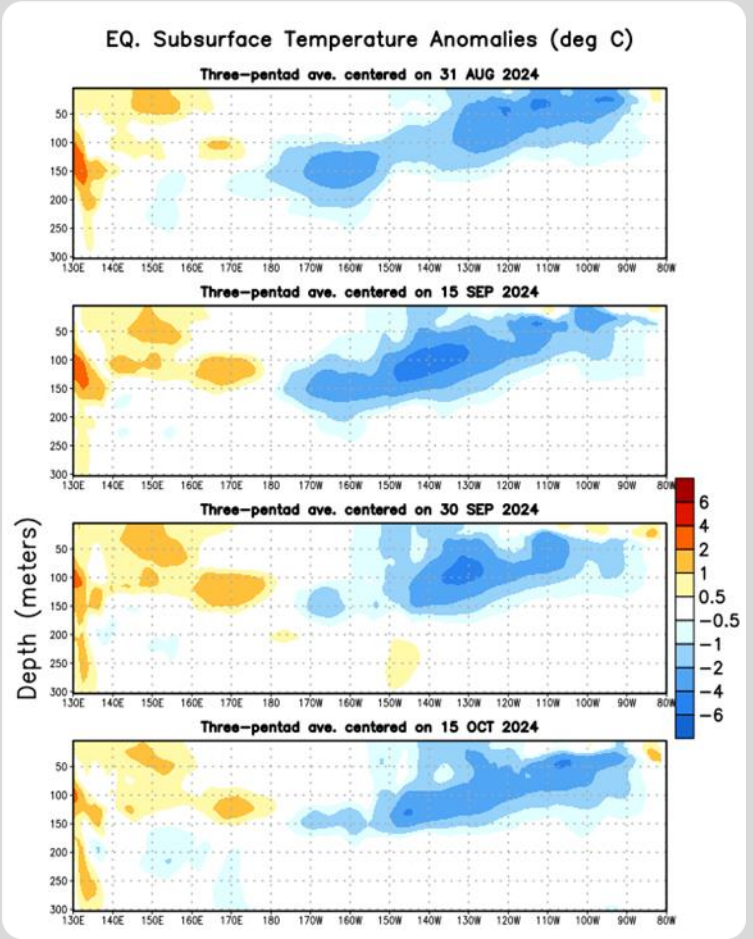

Below-average temperatures remain at depth in the central and eastern Pacific Ocean, while above-average temperatures continue in the western Pacific.

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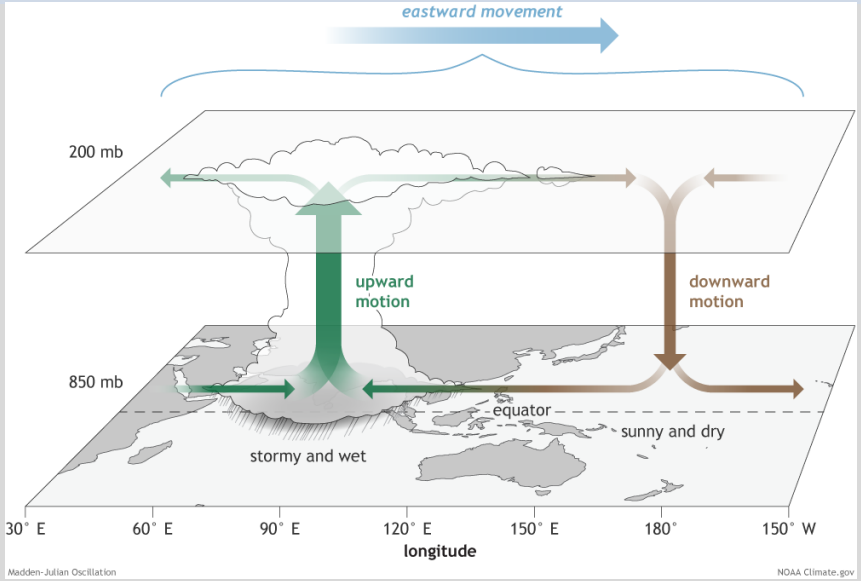

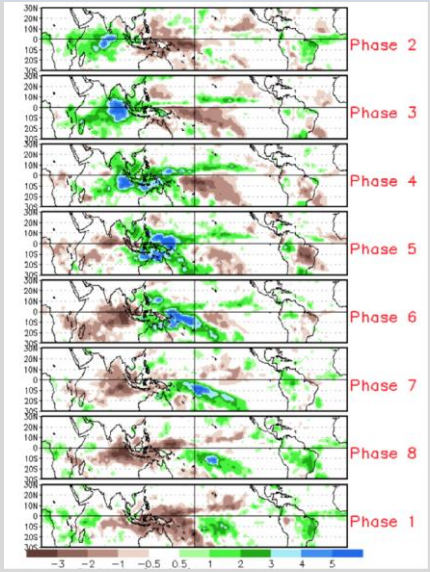

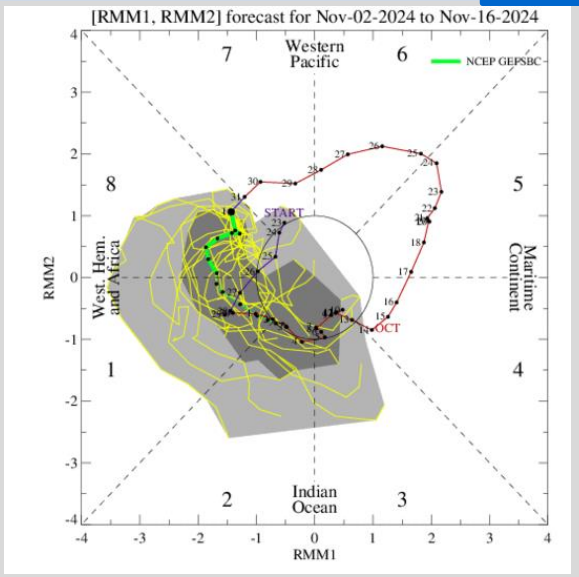

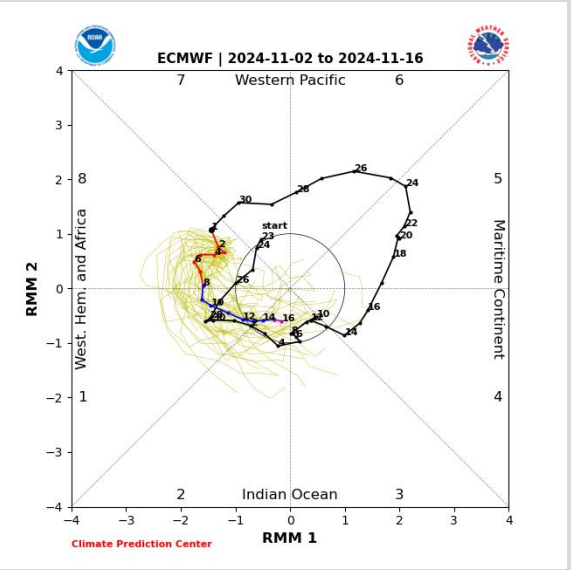

The Madden-Julian Oscillation (MJO) is an area of enhanced thunderstorms that travels around the world every 30 to 60 days from west to east along/near the equator. Ahead and behind the active stormy area are areas of suppressed convection and drier conditions. The MJO affects near-surface wind patterns, because the rising air in the stormy region cause surface winds to blow toward the active area. During a developing La Niña, the trade winds are stronger than average, helping to bring cooler waters up to the surface. The MJO is finally back and is expected to play a role in helping to draw storm systems farther south over/near NM as it enters phases 7, 8, and 1 from late October through early winter. Why? Thunderstorms associated with the ascending side of this atmospheric oscillation result in a stronger than is typical temperature/pressure difference between the tropics and the poles. The ideal gas law (PV = nRT) where P is pressure, V = volume, n = amount of substance, R = gas constant, and T = temperature, teaches us that if the temperature goes up or down, so must pressure and a stronger Asian-Pacific (AP) jet stream is enhanced. How? At the same level in the tropics, temperatures/pressures are much higher as water changes phase from a gas to a liquid. This phase change releases latent heat. Poles are much colder with lower pressure at the same height above ground level compared to the tropics. The AP jet becomes enhanced when there are more thunderstorms in the tropics as a result. What do the cool waters of La Niña do to this process? Lead to fewer tropical thunderstorms than are typical in the eastern equatorial Pacific. So how does that enhance the AP jet stream over North America in winter? When the AP jet encounters the lack of thunderstorms or a strong temperature/pressure change as it races eastward, it's forced to split to get back into (geostrophic) balance. A ridge of high pressure over the northeast Pacific is born. Upper level troughs in the northwest flow aloft on the downstream side of this ridge is what typically gives the PACNW above average precipitation during La Niña and a cold northwest flow aloft to much of the western U.S. mainly north of the 37th parallel or CO/NM border. What is it that climate change or a warming of these ocean waters doing to La Niña? A warmer planet is a thirstier planet and deep tropical convection as a whole is more prevalent globally as a result of the additional precipitable water or PWAT. Warmer waters also allow for more rapid intensification of organized convective systems as we've seen recently with Hurricane Alberto and Hurricane Helene. These rapid changes have been observed in the Central and West Pacific (WPAC), including influencing the MJO. These changes also make for a more volatile AP jet and since the earth still gets dark north and south of 66° latitude during winter, large swings in weather take place over much of the country, but especially for the Northern and Great Plains including the Upper Midwest. Stronger than average northwest flow aloft is notorious for bringing upper level troughs in faster than weather prediction models forecast. In NM, this pattern is likely to bring about an abrupt change in weather toward la November along with making modified cold air outbreaks in the form of backdoor cold fronts more frequent than is typical.

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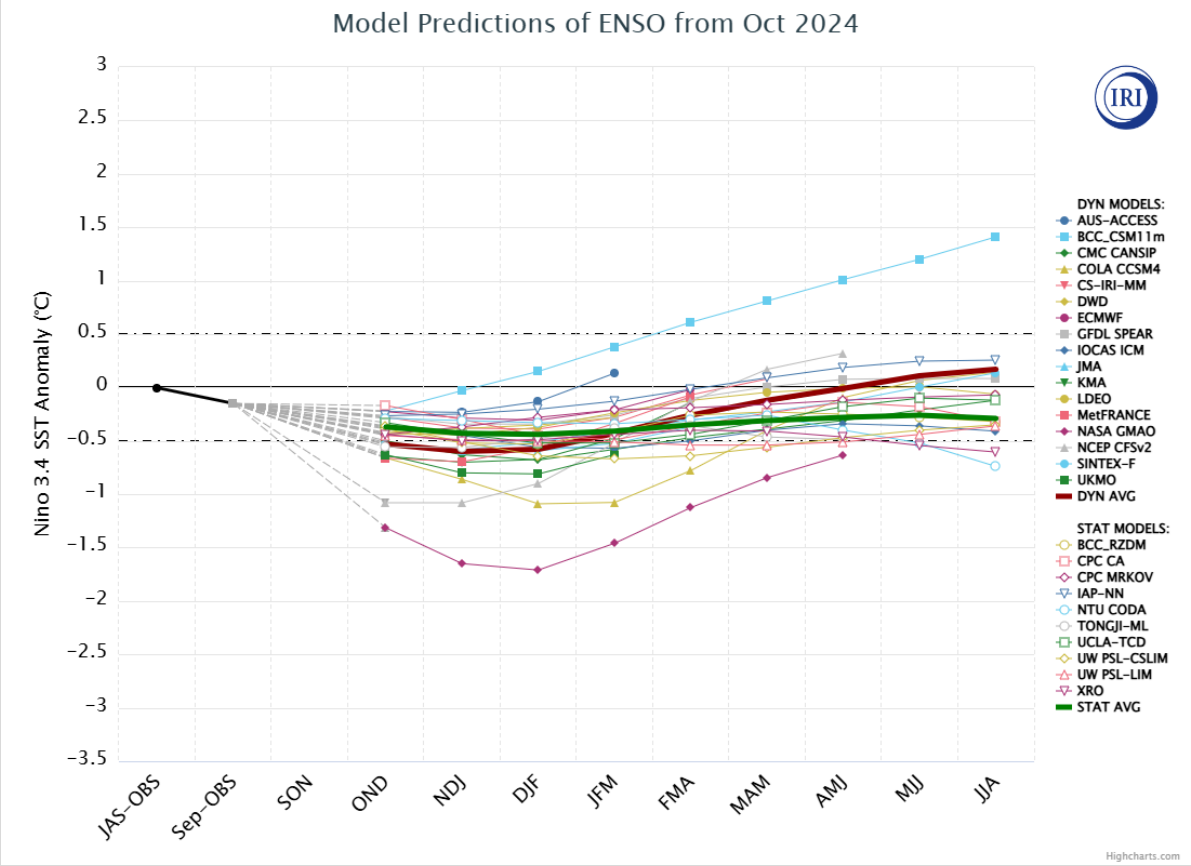

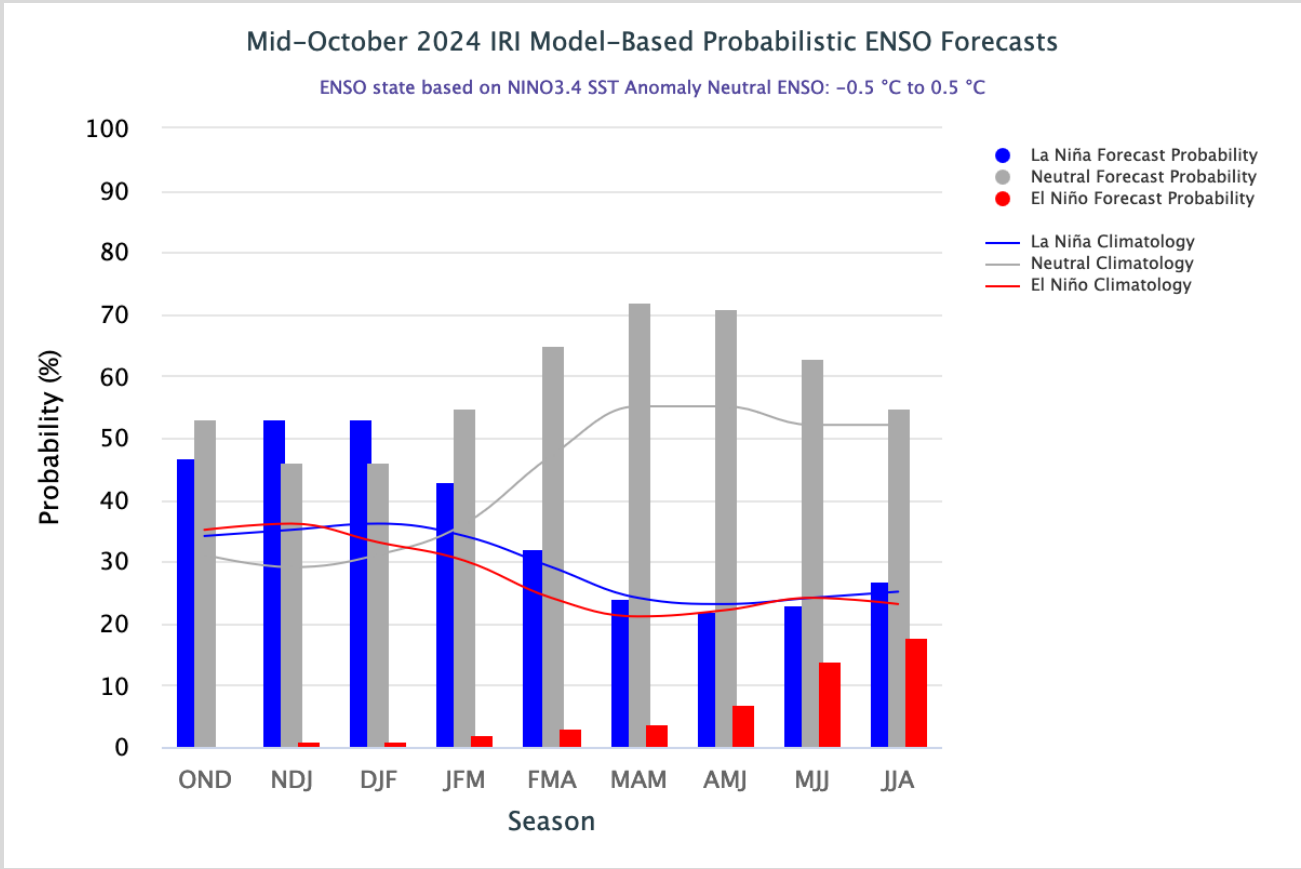

Model prediction of ENSO from September 2024. Dynamical model average for November and December is near -0.5°C, which would result in a weak La Niña climate pattern. October models have trended warmer, resulting in greater odds for a weak La Niña to develop in November. Both forecast clusters would result in a weak but influential La Niña event in November and during winter 2024-25.

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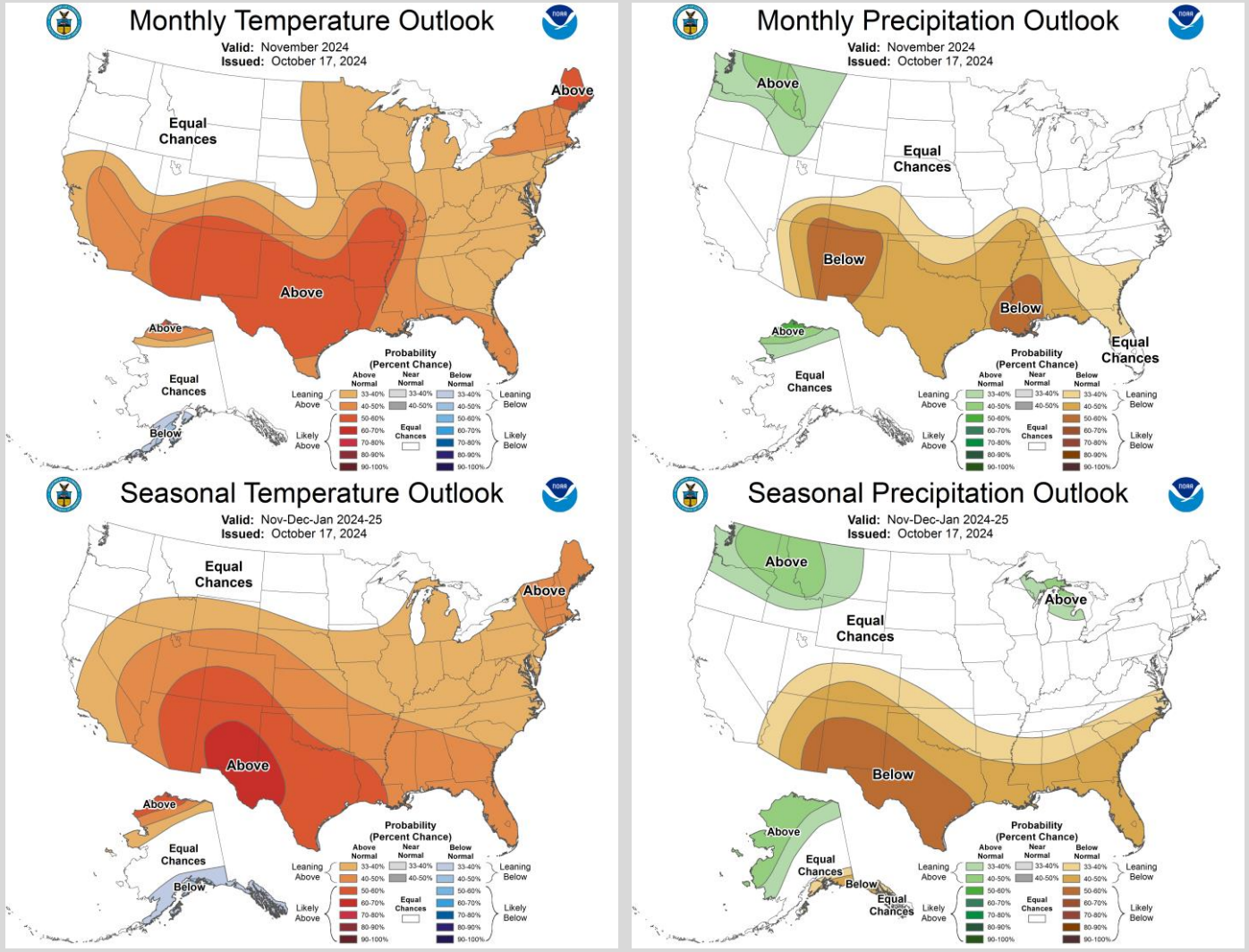

NWS's Climate Prediction Center's (CPC) Official 2024 Climate Outlook for November (top) and November, December and January showing probabilities favoring below to well below average precipitation and above to well average temperatures.

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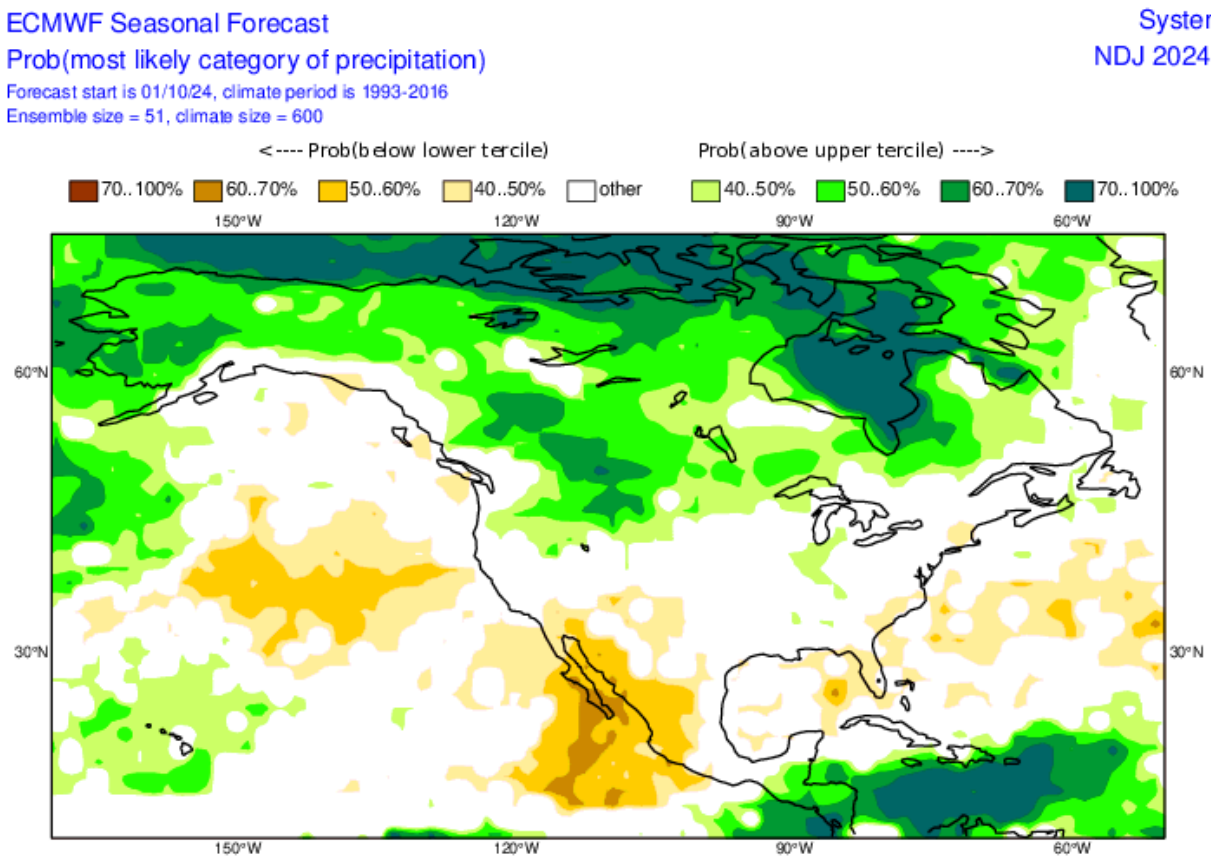

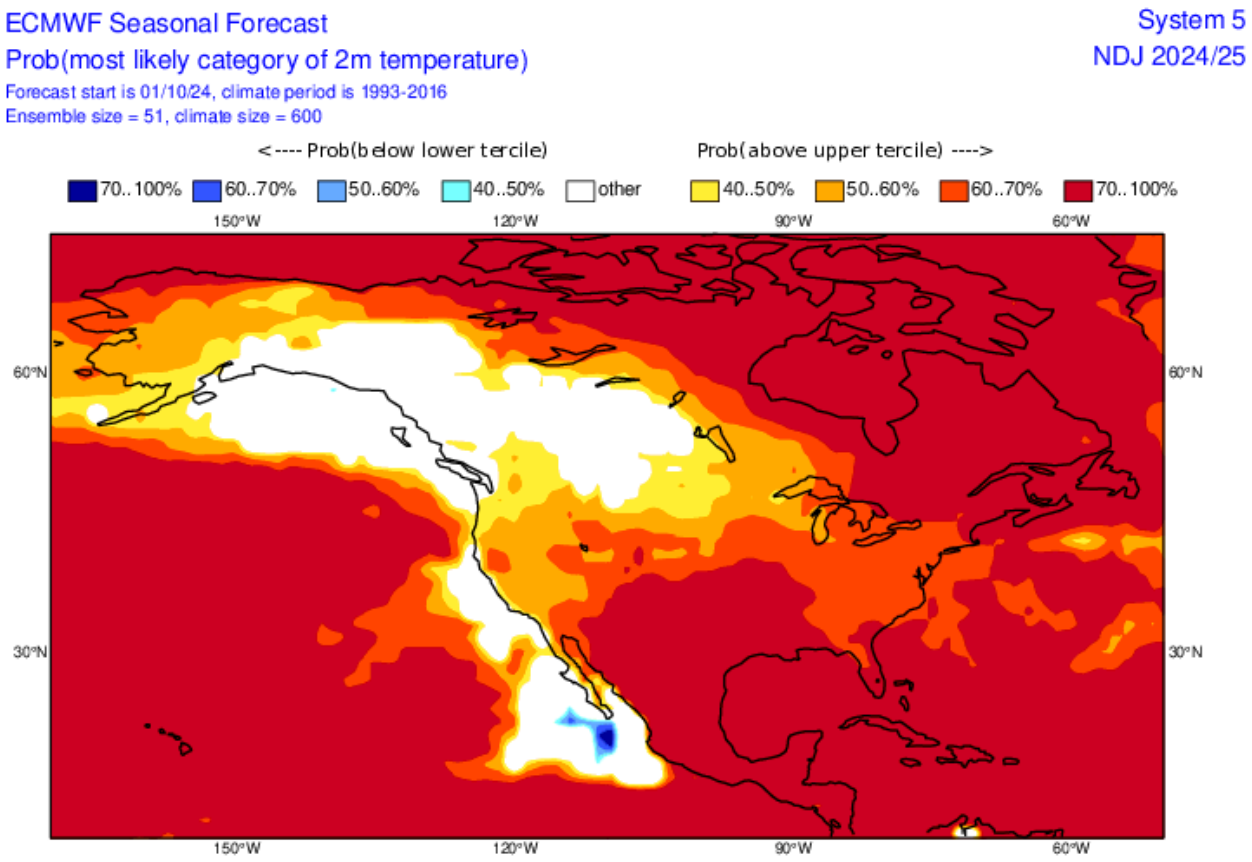

Seasonal precipitation and temperature difference from average forecast from the European Center for Medium Range Weather Forecasts (ECMWF) seasonal model forecasting near to slightly below average precipitation in NDJ and above average temperatures.

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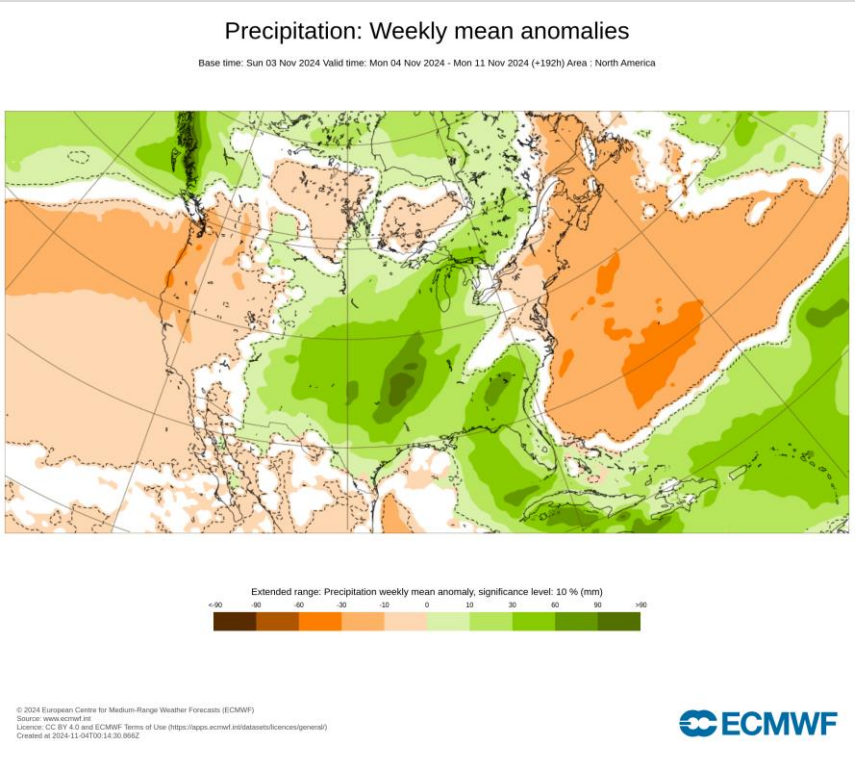

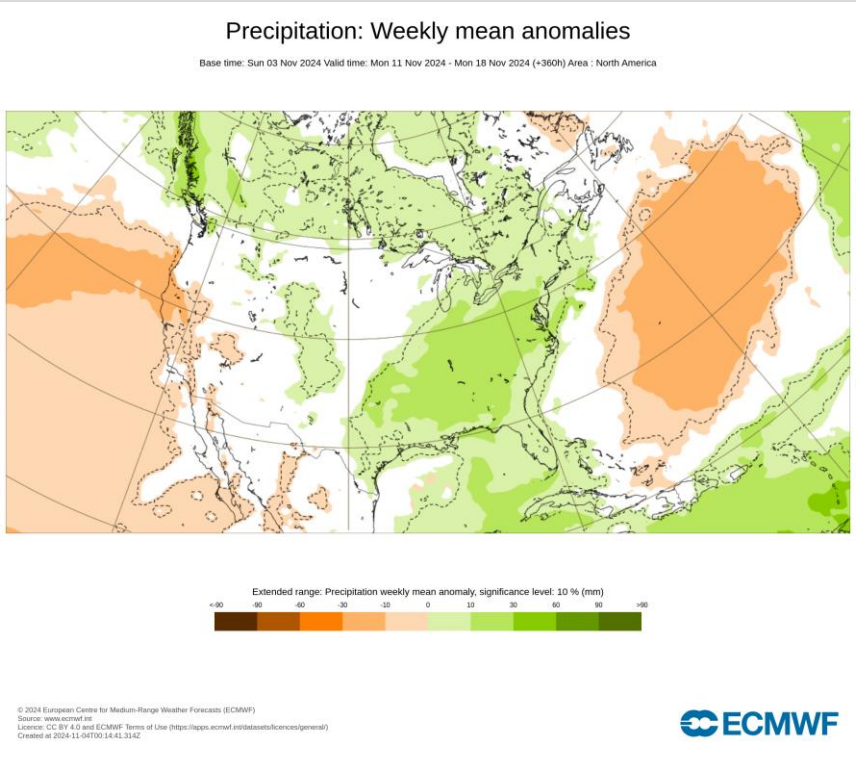

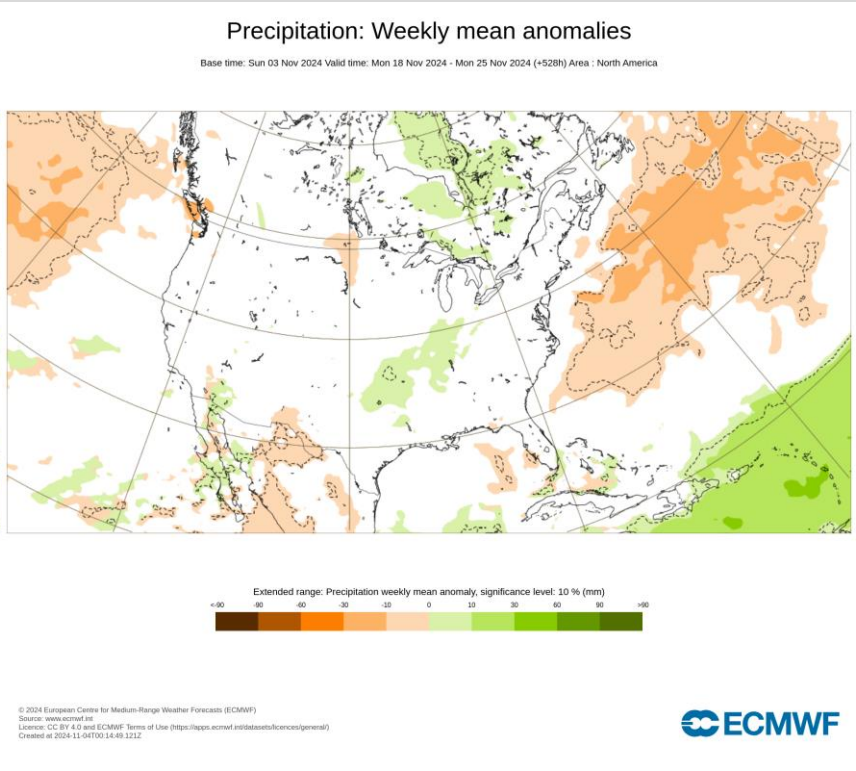

Weekly difference from average precipitation forecasts from the ECMWF (ENS) model. Well above average precipitation, mainly in the form of snow is favored for central and northern NM during the remainder of November.

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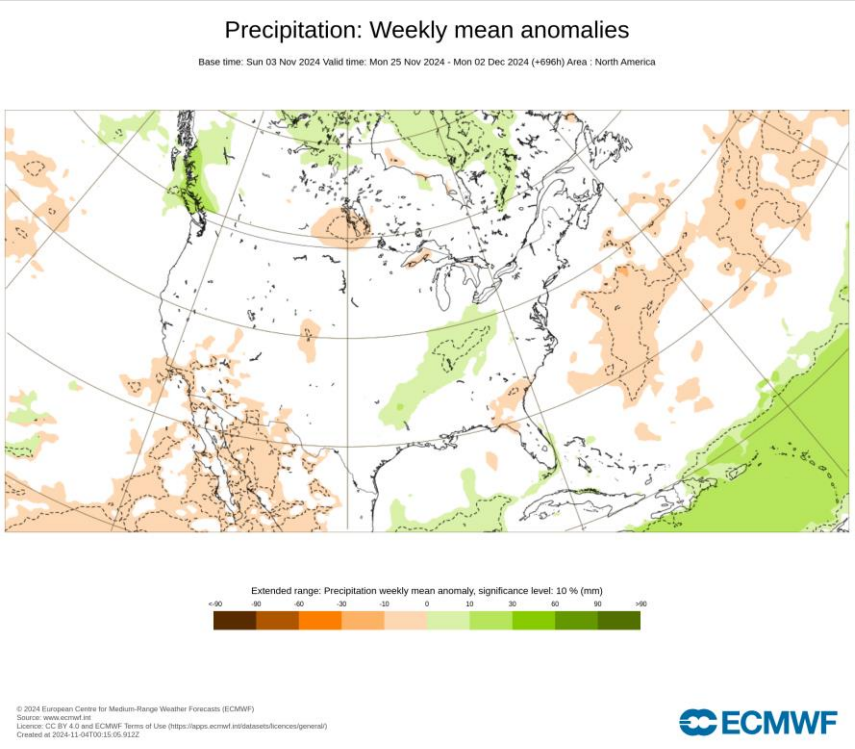

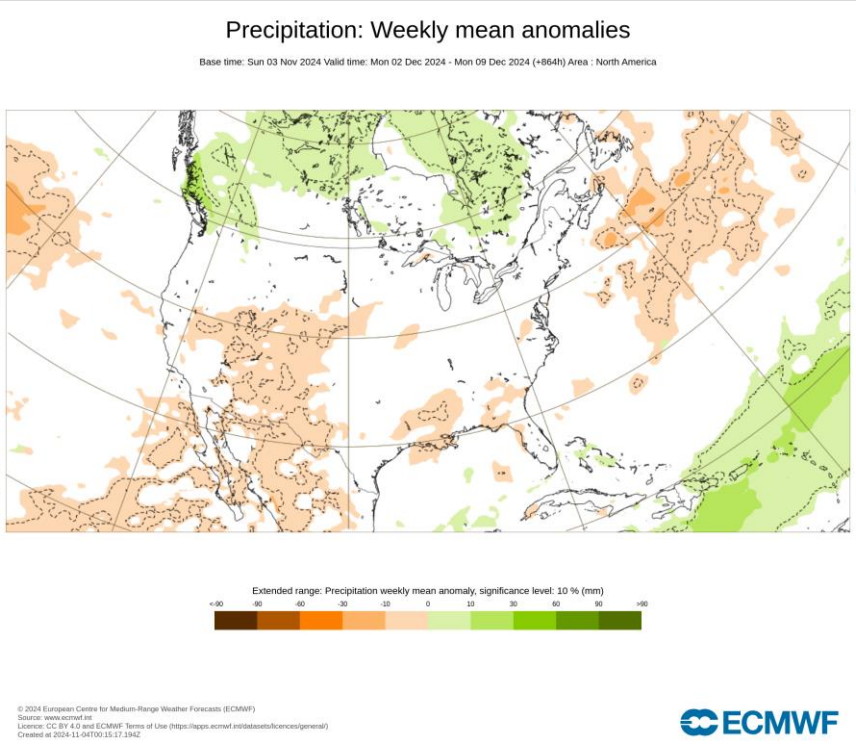

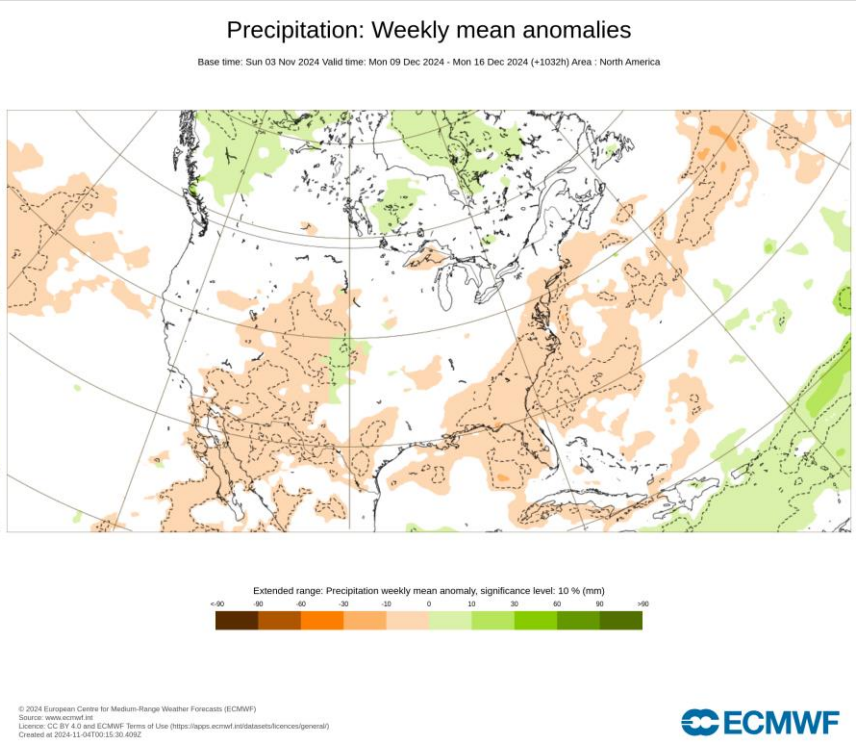

Weekly difference from average precipitation forecasts from the ECMWF for late November into early December 2024. The ensemble model is forecasting near average last week of November precipitation with slightly below average precipitation in December. That's likely to change once the model members pick up on a long-lived negative PNA pattern. Green against brown colors, interestingly, indicate convective precipitation. Perhaps a strong backdoor, upslope snow event in mid December?

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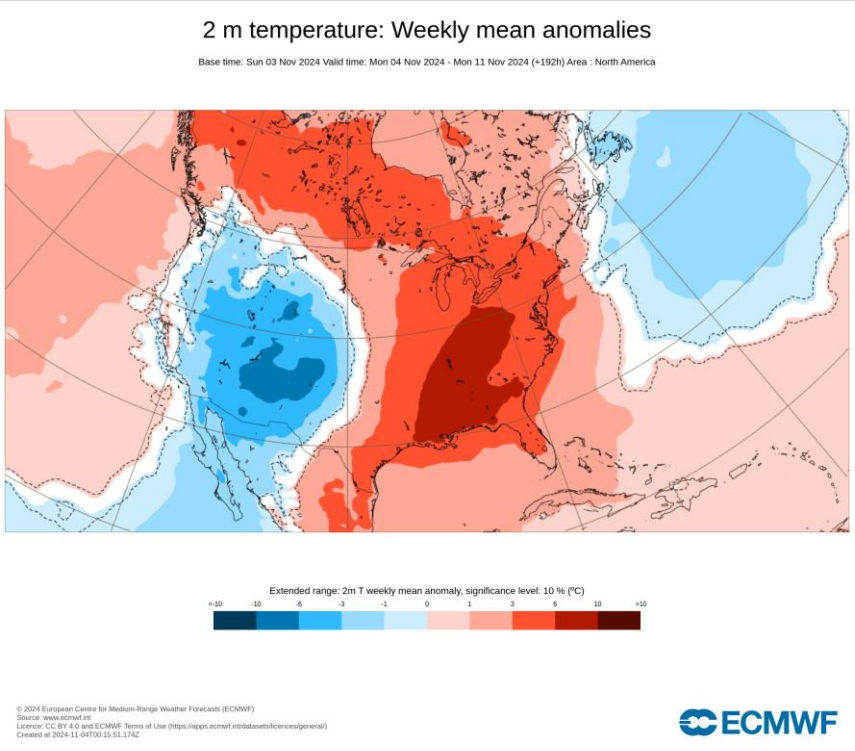

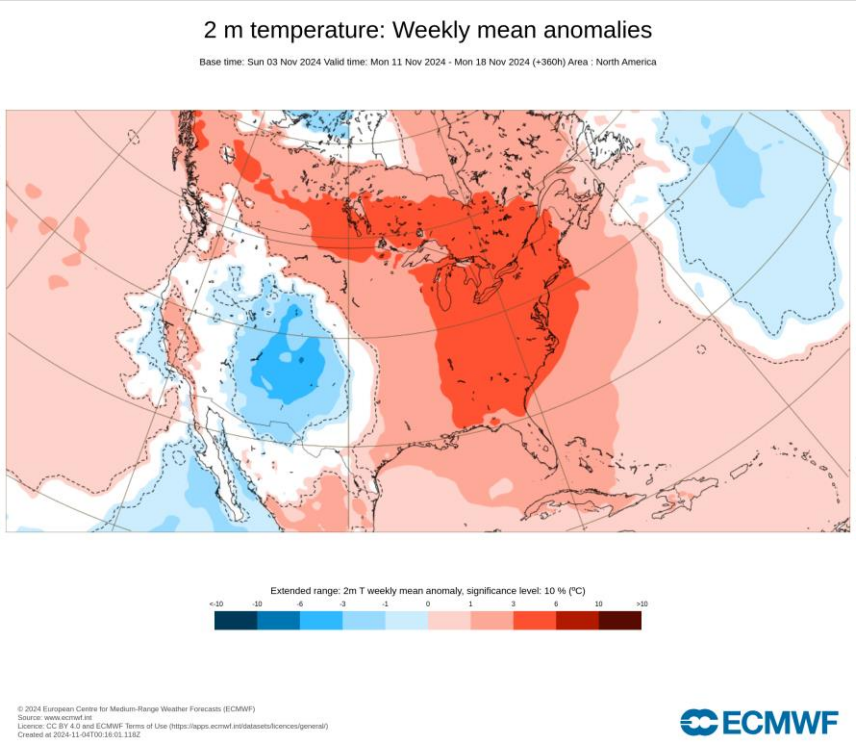

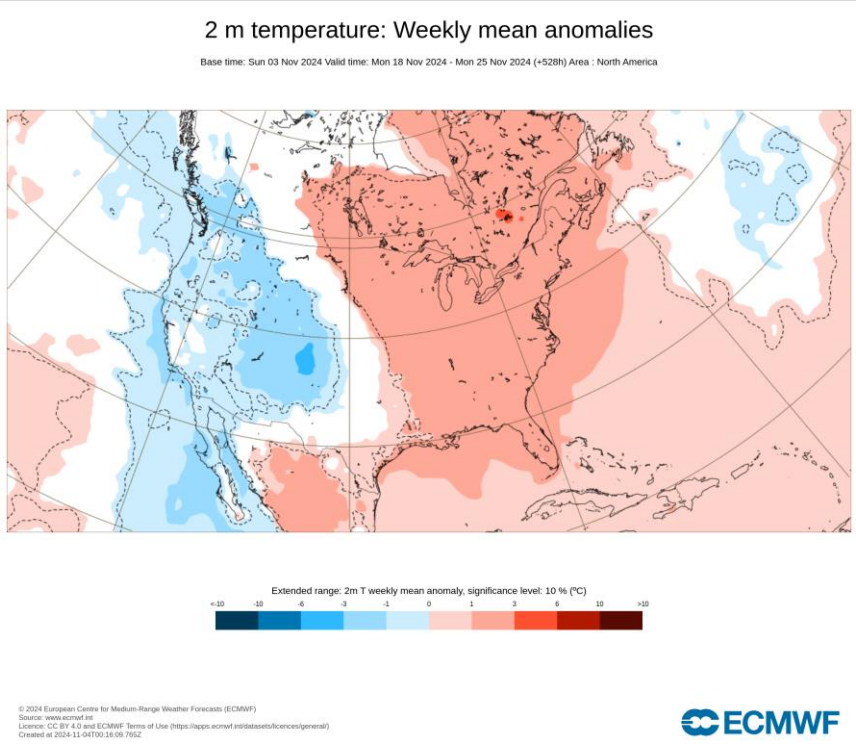

Weekly difference from average temperature forecasts from the European Center for Medium Range Weather Forecasts (ECMWF) for latter October. ECMWF's extended ensemble model keeps the Southwest U.S. warmer than average through the month.

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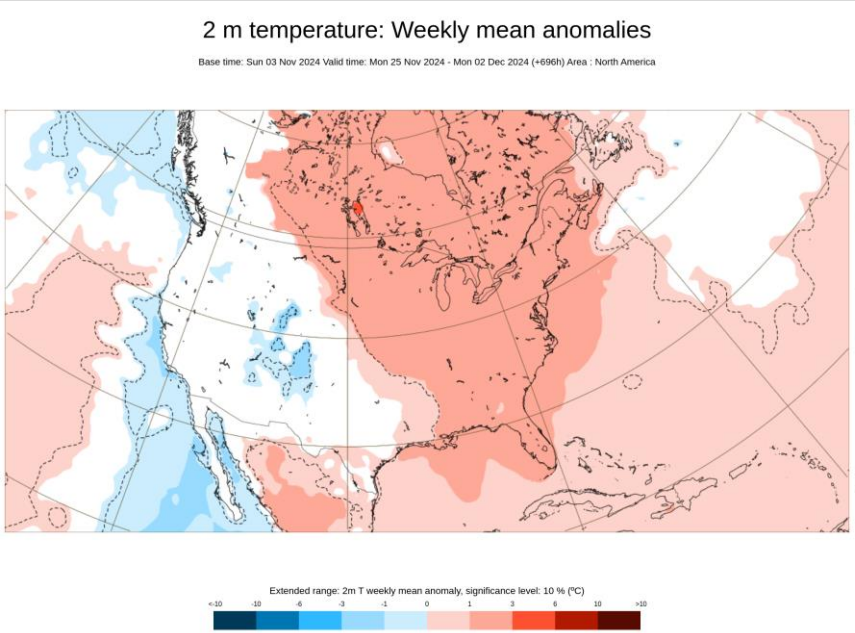

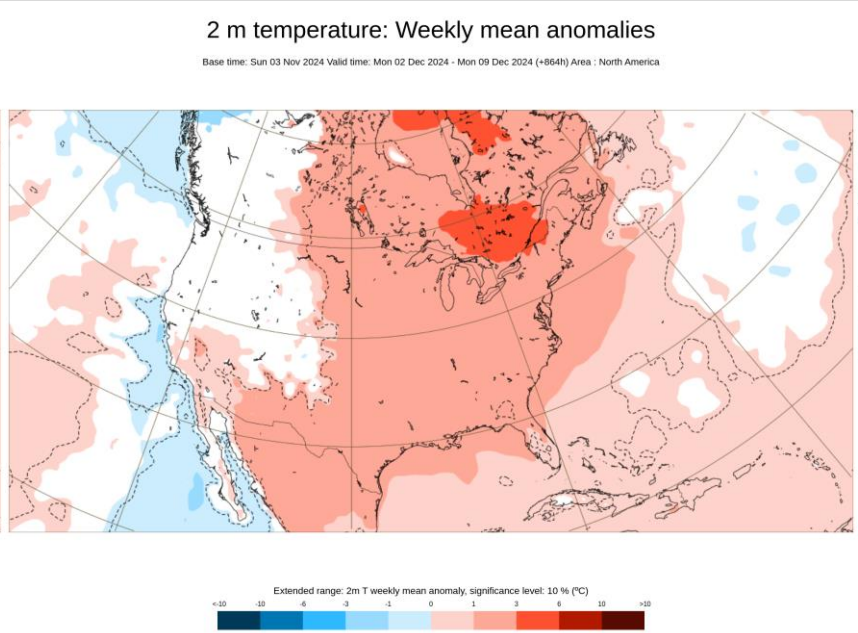

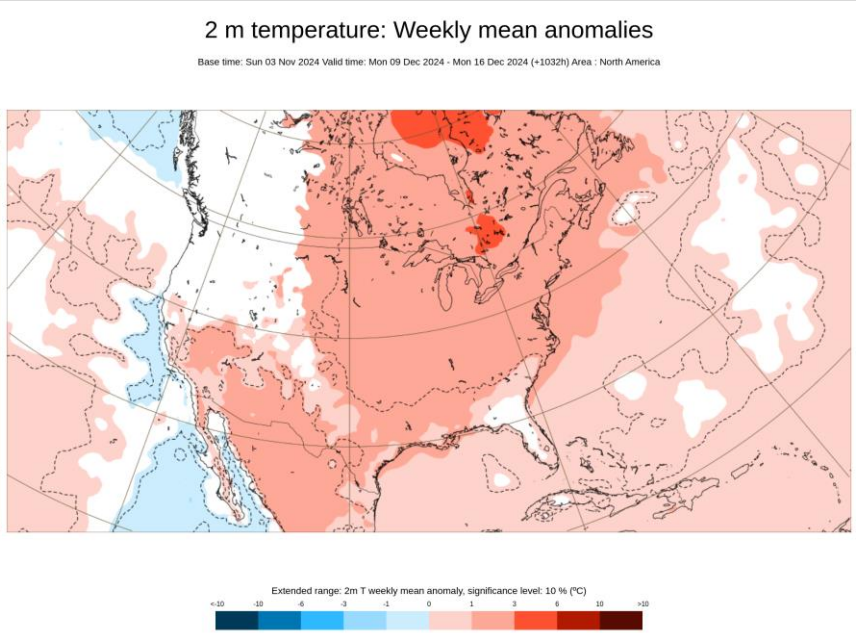

Weekly difference from average temperature forecasts from the European Center for Medium Range Weather Forecasts (ECMWF) for much of November. ECMWF's extended ensemble model keeps the Southwest U.S. colder to much colder than average through much of November and into early December.

2024 Fall Outlook

For Norteña & Central Nuevo México

Albuquerque
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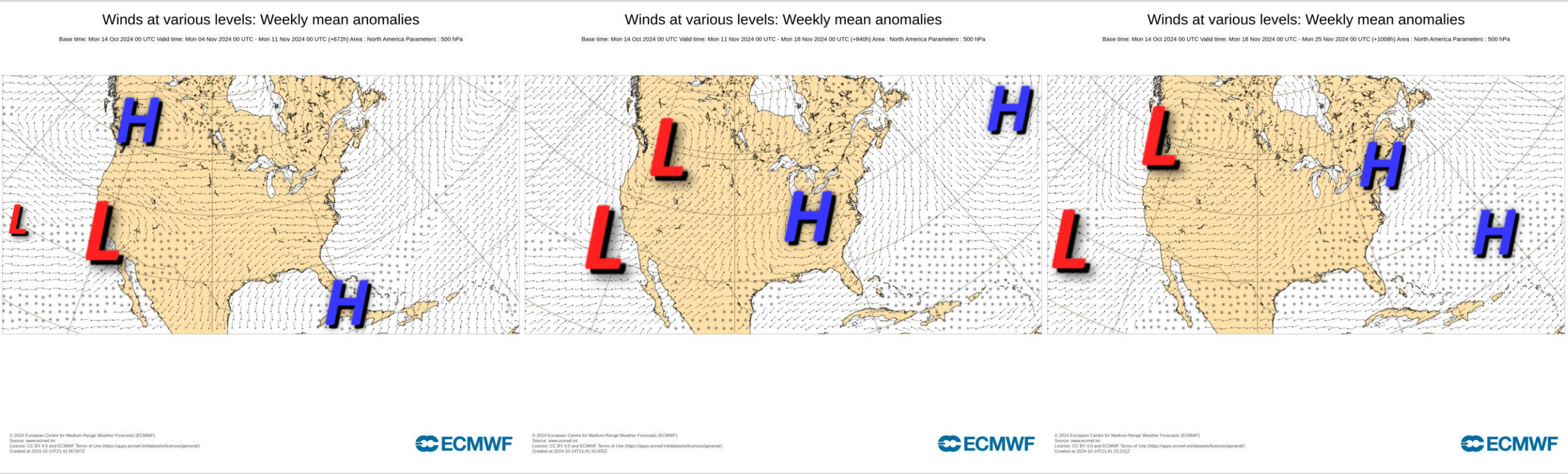

Weekly 500 hPa or ~18,000 ft MSL wind forecasts for November from the ECMWF extended ensemble model. During a weak to moderate La Niña, the monsoon high hangs on longer than average due to all of deep thunderstorms in the tropics and subtropics continuing beyond what is typical. This year, however, if this forecast pans out, this could be the latest in the historical record that the monsoon climate pattern continues into mid November.

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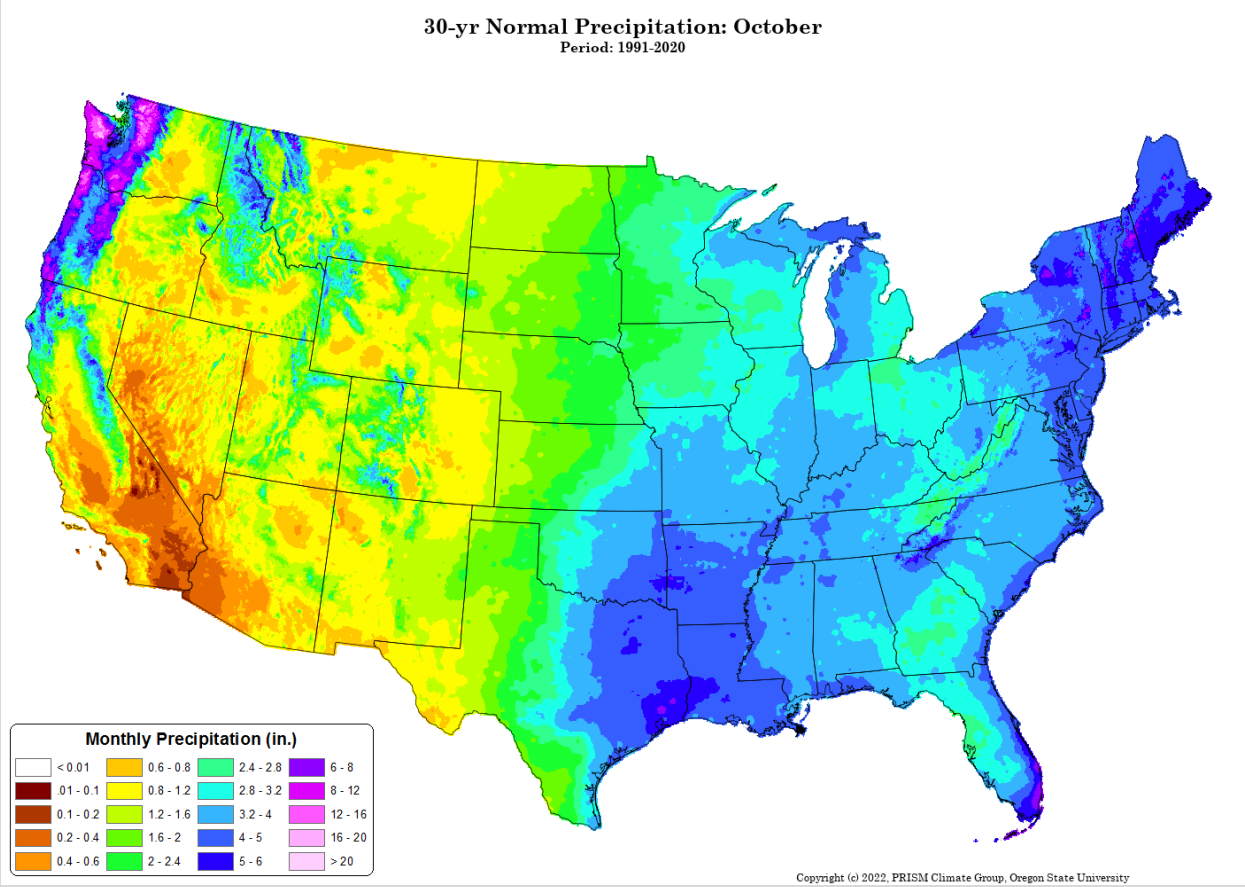

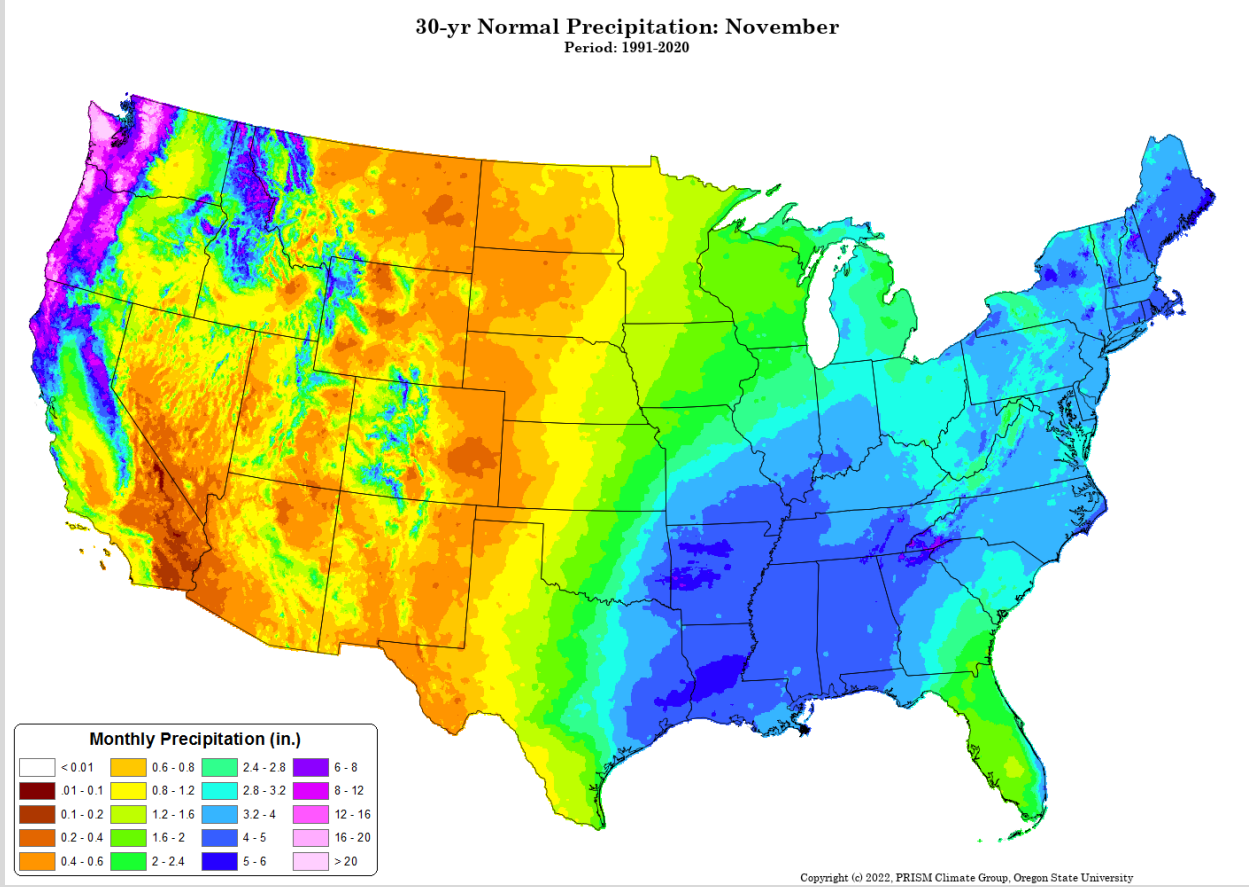

What is average or normal precipitation during fall? These charts show normal or average precipitation for each month during October and November. During the fall months, heavier precipitation gradually shifts to the mountains.

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****November 2024 Forecast:****

Confidence is very high for well above average precipitation and snowfall areawide along with below to well below average temperatures. The cool or negative phase of a well-known climate pattern, the Pacific North American (PNA), continues in the North Pacific in response to La Niña. Winter will be here this week.

2024 Fall Outlook

For Norteña & Central Nuevo México

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- Outlook provided by National Weather Service Forecast Office Albuquerque, NM.
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