2020 Fall Outlook

For the Northern Two-thirds of New Mexico

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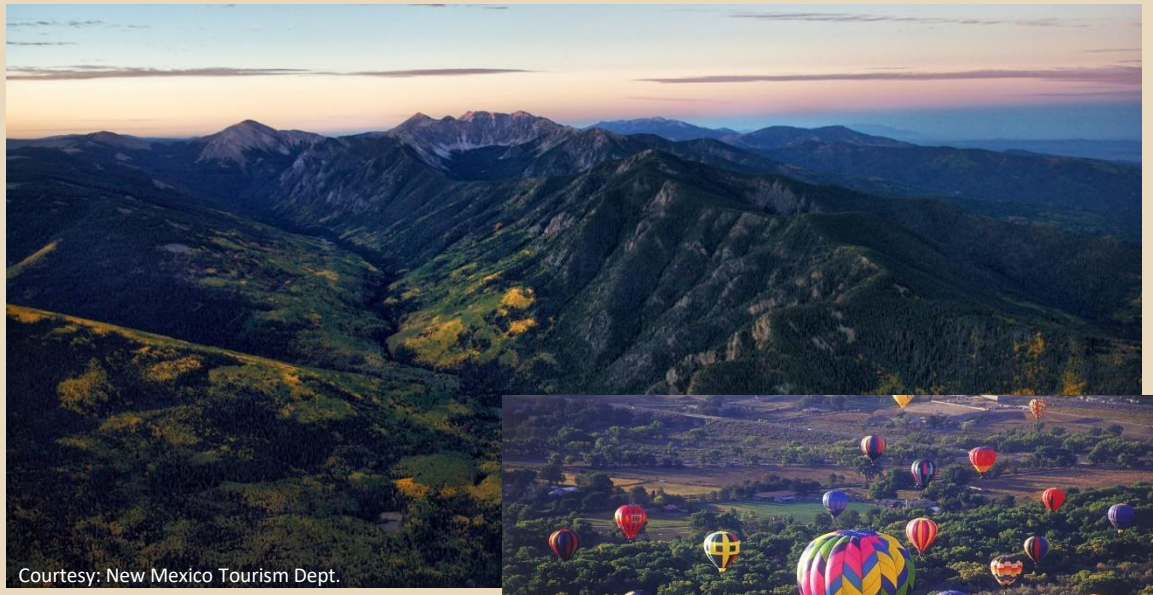
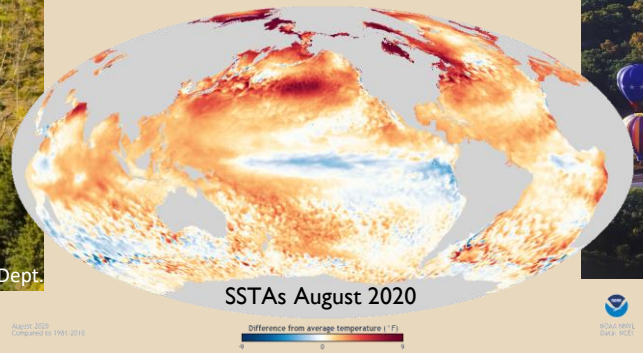
Looking NW at the east side of the Brazos Cliffs in the Tusas Mountains from near Hopewell Lake. Courtesy: New Mexico Tourism Dept.



Courtesy: New Mexico Tourism Dept.



SSTAs August 2020

What happened to North American Monsoon (NAM), again? The semi-permanent sub-tropical high dubbed the "Four Corners' High (FCH)" was stronger to much stronger than average at times in late July and much of August, similar to 2019. Is this the new "normal"? It's looking more and more like it is the new normal. Decadal data indicate that the FCH has been trending stronger over the past 15 years or so. Why? The most likely explanation has to do with a warming Earth. Warmer waters in the tropics and sub-tropics lead to more thunderstorms in that region which, in turn, lead to stronger downward motion in the mid-latitudes. Sea Surface Temperatures (SSTs) in the equatorial Pacific are currently below average or in a weak La Niña state. How will a cooler than average eastern equatorial Pacific impact weather across the northern two-thirds of the state October and November?

2020 Fall Outlook

Northern Hemisphere Circulation

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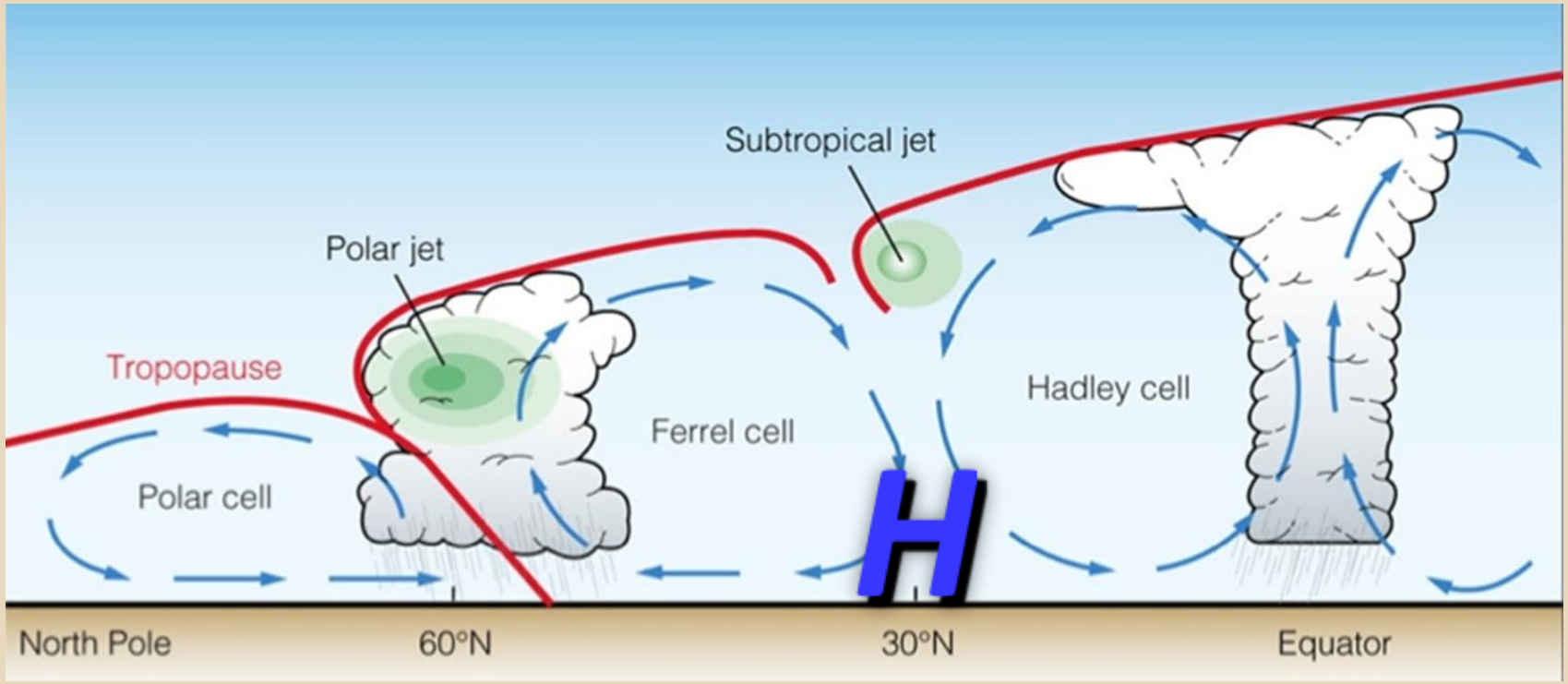

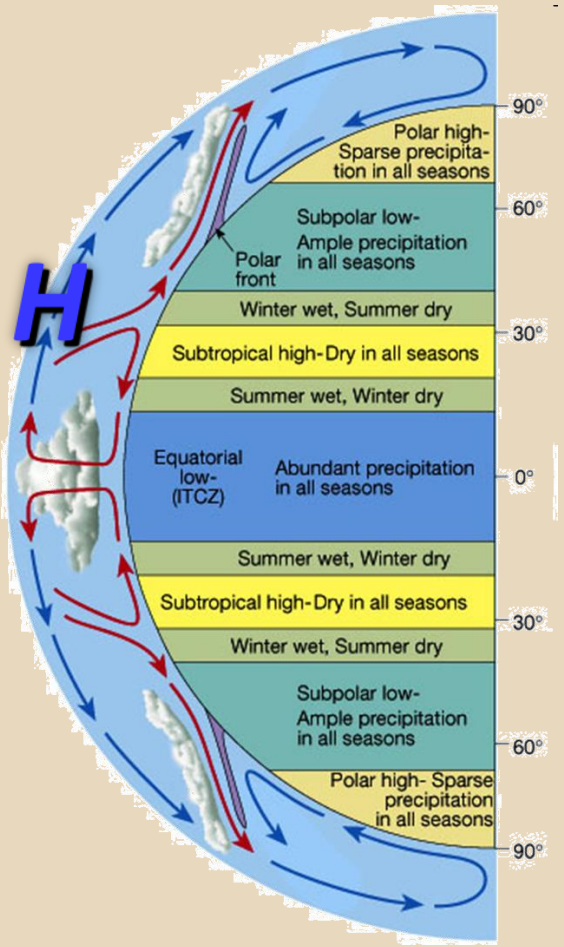

Figures 1-2. Why would a warmer earth lead to a stronger FCH? Warmer water near the equator leads to warmer near surface air and a general increase in tropical and sub –tropical thunderstorms. This increased activity results in not just a stronger Hadley cell but a stronger Ferrel cell as well thanks to a stronger temperature difference between the poles and the equator. These two more robust cells result in a FCH that is stronger to much stronger than average.

2020 Fall Outlook

Latest Sea Surface Temperature Observations & Oscillation Index Values

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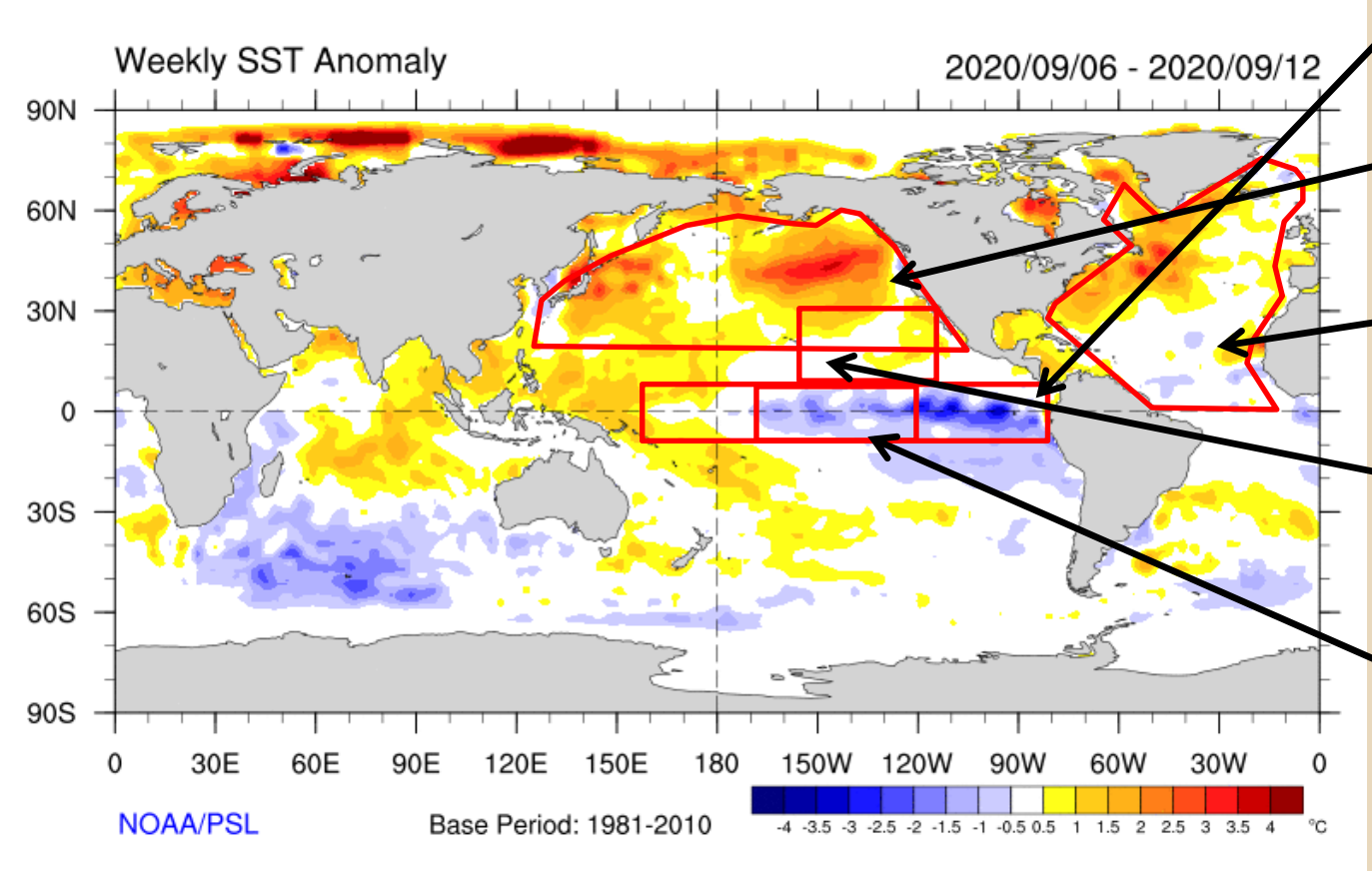
***SSTs are what drive tropical & subtropical thunderstorms. It's these thunderstorms that drive global weather patterns/climate.**



- Multivariate ENSO Index (MEI) for JUL-AUG 2020: **-1.0**
- Pacific Decadal Oscillation (PDO) for AUG 2020: **-0.28**
- Atlantic Multidecadal Oscillation (AMO) for JUL 2020: +**0.44**
- Pacific Meridional Mode (PMM) for JUL 2020: **+1.97**
- Oceanic Niño Index (ONI) (uses Niño 3.4 region - inner rectangle) for JJA 2020: **-0.4**

Figure 3. SST Anomalies in the Equatorial Pacific Ocean in early September 2020 showing cooler than average conditions in the equatorial Pacific.

2020 Fall Outlook

Sub-surface Temperatures

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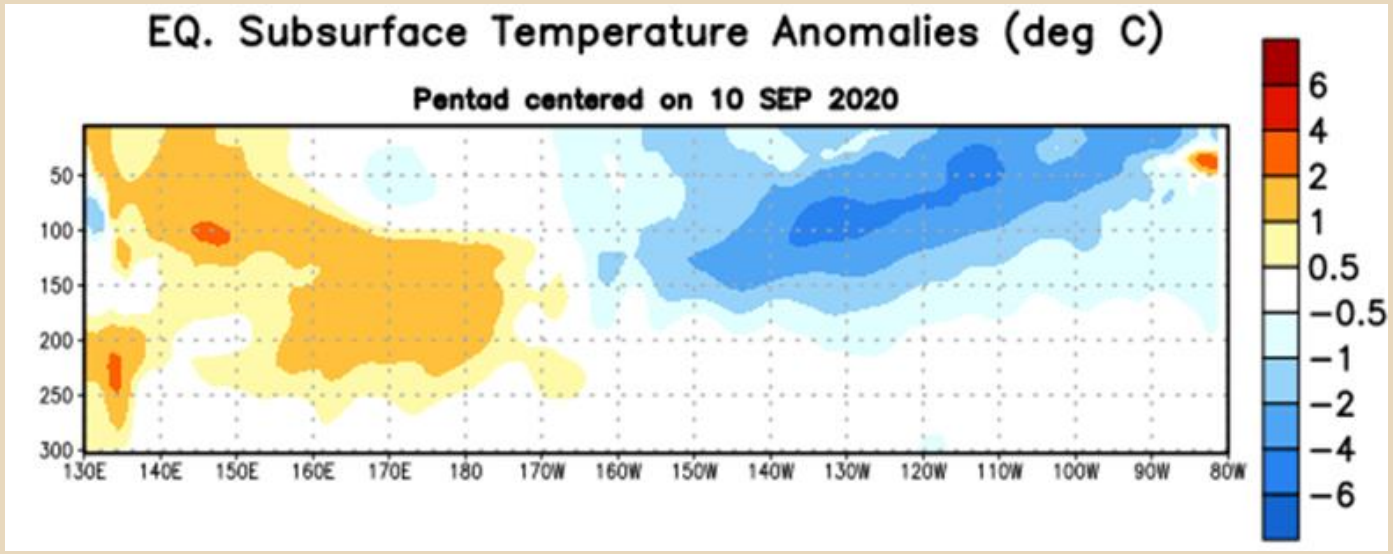

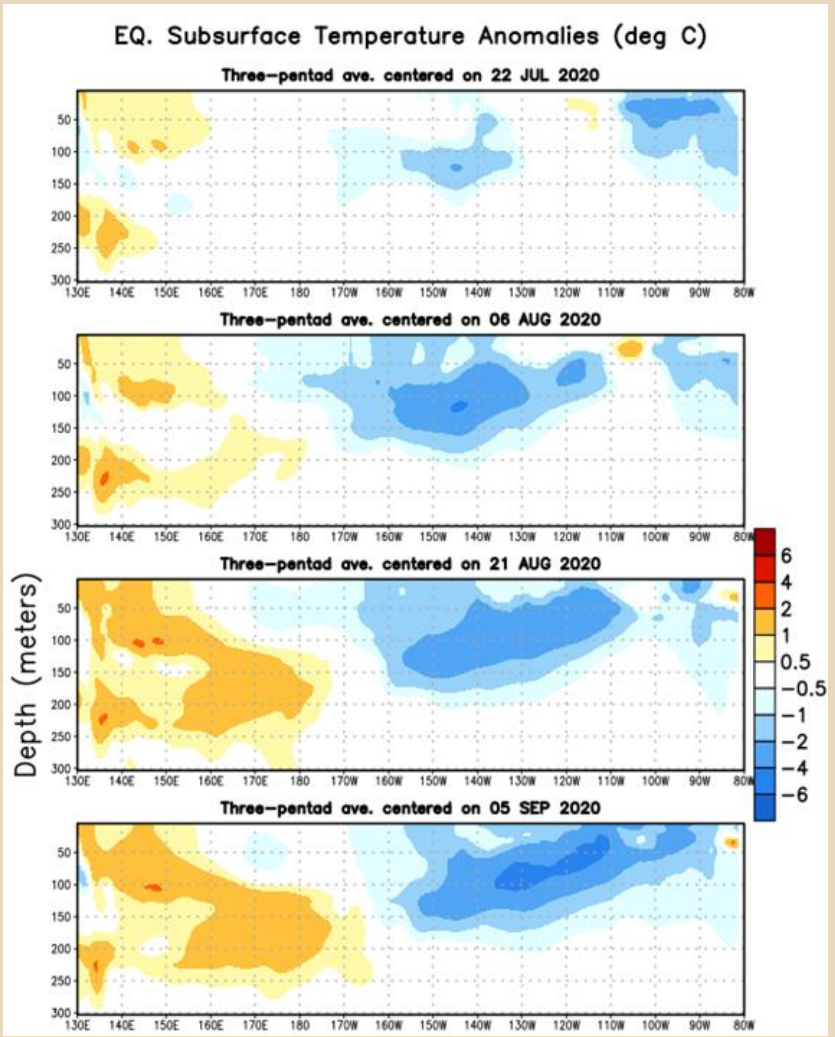

Figures 4-5. Sub-surface temperature anomalies at the equator. Sub-surface temperatures often precede surface temperatures by several months. An increasing amount of cooler than average water under the surface provides some additional confidence that in the fact climate models are on track forecasting a weak La Niña in fall 2020.

2020 Fall Outlook

Pacific-North American Teleconnection Pattern (PNA)

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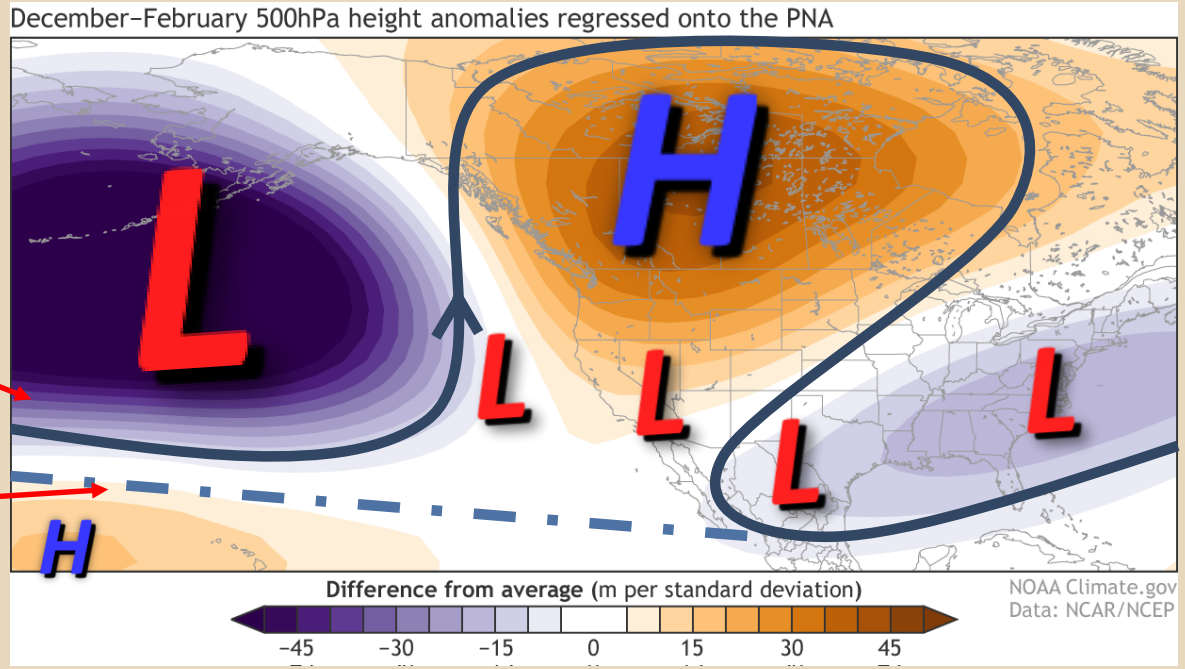

Figure 6. December-February 500-hPa geopotential height anomalies regressed onto the monthly PNA index (an idealized PNA graphic for winter). Data shown for 1979-80 to 2018-19. Purple shading indicates below-average pressure and winds that flow counter-clockwise following the contours. Orange shading denotes above-average pressure and winds that flow clockwise. The Pacific/ North American teleconnection pattern (PNA) is one of the most prominent modes of low-frequency variability in the Northern Hemisphere outside of the tropics. The positive phase of the PNA pattern typically features above-average heights in the vicinity of Hawaii and over the intermountain region of North America, and below-average heights located south of the Aleutian Islands and over the southeastern United States. The PNA pattern is associated with strong fluctuations in the strength and location of the East Asian jet stream. The positive phase is associated with an enhanced East Asian jet stream and with an eastward shift in the jet exit region toward the western United States. The negative phase is associated with a westward retraction of that jet stream toward eastern Asia, blocking activity over the high latitudes of the North pacific, and a strong split-flow configuration over the central North Pacific. For New Mexico, often times the strong storms in the eastern Pacific will undercut the upper high over Canada, moving east or northeast through the southwest U.S.

2020 Fall Outlook

Positive Pacific-North American Pattern (PNA)

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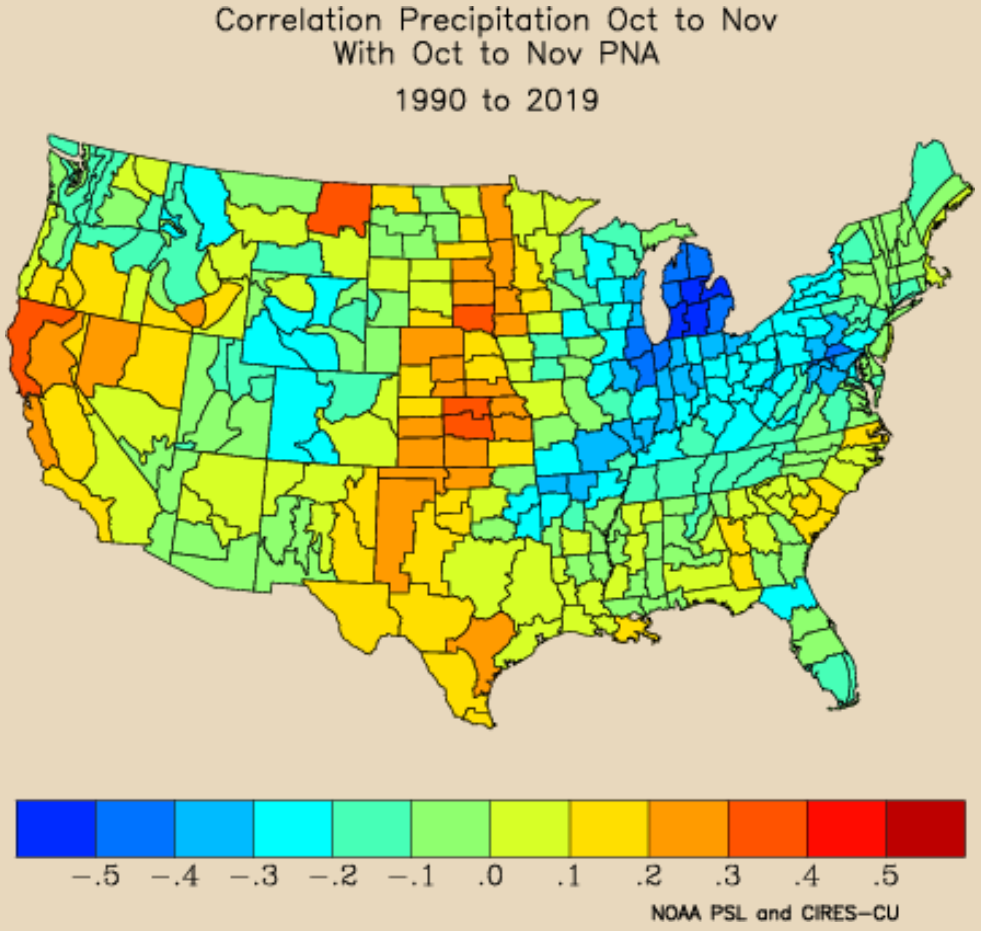

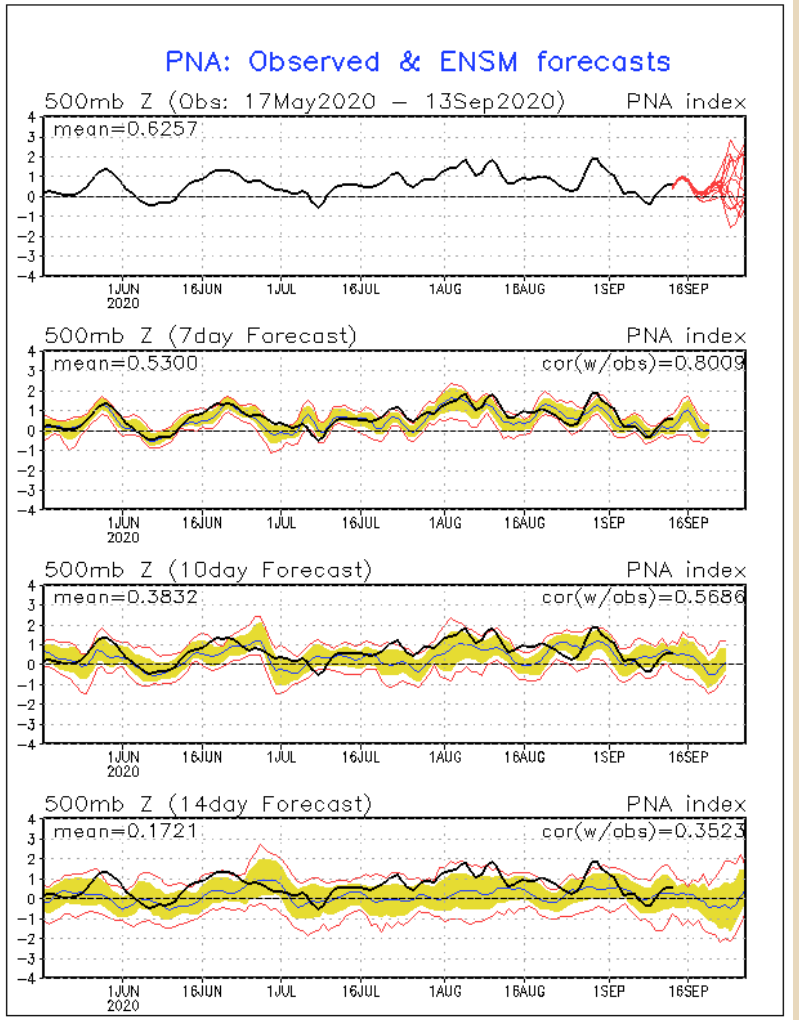

Figures 7-8. The 2018-19 weak to moderate El Niño sent the jet stream into a familiar pattern. This pattern has yet to change for an extended period and it is forecast to continue. 1990 to 2019 (left image) correlations between the PNA Index and precipitation show that the eastern plains is the most likely area in New Mexico to have above average precipitation during a positive PNA in October and November. Observed PNA index (since May 17, 2020) and ensemble forecasts keeping the index positive through 14 days.

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Madden-Julian Oscillation (MJO)

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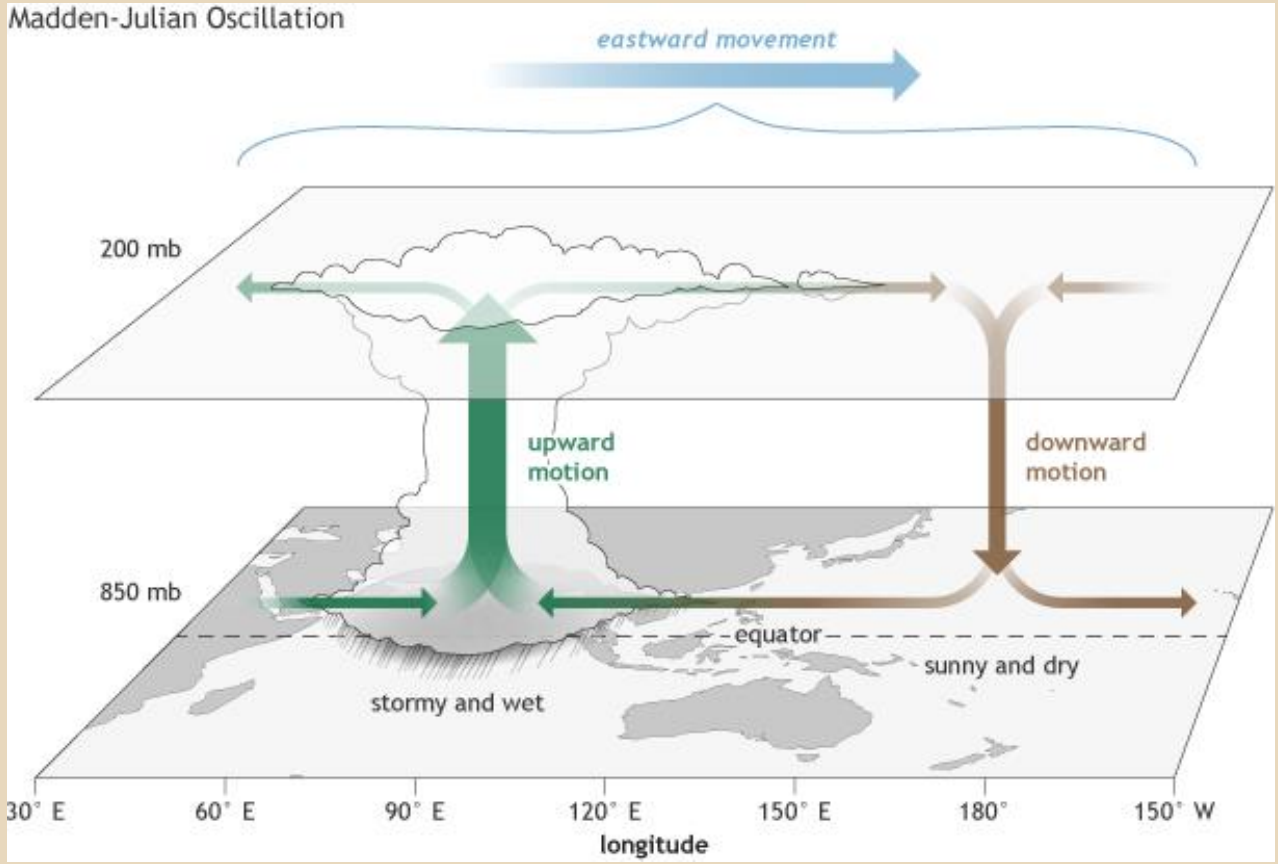

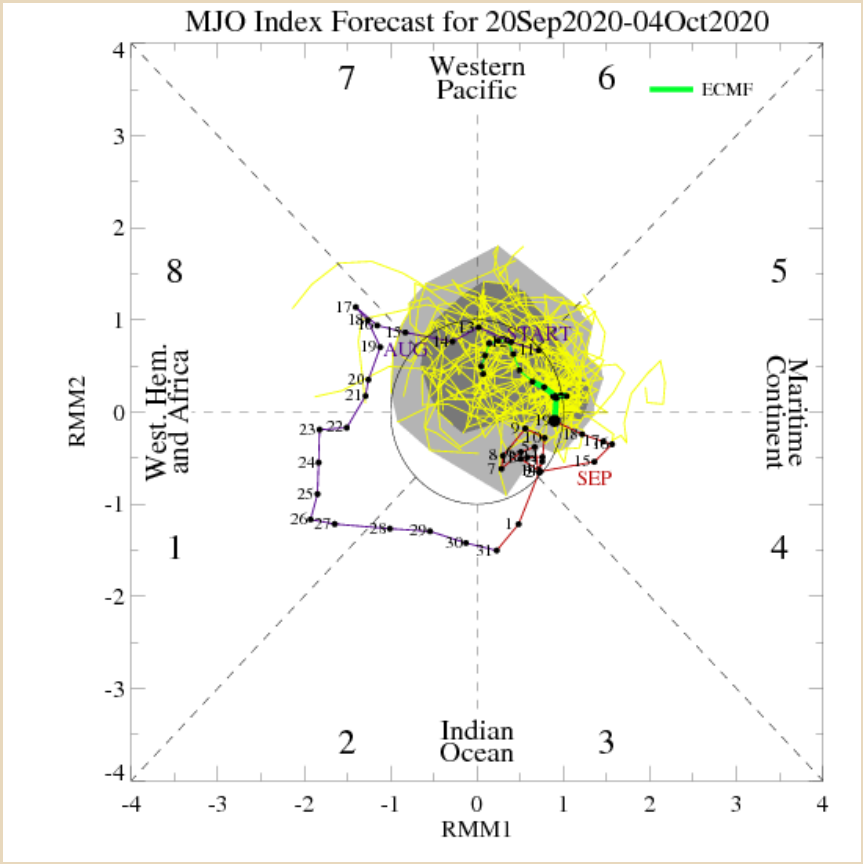

Figures 9-10. The MJO is an area of enhanced thunderstorms that travels around the world every 30 to 60 days from west to east along/near the equator. Ahead and behind the active stormy area are areas of suppressed convection and drier conditions. The MJO affects near-surface wind patterns, because the rising air in the stormy area causes surface winds to blow toward the active area. The MJO can play a role in New Mexico's weather at any time of year but it tends to have its greatest impacts during the fall. The majority of forecast models for late September into early Ocotober bring the MJO into phase(s) 5/6 (right image) and keep it relatively weak.

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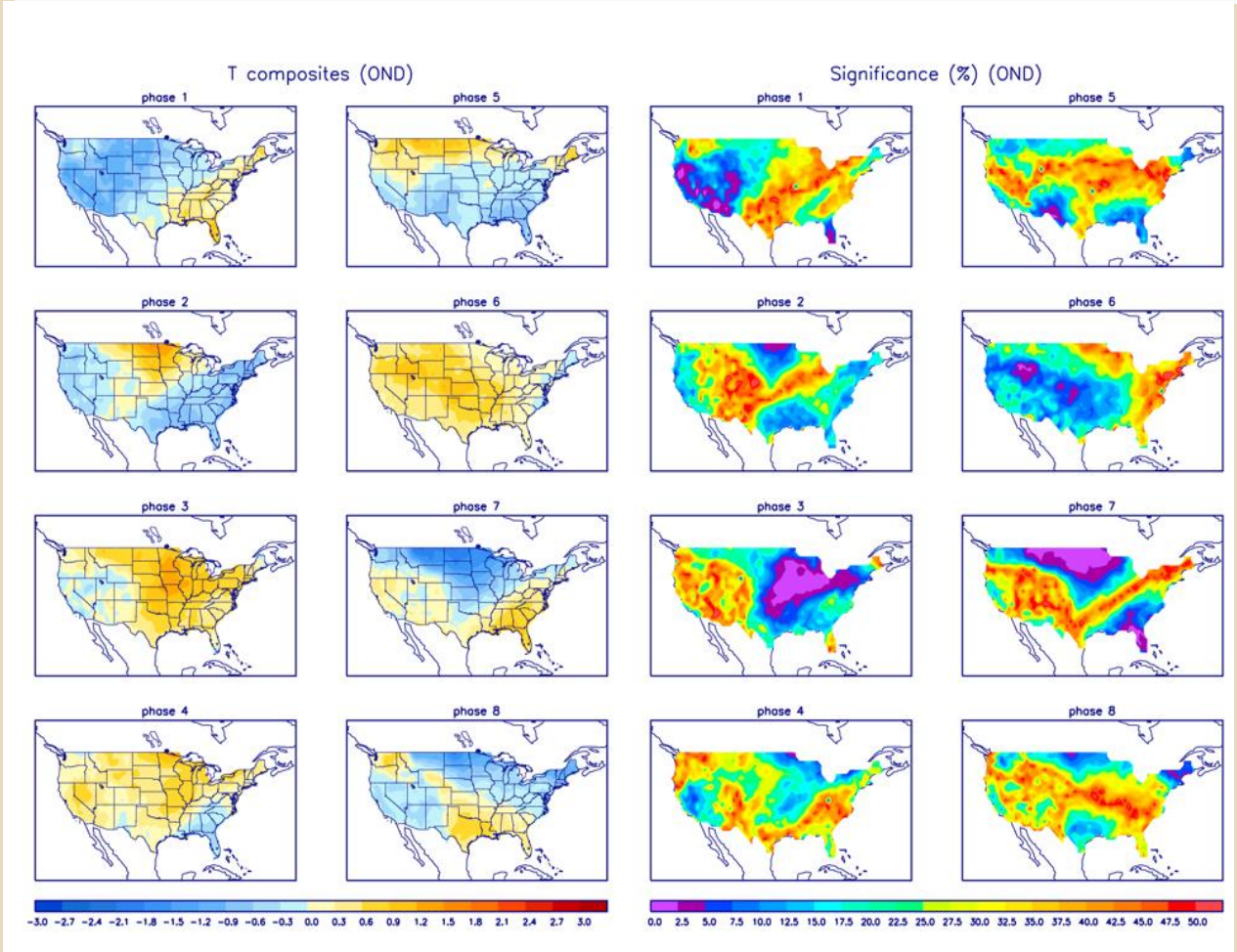
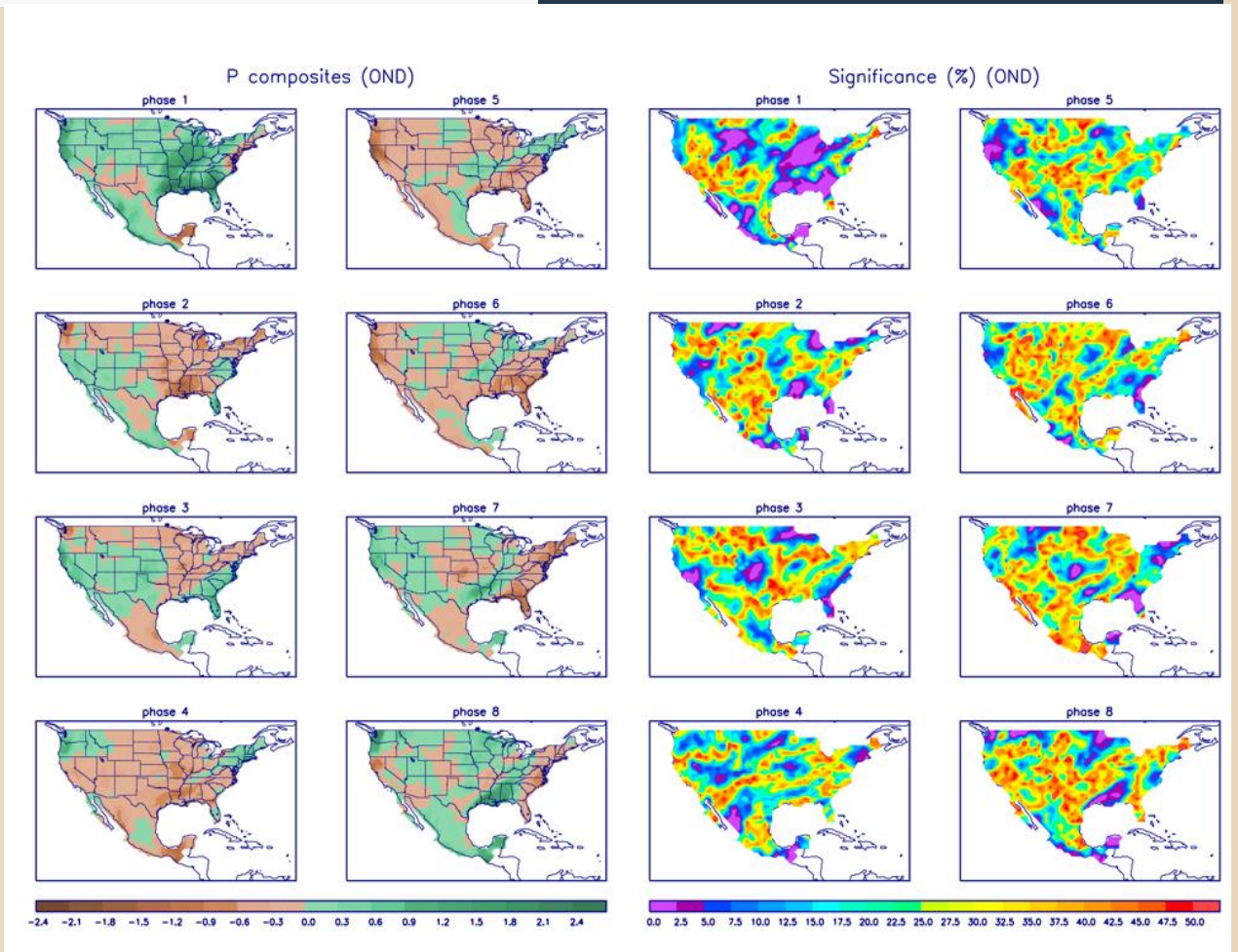
Madden-Julian Oscillation (MJO) - Phases





Figures 11-12. Temperature and precipitation anomalies during October, November, and December (OND) with each phase of the MJO. Note the above average precipitation across northern New Mexico during phase 1 as well as the above average precipitation over western NM during phases 8 and 2. Global models are in good agreement that the MJO will strengthen as it transitions into phase 8 during the second week of September 2020 (previous slide).

2020 Fall Outlook

"Analog" Year – 2016

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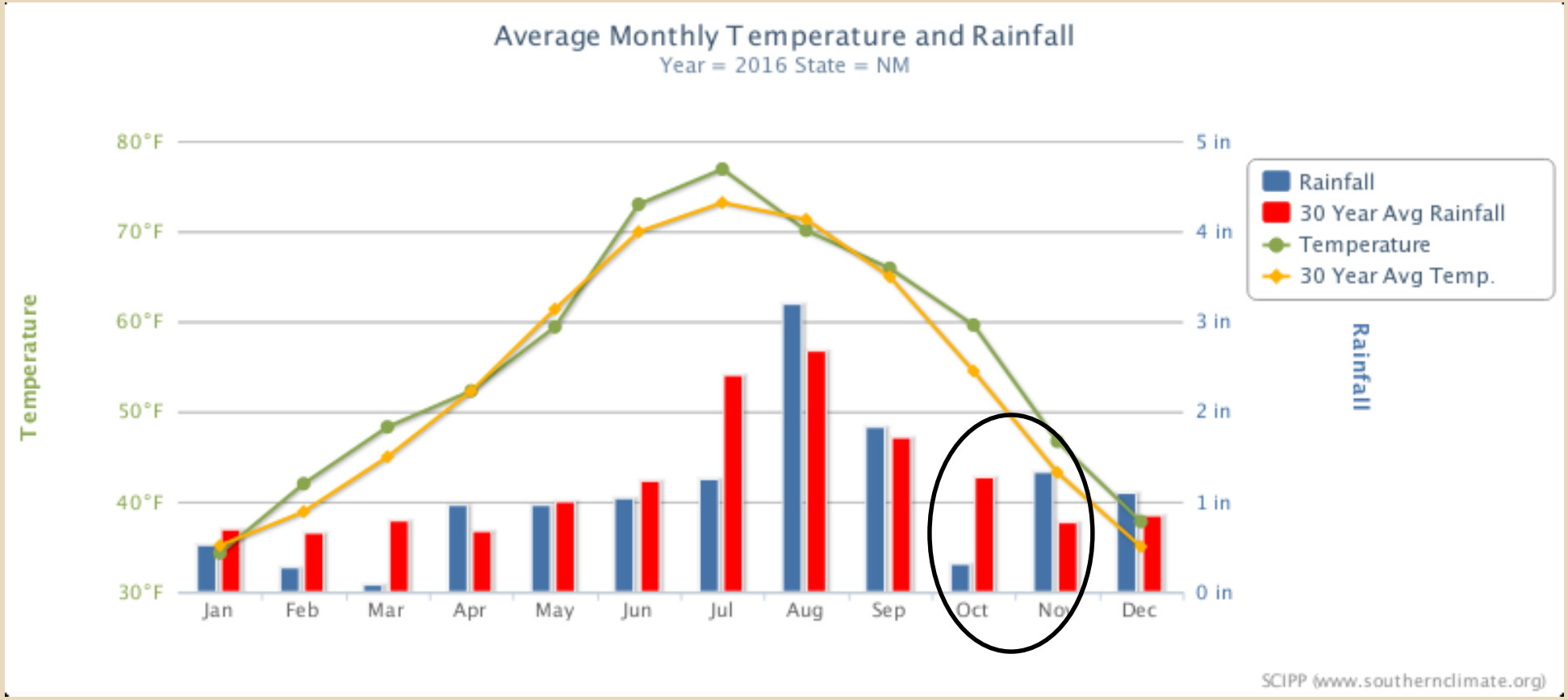

Figures 13. Statewide temperature and precipitation for the only "true" analog to 2020, 2016. Note that fall temperatures were above the 30-year climatological average. October precipitation was below to well below average with November precipitation above average.

2020 Fall Outlook

"Analog" Year 2016 by Climate Division

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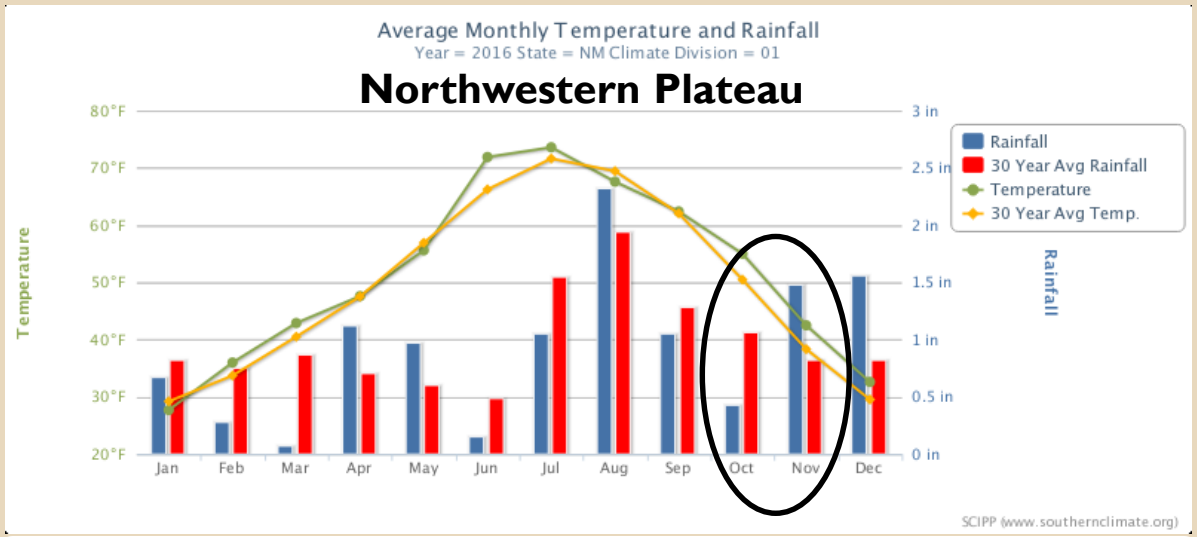

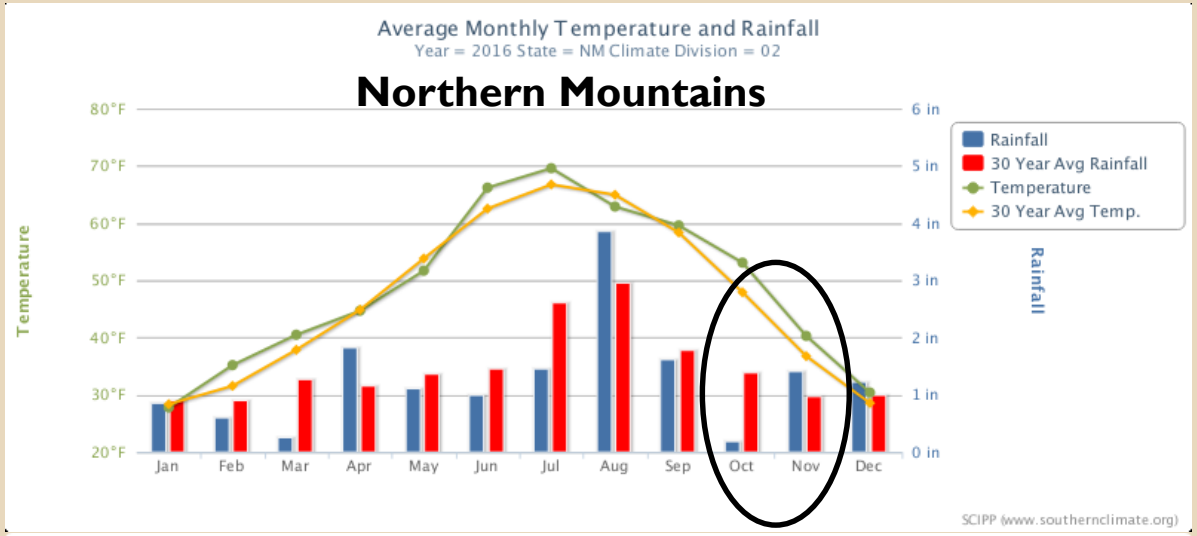

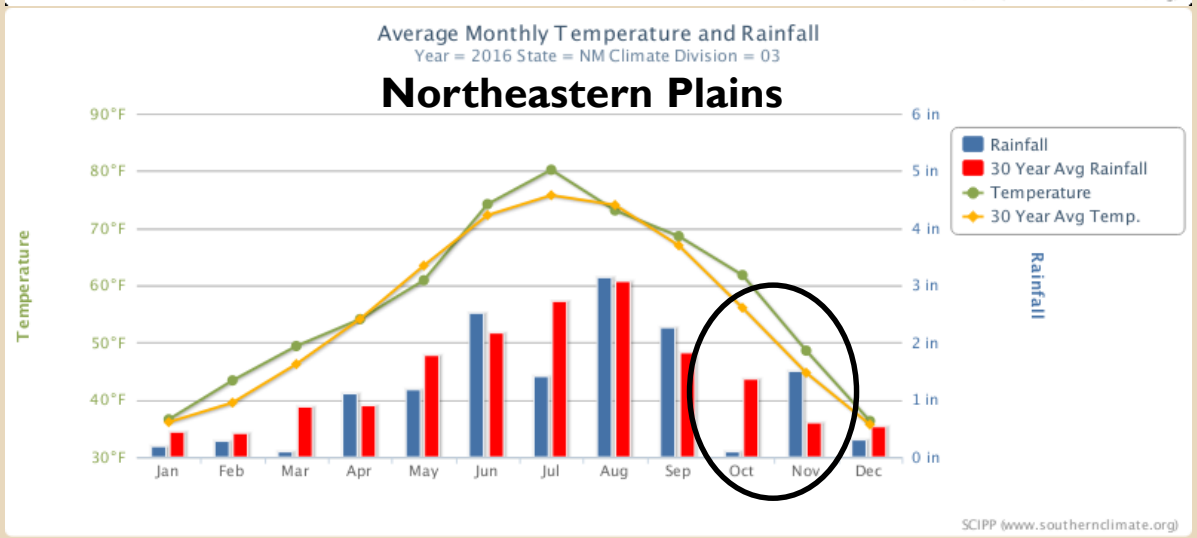

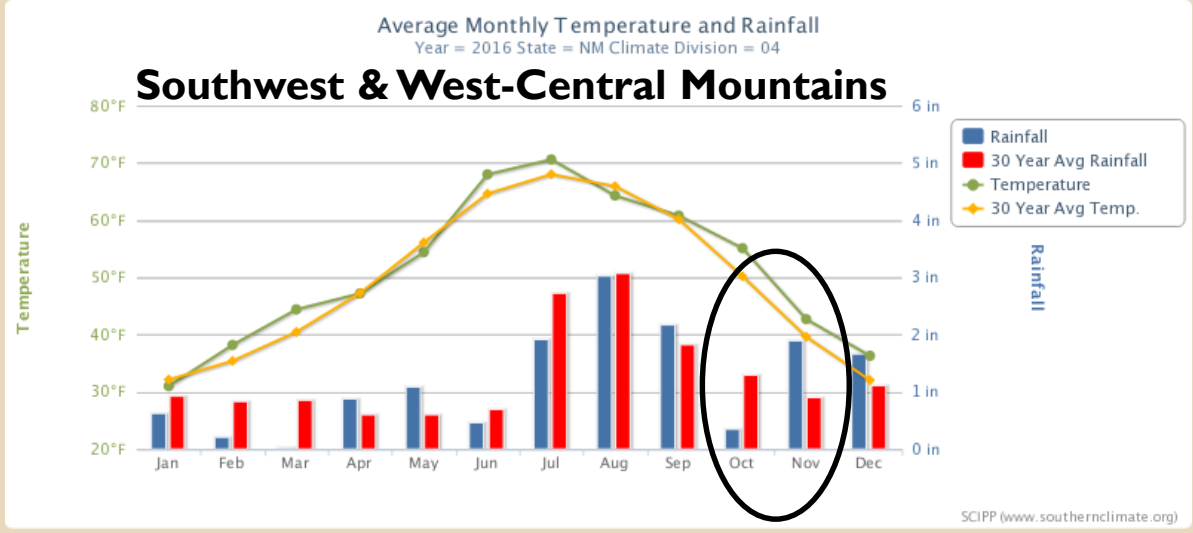

Figures 14-17. Climate Division temperature and precipitation in 2016. Note that fall temperatures were mainly above average while precipitation was below to well below average in October but above average in November.

2020 Fall Outlook

2016 by Climate Division cont'd

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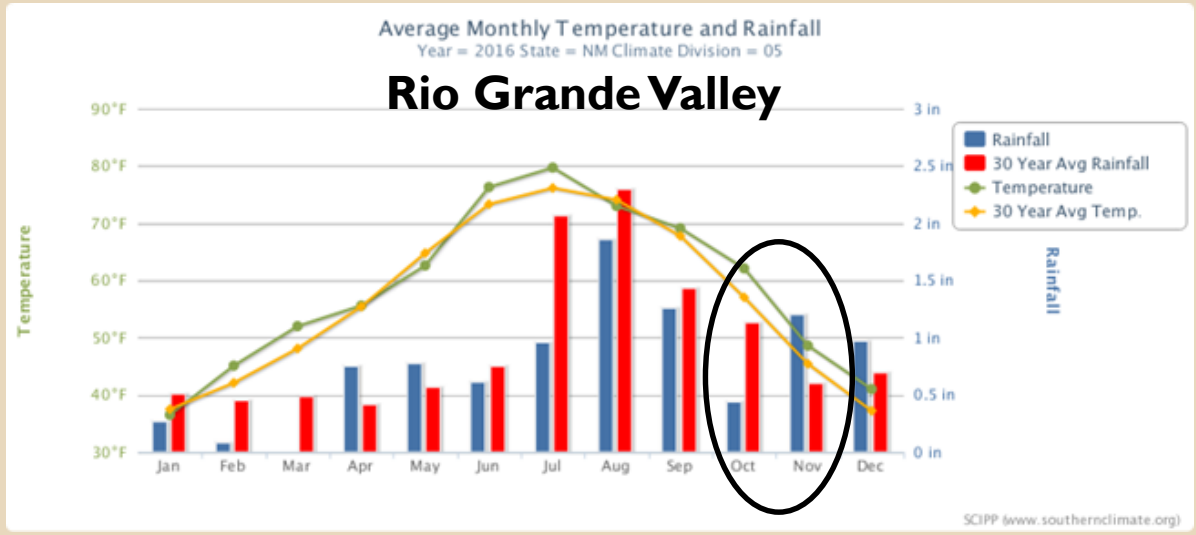

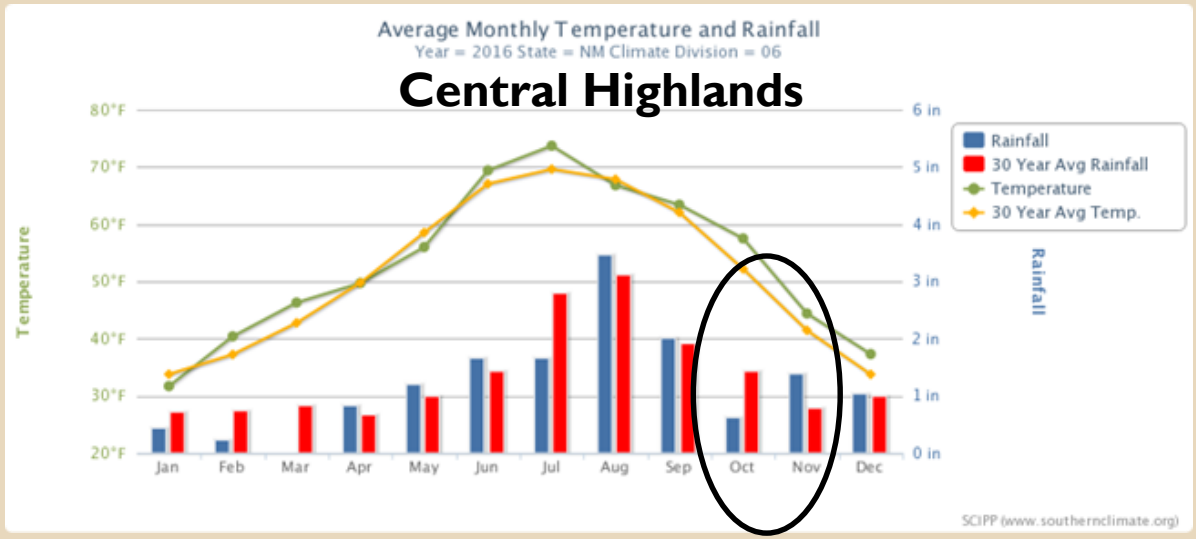

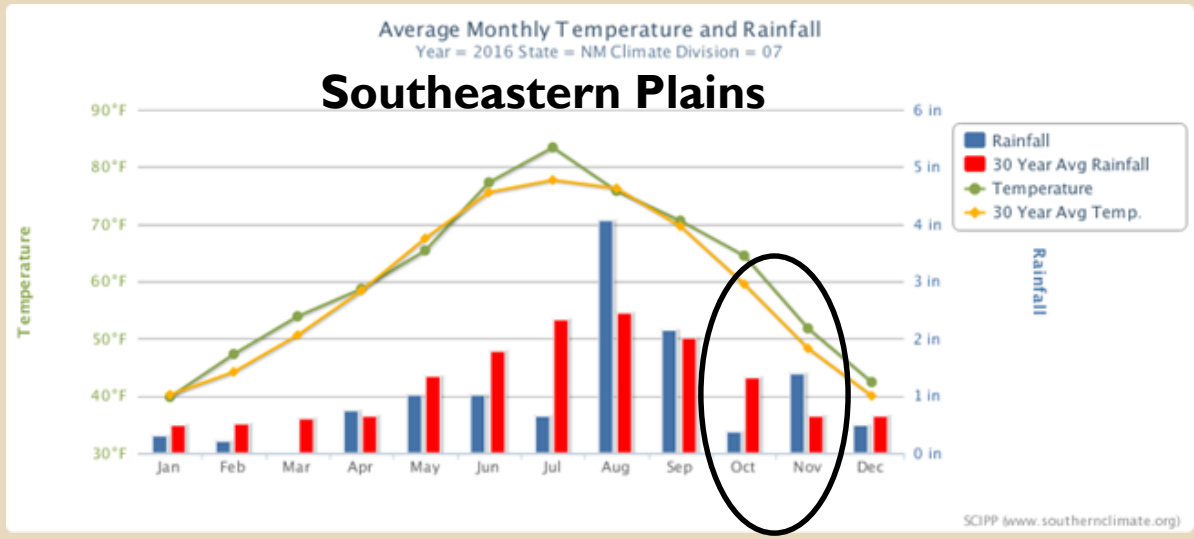

Figures 18-20. Climate Division temperature and precipitation in 2016. Note that fall temperatures were mainly above average while precipitation was below to well below average in October but above to well above average in November.

2020 Fall Outlook

ENSO SST Predictions

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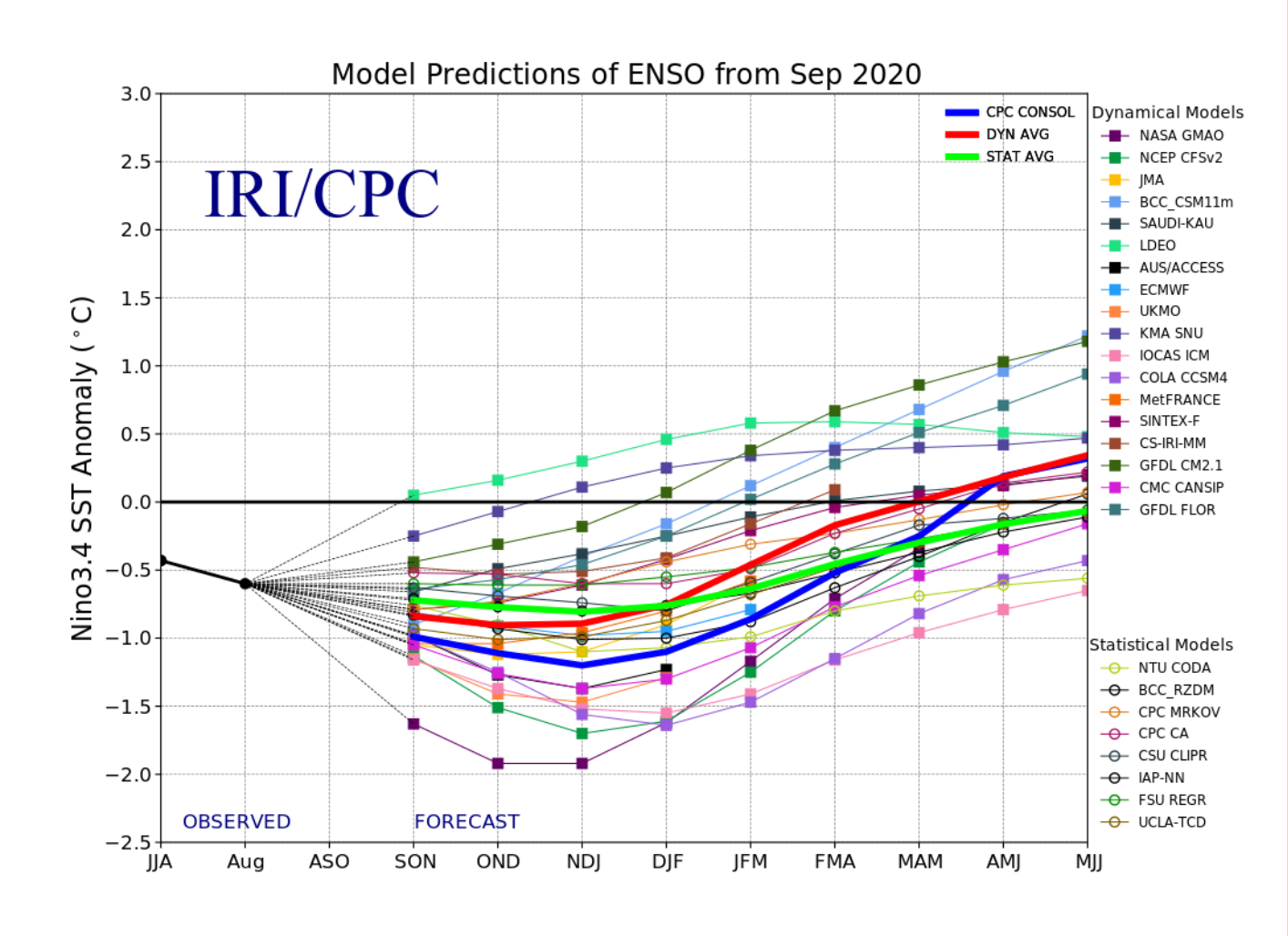

Figure 21. The vast majority of both dynamical (red line) models and statistical models (green line) indicate weak to moderate La Niña conditions in fall 2020.

2020 Fall Outlook

Oct-Nov Climate Model Forecasts - *Precipitation*

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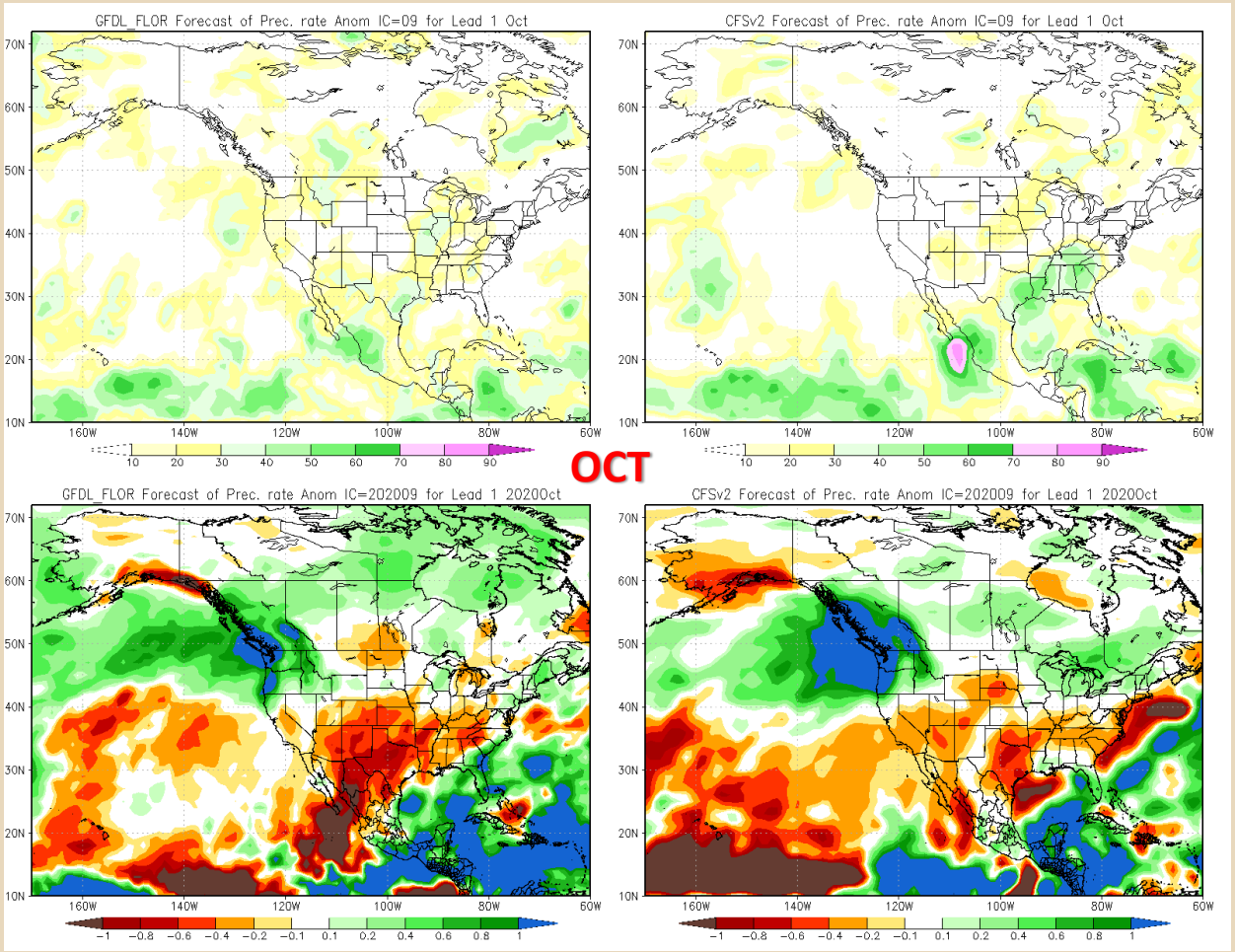

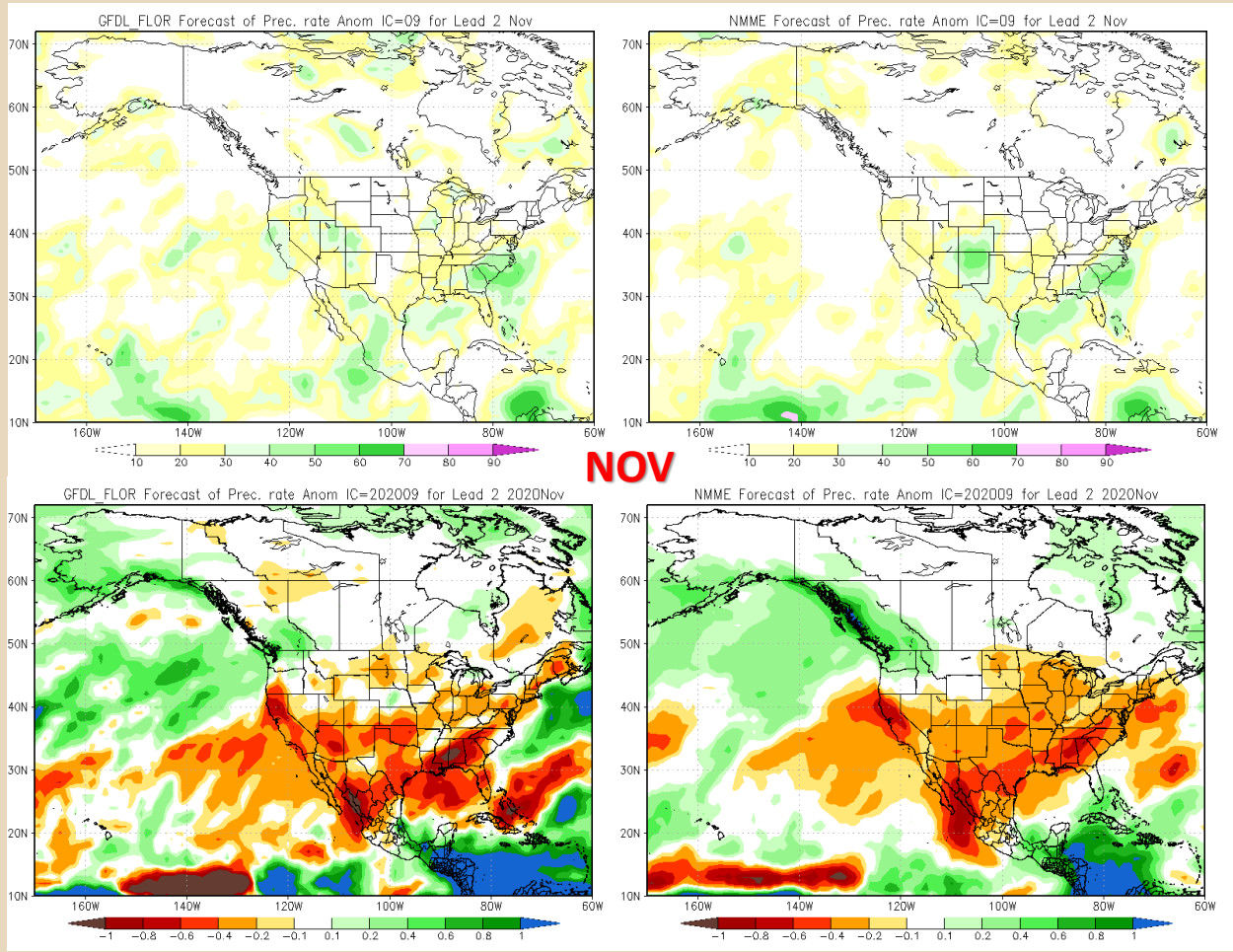

Figures 25-32. Top two climate model precipitation rate skill percentages (top row) for October and November 2019. Model forecasts (bottom row) are below average for precipitation in October and slightly below average for November.

2020 Fall Outlook

Oct-Nov Climate Model Forecasts - *Temperature*

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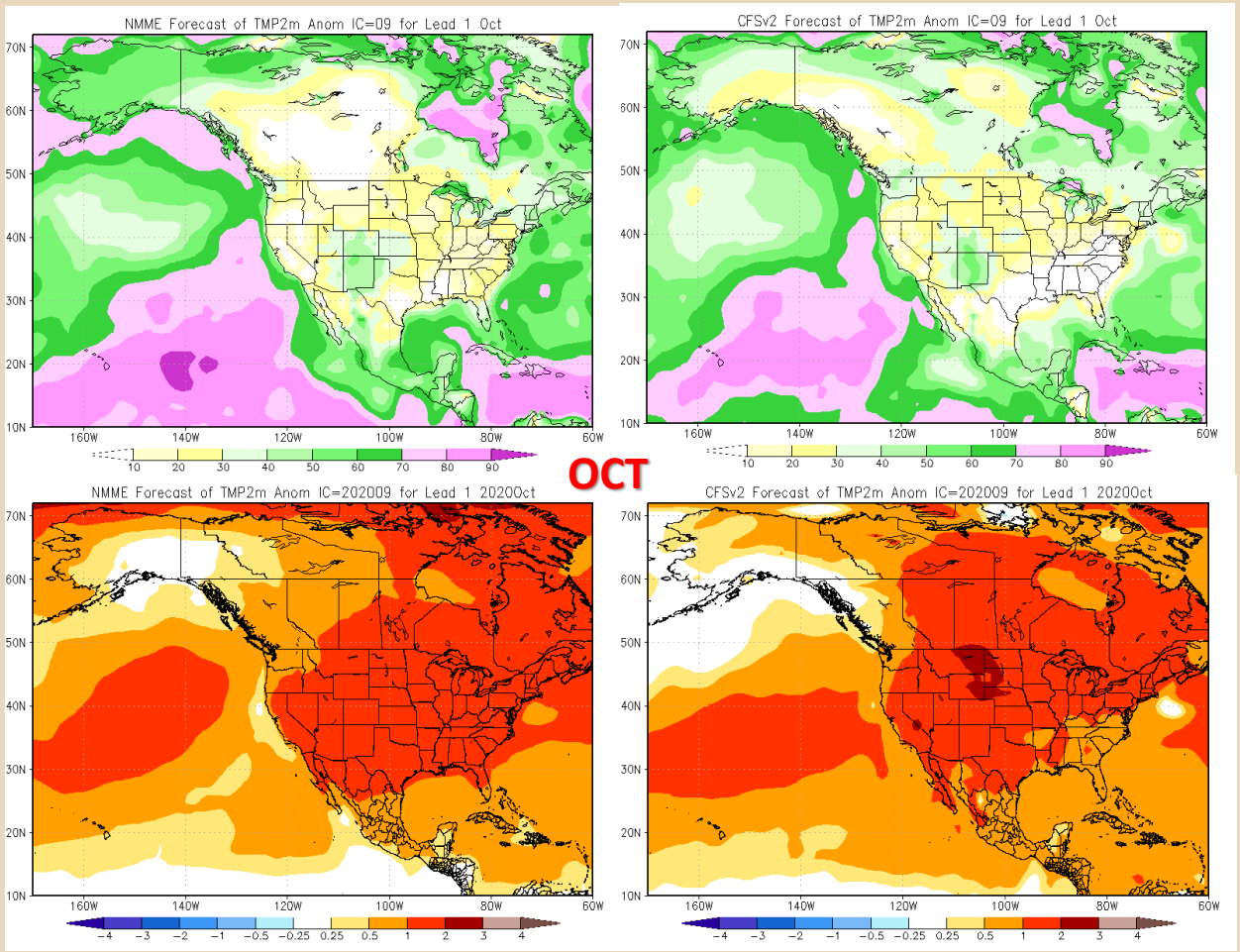

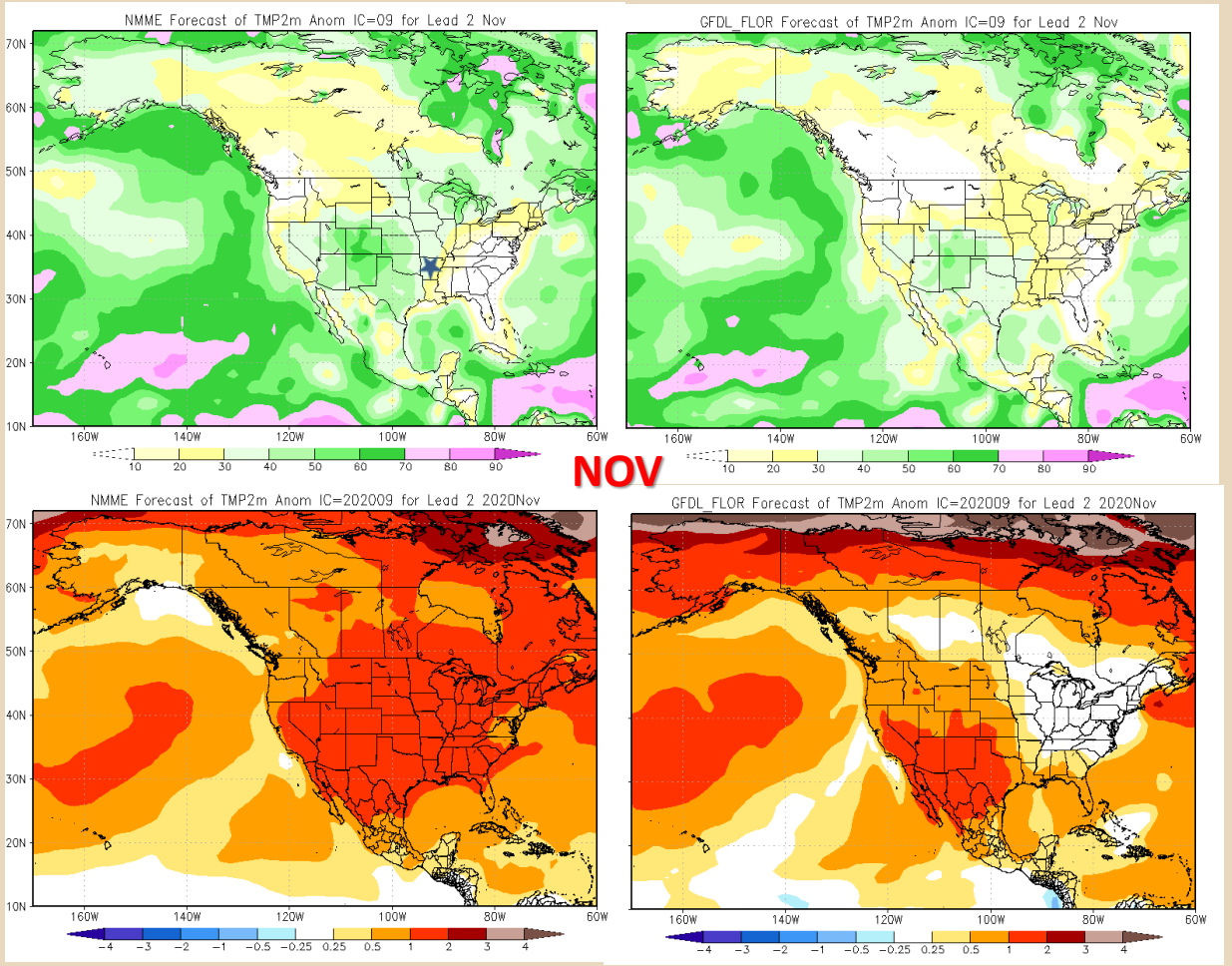

Figures 33-40. Climate model temperature anomaly plots from the two climate models which have the highest skill percentages for October and November (top four images). Model forecasts (bottom four images) indicate above average temperatures during both months. The temperature trend during autumn in New Mexico since the early 1980's has been steadily increasing.

2020 Fall Outlook

Climate Prediction Center's (CPC) SON/Fall Outlook

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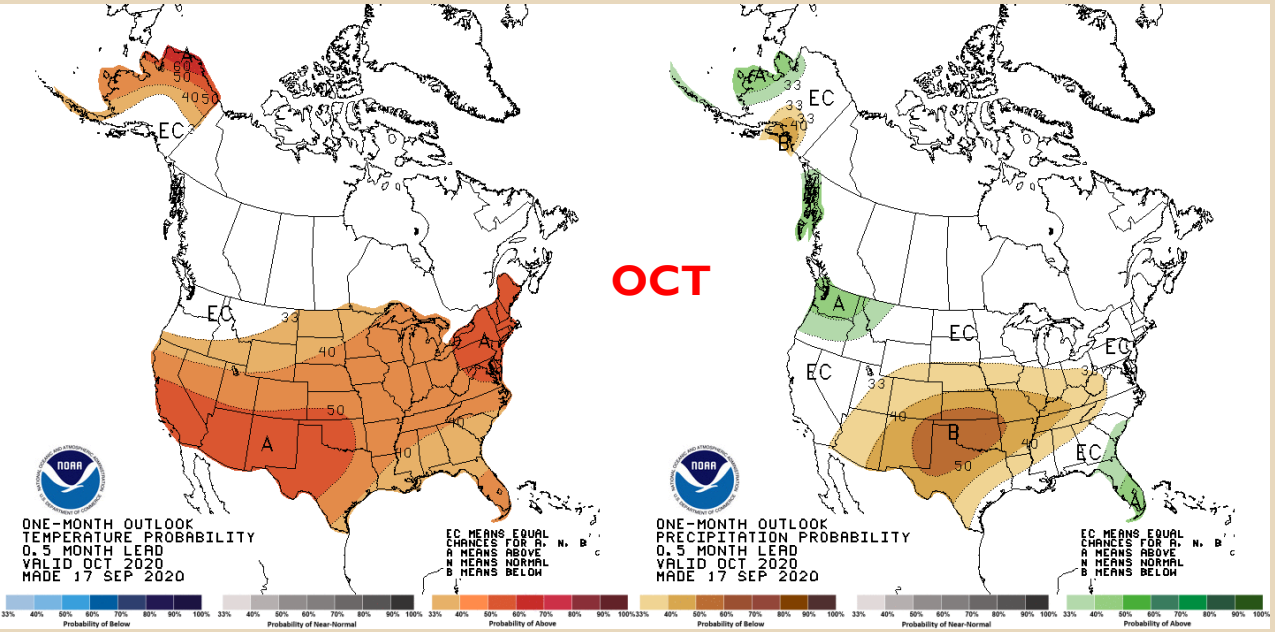
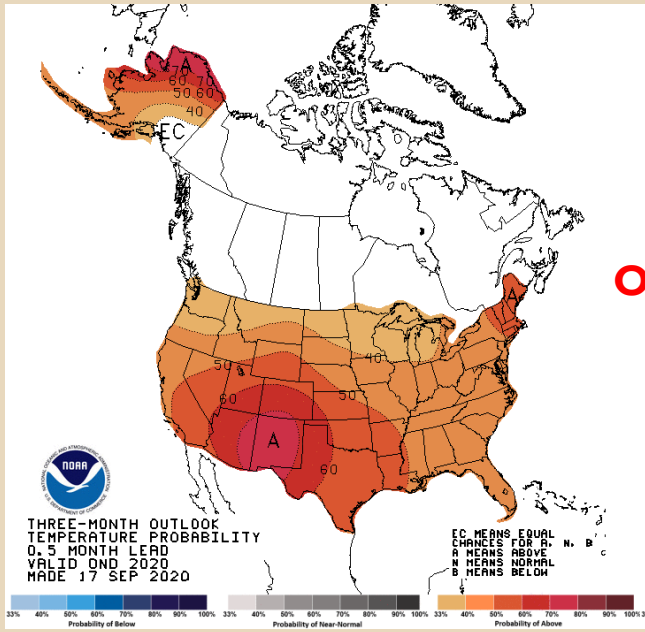


OCT



OND

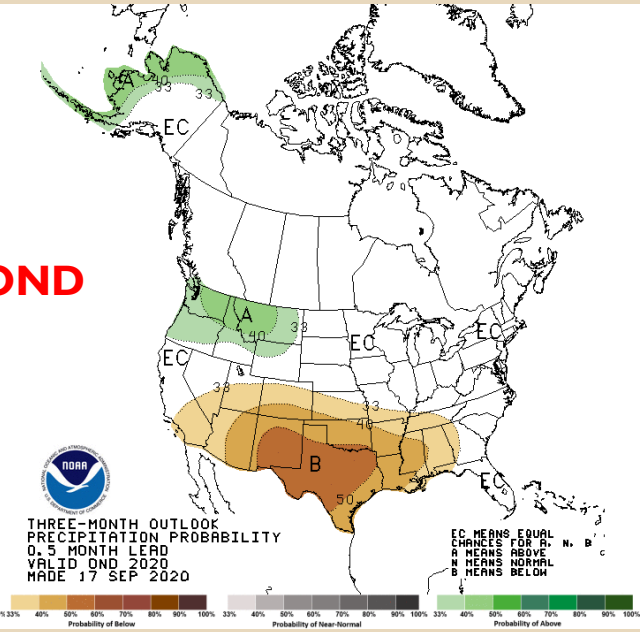


Figure 41. CPC agrees with the climate model consensus of higher than average chances for above average temperatures. The precipitation forecast is similar as well.

2020 Fall Outlook

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Summary

- Forecasts from the most highly-skilled climate forecast models combined with recent fall seasons during a weak La Niña event indicate that precipitation in central and northern New Mexico during October 2020 will most likely be below 1981-2010 climatological averages while odds favor slightly below to below average precipitation in November.

- Climate model forecasts along with recent temperature trends indicate that temperatures in central and northern New Mexico during October and November 2020 will most likely range from slightly above to above seasonal averages.

2020 Fall Outlook

Outlook Information

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