

# 2022-23 Winter Outlook

For Central & Northern New Mexico



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Courtesy: Endless Blue



Courtesy: Taos Ski Valley - @shotsfromabove



Courtesy: NM Magazine



Courtesy: Sandia Peak Tramway



Courtesy: NM Magazine



Courtesy: Visit Red River

**How Will A “Triple-Dip” or three La Niña events during the winter season in a row influence 2022-23 winter precipitation and temperature in central and northern New Mexico?**



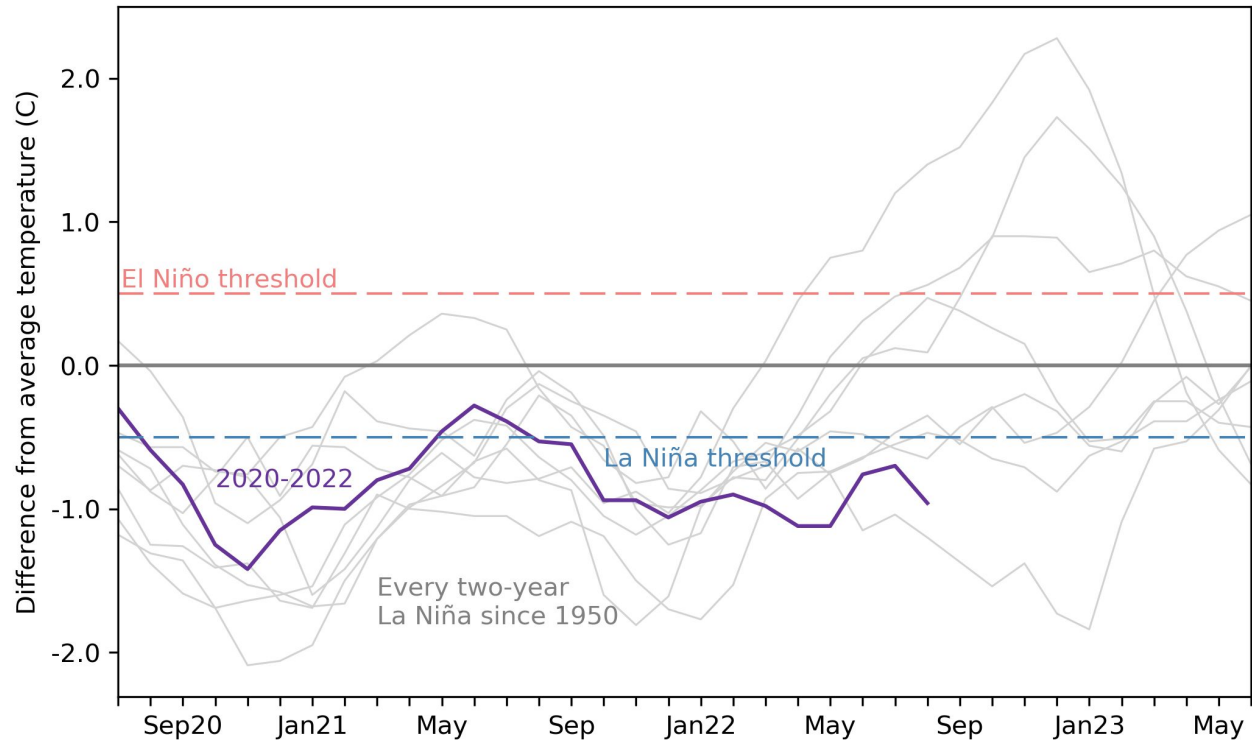
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## What is a “Triple-Dip” La Niña?

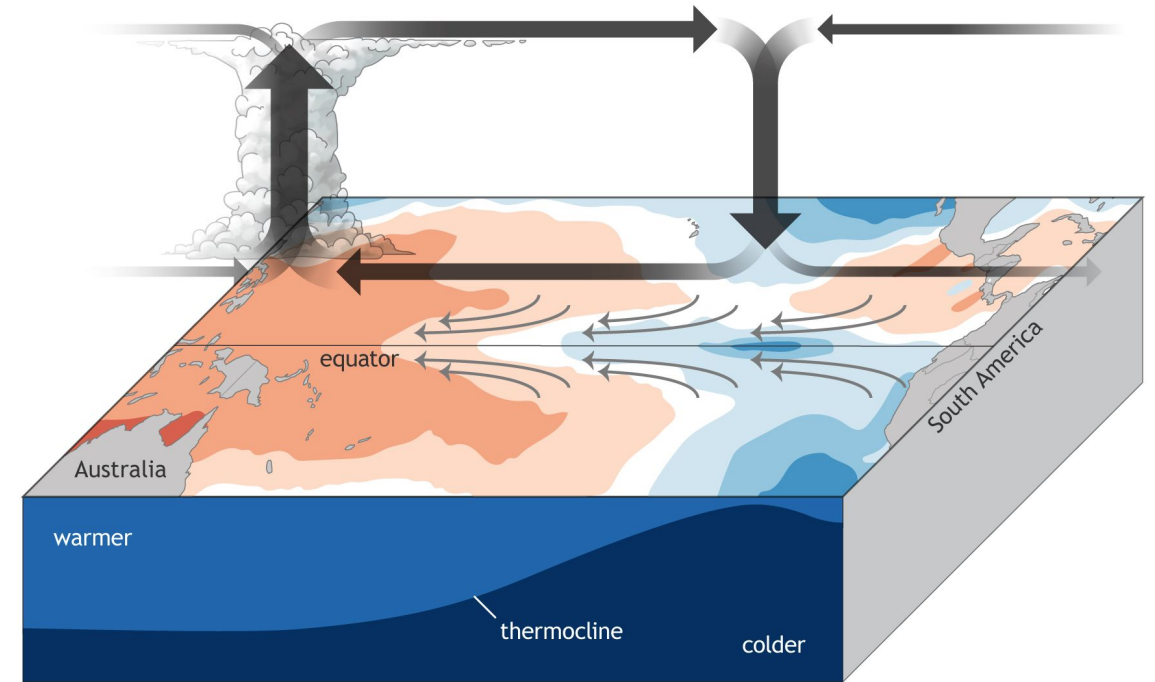


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Monthly sea surface temperature Niño3.4 Index values



Atmosphere-ocean feedbacks during El Niño-Southern Oscillation  
La Niña



NOAA Climate.gov

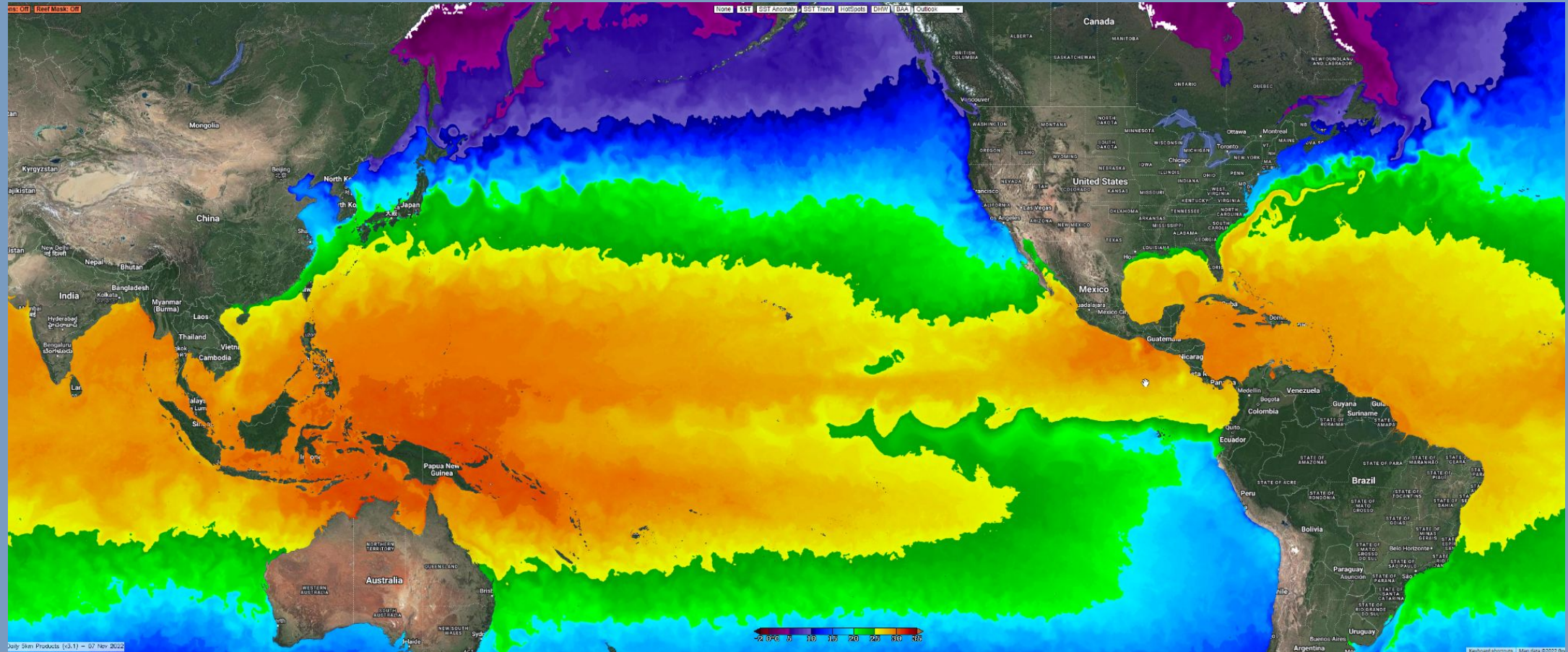
**Triple dips are a rare occurrence. Only two have happened since 1950. Image on left shows a three-year history of sea surface temperatures in the Niño-3.4 region of the tropical Pacific for the 8 existing double-dip La Niña events (gray lines) and the current event (purple line). Of all the previous 7 events, 2 went on to La Niña in their third year (below the blue dashed line), 2 went on to be at or near El Niño levels (above the red dashed line) and three were neutral. Graphic on right shows how La Niña influences tropical thunderstorms and ultimately the polar and subtropical jet streams.**

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## Current Sea Surface Temperatures (SSTs)



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**Global Sea Surface Temperatures (SSTs) from early November 2022. What does it show? La Niña is underway as well as a negative Pacific Decadal Oscillation (PDO). What does a negative or cool phase of the PDO mean generally? Negative or cool phases of the PDO are associated with below average precipitation in the Southwestern U.S. Combine that with a triple-dip La Niña and the winter outlook for central and northern NM is setting up better than this time last year and very similar to late fall 2020.**

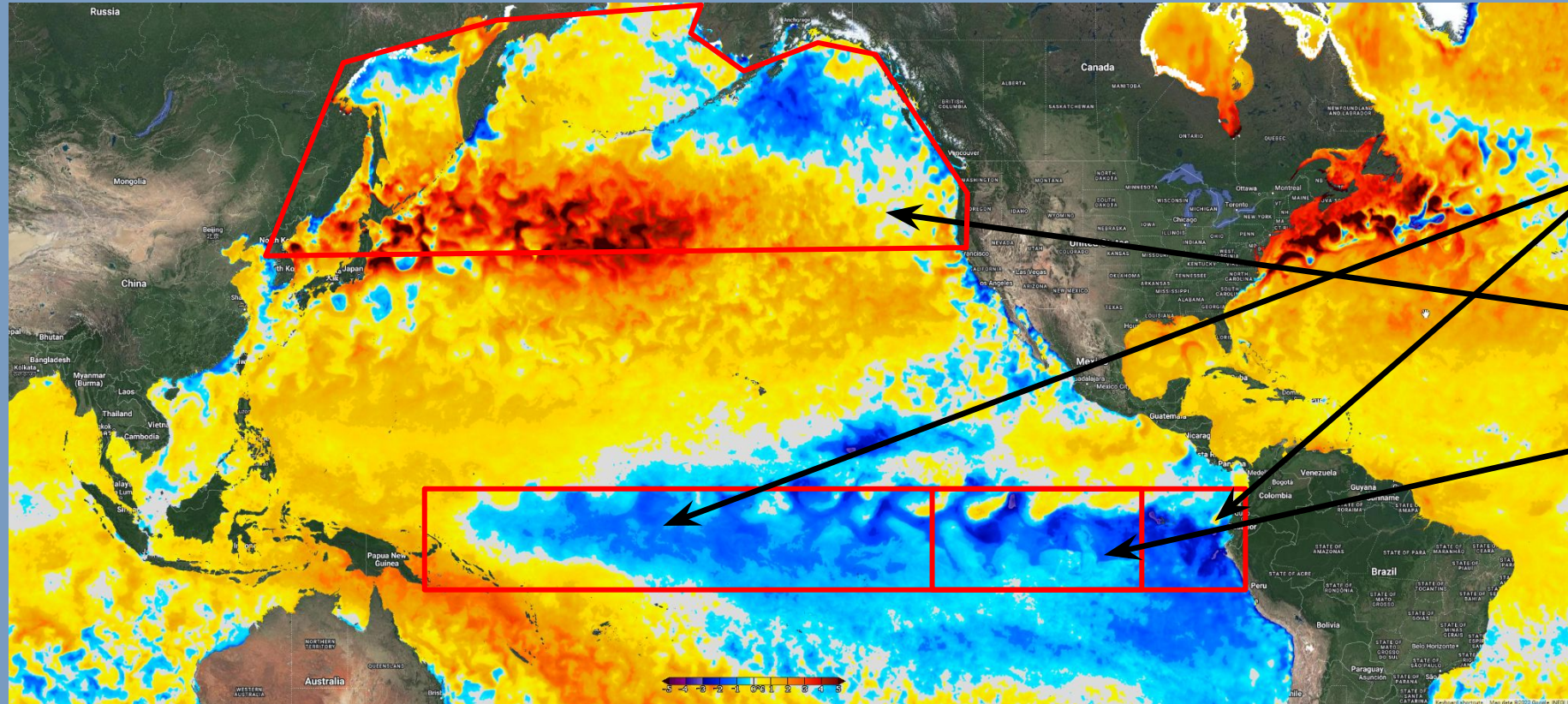


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## Sea Surface Temperature Anomalies (SSTAs) & Oscillation Index Values



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- Multivariate ENSO Index (MEI) for SEP-OCT 2022: -1.7
- Pacific Decadal Oscillation (PDO) for SEP 2022: -1.55
- Oceanic Niño Index (ONI) (uses Niño 3.4 region - inner rectangle) for ASO 2022: -1.0

Daily global SST difference from average from November 7, 2022 showing La Niña and negative or cool phase of the PDO. Cooler than average temperatures have been expanding in the eastern equatorial Pacific Ocean during fall with a moderate La Niña currently underway. There is a 76% chance of La Niña continuing through winter and a 57% chance through the February through April timeframe. Don't expect any sudden changes in spring, however, given that the atmosphere will take time to response to a climate pattern that has been in place for approximately 3 years.

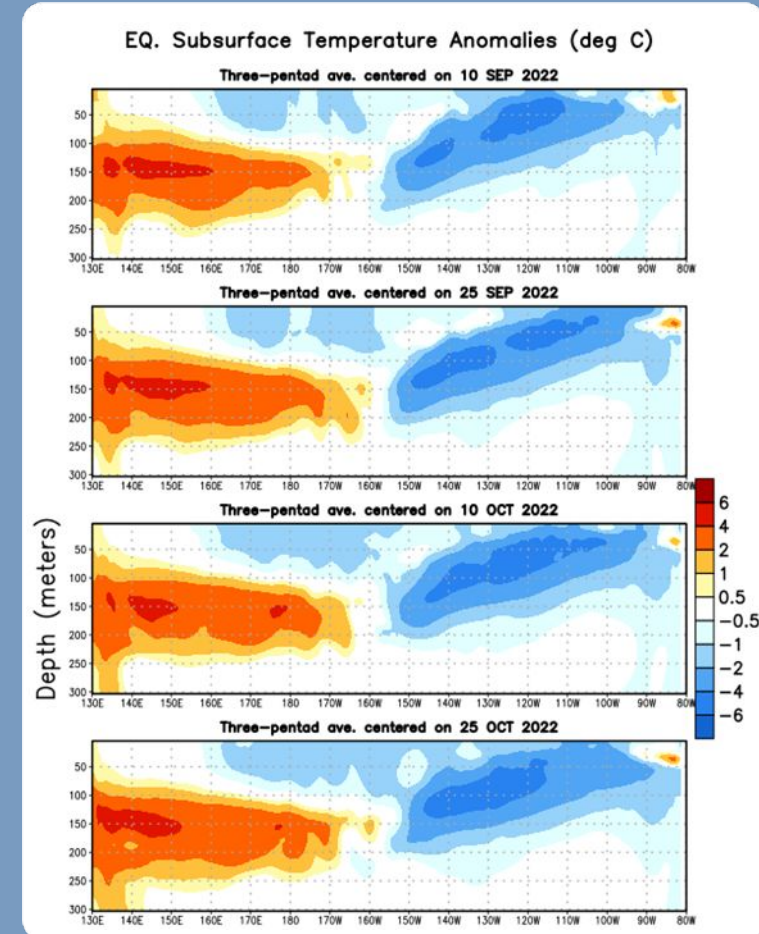
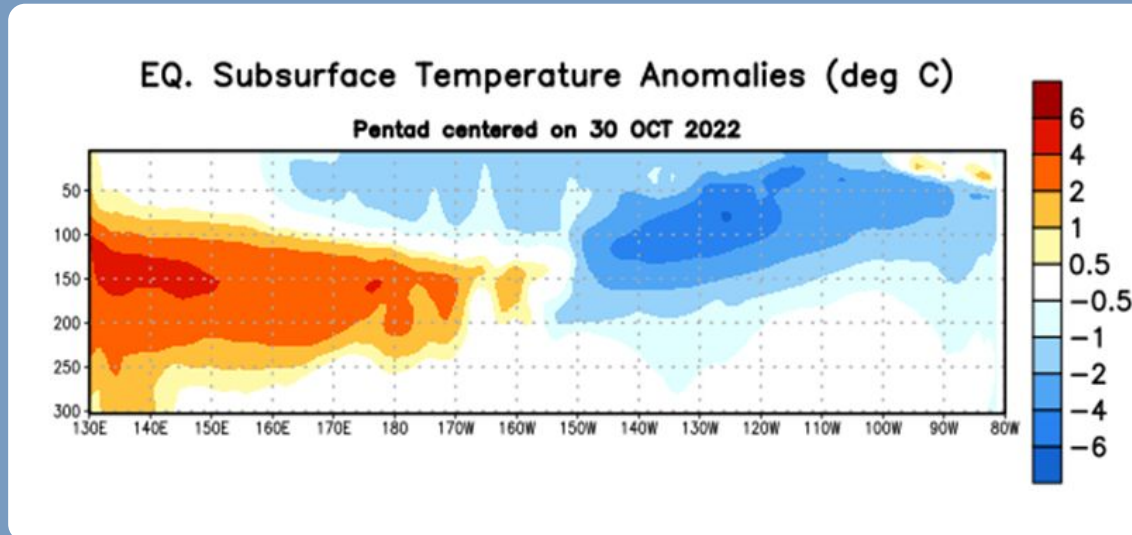


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## Sub-Surface Temperature Departures in the Equatorial Pacific 2020 vs. 2021



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Subsurface temperature anomalies starting in September 2022 and ending in late October. Negative anomalies have continued to intensify in the central and eastern equatorial Pacific Ocean while positive subsurface temperature anomalies at depth have strengthened in the western Pacific.



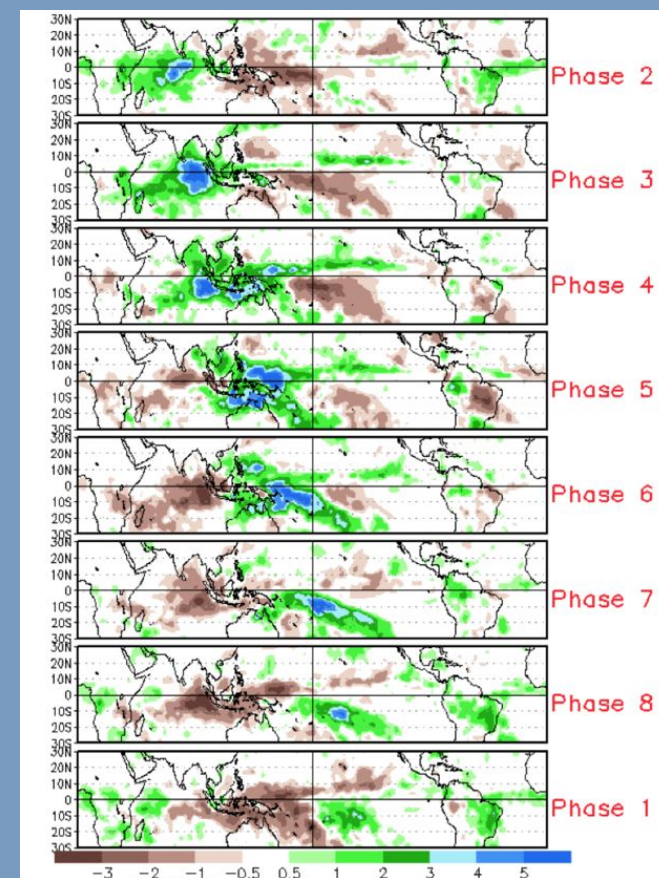
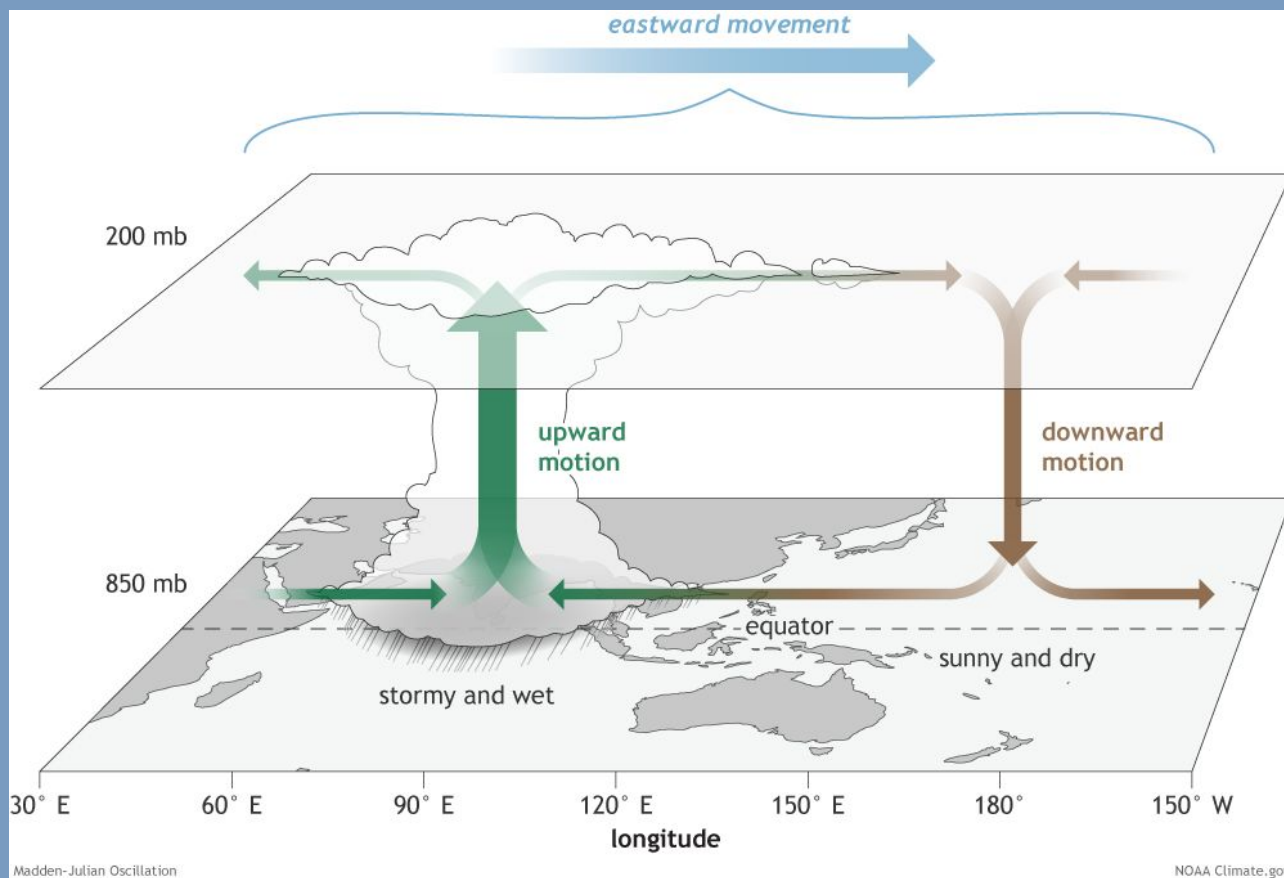
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## Madden-Julian Oscillation (MJO)



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The 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 area causes 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. If the MJO is active/strong, it typically changes the wind patterns temporarily and helps La Niña develop.



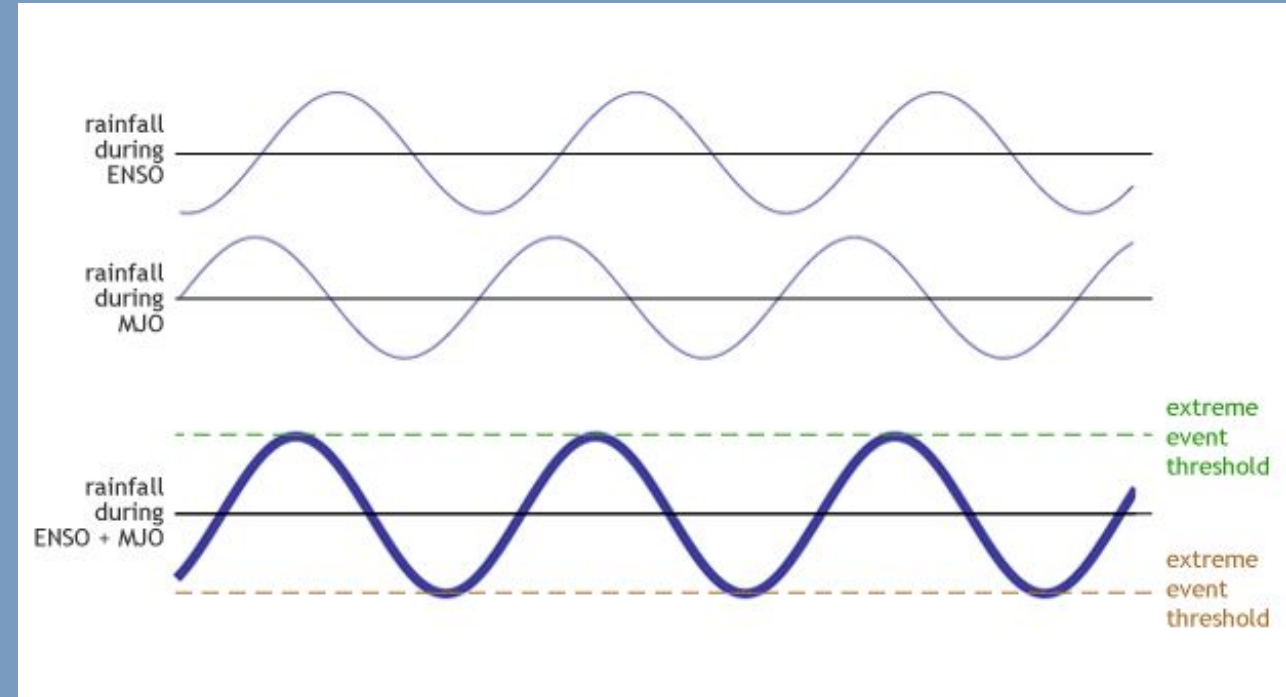
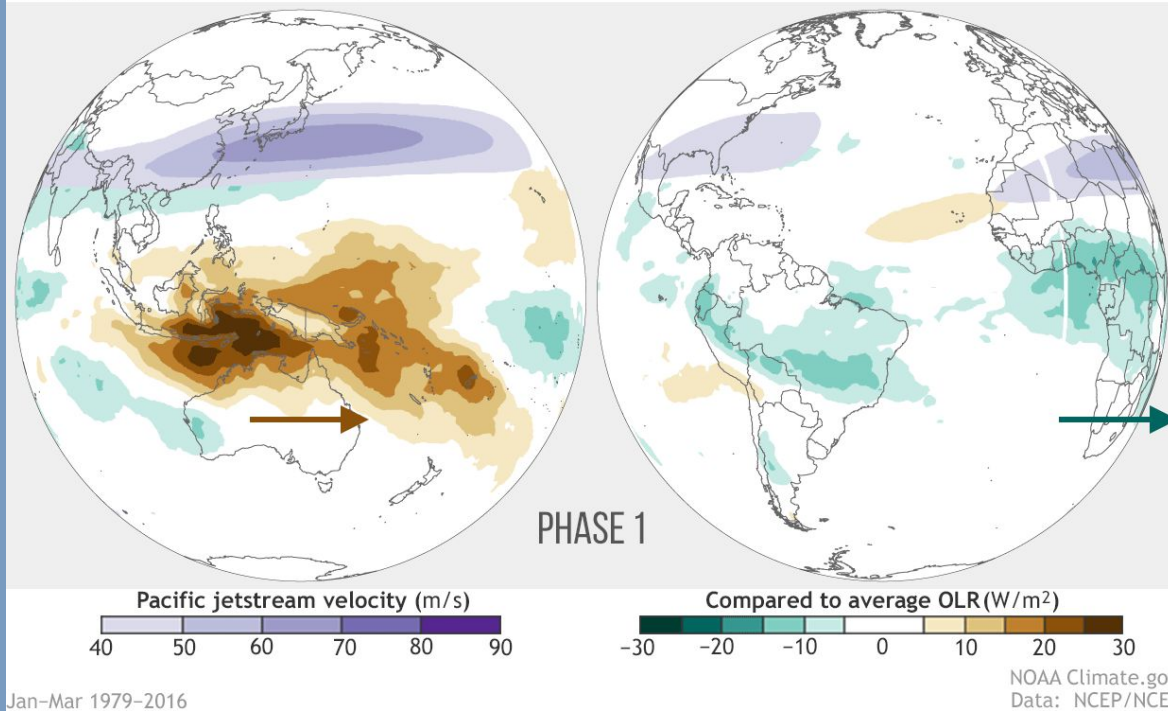
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## MJO Cont'd



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Average MJO cloud and wind patterns



The timing of the MJO is vital to whether or not La Niña constructively (amplifies) or destructively interferes (cancels) with MJO related thunderstorms. In other words, if the MJO moves into the EPAC while La Niña is at its peak strength, the MJO is rendered weak or having little influence on the storm track. Conversely, if the MJO translates eastward into the EPAC while La Niña is relatively weak, the influence on bringing the storm track farther south is greater.

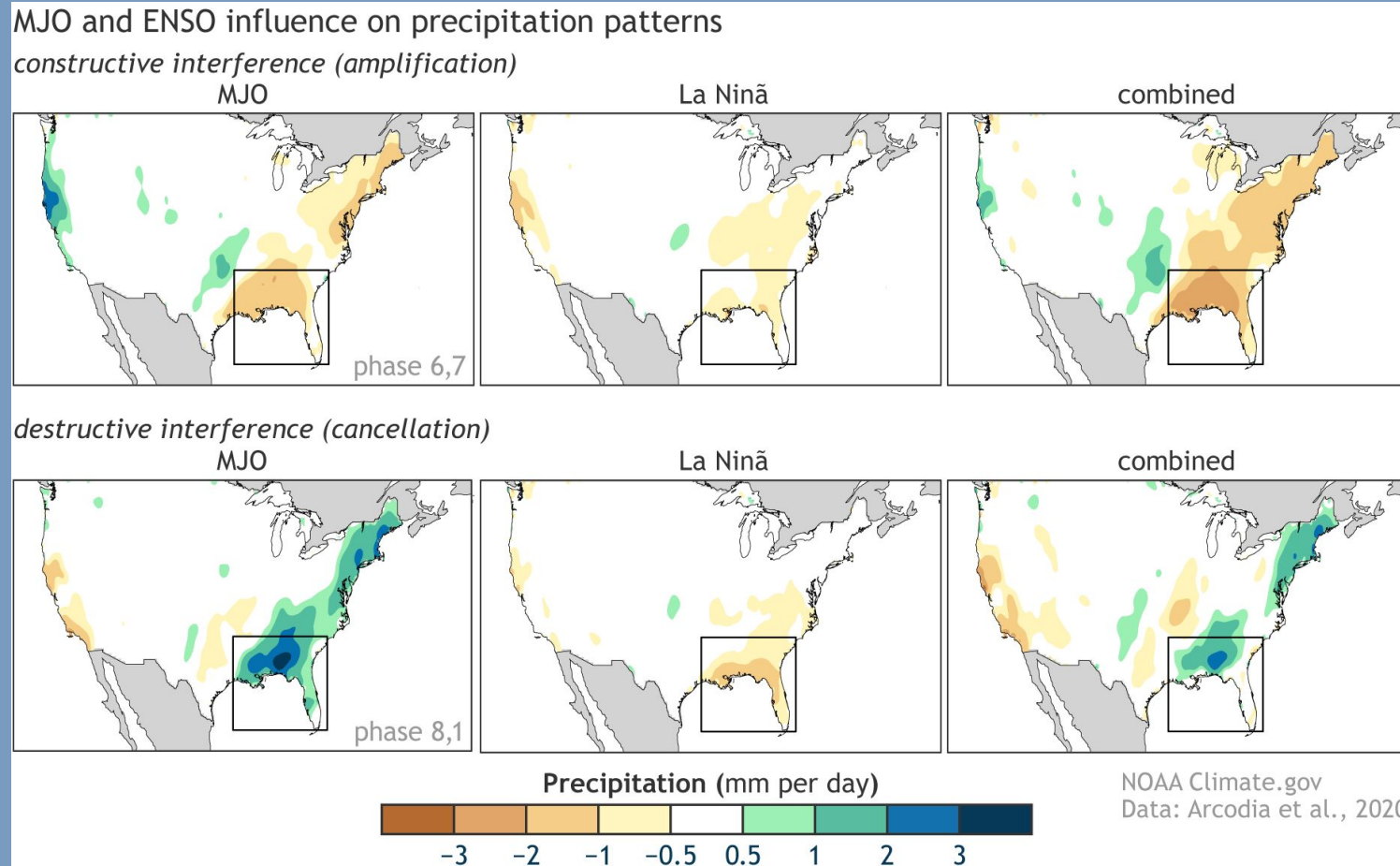


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## MJO Combined with La Niña – Destructive & Constructive Interference



Graphic showing the influence of the timing and strength of the MJO during La Niña with both constructive and destructive influences on rainfall in the southeast U.S. The strength of the MJO convection, how fast it moves eastward, and how far it travels all change based on ENSO conditions. These ENSO-modified MJO events then lead to varied impacts on U.S. rainfall. (Arcodia et al., 2020).



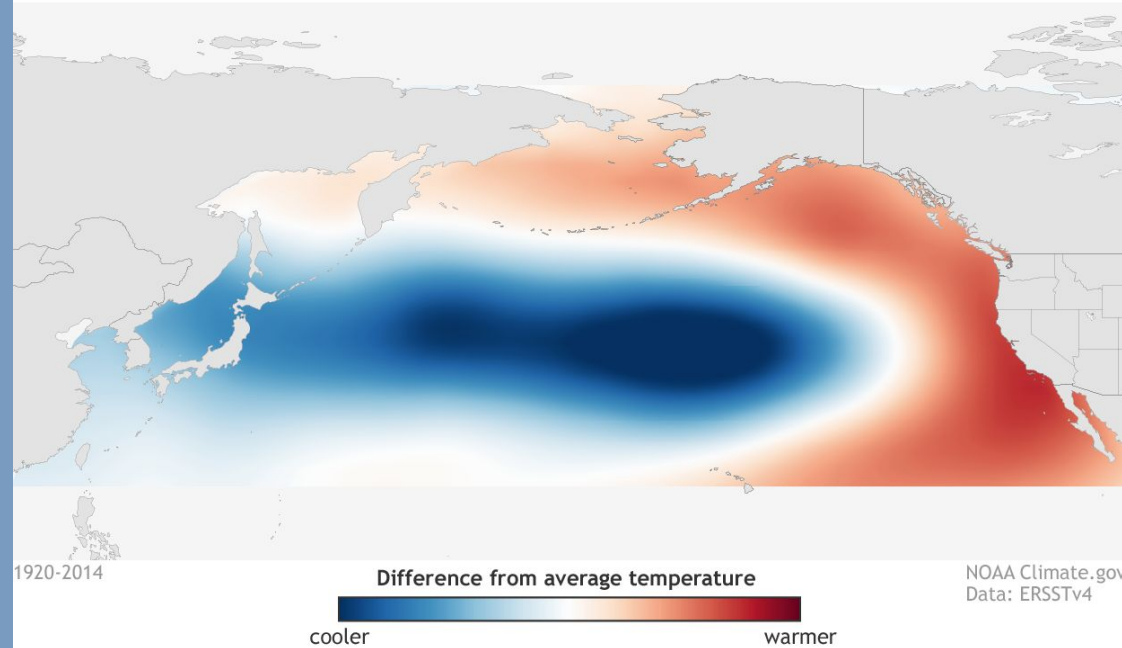
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## The Pacific Decadal Oscillation (PDO)

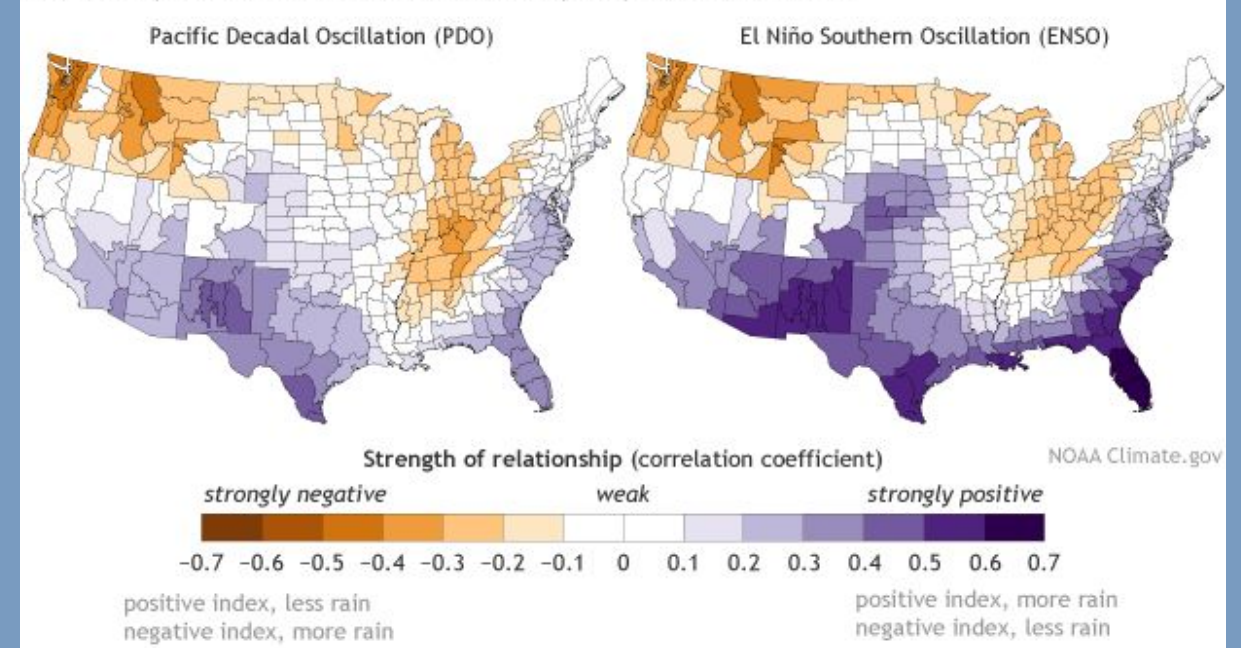


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Pacific Decadal Oscillation warm phase pattern



Relationship between PDO/ENSO status and precipitation anomalies



**Typical Sea Surface Temperature Anomaly (SSTA) pattern in the North Pacific Ocean during the warm phase of the Pacific Decadal Oscillation phase (PDO) (left). As with ENSO, a positive PDO correlates well with above average winter precipitation in the Southwest United States. The opposite is true for the negative phases of the PDO and ENSO.**



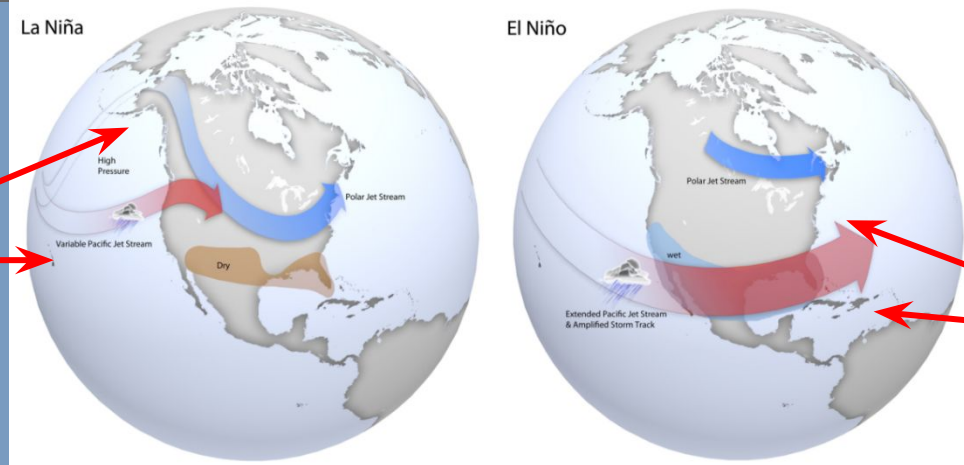
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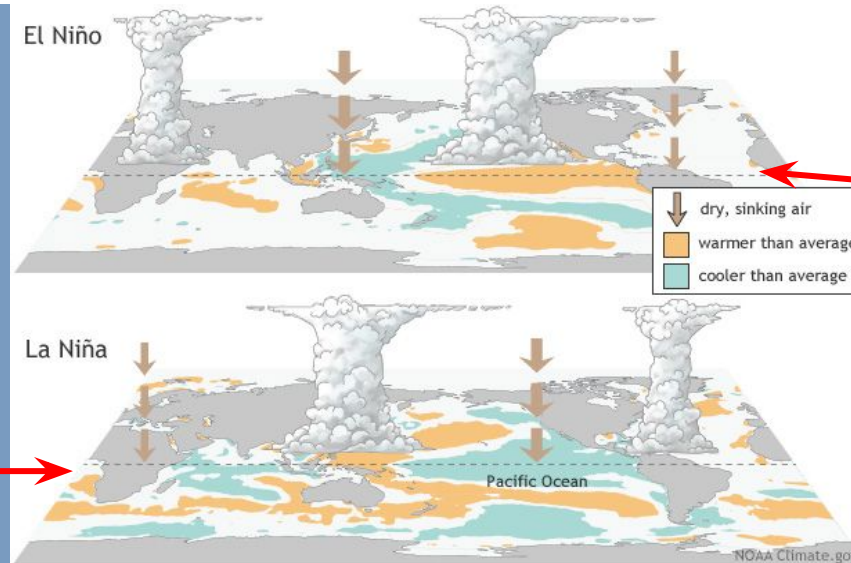
## Why SSTs in the Eastern Pacific Ocean Are So Important WRT to Climate

Typical Jet Stream Pattern during La Niña



Typical Jet Stream Pattern during El Niño

Typical Tropical circulations during La Niña



Typical Tropical circulations during El Niño

**Warmer SSTs support deep tropical and subtropical convection farther east than average. This deep convection draws the jet stream farther south into the far eastern Pacific Ocean and southwestern United States during El Niño. The opposite is true during moderate to strong La Niñas and the polar jet stream generally remains north of New Mexico. Weak La Niñas are sometimes wetter and cooler than average.**



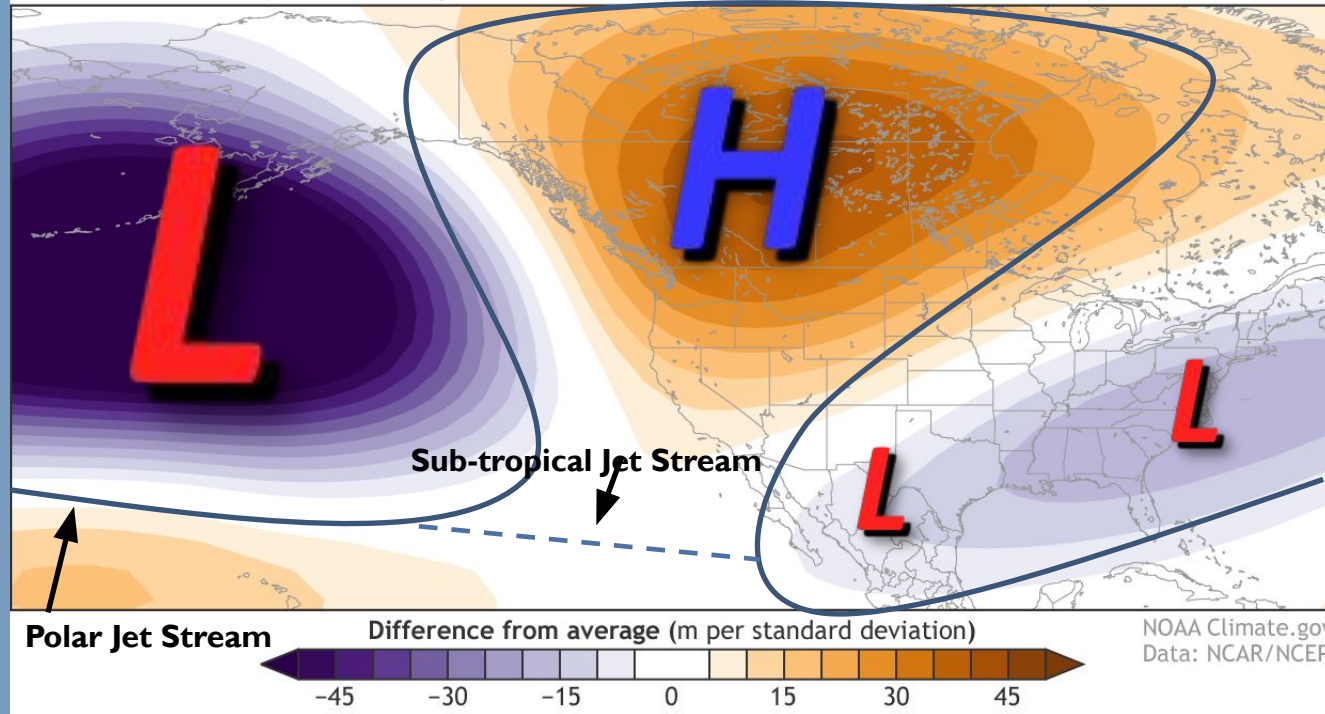
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## Positive Pacific-North American Teleconnection Pattern (PNA)

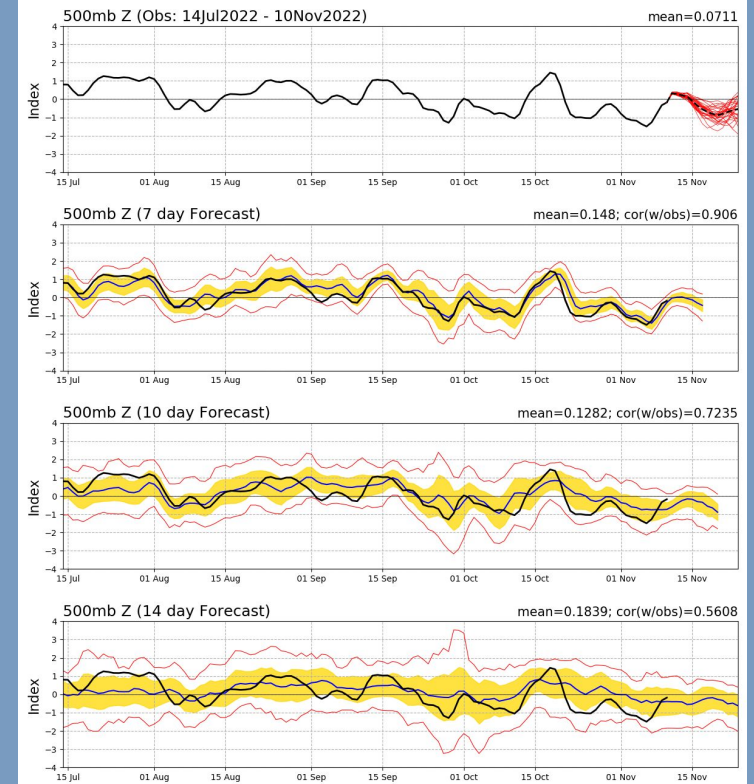


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December–February 500hPa height anomalies regressed onto the PNA



PNA Index: Observed & GEFS Forecasts



December–February 500-hPa geopotential height anomalies regressed onto the monthly PNA index. Data shown for 1979–80 to 2018–19. Purple shading indicates below-average pressure and winds that flow counter-clockwise following the contours. Orange shading denotes above-average pressure and winds that flow clockwise. In the positive state of the PNA, above-average pressure is found over the subtropical Pacific (close to Hawaii) and centered over western Canada. Below-average pressure occurs over the North Pacific Ocean and along the southeastern United States. If tropical convection sets up in right locations, this prolonged “preferred” atmospheric pattern is capable of resulting in cold, clipper type-troughs or closed lows from the north and northwest.

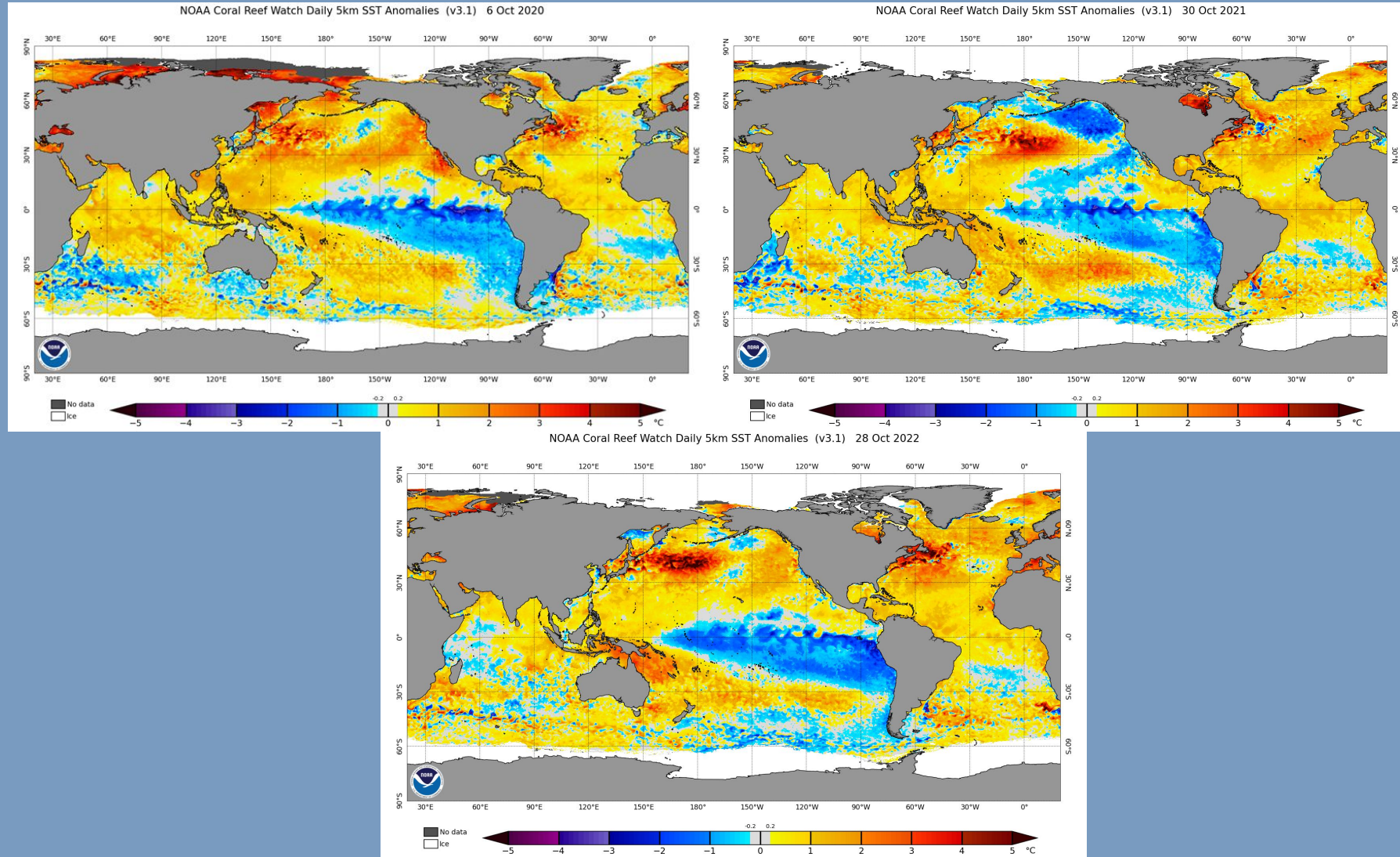


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Comparing Late Oct 2017 Global SSTAs to Late Oct 2021



**SSTAs from very recent analog years, 2020 and 2021, along with current conditions. Note the differences in the northeast Pacific. The PDO is much weaker this year compared to last year and a lot like 2020.**

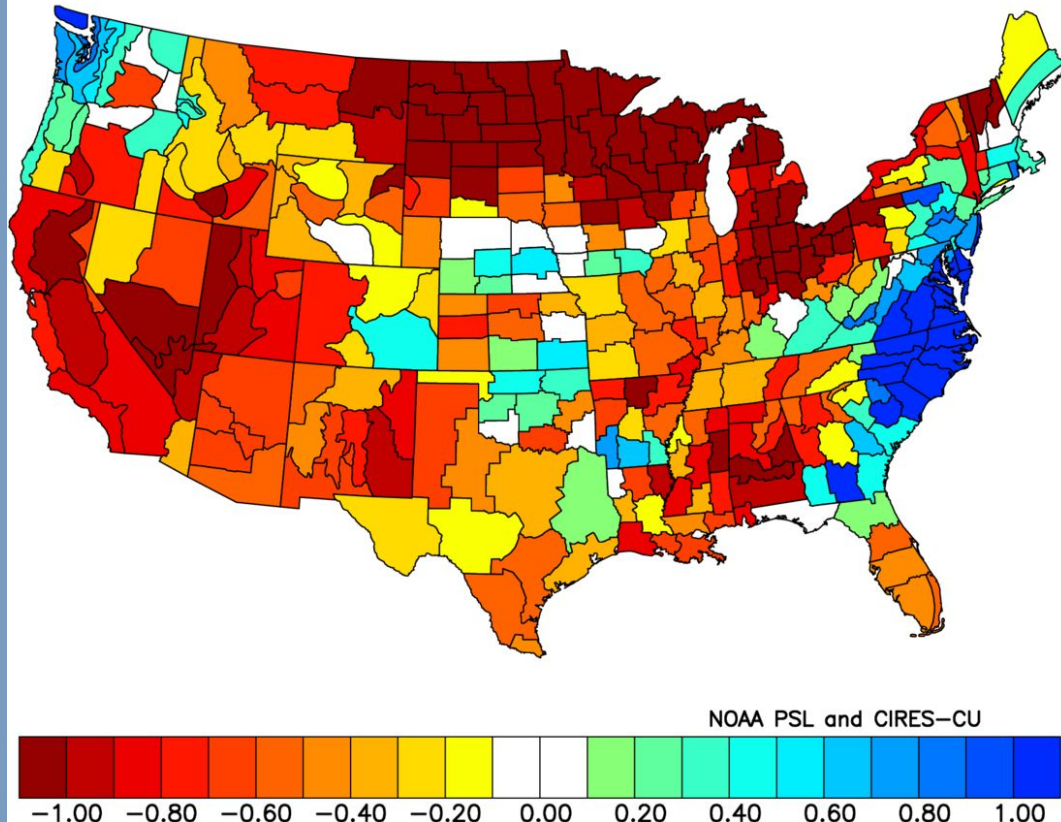
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## Standardized Precipitation Difference from Average

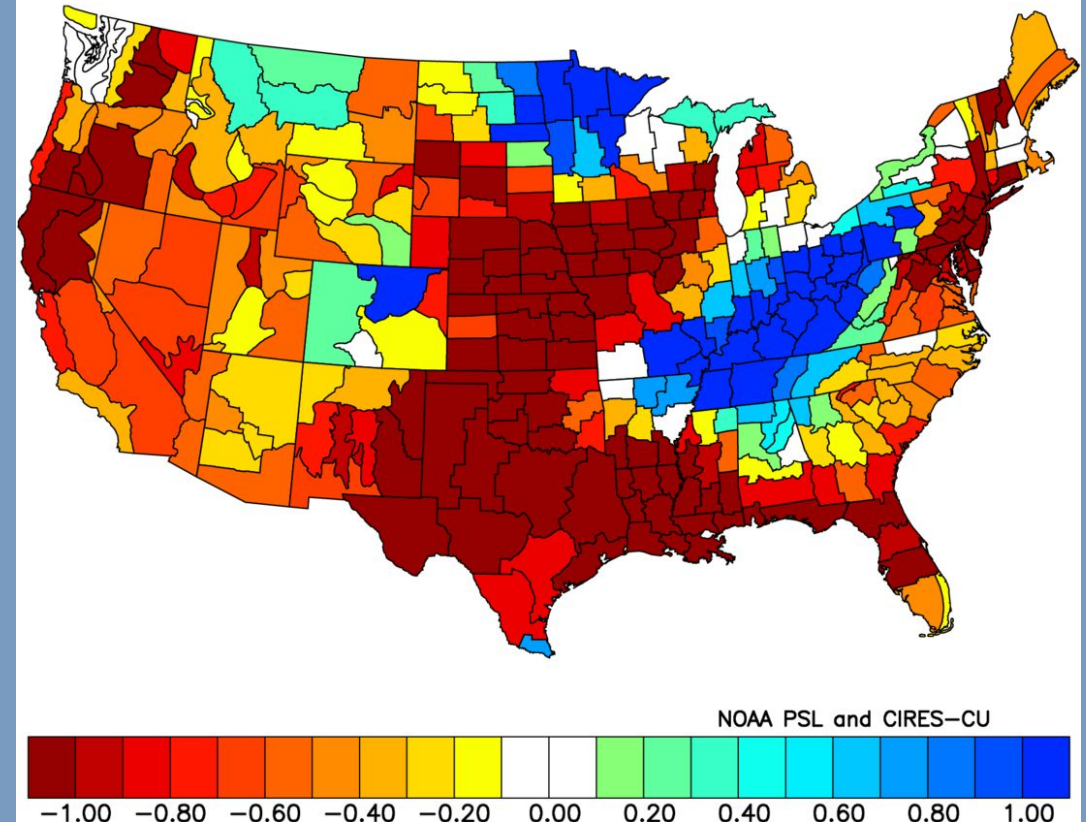


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NOAA/NCEI Climate Division Standardized Precipitation Anomalies  
Dec to Feb 2020–21  
Versus 1991–2020 Longterm Average



NOAA/NCEI Climate Division Standardized Precipitation Anomalies  
Dec to Feb 2021–22  
Versus 1991–2020 Longterm Average



**DJF precipitation anomaly plots for CPC's climate divisions comparing the most recent analog years, 2020-21 and 2021-22, with 30-year climatological averages. This year is setting up more like 2020-21.**

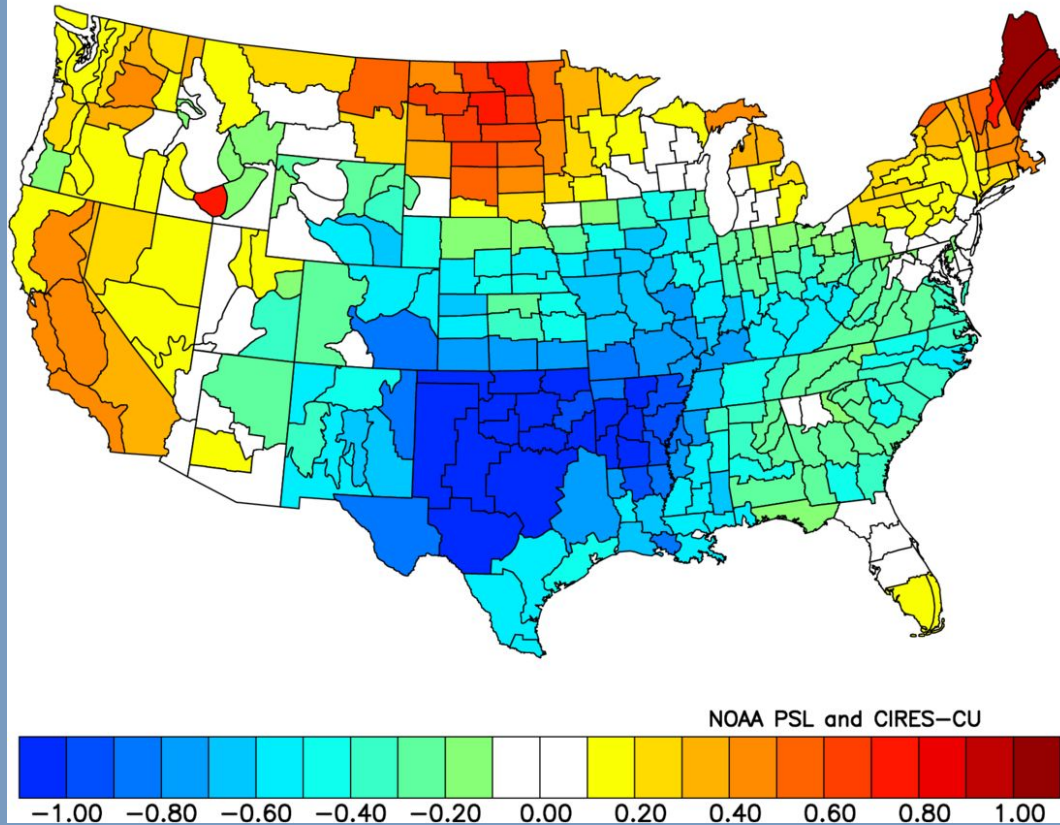


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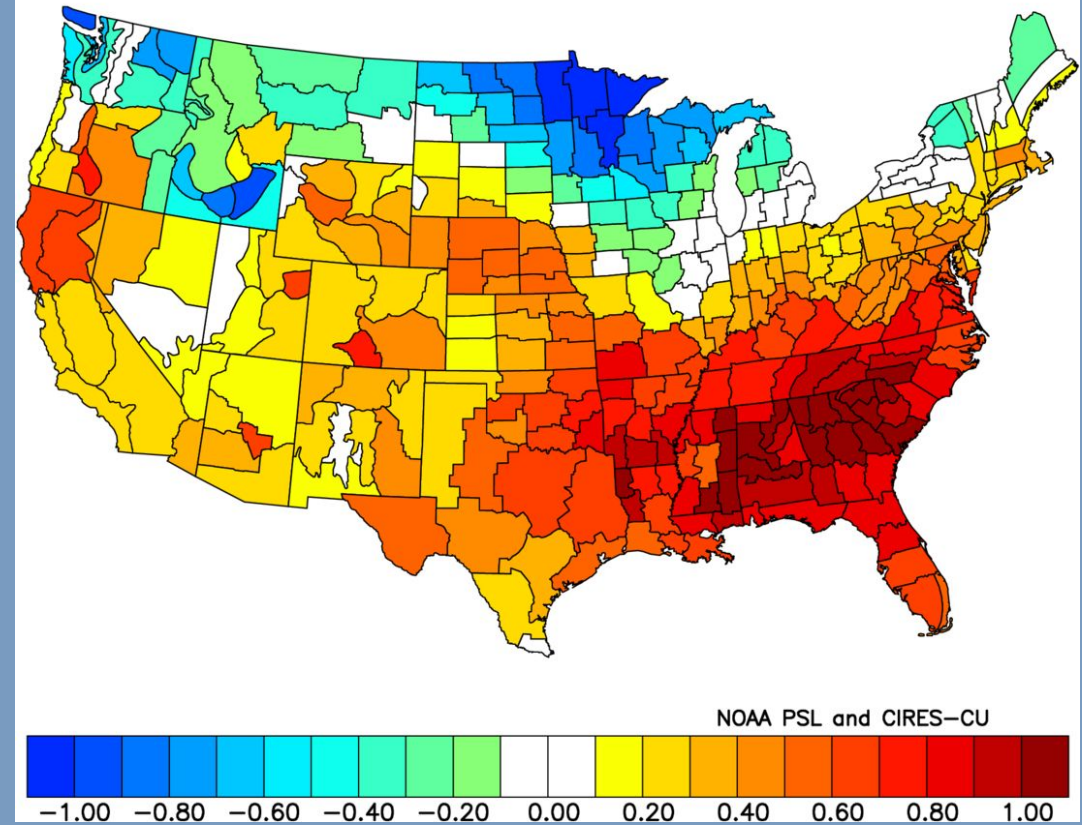


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NOAA/NCEI Climate Division Standardized Temperature Anomalies  
Dec to Feb 2020–21  
Versus 1991–2020 Longterm Average



NOAA/NCEI Climate Division Standardized Temperature Anomalies  
Dec to Feb 2021–22  
Versus 1991–2020 Longterm Average



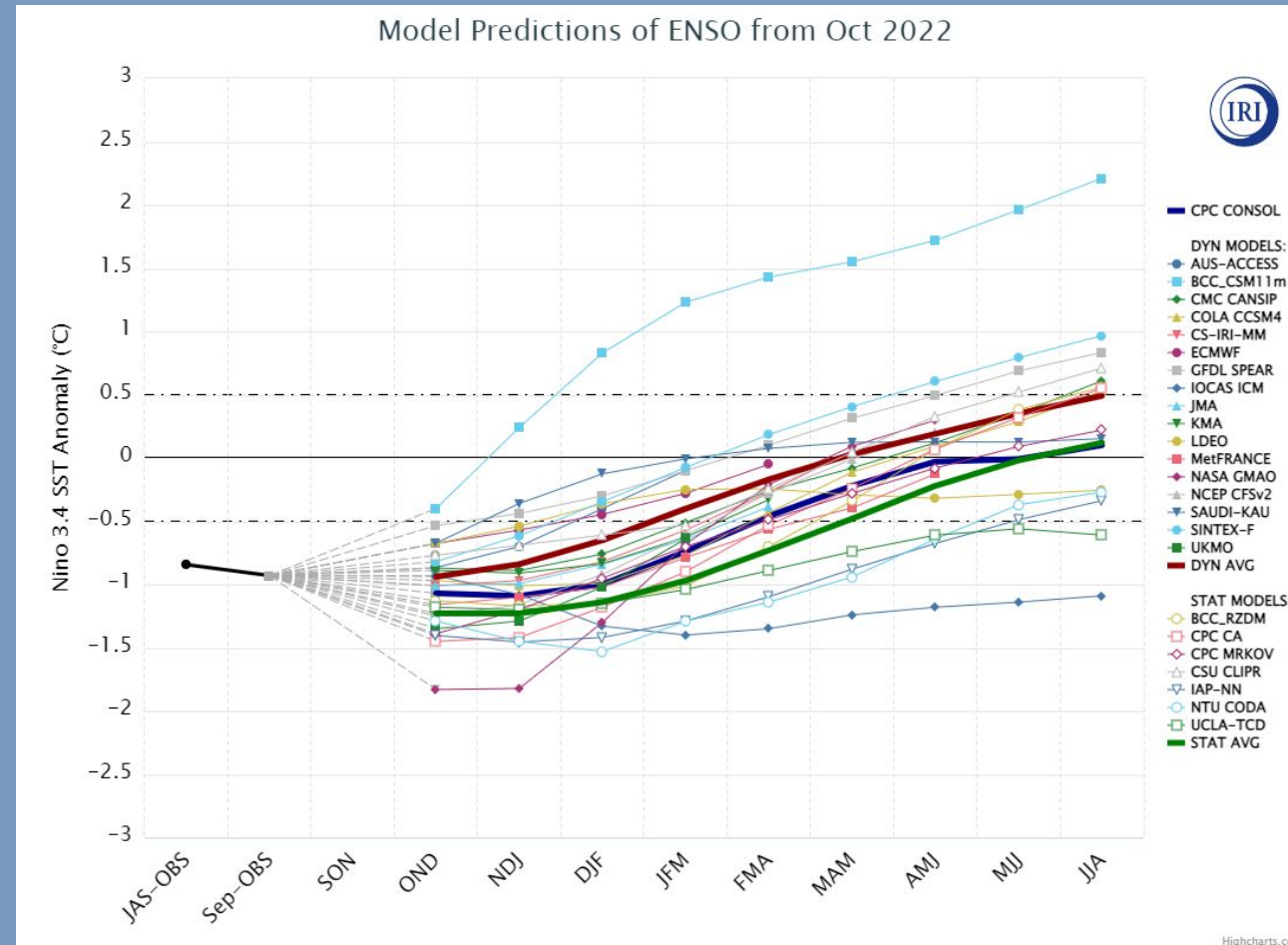
**DJF temperature anomaly plots for CPC's climate divisions comparing the most recent analog years, 2020-21 and 2021-22, with 30-year climatological averages. This year is setting up more like the colder 2020-21 winter season.**

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## Latest SST Model Forecast



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The following graph shows forecasts made by dynamical and statistical models for SST in the Nino 3.4 region for nine overlapping 3-month periods. Note that the expected skills of the models, based on historical performance, are not equal to one another. The skill also generally decrease as the lead time increases.



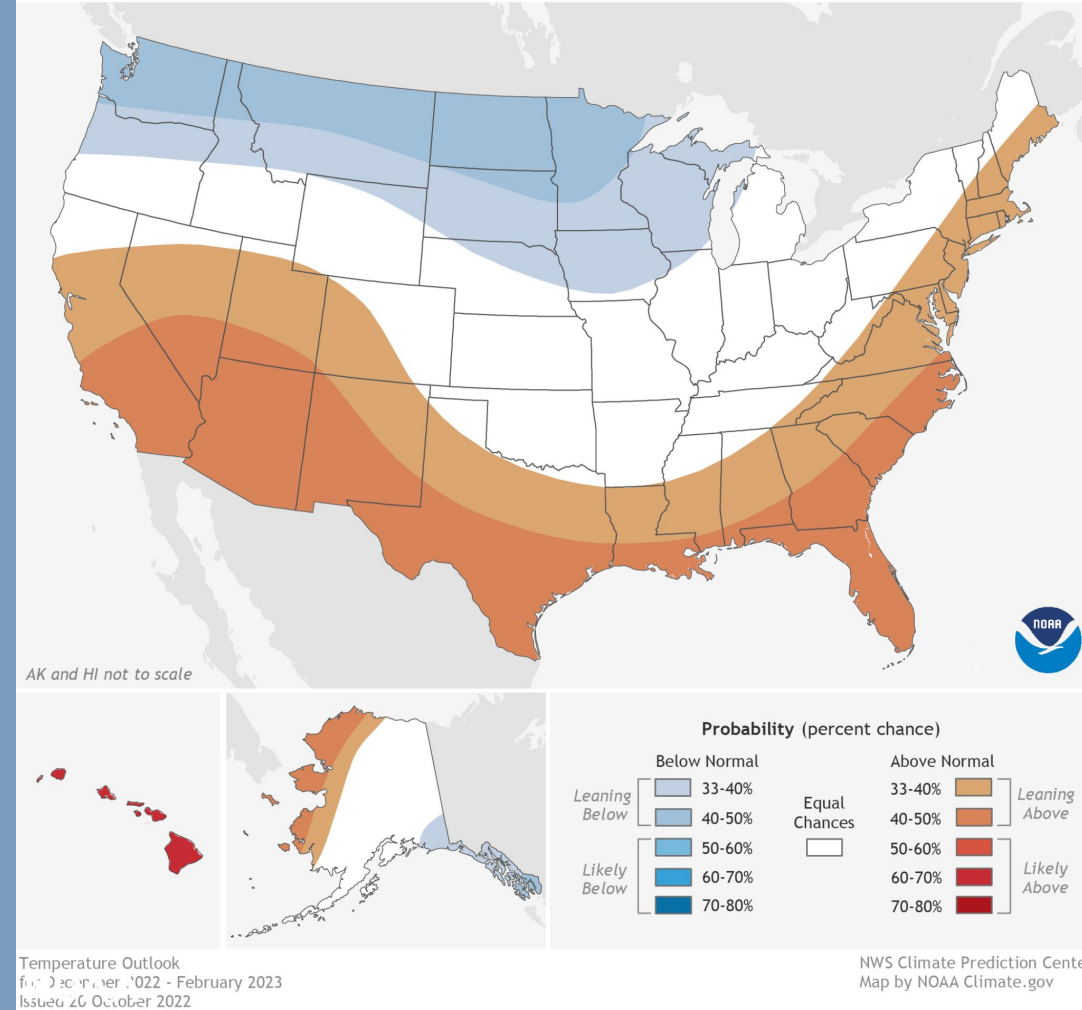
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Climate Prediction Center's Official 2022-23 Winter Outlook

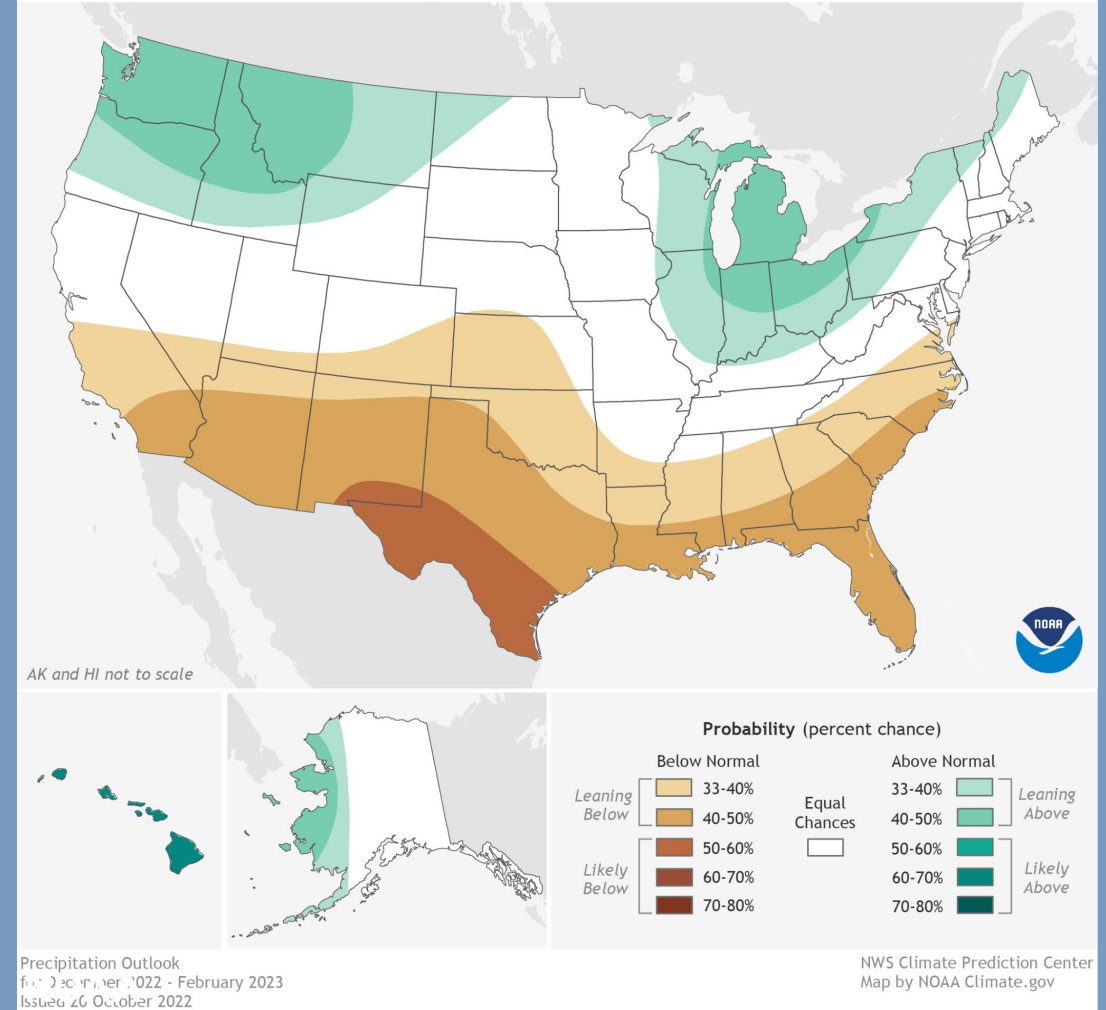


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Winter 2022-23: U.S. Temperature Outlook



Winter 2022-23: U.S. Precipitation Outlook



**CPC's DJF 2022-23 precipitation and temperature forecasts favoring below average precipitation and above average temperatures for all of New Mexico.**

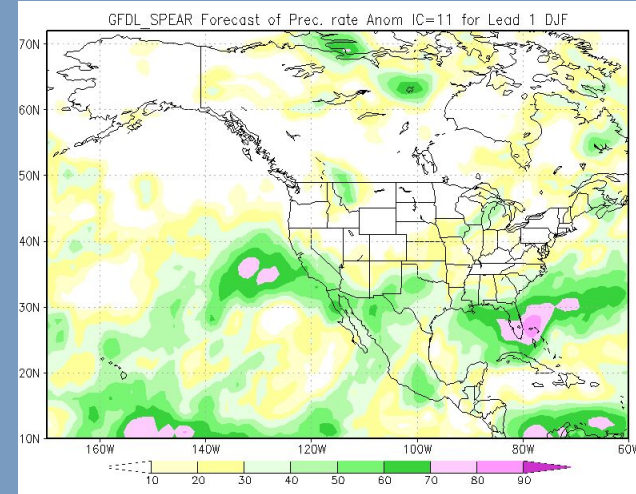
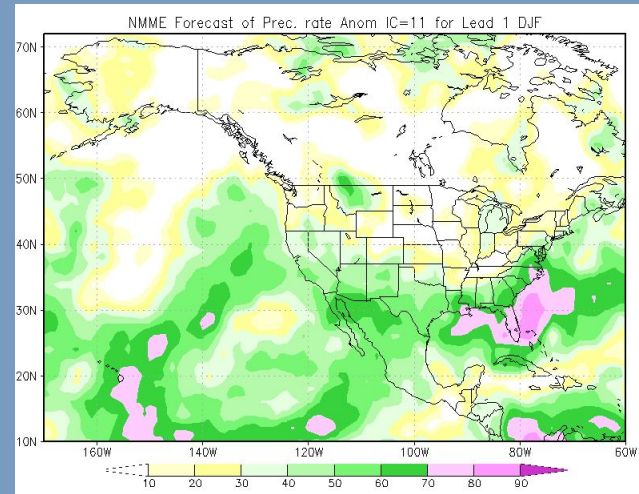
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## Numerical Climate Prediction Model Precipitation – December 2021

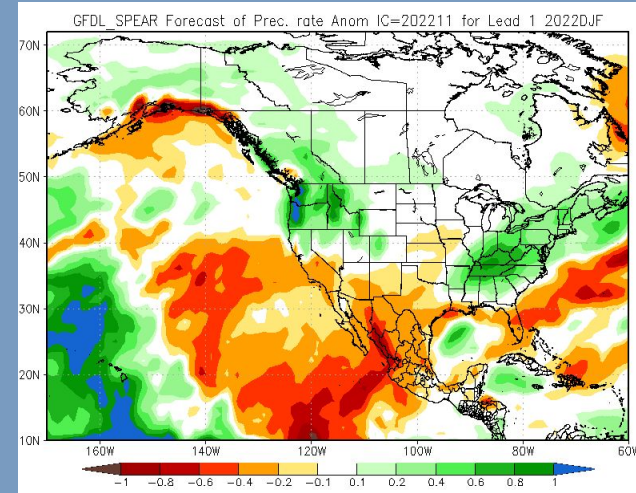
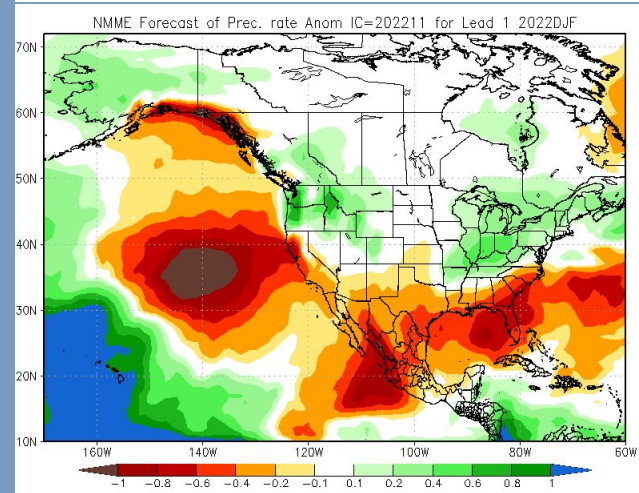


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**Models with the highest  
forecast skill**



**White equates to average  
precipitation, orange is below  
and green is above.**



**Model precipitation rate anomaly plots from the two climate models which have the highest forecast skill percentages for DJF 2022-23 (top), the North American Multi-Model Ensemble (NMME) and Geophysical Fluid Dynamics Laboratory (GFDL\_SPEAR). Forecasts range from average to below average precipitation for DJF across New Mexico.**



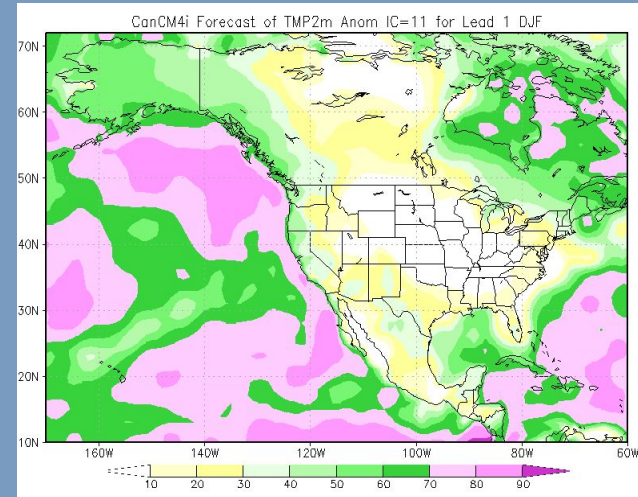
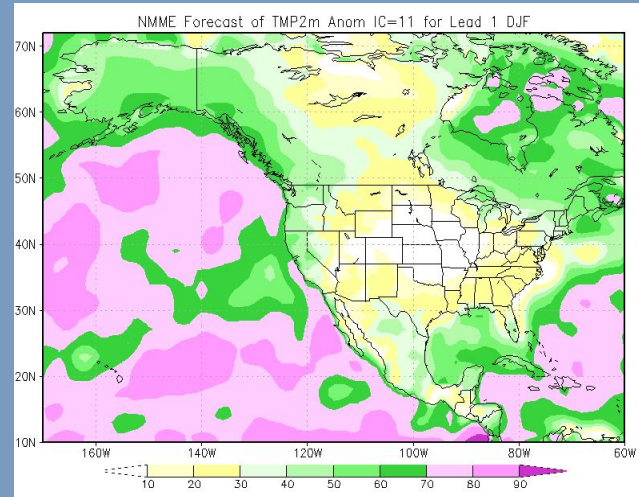
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## Numerical Climate Prediction Model Temperature – DJF 2022-23

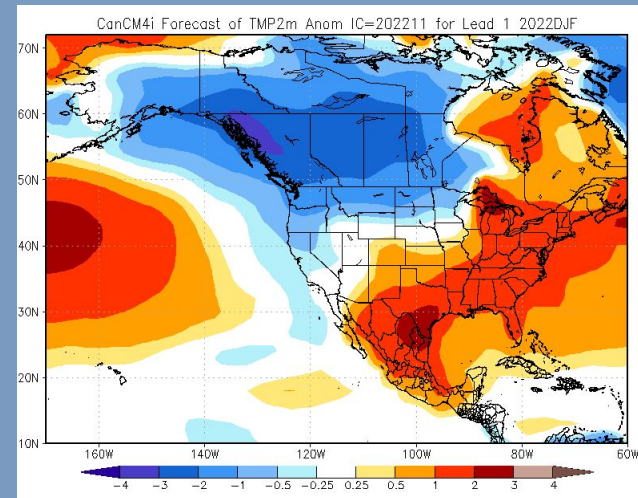
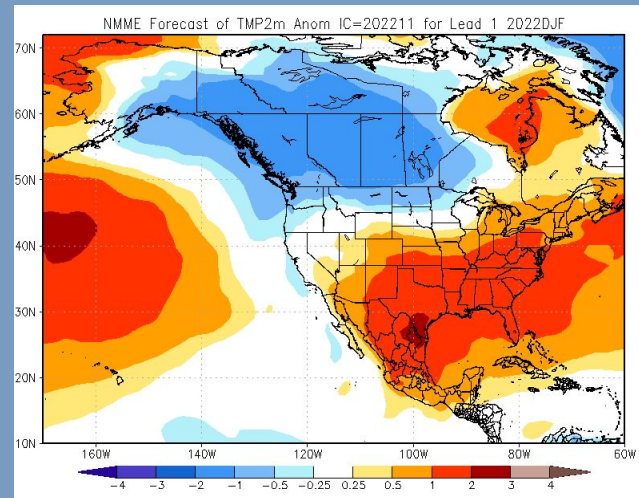


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**Highest forecast skill in DJF**



**White equates to average temperature, orange/red is above and blue is below.**



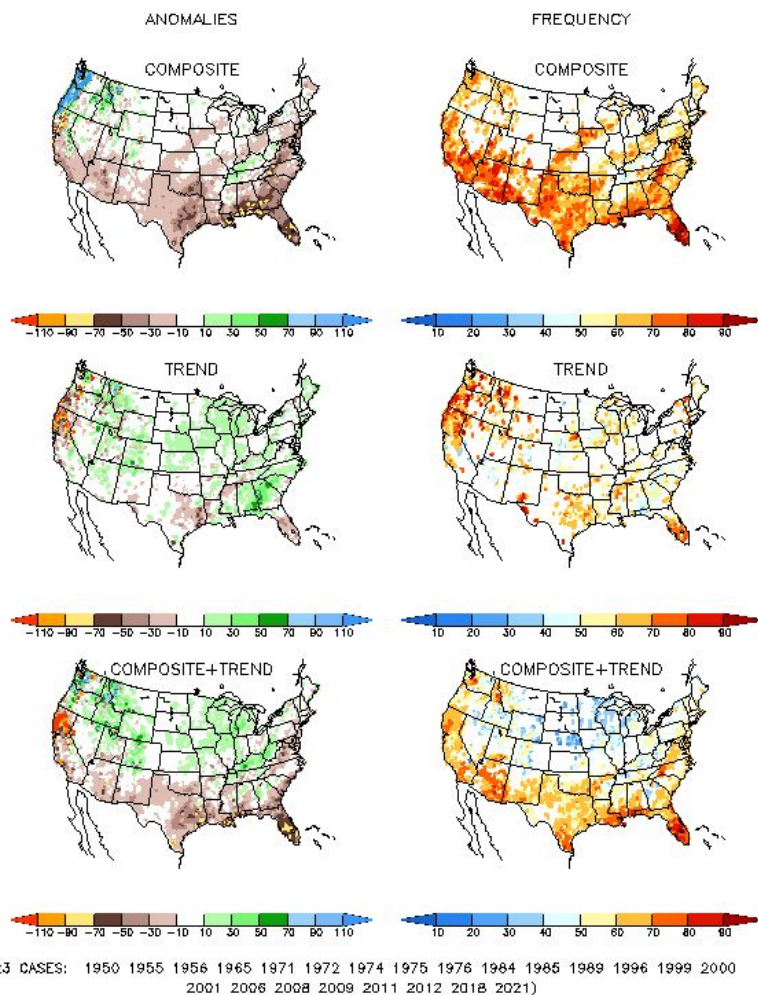
**Model temperature anomaly plots from the two climate models which have the highest skill percentages in DJF 2022-23 (top), the North American Multi-Model Ensemble (NMME), Canadian Climate Model (CanCM4i\_ensemble). Forecasts range from slightly above average to well above average temperature in DJF 2022-23 across New Mexico.**

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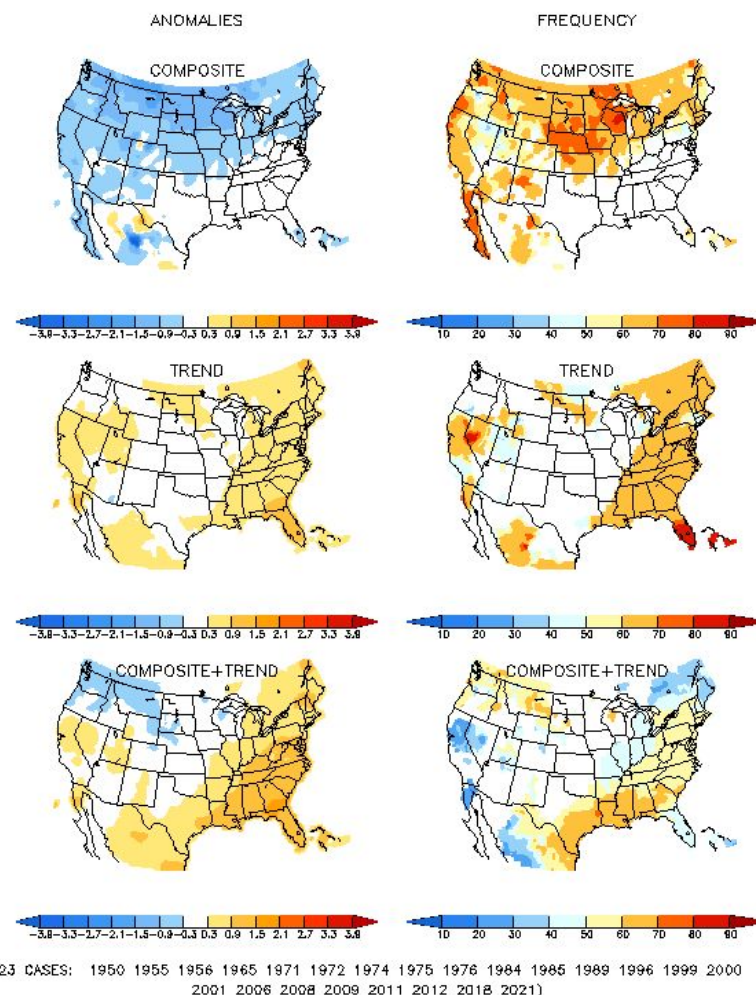


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DJF LA NINA PRECIPITATION ANOMALIES (MM)  
AND FREQUENCY OF OCCURRENCE (%)



DJF LA NINA TEMPERATURE ANOMALIES (C)  
AND FREQUENCY OF OCCURRENCE (%)



La Niña precipitation and temperature composite and trend anomalies for 23 winter seasons of La Niña. The trend for precipitation for far northwest and north-central NM is wetter.



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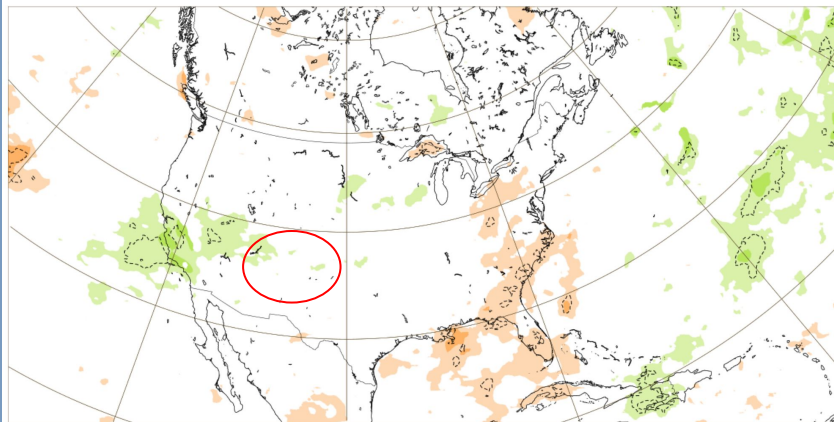
ECMWF (European model)



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## Precipitation: Weekly mean anomalies

Base time: Thu 10 Nov 2022 Valid time: Mon 05 Dec 2022 - Mon 12 Dec 2022 (+768h) Area : North America

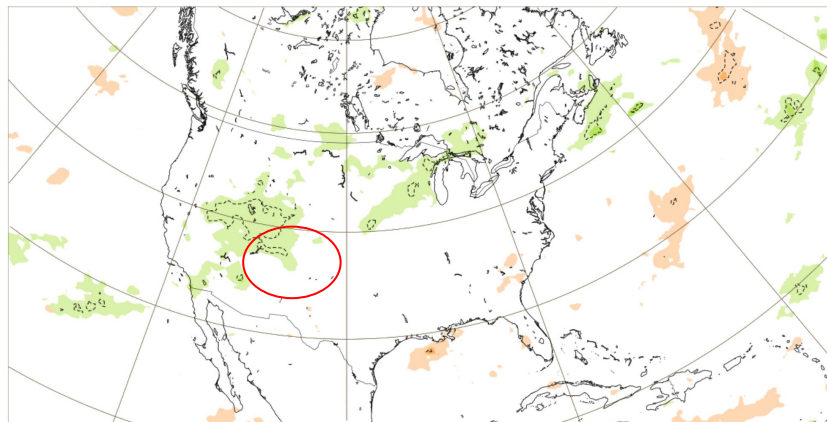


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## Precipitation: Weekly mean anomalies

Base time: Thu 10 Nov 2022 Valid time: Mon 12 Dec 2022 - Mon 19 Dec 2022 (+936h) Area : North America

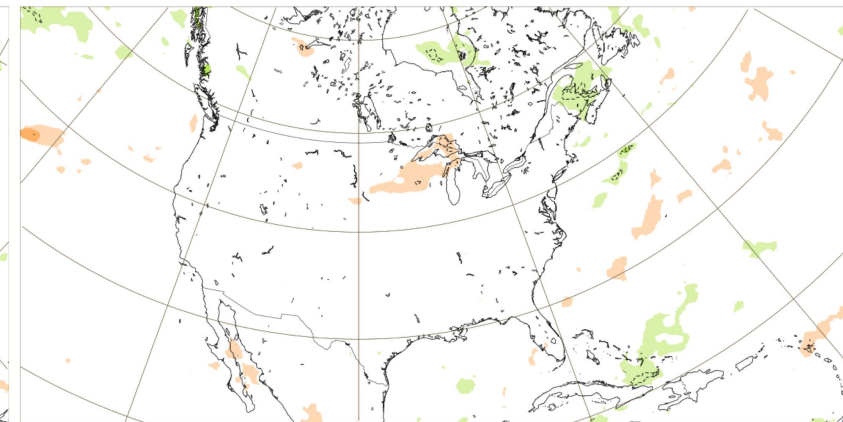


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## Precipitation: Weekly mean anomalies

Base time: Thu 10 Nov 2022 Valid time: Mon 19 Dec 2022 - Mon 26 Dec 2022 (+1104h) Area : North America



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**European Centre for Weather Forecasting (ECMWF) Extended Range ENS model which goes out six weeks hints at two possible storm systems (weekly mean precipitation anomaly in green) moving through northern NM the week of December 5, 2022 and the week of December 12. No clear signal either way for the week of Christmas.**

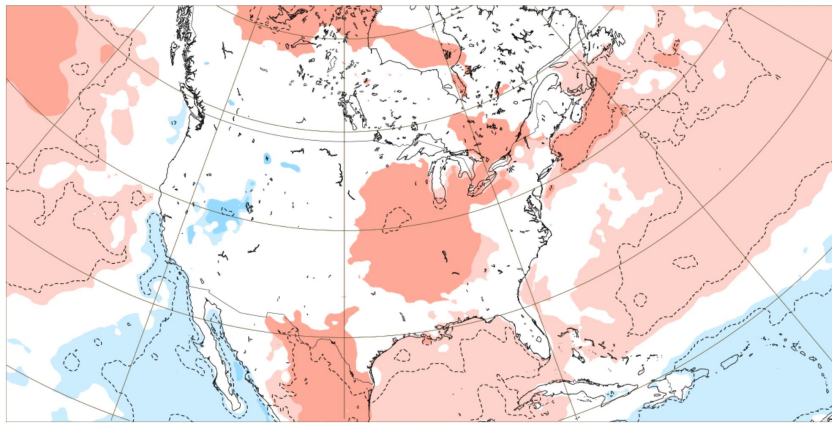
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## 2 m temperature: Weekly mean anomalies

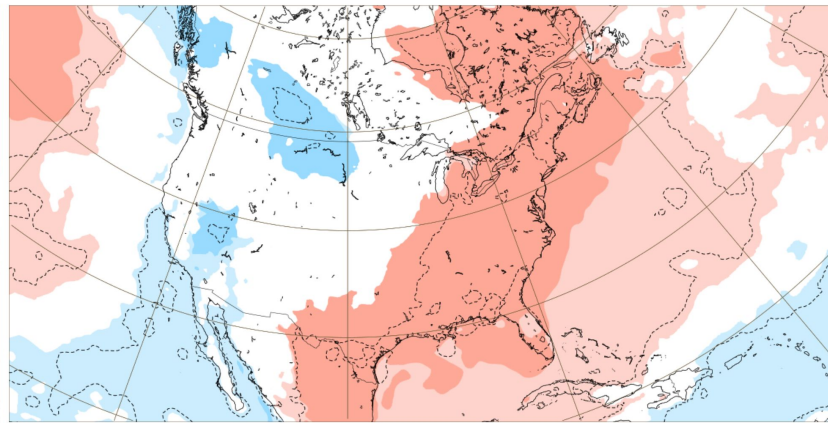
Base time: Thu 10 Nov 2022 Valid time: Mon 05 Dec 2022 - Mon 12 Dec 2022 (+768h) Area : North America



Extended range: 2m T weekly mean anomaly, significance level: 10 % (C)  
<-10 -10 -6 -3 -1 0 1 3 6 10 >10

## 2 m temperature: Weekly mean anomalies

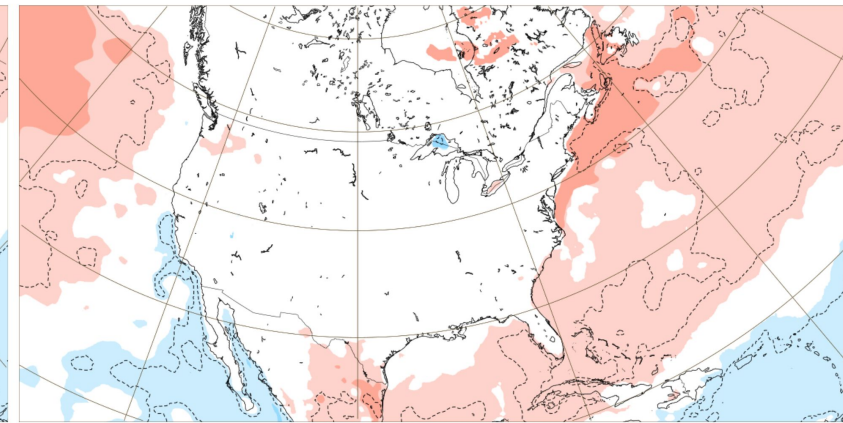
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**European Centre for Weather Forecasting (ECMWF) extended model which goes out six weeks shows a possible storm system moving through NM the week of December 5, 2022 and the week of December 12, 2022 but as of now, don't look particularly cold (white = .**

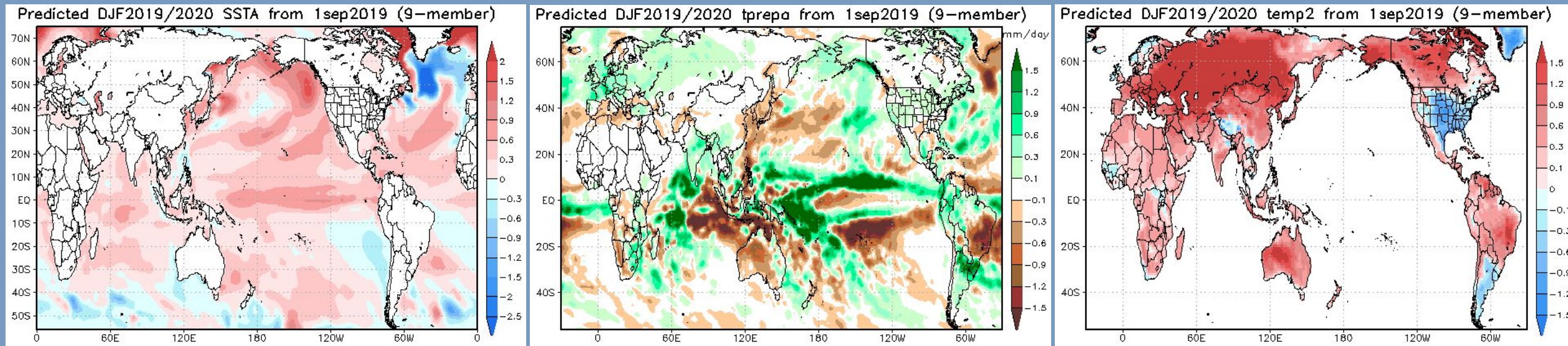


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Japan Agency for Marine-Earth Science & Technology (JAMSTEC)



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## ENSO forecast from JAMSTEC:

...the model predicts that an El Niño-like pattern (looks a mixture of Modoki-type and canonical-type) will appear in the tropical Pacific from winter through the first half of year 2020.

**Figures 32-34.** JAMSTEC is forecasting a weak central Pacific or Modoki El Niño this winter. Their ensemble climate model (SINTEX-F) is also forecasting slightly above average precipitation for much of the western U.S. along with colder than average temperatures for the vast majority of the lower 48.

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## Summary



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- Forecasts from the most highly skilled climate forecast models along with precipitation and temperature data from winter 2020-21 and 2021-22 indicate that precipitation in central and northern New Mexico during December, January, and February (DJF) 2022-2023 will most likely range from near average in far northern NM to slightly below average central areas and below average south.
- Forecasts from the most highly skilled climate models suggest that snowfall will range from near average far northwest and north-central to below average in central and well below average south.
- Temperature trends from the past 20 years combined with data from recent analog years (2020-21 in particular) along with forecasts from the most highly skilled climate models suggest temperatures will range from slightly below to near 1991-2020 climatological averages in DJF 2022-23.



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## Outlook Information



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### A few recent, notable quotes about the 2022-23 La Niña/ENSO from one of the World's Leading Climate Scientists

The La Niña cooling in the tropical Pacific can readily reverse, with an El Niño pattern effectively pumping heat out of the ocean and into the atmosphere. A preliminary analysis colleagues and I conducted suggests that the global ocean heat content is at record-high levels. Exceptionally warm deep waters in the tropical western Pacific right now suggest prospects for the next El Niño event in 2023, potentially resulting in more global temperature records in 2024 as some ocean heat returns to the atmosphere.

All La Niñas are not the same, however. Because of how sea temperatures responded to the heat in the extratropics, the environment today is very different than it was two years ago. Warmth in the North Pacific could have consequences for the “pineapple express” and other West Coast U.S. storms this coming winter.

**Kevin Trenberth** - Distinguished Scholar, NCAR;  
Affiliated Faculty, University of Auckland

- Outlook provided by National Weather Service Forecast Office Albuquerque, NM.
- For further information contact Andrew Church: [andrew.church@noaa.gov](mailto:andrew.church@noaa.gov) (505) 244-9150