2019-20 Winter Outlook

For Northern & Central New Mexico

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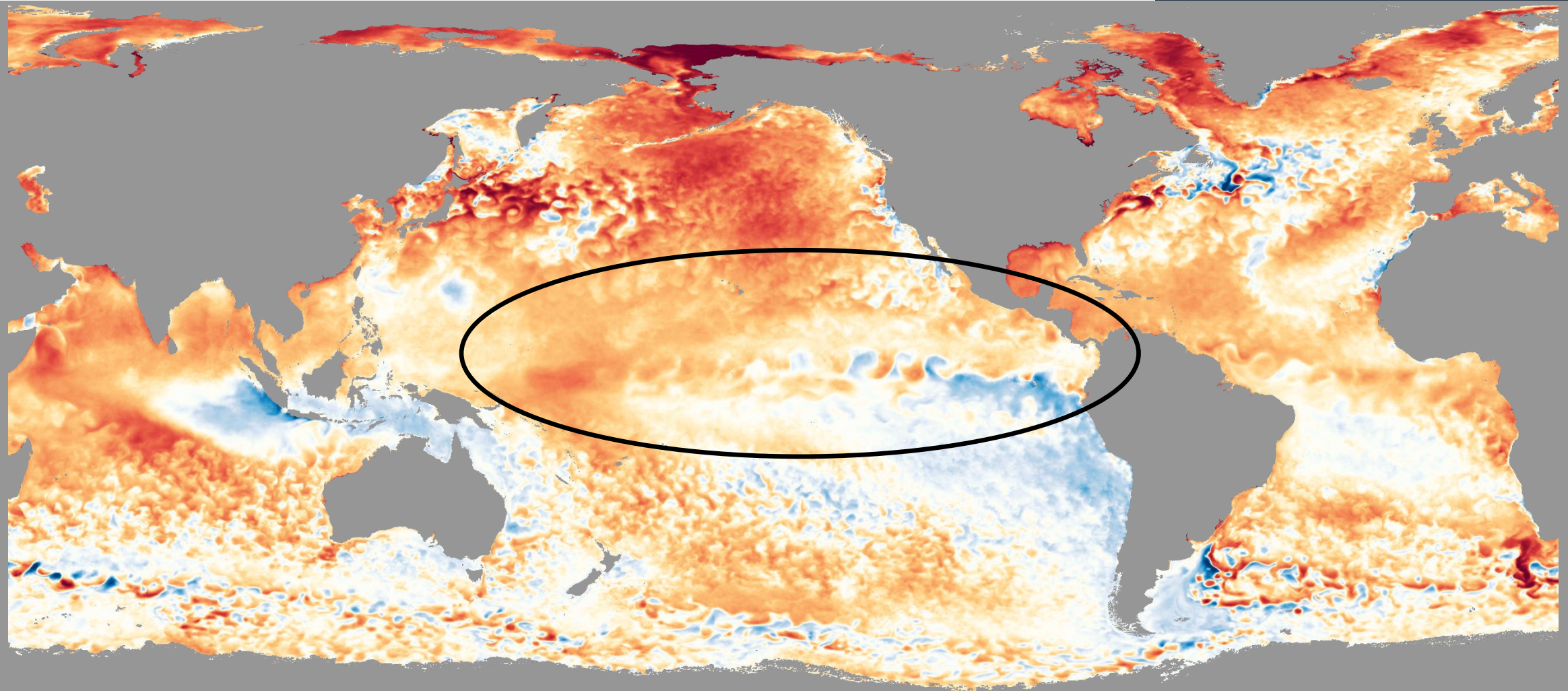

Figure 1. Global Sea Surface Temperature (SST) anomalies from mid October 2019. Orange/red color depicts above average temperatures and blue depicts below average temperatures. The El Niño of 2018-19 has ended and neutral conditions have returned to the tropical Pacific Ocean. How might this influence the upcoming winter season for northern and central New Mexico?

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Weekly Sea Surface Temperature Observations & Oscillation Index Values

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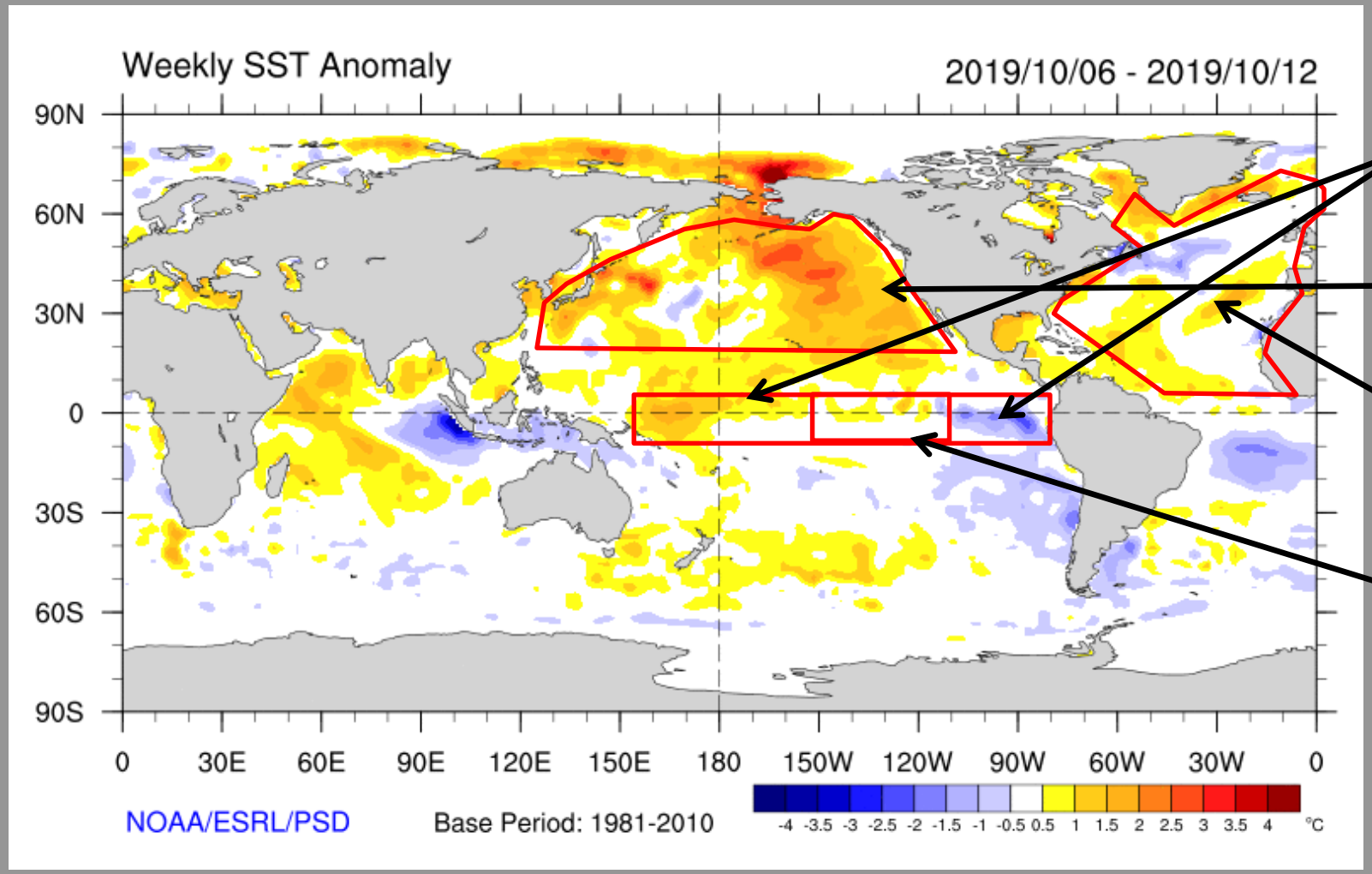

- Multivariate ENSO Index (MEI) for AUG_SEP 2019: +**0.2**
- Pacific Decadal Oscillation (PDO) for SEP 2019: +**0.41**
- Atlantic Multidecadal Oscillation (AMO) for SEP 2019: +**0.242**
- Oceanic Niño Index (ONI) (uses Niño 3.4 region - inner rectangle) for JAS 2019: **+0.1**

Figure 2. Latest weekly global SST anomalies showing cooler than average temperatures losing ground in the eastern equatorial Pacific Ocean.

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Sub-Surface Temperature Departures in the Equatorial Pacific

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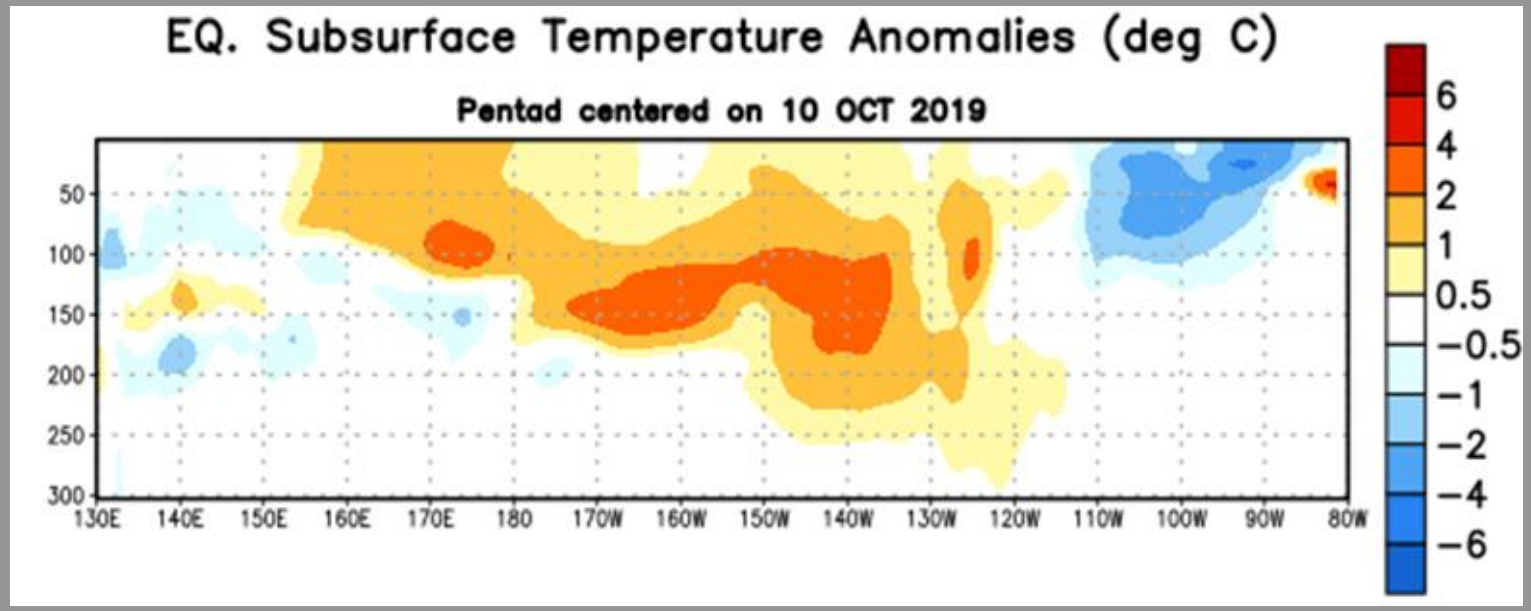

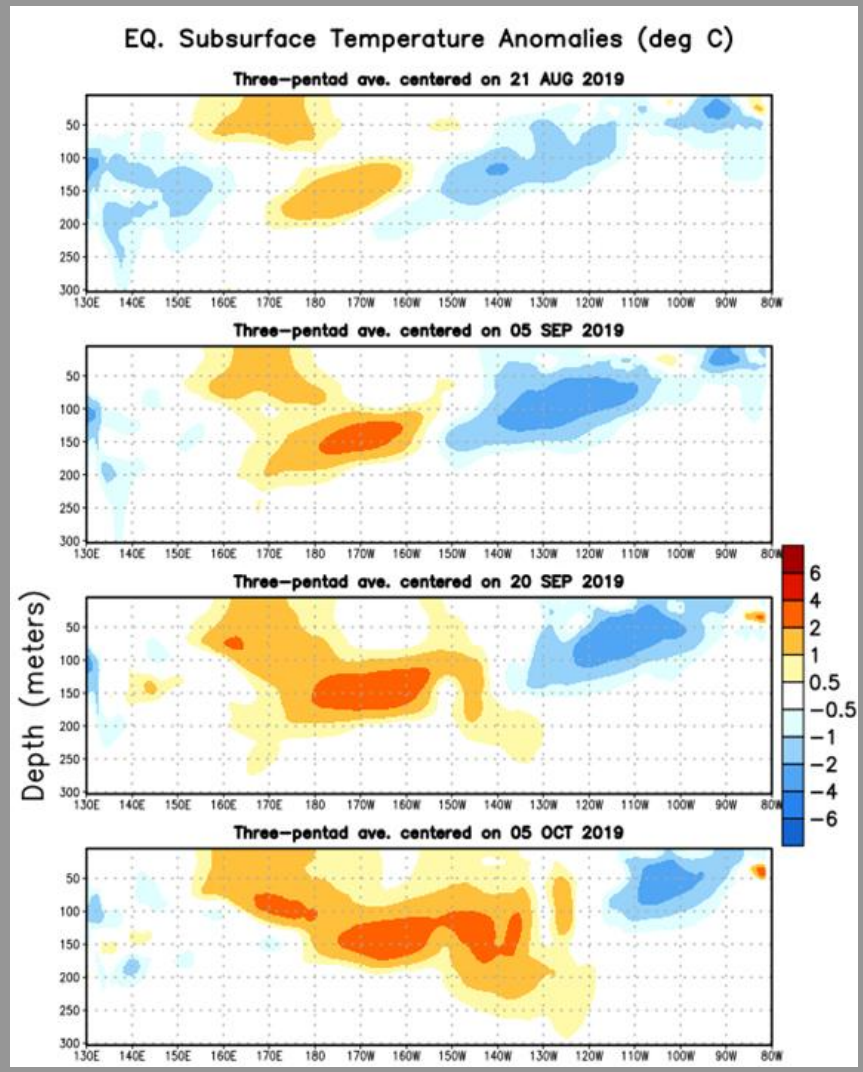

Figures 3-4. Since late August, negative subsurface temperature anomalies have continued to shrink in the eastern equatorial Pacific Ocean while positive subsurface temperature anomalies have strengthened in the central Pacific.

2019-20 Winter Outlook

A Neutral Eastern Equatorial Pacific?

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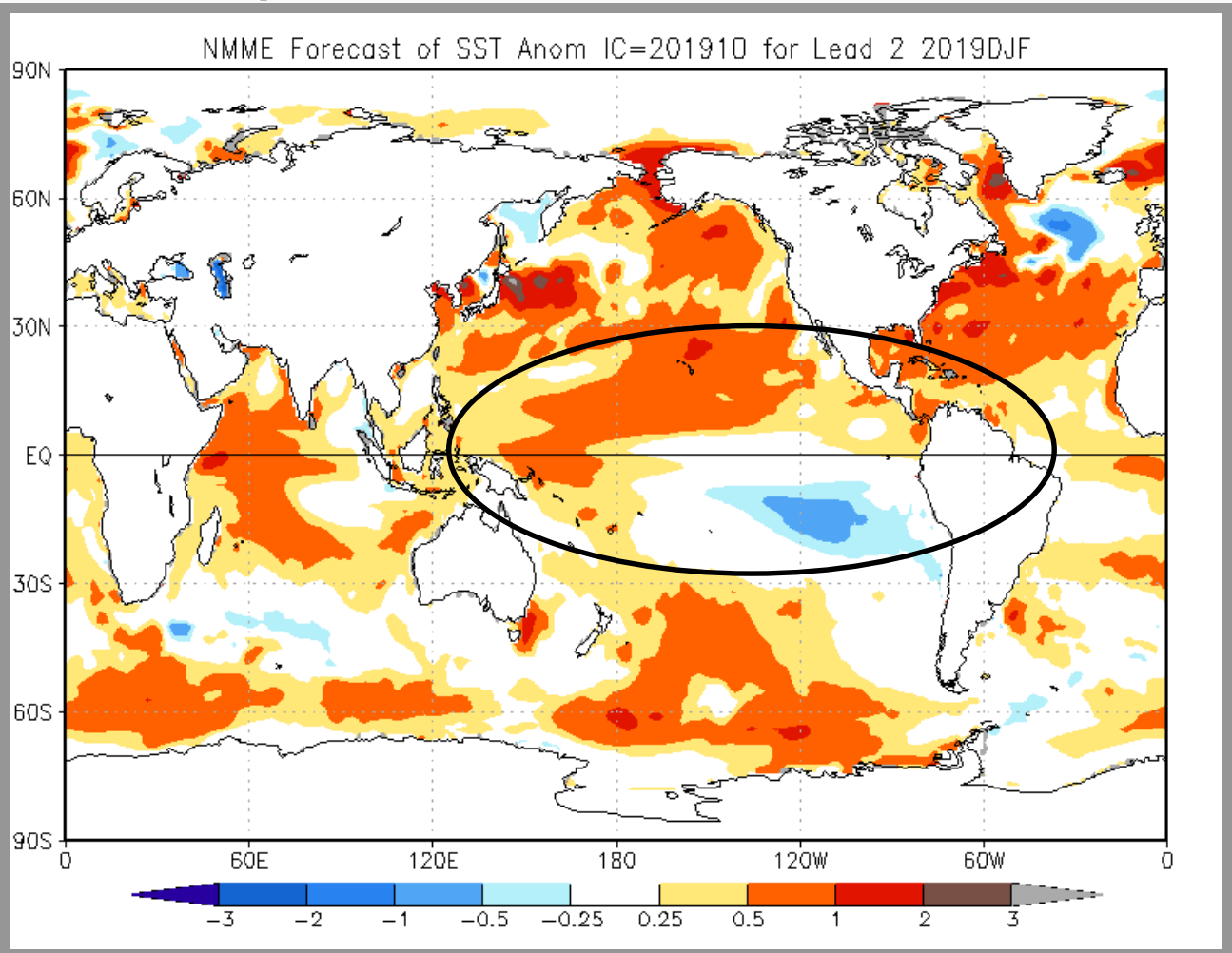

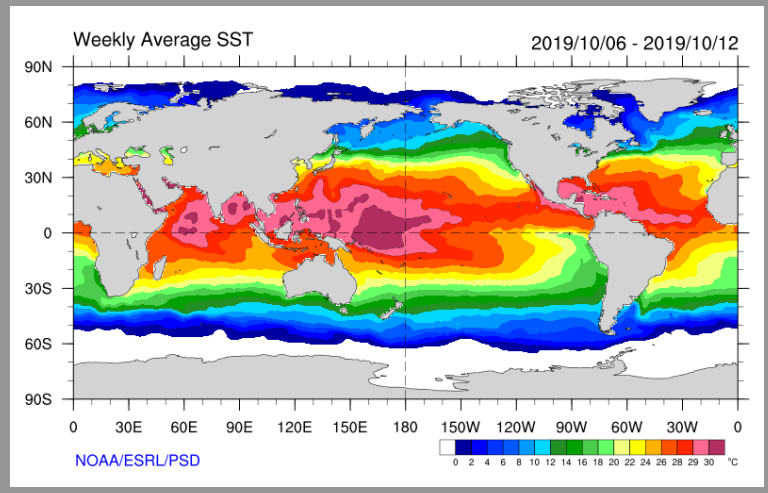

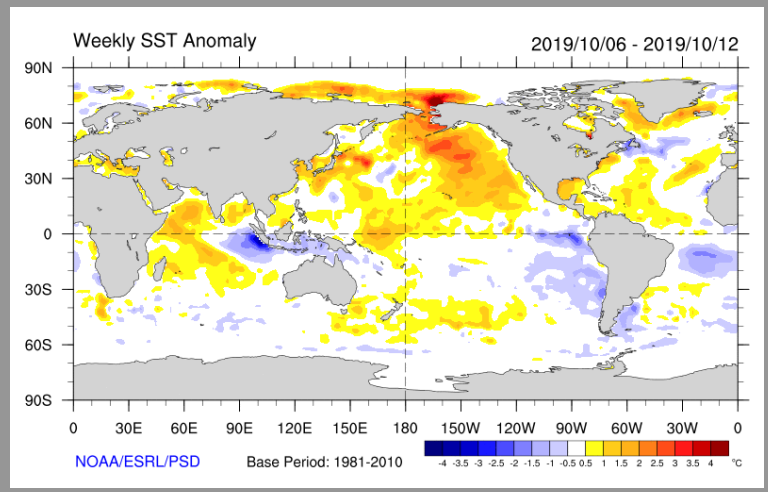

Figures 5-7. NMME SST anomaly forecast for DJF (left) showing that departures in temperatures are not forecast to change much from current conditions (bottom right). How does that change northern hemispheric weather patterns in winter given the current state of SSTs (top right)? Typically, it's about the temperature gradient or the rate of change of temperature with distance in a given direction that leads to tropical and sub-tropical thunderstorms which impact the location of the jet stream.

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Madden-Julian Oscillation (MJO) and El Niño

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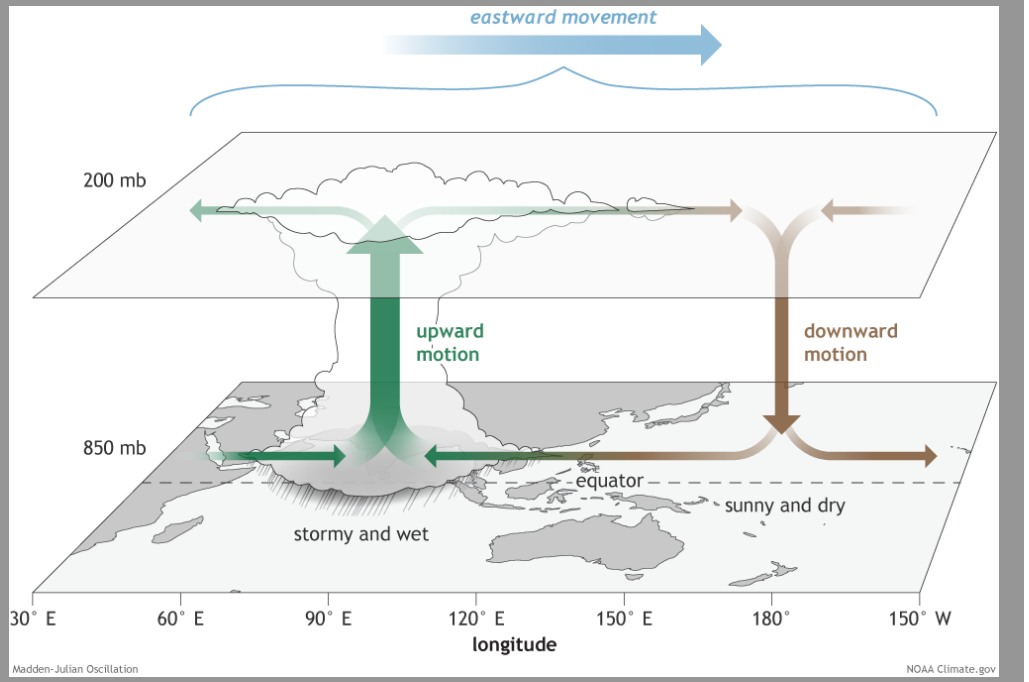

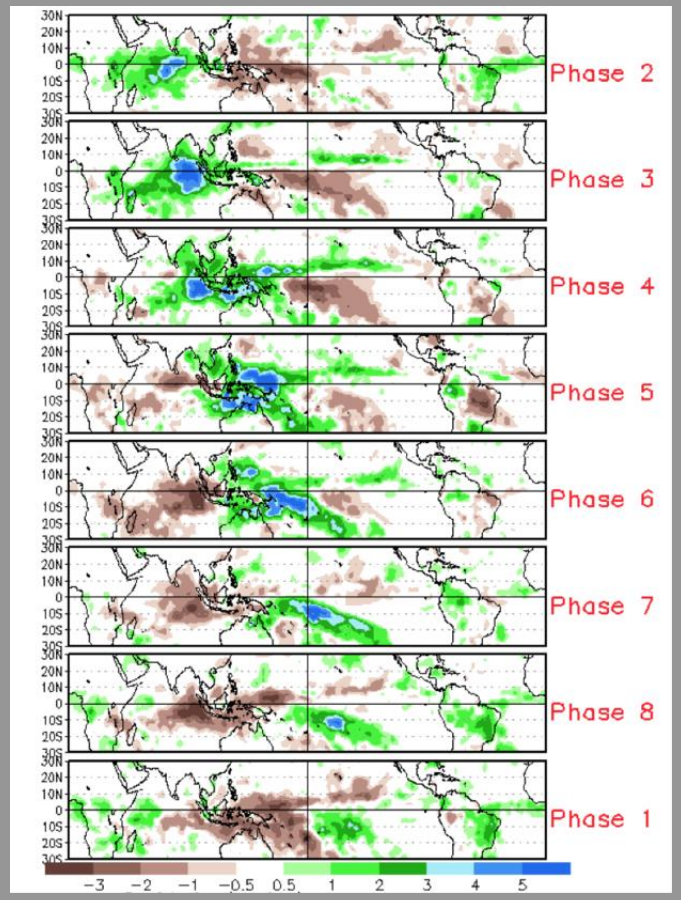

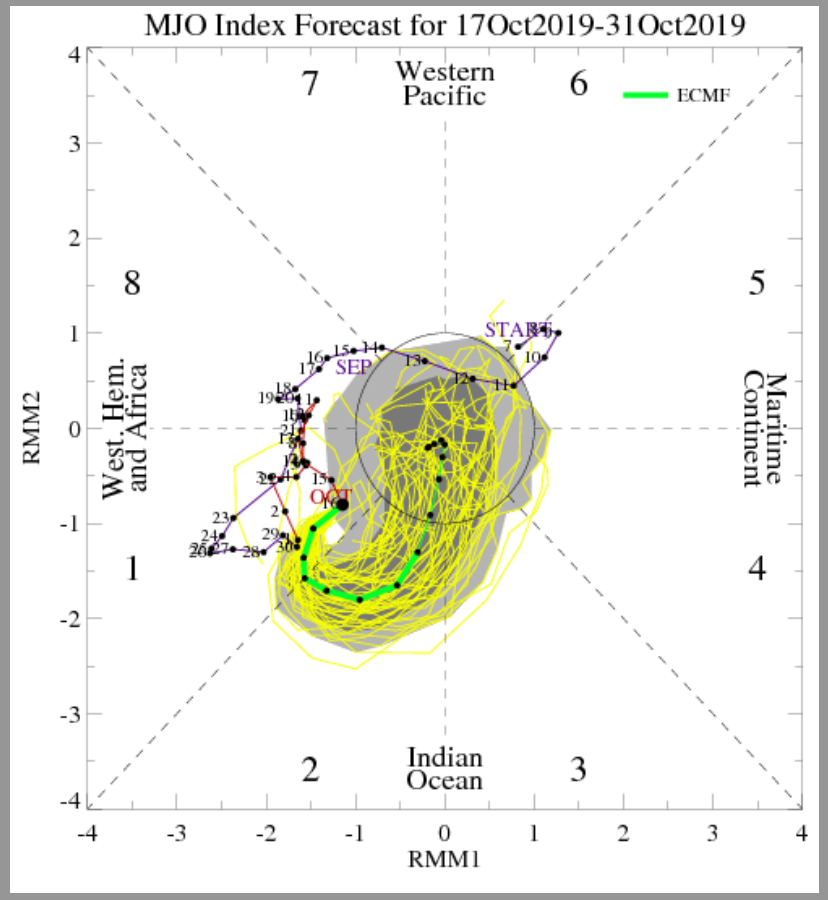

Figures 8-10. The MJO is an area of enhanced thunderstorms that travels around the world every 30 to 60 days from west to east along/near the equator. Ahead and behind the active stormy area are areas of suppressed convection and drier conditions. The MJO affects near-surface wind patterns, because the rising air in the stormy area causes surface winds to blow toward the active area. During a developing El Niño, the trade winds are weaker than average, warming up surface waters (vice versa during La Niña). If the MJO is active/strong, it typically changes the wind patterns temporarily and helps either and El Niño or La Niña develop.

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The Pacific Decadal Oscillation (PDO)

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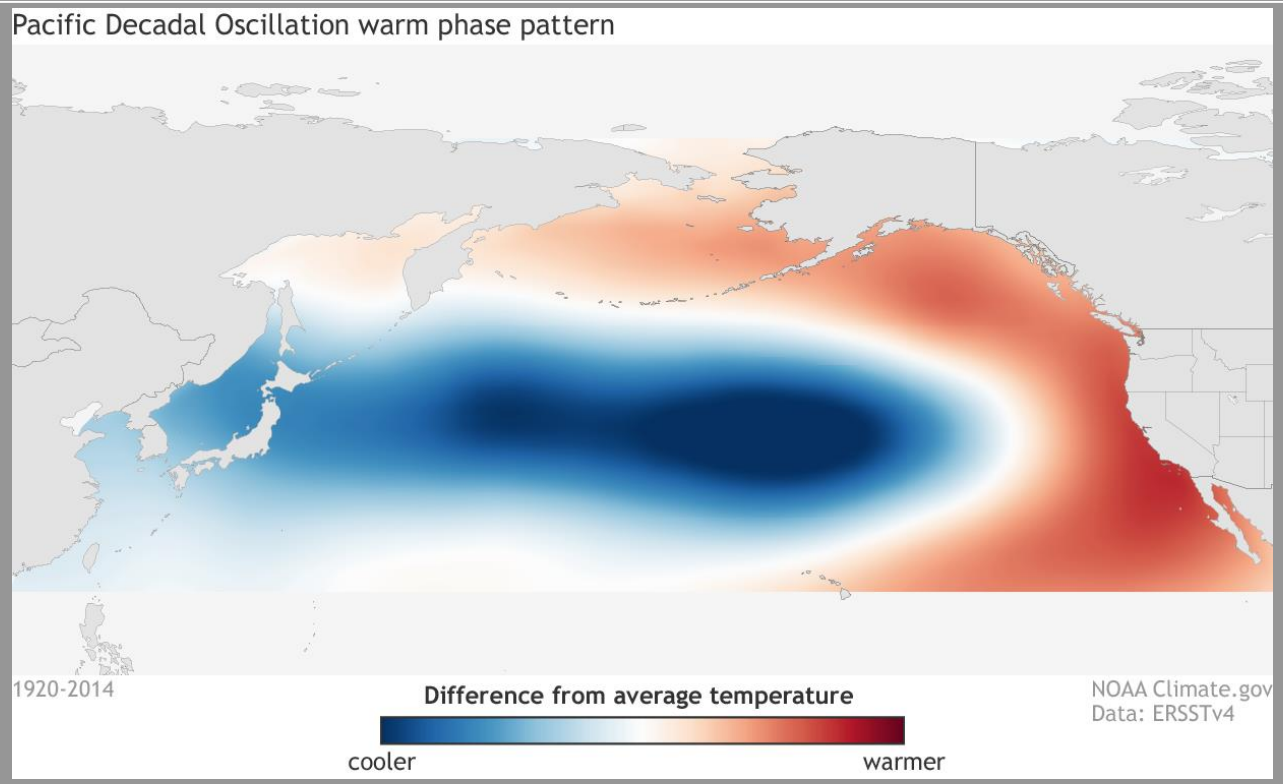
A key factor during a positive PDO is increased low-level moisture availability in far northeast Pacific/Gulf of CA.



PDO Aug, Sep, Oct 2019	PDO Aug, Sep, Oct 2016	PDO Aug, Sep, Oct 1998	PDO Aug, Sep, Oct 1992	PDO Aug, Sep, Oct 1987
0.38, ??, ??	0.52, 0.45, 0.56	-0.22, -1.21, -1.39	1.44, 0.83, 0.93	2.83, 2.44, 1.36

Figure 11. Typical Sea Surface Temperature Anomaly (SSTA) patterns in the North Pacific Ocean during a positive Pacific Decadal Oscillation phase (PDO). As with ENSO, a positive PDO correlates well with above average winter precipitation in the southwest United States.

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

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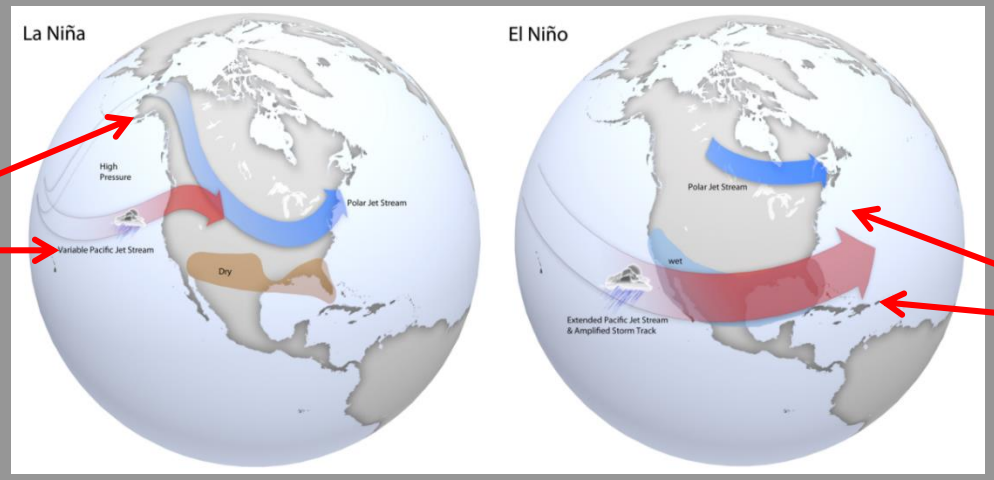
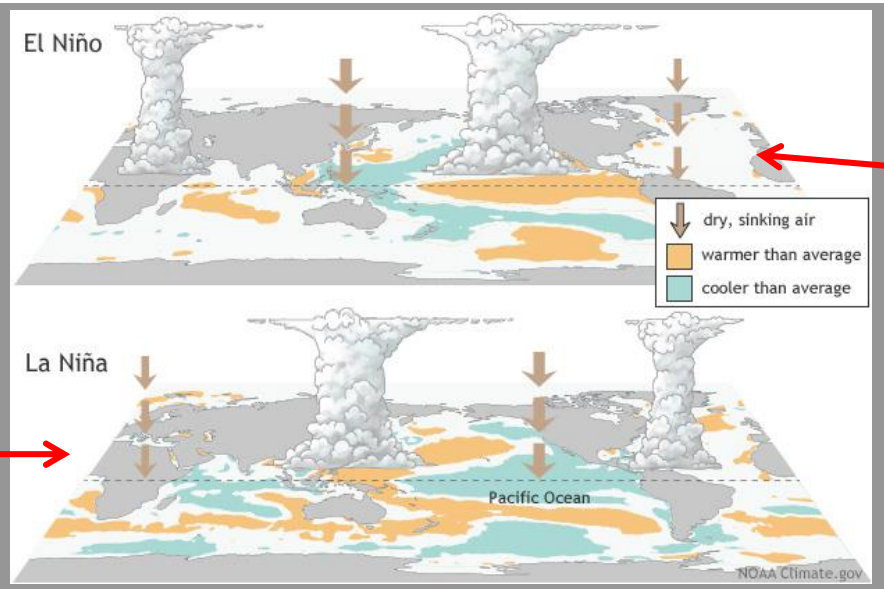
Typical Jet Stream Pattern during La Niña



Typical Jet Stream Pattern during El Niño



Typical Tropical circulations during El Niño

Typical Tropical circulations during La Niña

Figures 12-13. 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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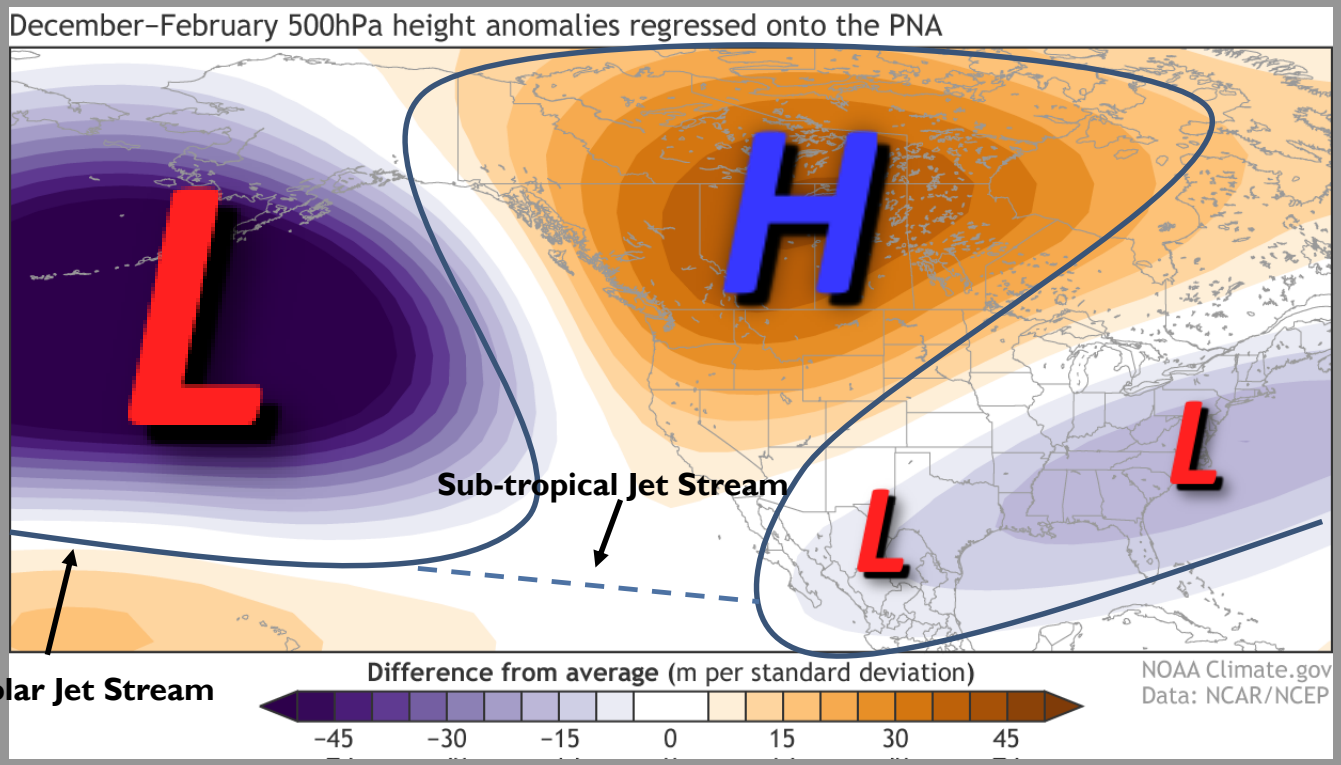
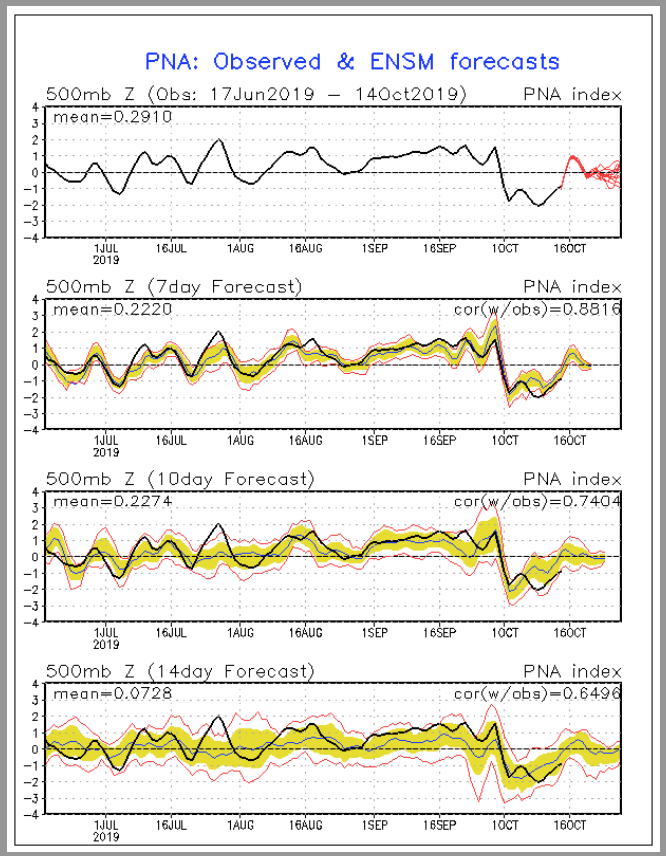
Positive Pacific-North American Teleconnection Pattern (PNA)





Figures 14-15. 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 Most of last winter and spring across much of central and northern New Mexico was wetter and cooler than average. Why? The climate pattern can be attributed to a weak El Niño which sent the jet stream into a familiar pattern. A positive PNA pattern (above) developed in August 2018 and continued through much of the time since then. 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.

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Comparing Late Sept 2016 Global SSTAs to Late Sept 2019

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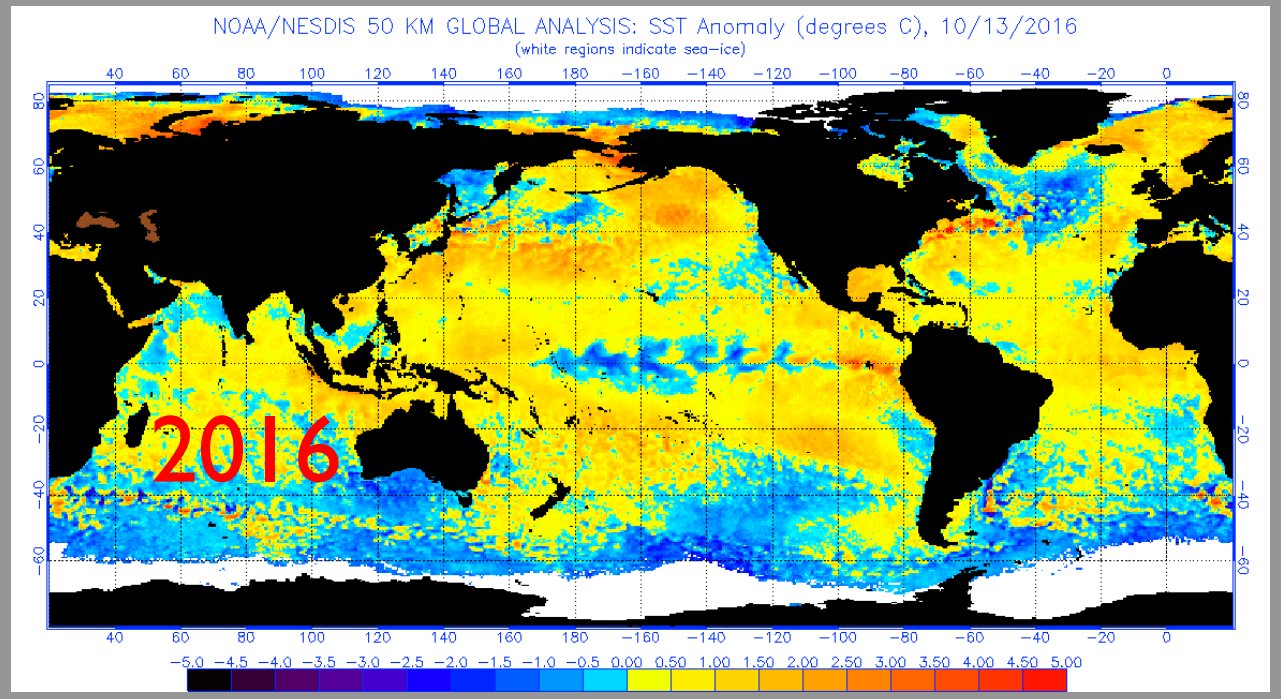

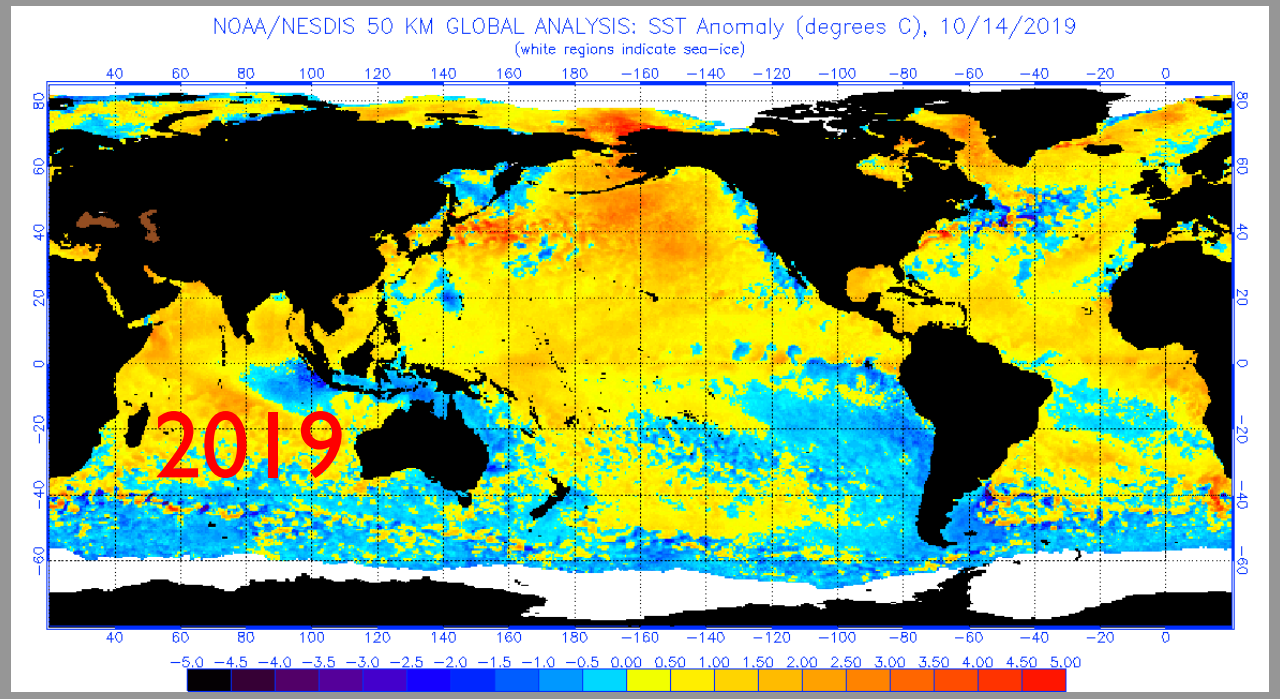

Figures 16-17. SSTAs from the most recent "analog" year, 2016 and current conditions. Note the many similarities.

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Precipitation and Temperature Anomalies

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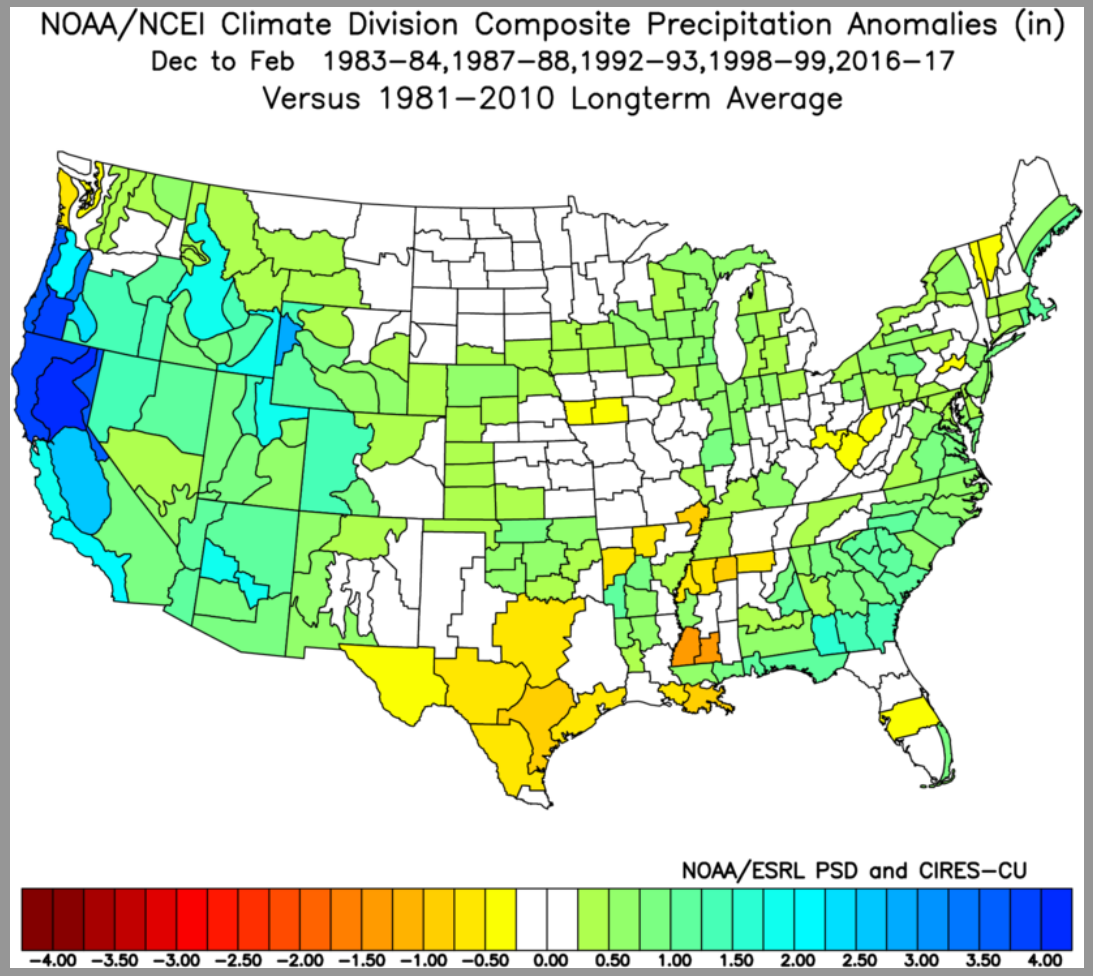

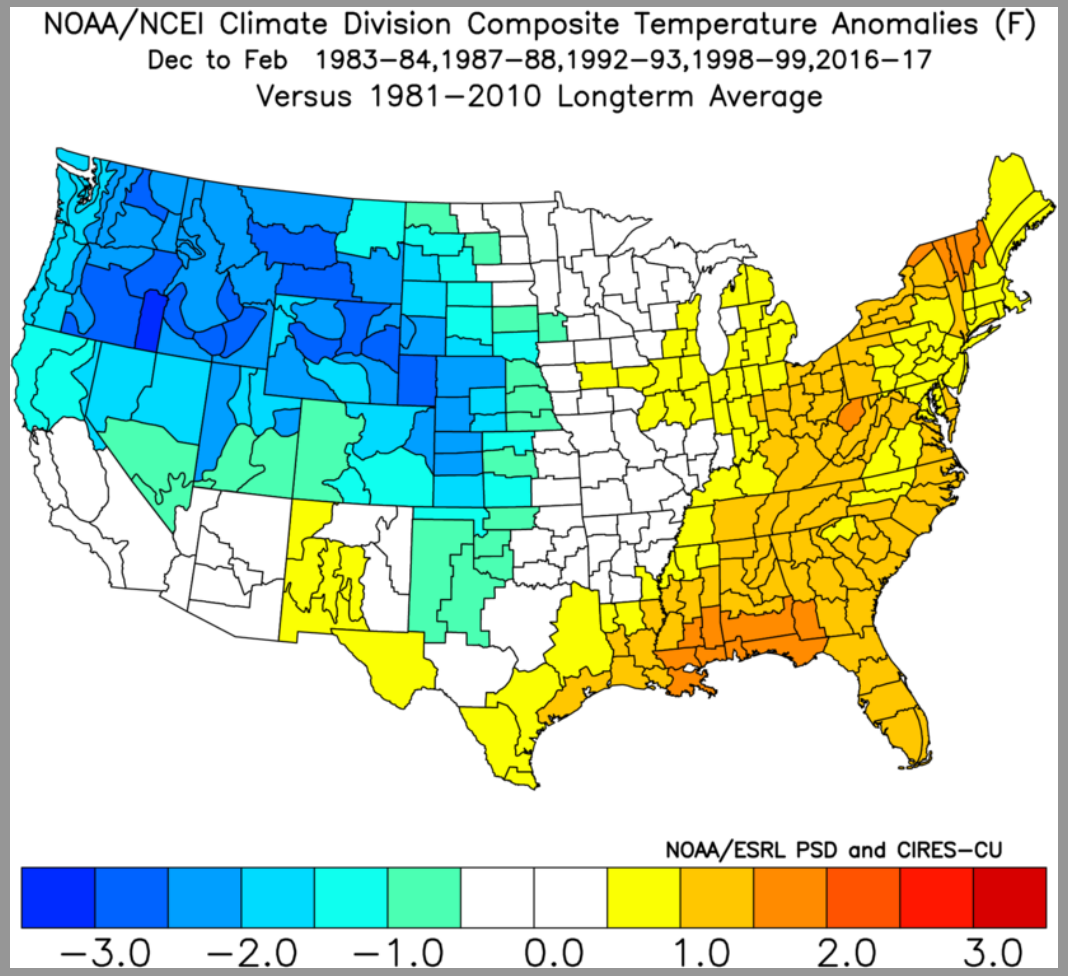

Figures 18-19 . DJF Precipitation and Temperature anomaly plots for CPC's climate divisions comparing five analog seasons (1983-84, 1987-88, 1992-93, 1998-99, & 2016-17) with 30-year climatological averages. Four climate divisions in western New Mexico were slightly above average for precipitation while central and eastern divisions were very near average with regard to precipitation. Temperatures were slightly above 1981-2010 climatological averages west and central and near average north and east.

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Most Recent (2016-17) Analog Year Precipitation

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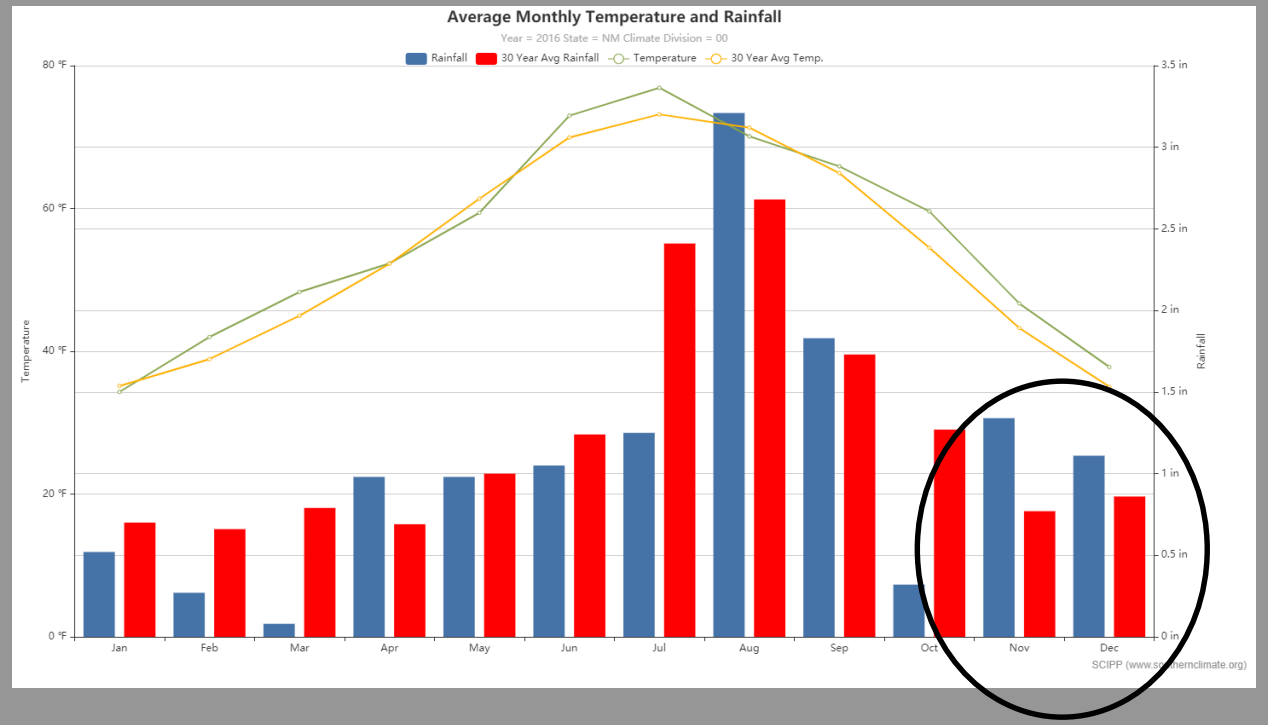

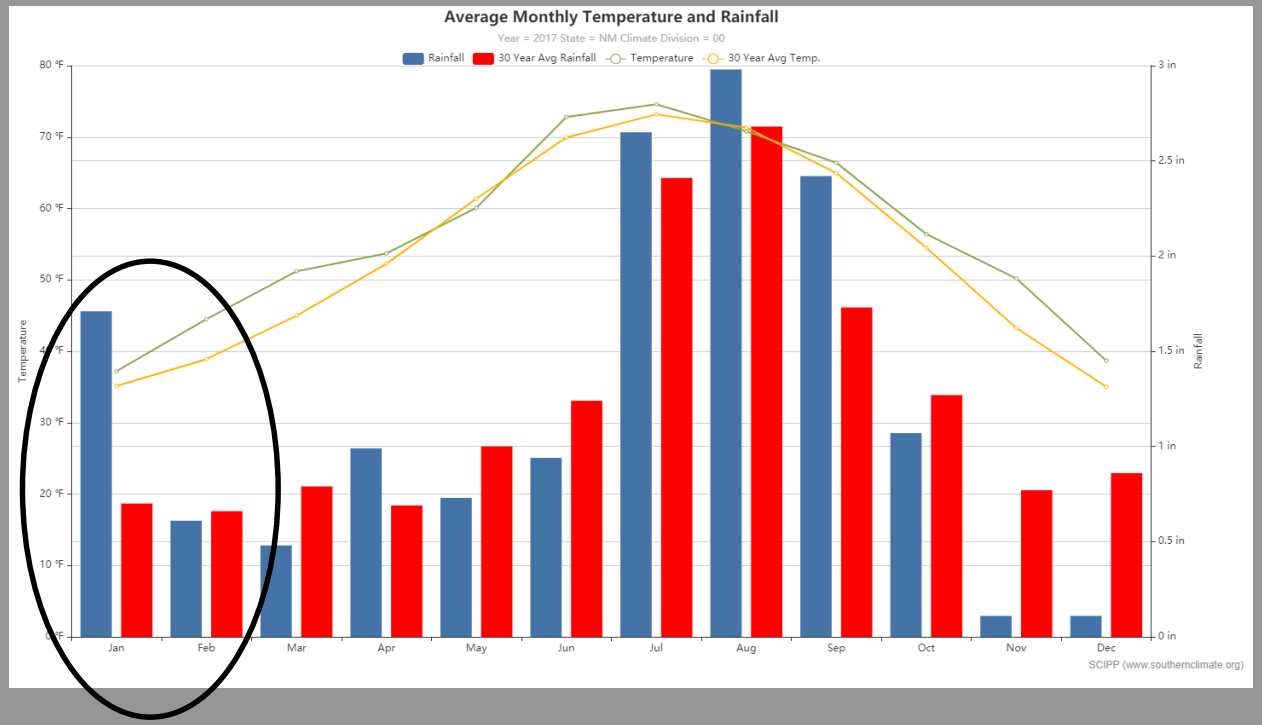

Figure 20-21. Precipitation was above average across New Mexico in December 2016, January 2017 and slightly below average in February 2017.

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Latest Climate Model Forecasts

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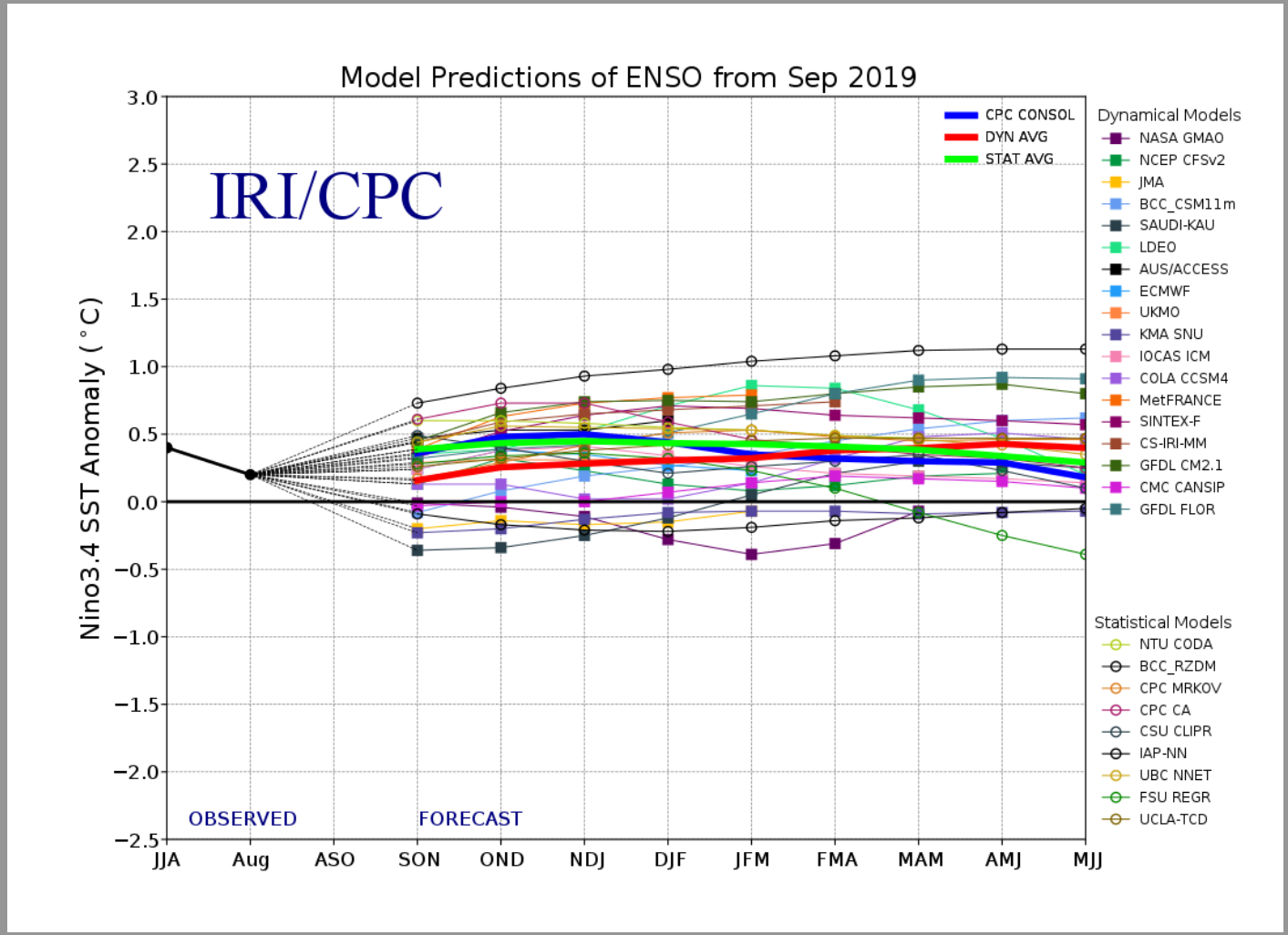

Figure 22. Vast majority of climate models stay the course and keep the eastern equatorial Pacific in a neutral state during the Northern Hemisphere winter (DJF) 2019-20 and keep in going through summer 2020.

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Climate Prediction Center's Official 2017-18 Winter Outlook

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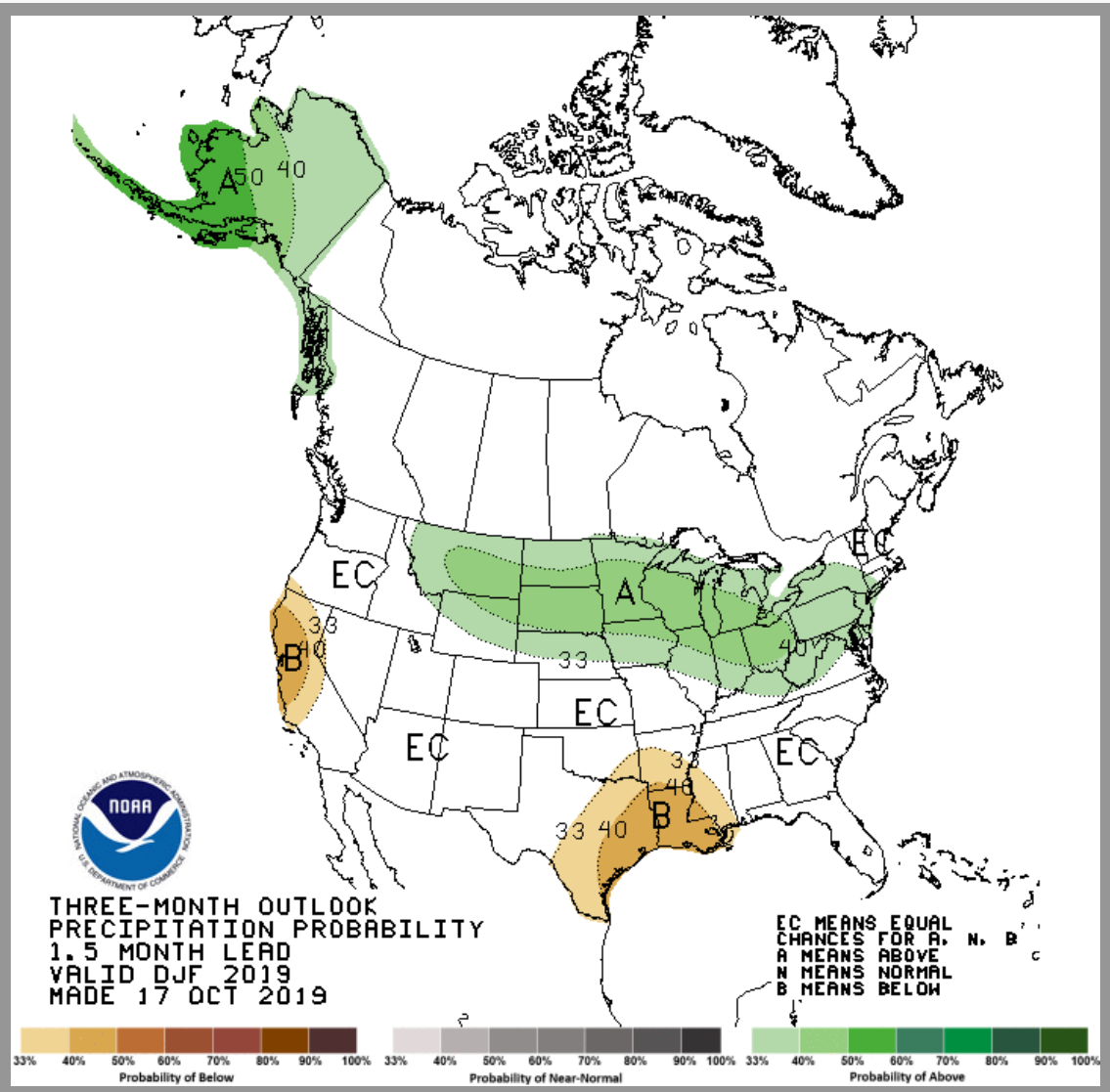

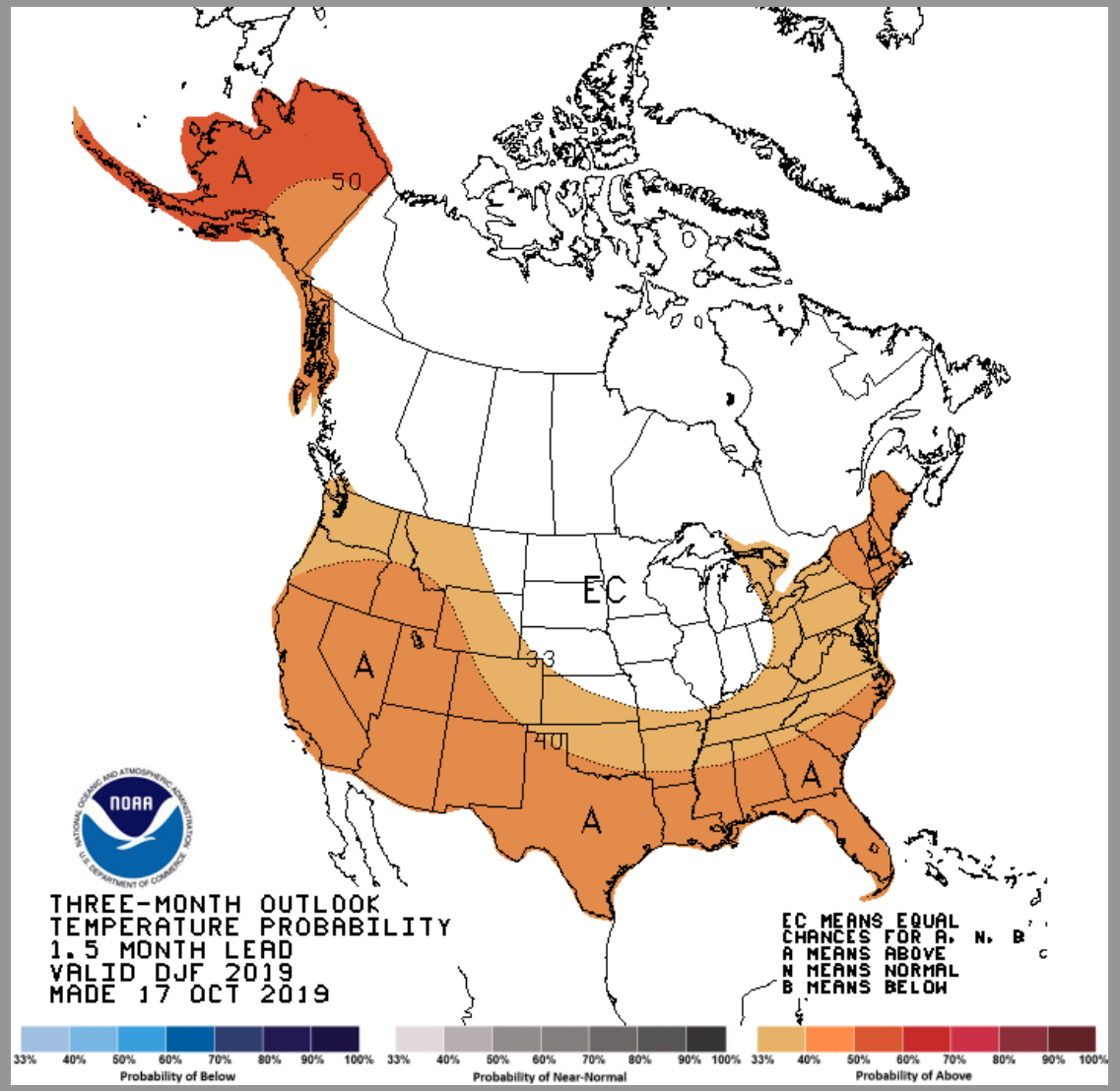

Figures 23-24. CPC's DJF 2019-20 precipitation and temperature forecasts favoring average precipitation and above average temperatures for all of New Mexico.

2019-20 Winter Outlook

Numerical Climate Prediction Model Precipitation for DJF

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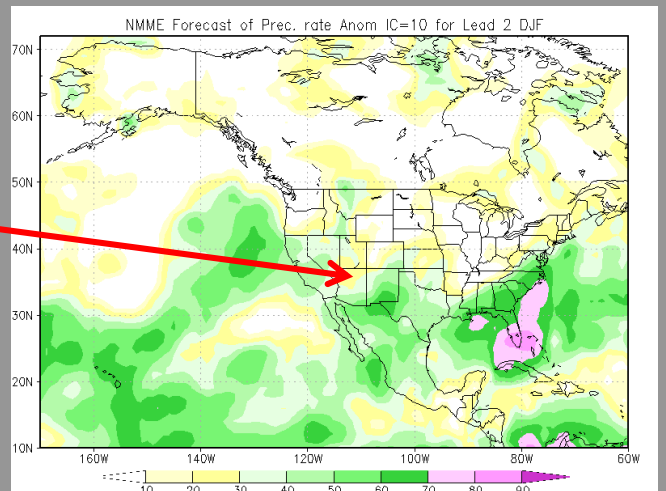
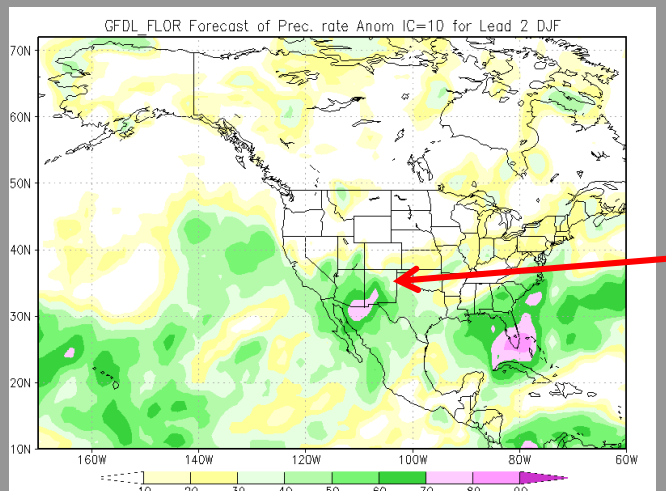
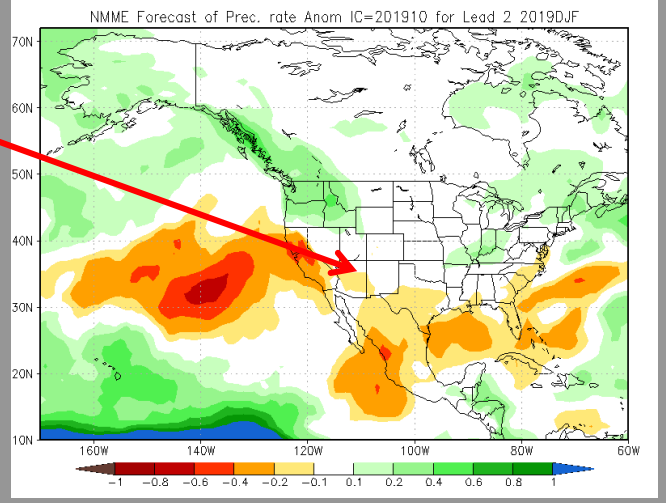
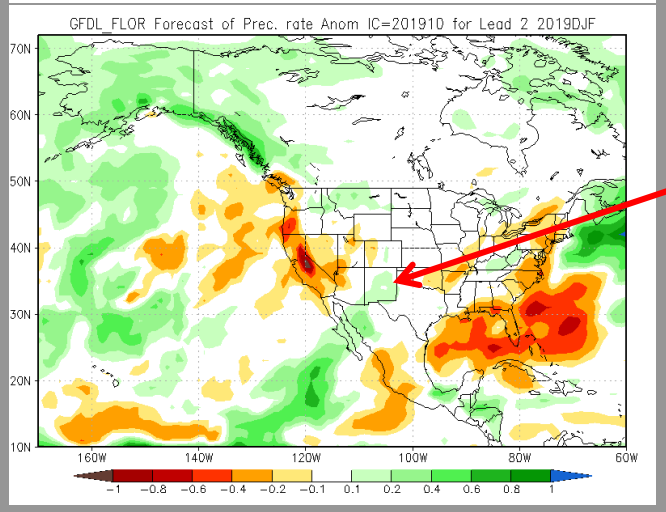
Highest model skill in DJF across southern NM.

White equates to average precipitation rates.









Highest model skill in DJF across southern NM.

Light green equates to slightly above average precipitation rates.

Figures 24-27. Model precipitation rate anomaly plots from the two climate models which have the highest skill percentages (top two images), the North American Multi-Model Ensemble (NMME) and the Geophysical Fluid Dynamics Laboratory (GFDL_FLOR) model. Forecasts range from average to slightly above average precipitation for DJF 2019-20 across New Mexico.

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Numerical Climate Prediction Model Temperatures for DJF

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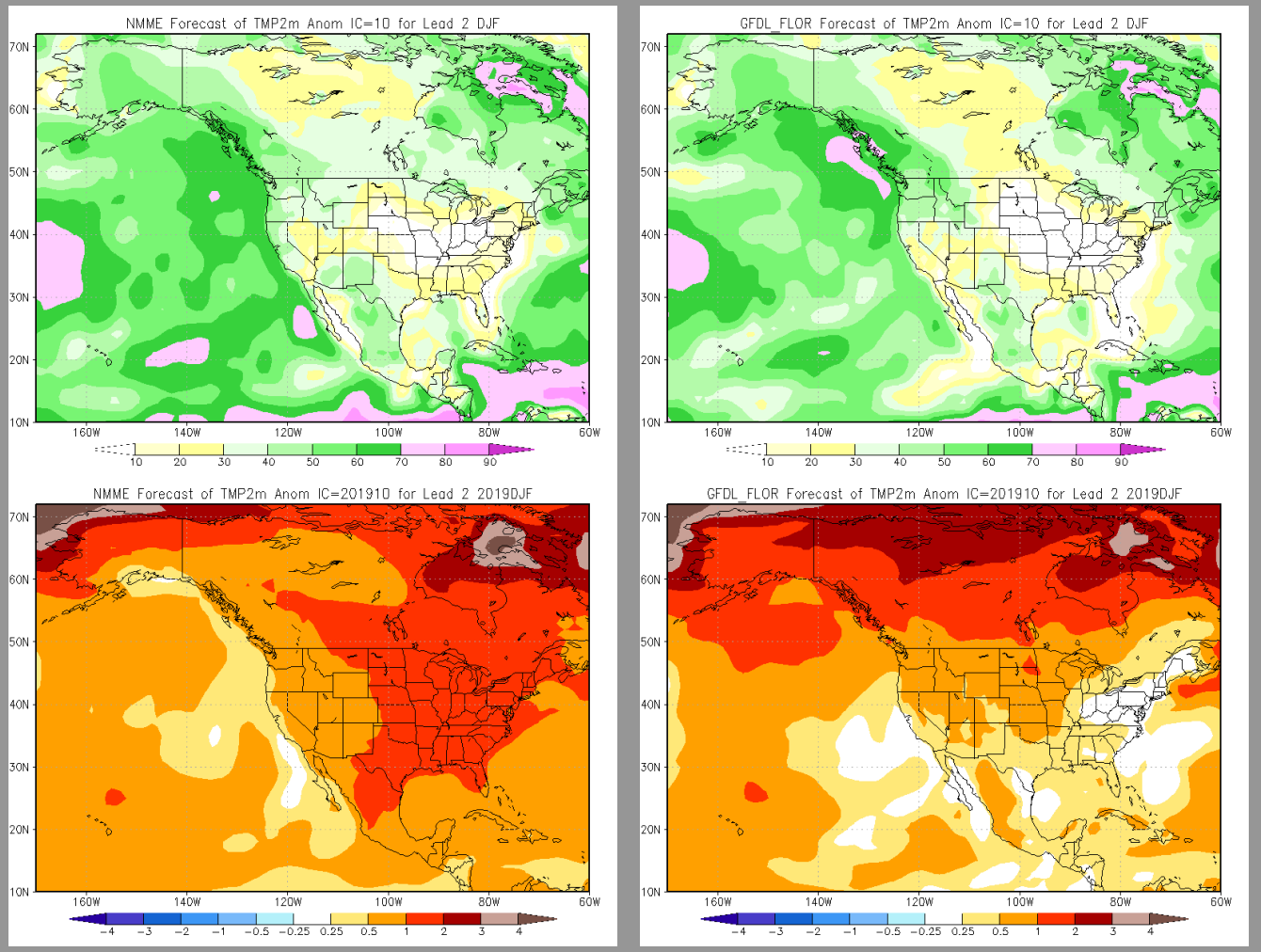

Figures 28-31. Two meter (6.5 feet above ground level) temperature anomaly forecasts from the two climate models which have the highest forecast skill percentages, the North American Multi-Model Ensemble (NMME) and the Geophysical Fluid Dynamics Laboratory (GFDL_FLOR) model. Both models forecast slightly above to above average temperatures during DJF 2019-20 across New Mexico.

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

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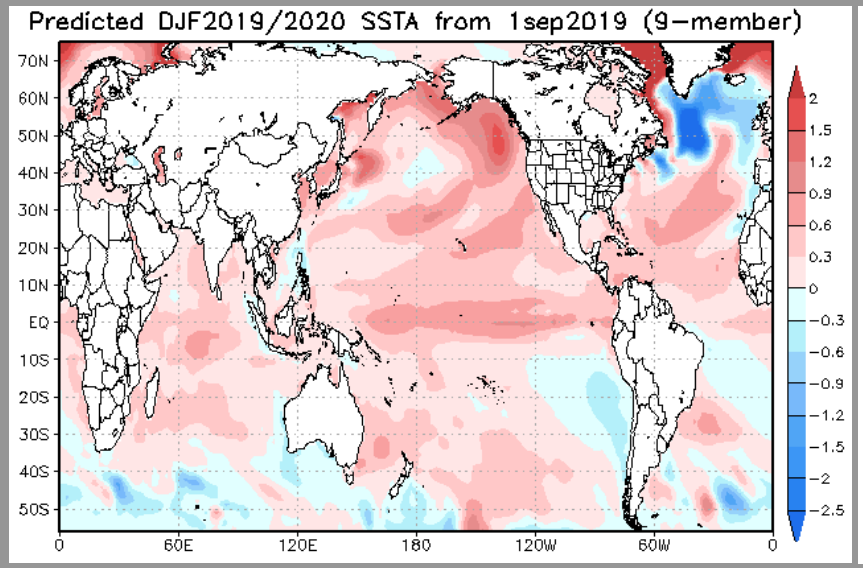

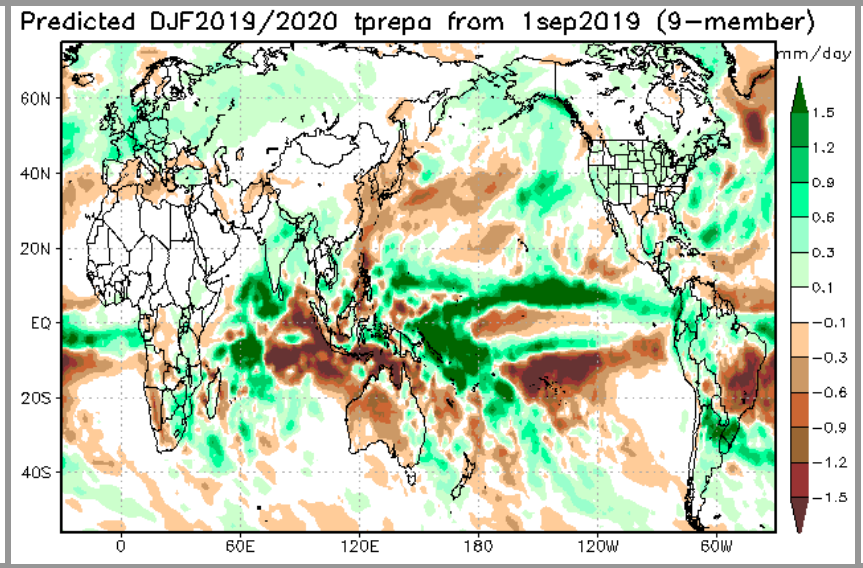

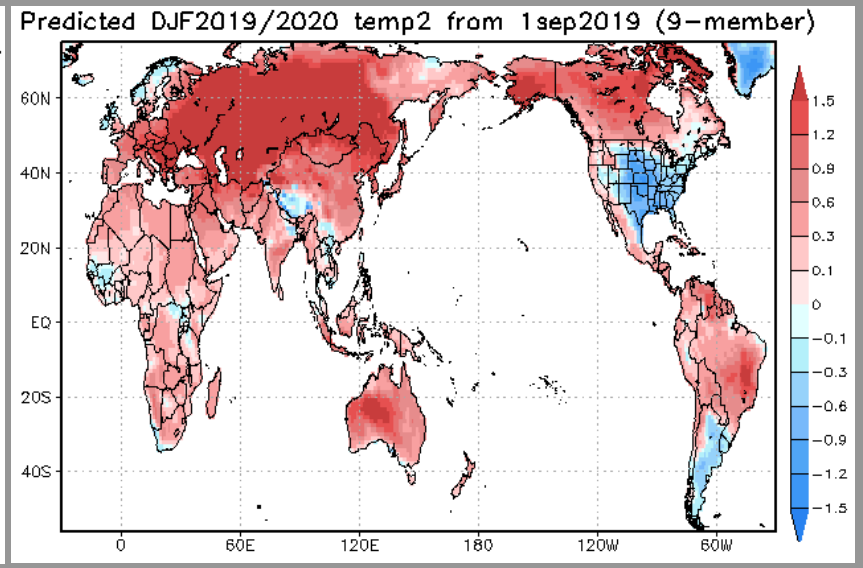

ENSO forecast from JAMSTEC:

...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.

2019-20 Winter Outlook

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Summary

- Precipitation data from five analog events (1983-84, 1987-88, 1992-93, 1997-98, and 2016-17) combined with forecasts from the most highly skilled climate forecast models indicate that precipitation in central and northern New Mexico during December, January and February (DJF) 2019-20 will most likely range from near to slightly above 1981-2010 climatological averages.

- Snowfall data from five previous weak to moderate El Niño events suggest that snowfall will range from near to slightly above average amounts in DJF 2019-20.

- Temperatures trends from the past 15 years combined with forecasts from the most highly skilled climate models suggest temperatures will range from slightly above to above average in DJF 2019-20.

2019-20 Winter Outlook

Outlook Information

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

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