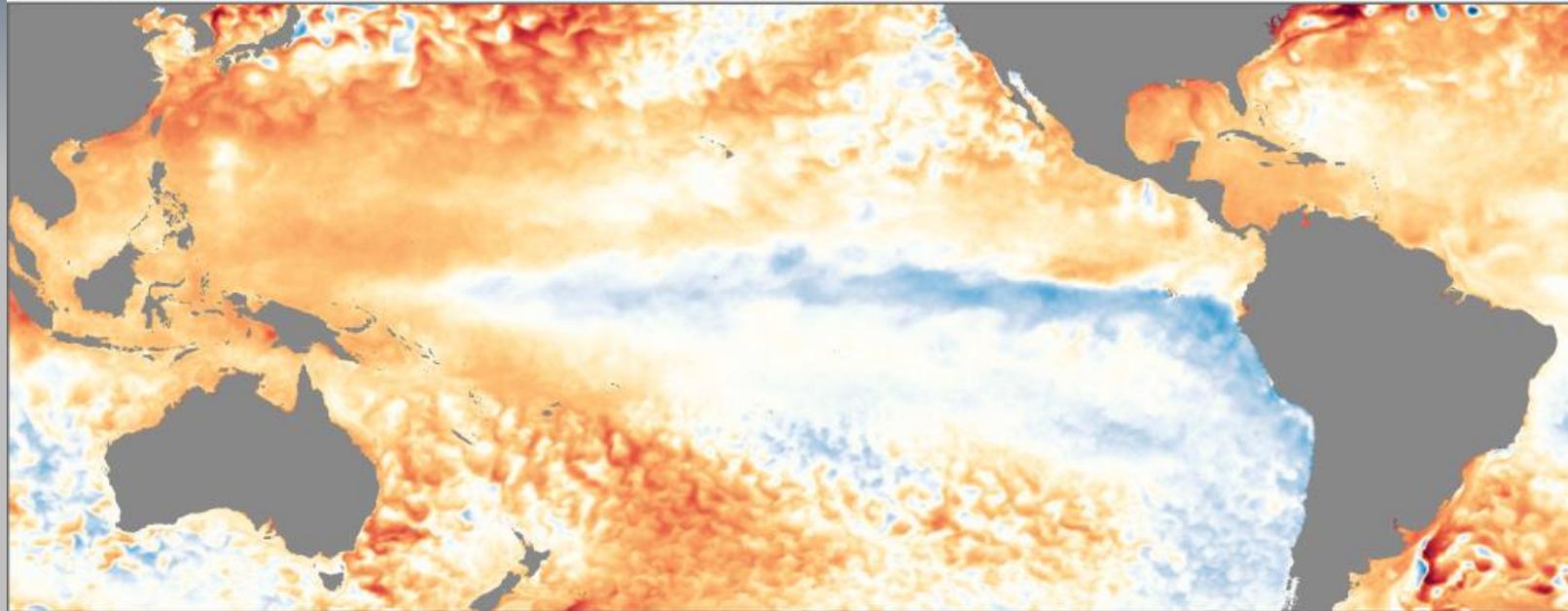




2017-18 Winter Outlook for Central & Northern New Mexico

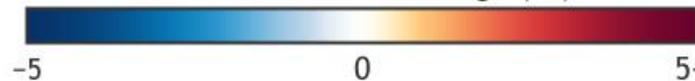


Sea surface temperature anomalies, October 2017



Compared to 1981-2010

Difference from average (°C)



NOAA Climate.gov
Data: NNVL

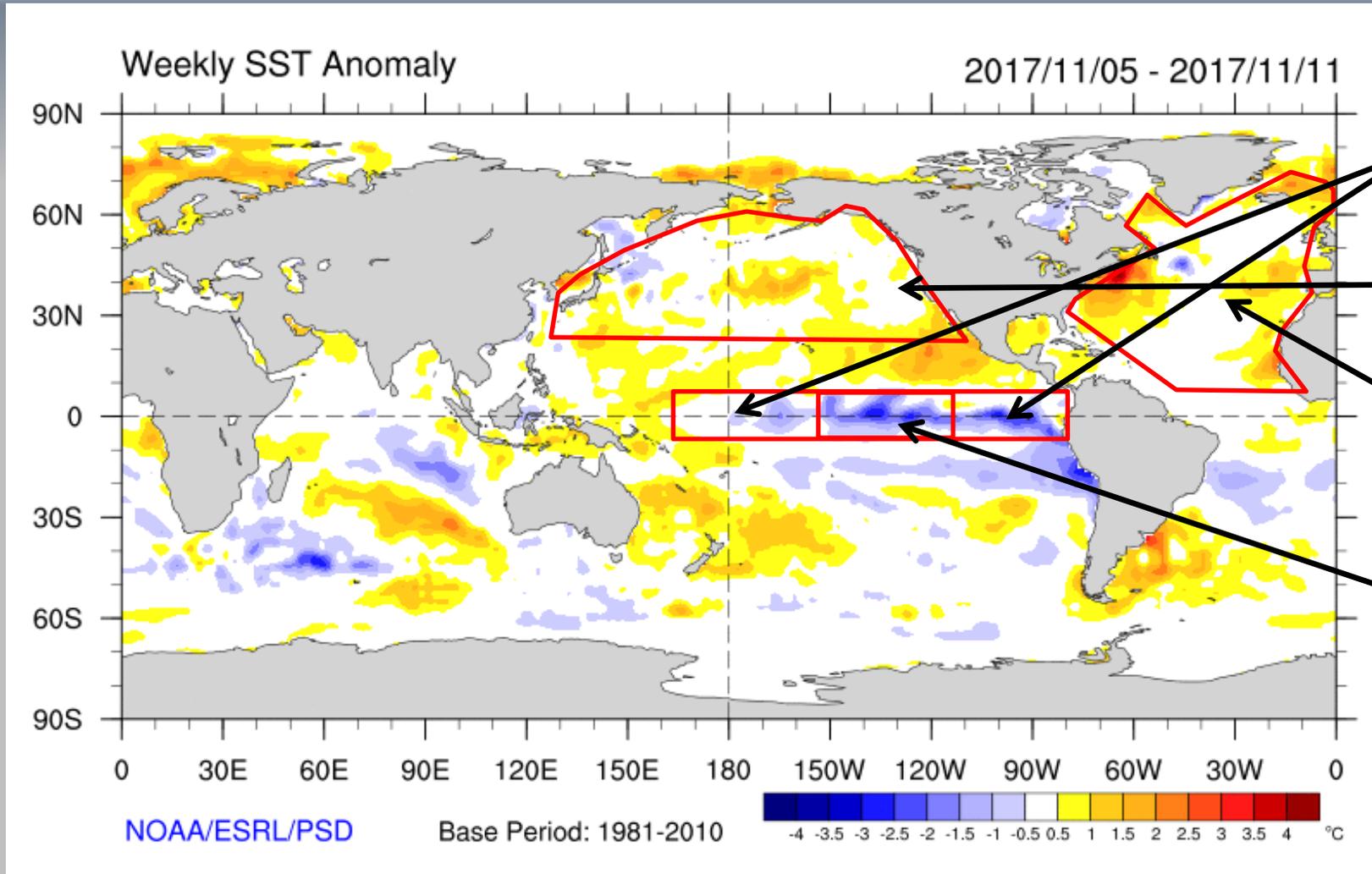
Figure 1. Sea Surface Temperature (SST) anomalies in the Pacific Ocean from October 2017. Orange/red color depicts above average temperatures and blue depicts below average temperatures. SSTs along the eastern equatorial Pacific have continued to trend cooler than average the past several months and a weak La Niña has resulted.

****Updated 11/16/17 to include October PDO index value and update weekly SSTA map on slide 2.**

How will a weak La Niña influence meteorological winter (December, January & February) precipitation and temperature in central and northern New Mexico?



Latest Sea Surface Temperature Observations & Oscillation Index Values

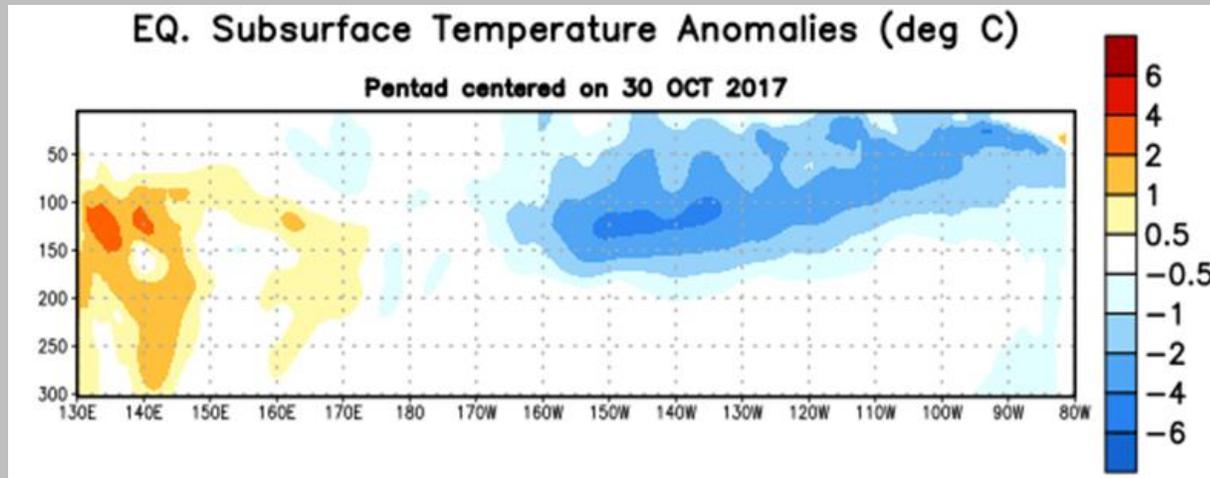


- Multivariate ENSO Index (MEI) for AUG_SEP 2017: -0.45
- Pacific Decadal Oscillation (PDO) for OCT 2017: +0.05
- Atlantic Multidecadal Oscillation (AMO) for SEP 2017: +0.44
- Oceanic Niño Index (ONI) (uses Niño 3.4 region - inner rectangle) for ASO 2017: -0.4

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



Sub-Surface Temperature Departures in the Equatorial Pacific



Recently, the strongest negative anomalies are between 170°W-80°W.

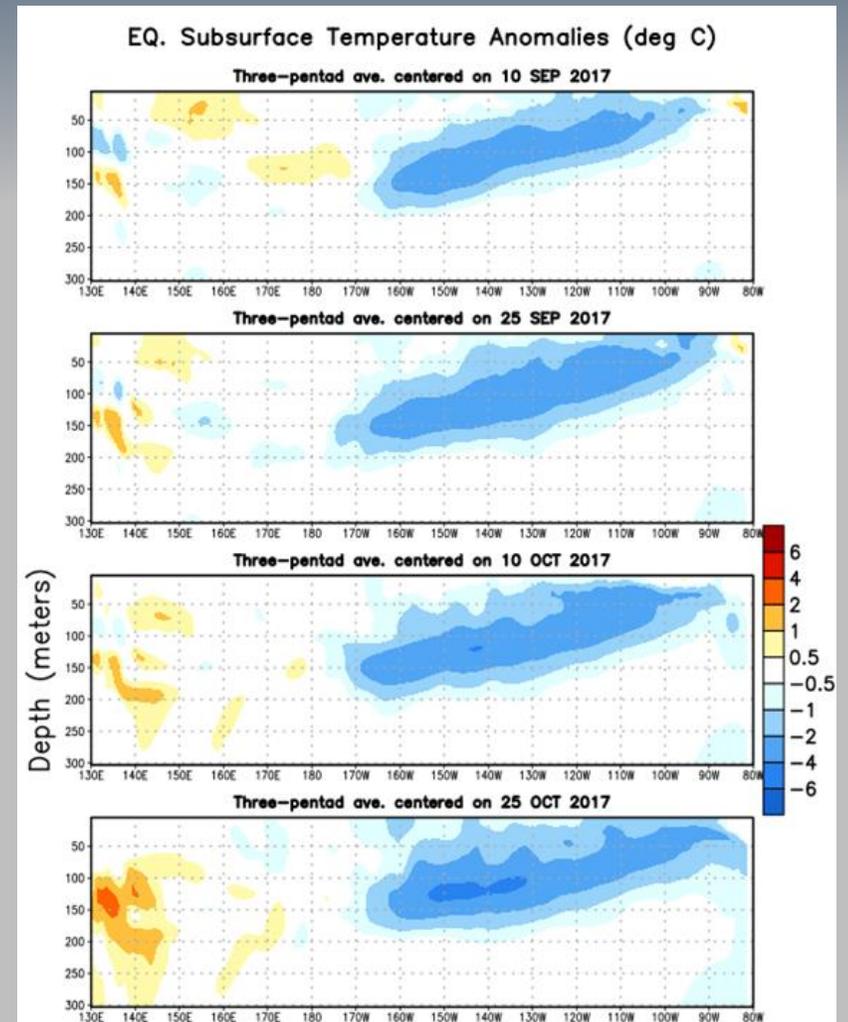


Figure 3 & 4. Negative subsurface temperature anomalies have strengthened across the central and eastern Pacific Ocean.



La Niña Events Since 1950

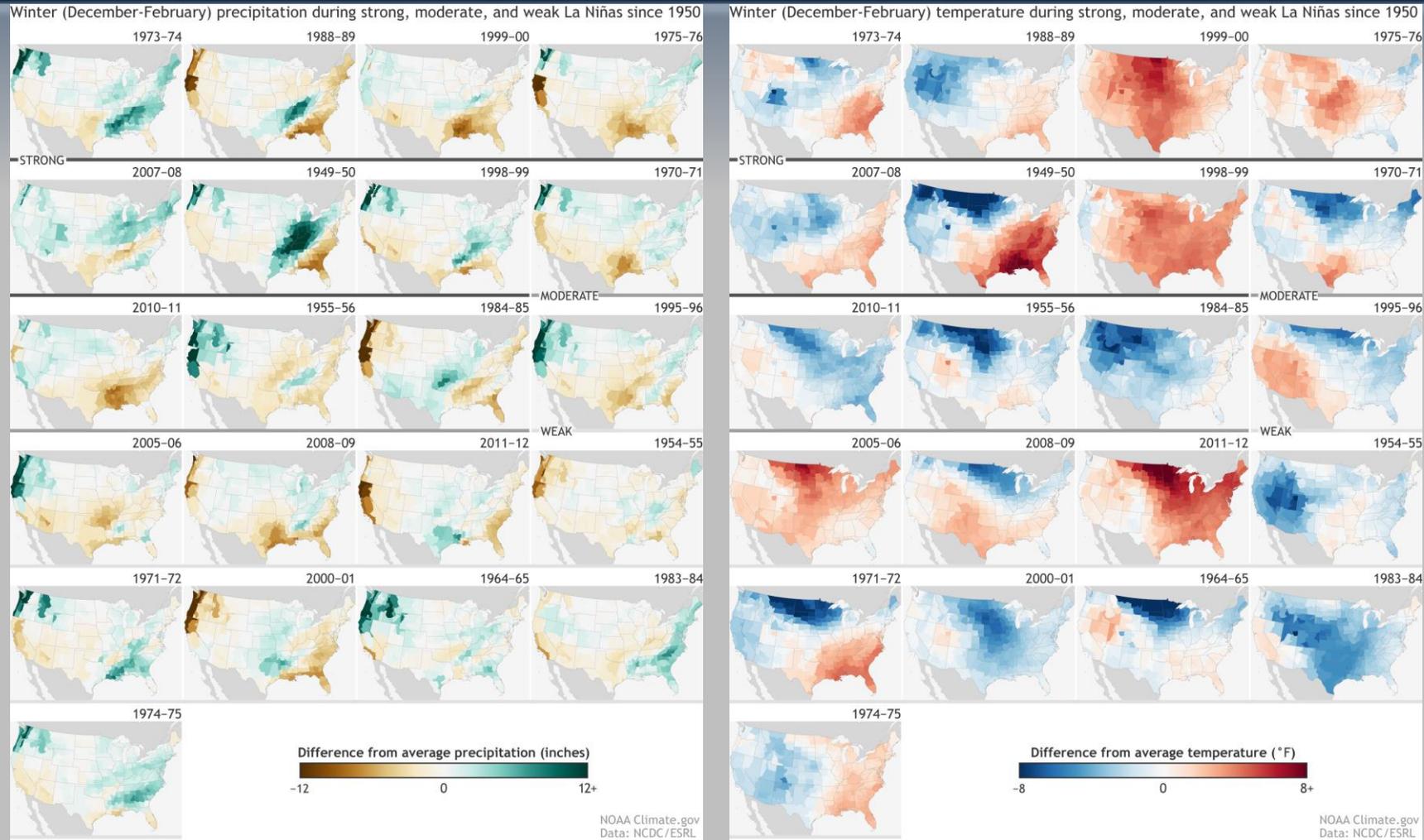


Figure 5 & 6. Difference from average precipitation (inches) and temperature (F) during winter from twenty-one La Niña events using the Oceanic Niño Index (ONI) since 1950. Moderate to strong La Niña events characteristically are warmer and drier than average for New Mexico while weak La Niñas can be either wet and cool or warm and dry.

Madden-Julian Oscillation (MJO)

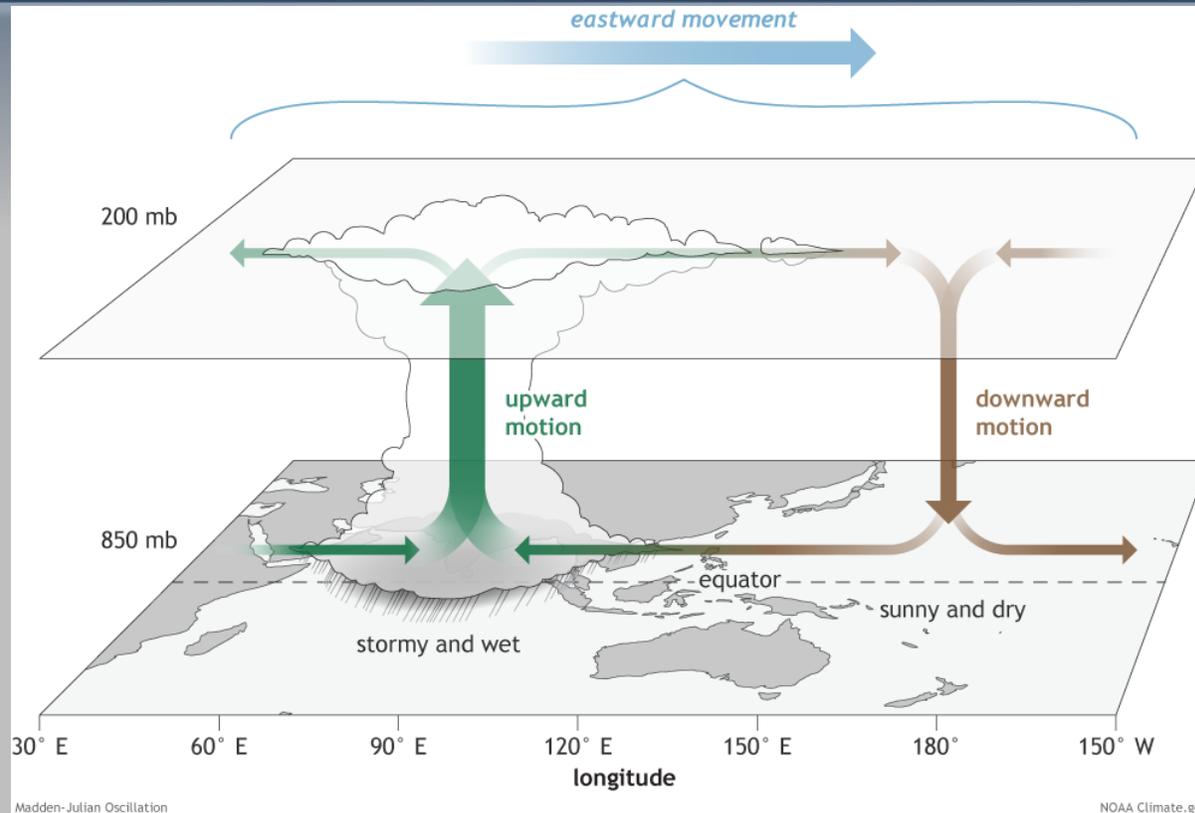


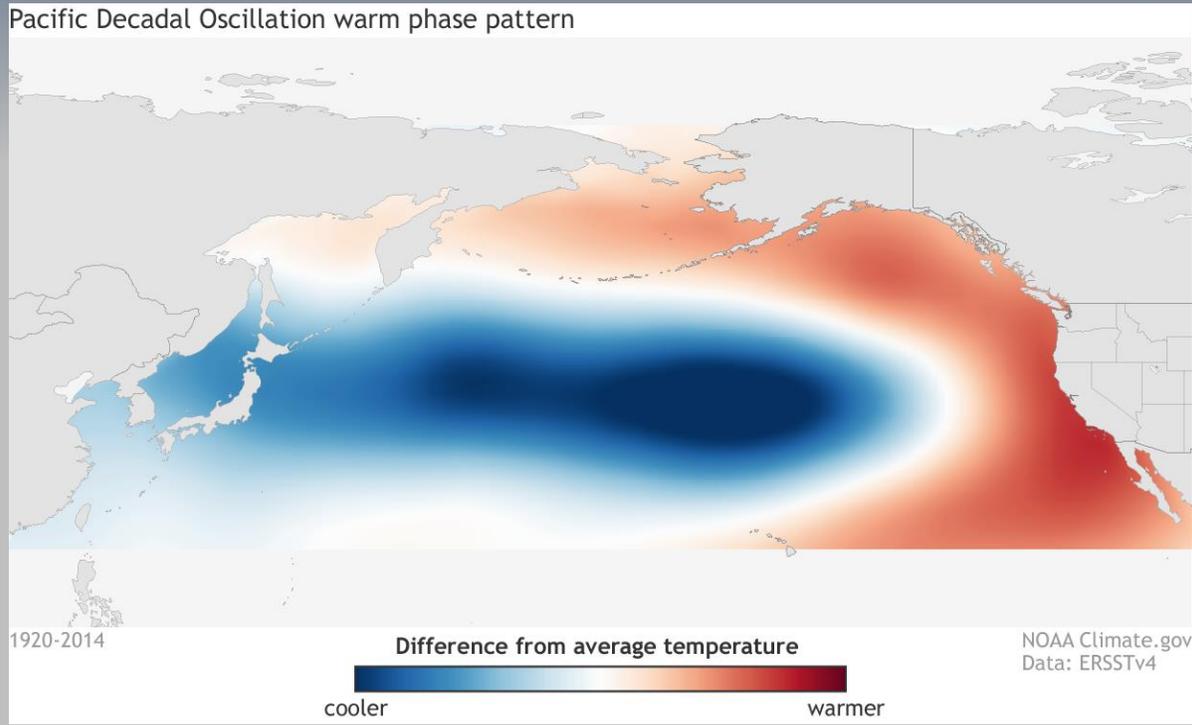
Figure 7. The MJO is an area of enhanced thunderstorms that travels around the world every 30 to 60 days from west to east along/near the equator. Ahead and behind the active stormy area are areas of suppressed convection and drier conditions. The MJO affects near-surface wind patterns, because the rising air in the stormy area causes surface winds to blow toward the active area. During La Niña, the trade winds are stronger than average, keeping the surface waters cooler (vice versa during El Niño). If the MJO is active, it typically changes the wind patterns temporarily. During October, the MJO was active and moved through from the Indian Ocean into the western hemisphere, weakening surface trade winds. But despite the winds temporarily weakening due to the MJO, the eastern equatorial Pacific remained cool. This leads us to believe that La Niña conditions are in place.



The Pacific Decadal Oscillation (PDO) & Analog Years



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



PDO Aug, Sep, Oct 2017	PDO Aug, Sep, Oct 2016	PDO Aug, Sep, Oct 2000	PDO Aug, Sep, Oct 1983	PDO Aug, Sep, Oct 1974	PDO Aug, Sep, Oct 1971	PDO Aug, Sep, Oct 1964	PDO Aug, Sep, Oct 1954
0.09, 0.32, ??	0.52, 0.45, 0.56	-1.19, -1.24, -1.30	1.85, 0.91, 0.96	0.27, 0.44, -0.10	-0.15, 0.21, -0.22	-1.03, -0.68, -0.37	0.08, -0.94, 0.52

Figure 8. Typical Sea Surface Temperature Anomaly (SSTA) patterns in the North Pacific Ocean during a positive Pacific Decadal Oscillation phase (PDO). As with ENSO, the PDO correlates well with winter precipitation in the southwest United States.



North Pacific Index (NPI) & the Aleutian Low

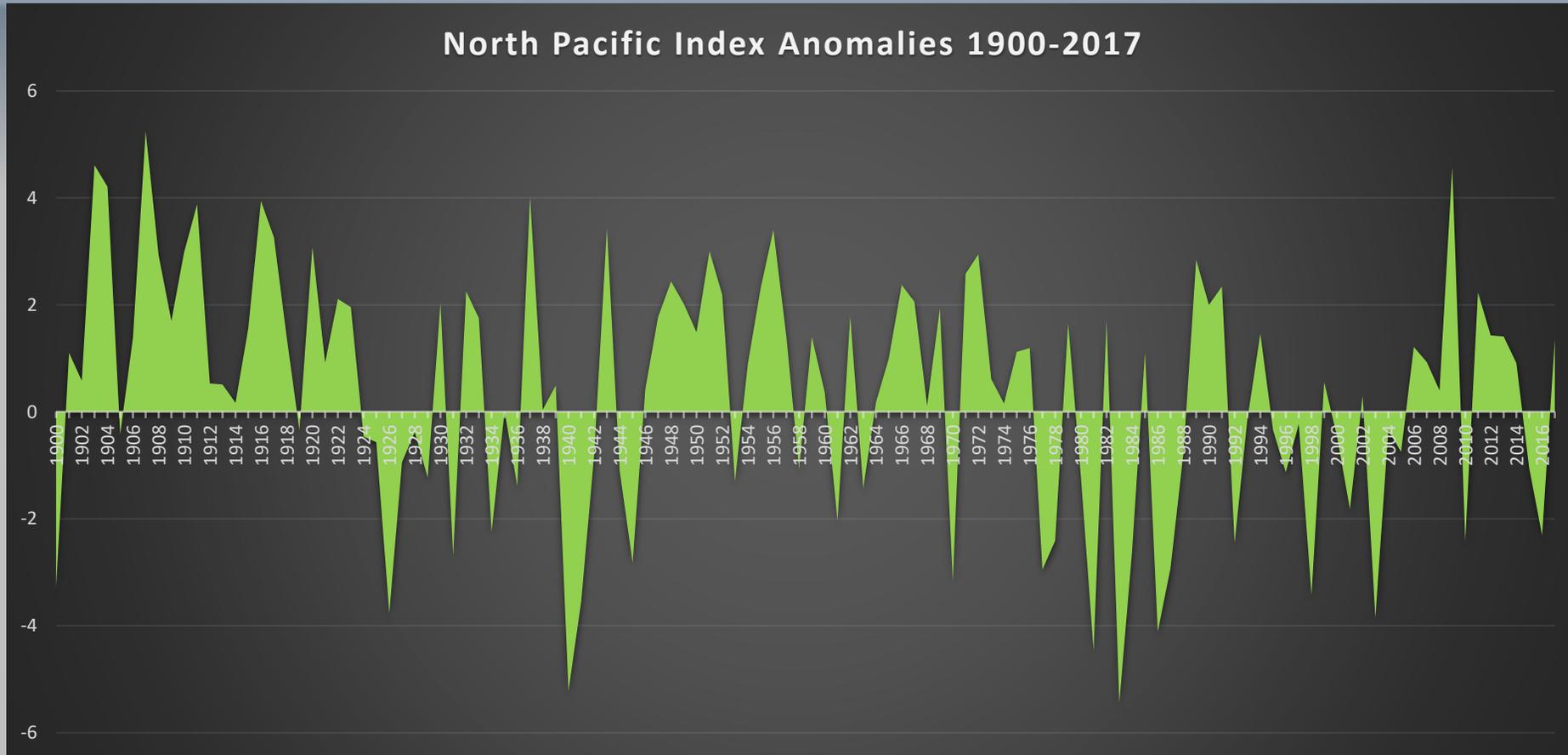
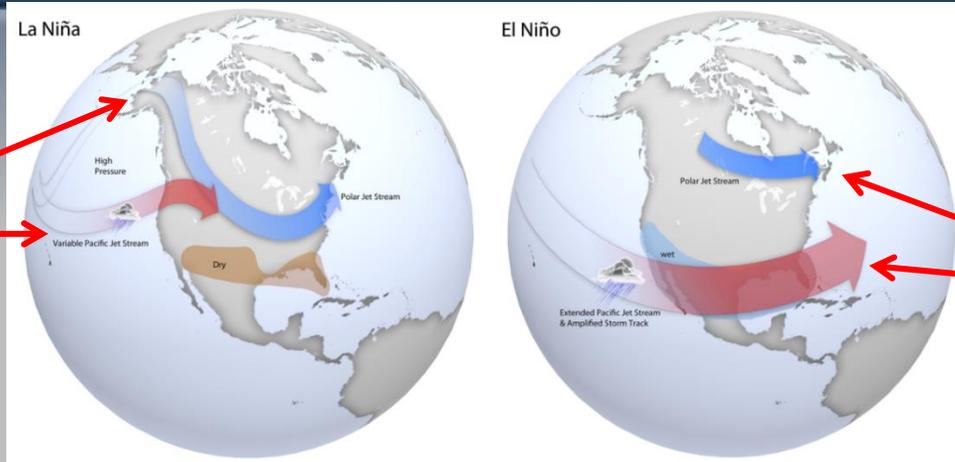


Figure 9. The North Pacific Index (NP index or NPI) is the area-weighted sea level pressure over the region 30°N-65°N, 160°E-140°W. The NP index is defined to measure inter-annual to decadal variations in the atmospheric circulation. The dominant atmosphere-ocean relation in the North Pacific is one where atmospheric changes lead changes in sea surface temperatures by one to two months. A negative NP Index (Nov-Mar) is associated with a positive PDO, a stronger than average Aleutian low, and a storm track farther south than average.

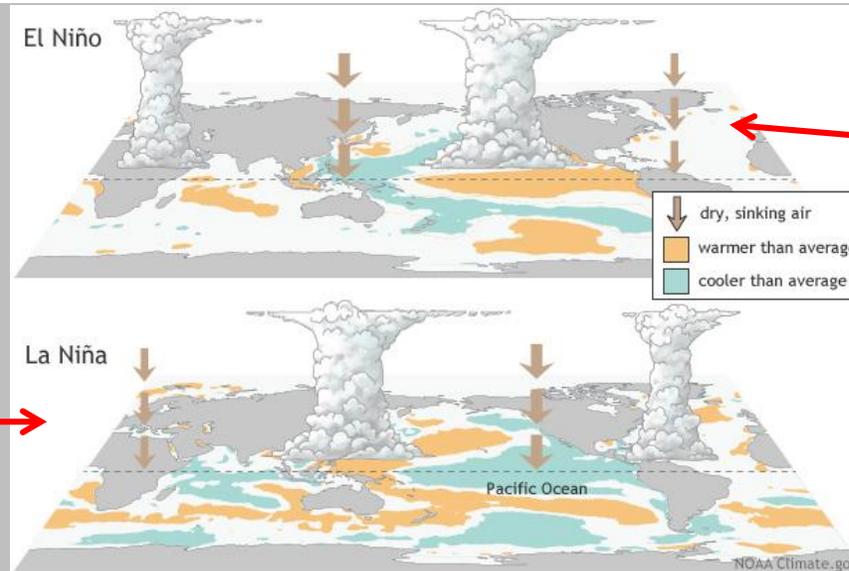
Why SSTs in the Eastern Pacific Ocean Are So Important WRT to Weather Patterns/Climate

Typical Jet Stream Pattern during La Niña



Typical Jet Stream Pattern during El Niño

Typical Tropical circulations during La Niña

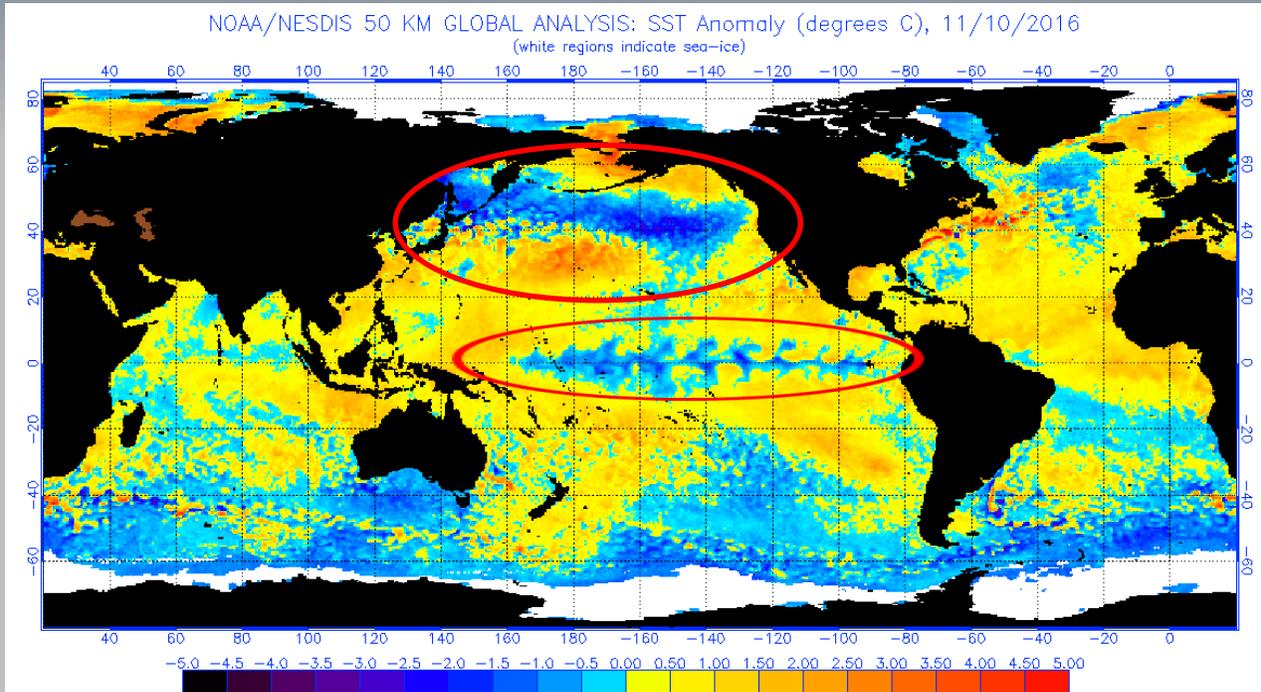
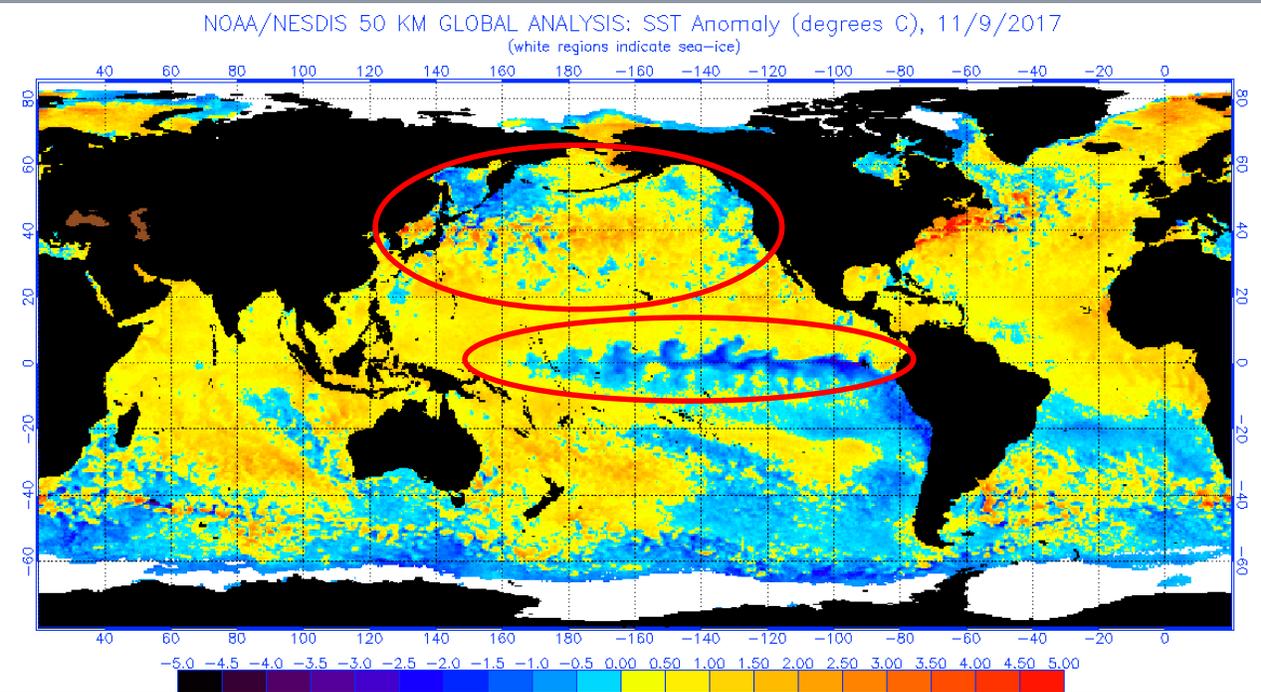


Typical Tropical circulations during El Niño

Figure 10 & 11. 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.



Comparing Early November 2016 Global SSTAs to Early November 2017



Figures 12 & 13. SSTAs from the most recent weak La Niña event, 2016-17, and current conditions. Note the differences between the north and southeast Pacific Ocean. The cooler than average temperatures along the west coast of South America are more prominent this year, possibly indicative of a slightly stronger La Niña event.



DJF Precipitation Anomaly Analog Years

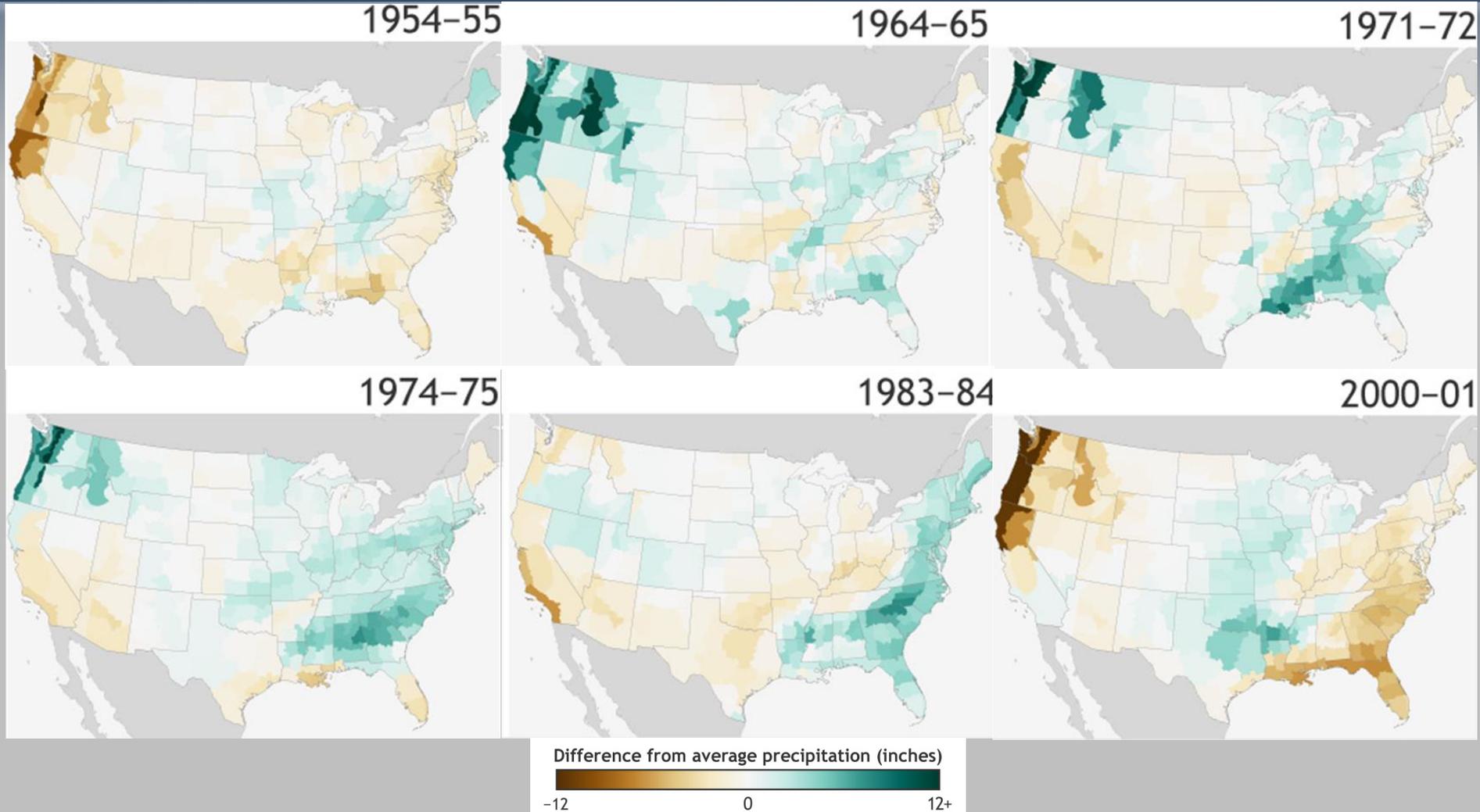


Figure 14-19. December-February precipitation compared to the 1981-2010 average during each weak La Niña winter through 2001. Each event was considerably different despite similar Pacific SST anomalies.



DJF Temperature Analog Years

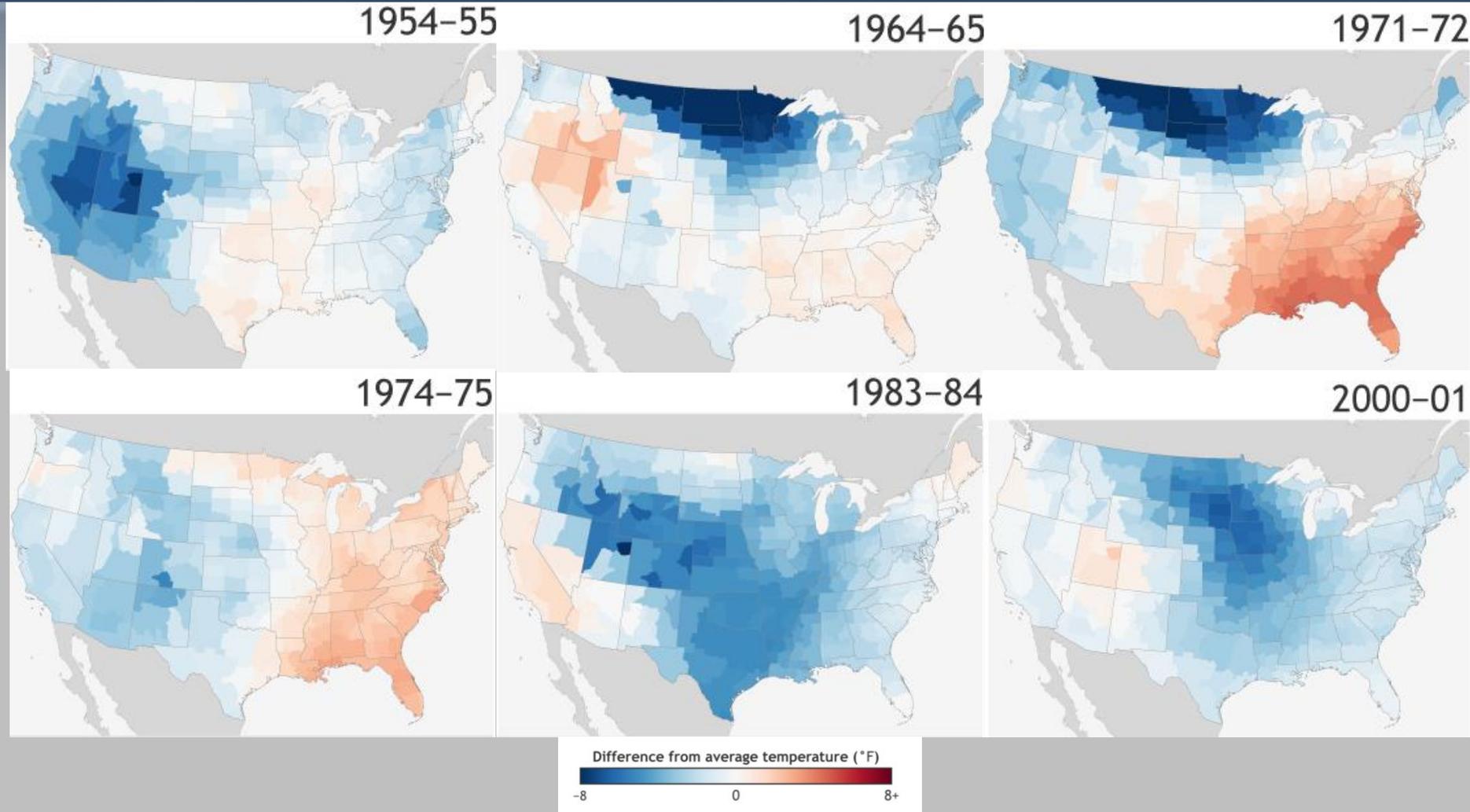


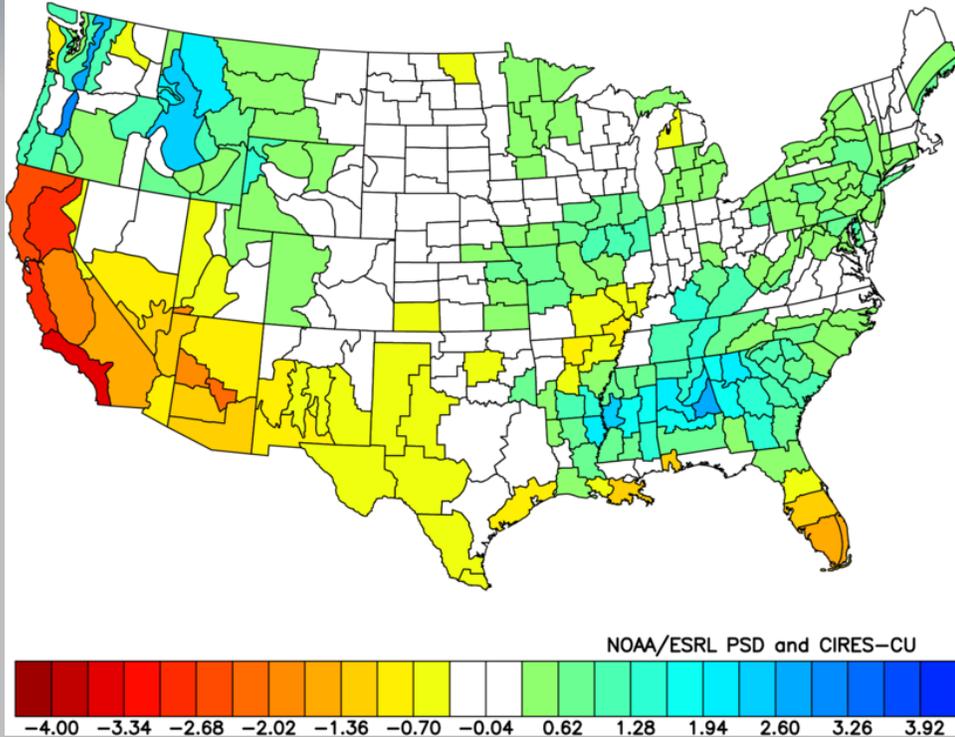
Figure 20-25. December-February temperatures compared to the 1981-2010 average during each weak La Niña winter since records began in 1950. Again, each event was significantly different despite similar SST anomalies.



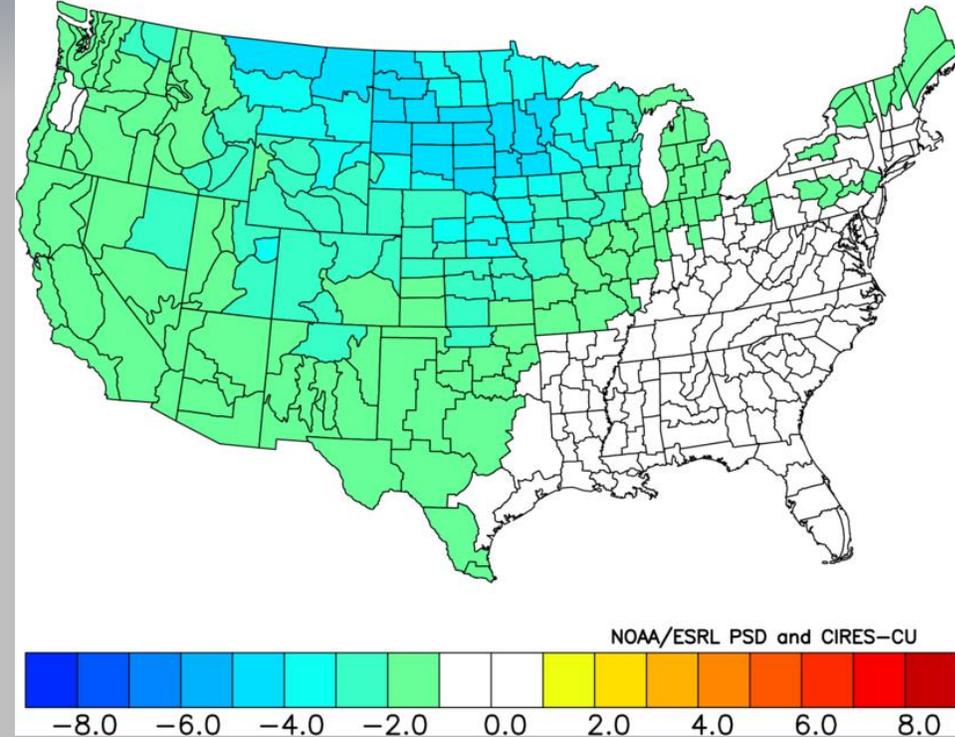
Precipitation and Temperature Anomalies



NOAA/NCEI Climate Division Composite Precipitation Anomalies (in)
Dec to Feb 1954-55, 1964-65, 1971-72, 1974-75, 1983-84, 2000-01
Versus 1981-2010 Longterm Average



NOAA/NCEI Climate Division Composite Temperature Anomalies (F)
Dec to Feb 1954-55, 1964-65, 1971-72, 1974-75, 1983-84, 2000-01
Versus 1981-2010 Longterm Average



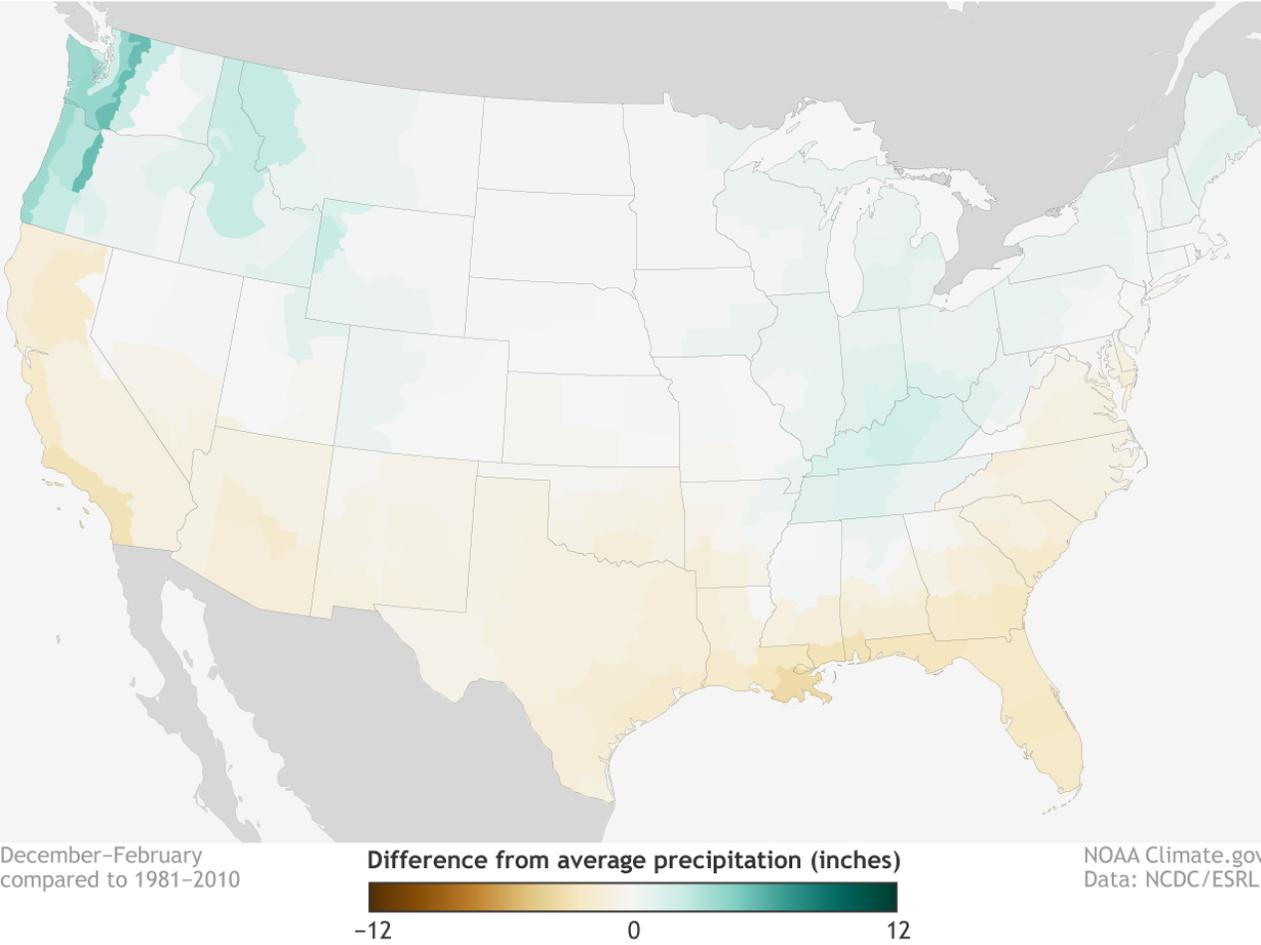
Figures 26 & 27 . DJF Precipitation and Temperature anomaly plots for CPC's climate divisions comparing six analog seasons (1954-55, 1964-65, 1971-72, 1974-75, 1983-84, & 2000-01) with 30-year climatological averages. Five climate divisions in the state were slightly below to below average for precipitation while the northern three divisions were very near average with regard to precipitation. Temperatures were slightly below to below 1981-2010 climatological averages.



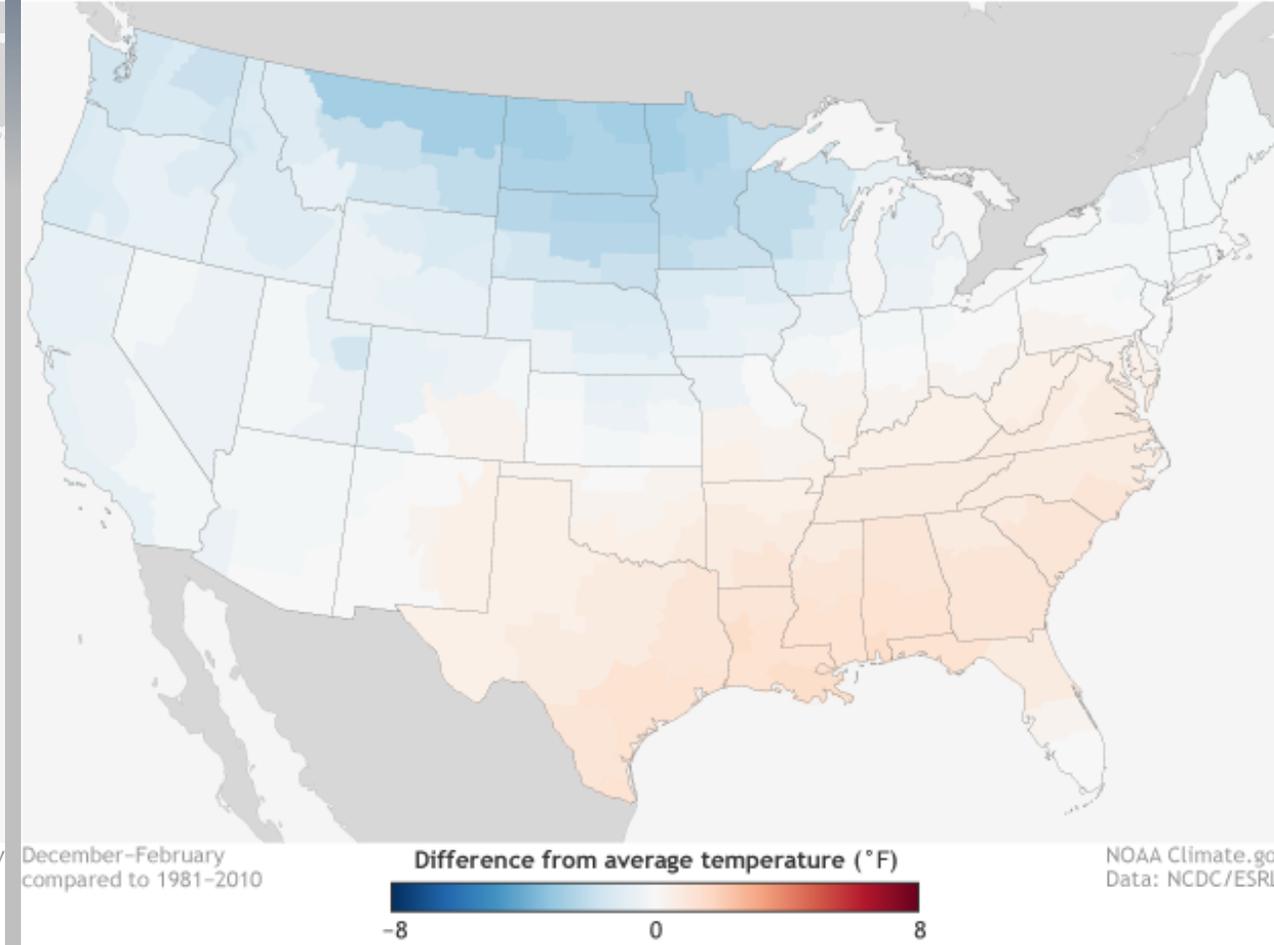
Averaging All 21 La Niña Events Since 1950



Precipitation patterns averaged across all La Niña winters since 1950



Temperature patterns averaged across all La Niña winters since 1950

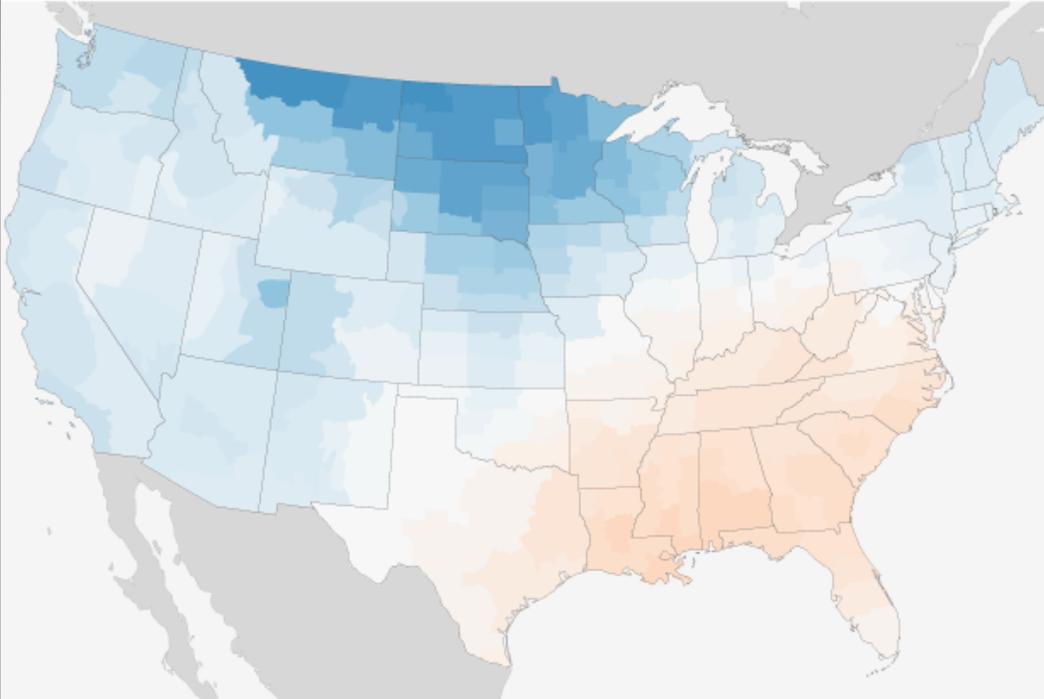


Figures 28 & 29. Precipitation and Temperature anomaly plots for all 21 La Niña events since 1950.



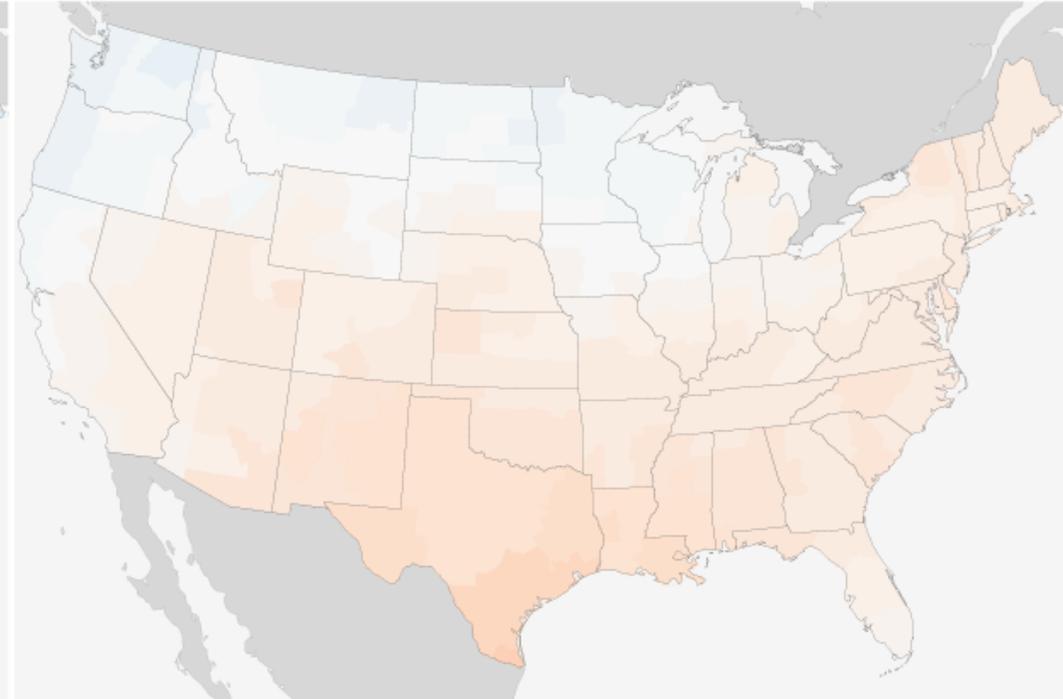
La Niña Temperature Trend

Comparing La Niña temperature patterns
Ten earliest La Niña winters



December–February
compared to 1981–2010

Ten latest La Niña winters



Difference from average temperature (°F)



-8

0

8

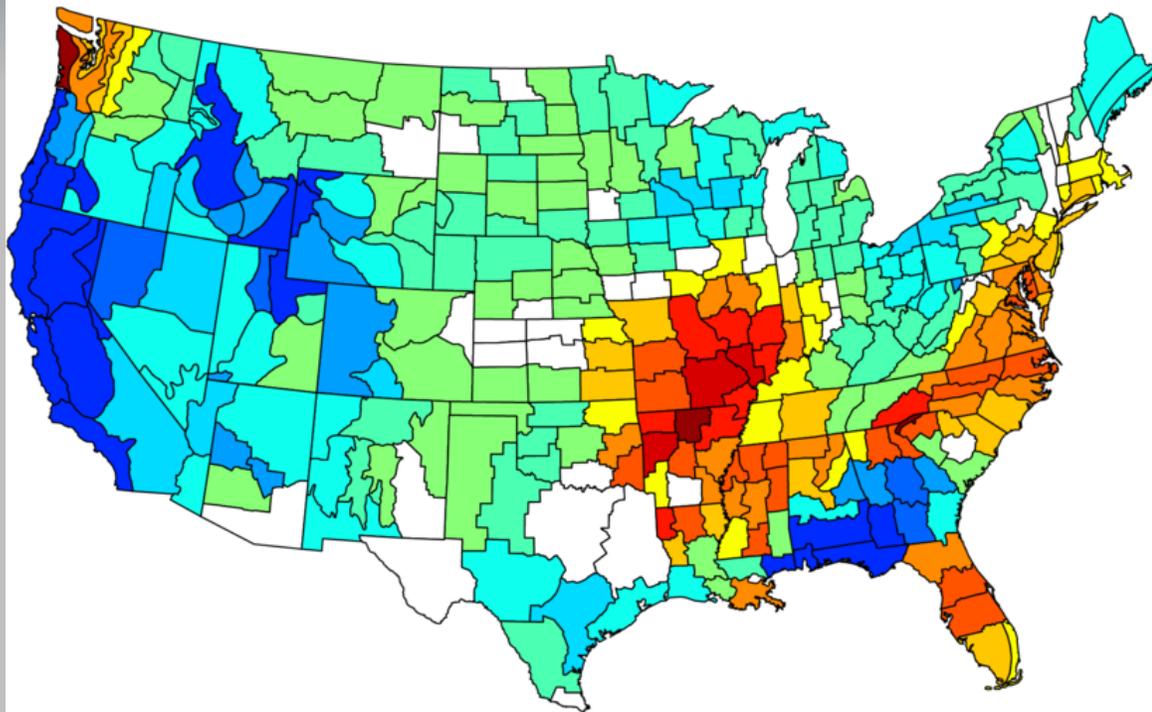
NOAA Climate.gov
Data: NCDC/ESRL

Figures 30 & 31. Comparing temperature anomalies from La Niña events since 1950. The clear trend shown in the last 10 events is that La Niña events are no longer colder than average for much of the nation as they once were. Warmer temperatures can result in “wetter” snow or lower ratio snowfall.



Last Year's La Niña

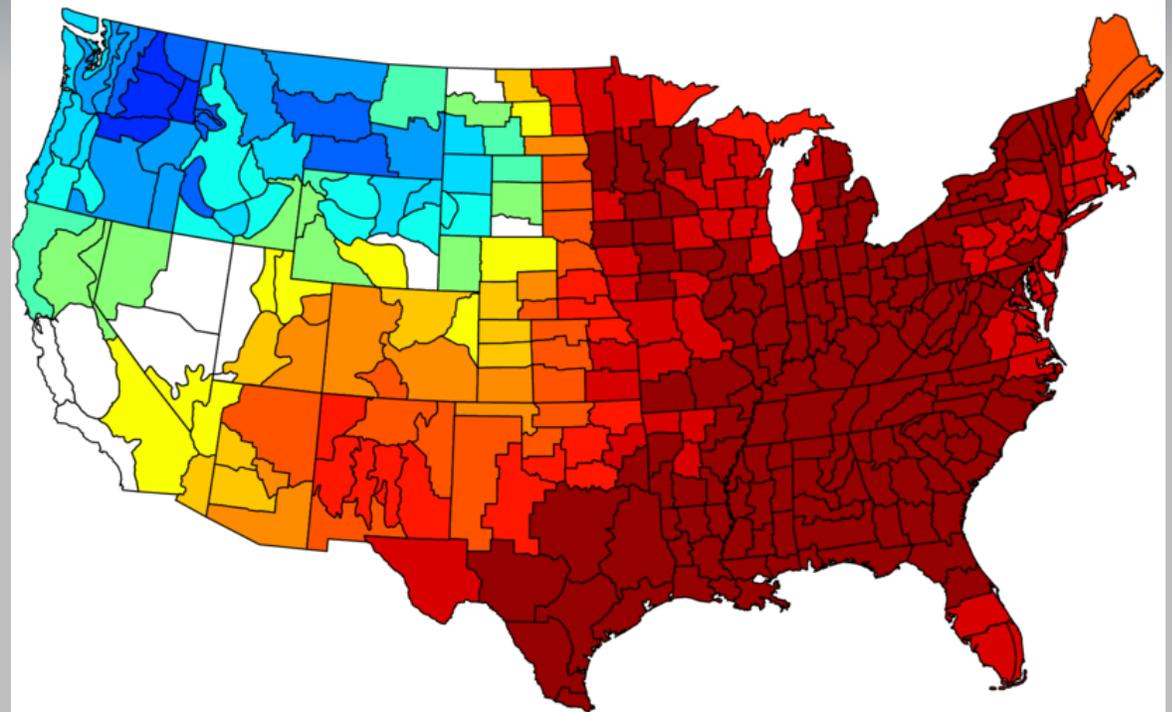
NOAA/NCEI Climate Division Precipitation Anomalies (in)
Dec to Feb 2016–17
Versus 1981–2010 Longterm Average



NOAA/ESRL PSD and CIRES-CU



NOAA/NCEI Climate Division Temperature Anomalies (F)
Dec to Feb 2016–17
Versus 1981–2010 Longterm Average



NOAA/ESRL PSD and CIRES-CU



Figures 32 & 33. Precipitation and temperature anomalies from DJF 2016-17.



Latest Climate Model Forecasts

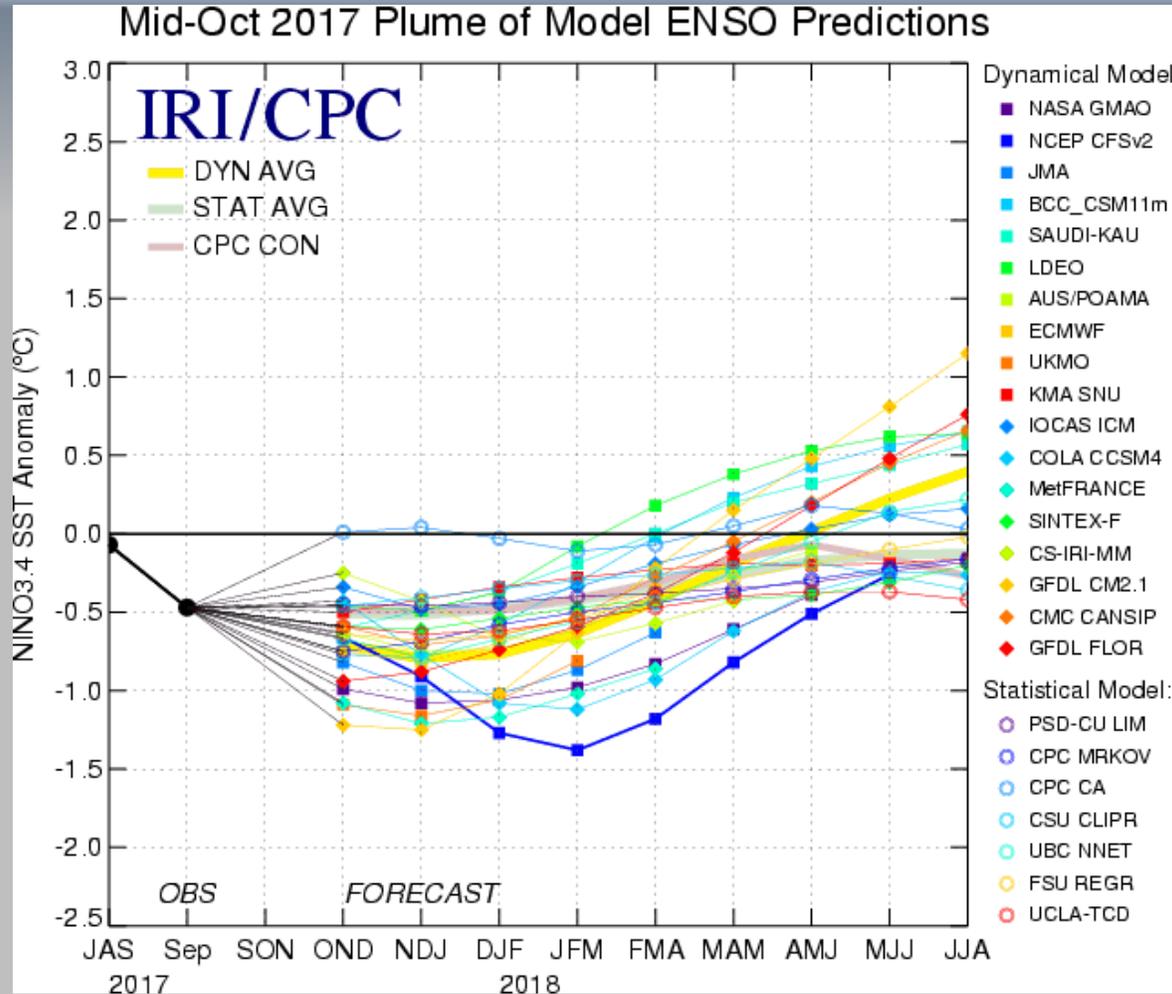
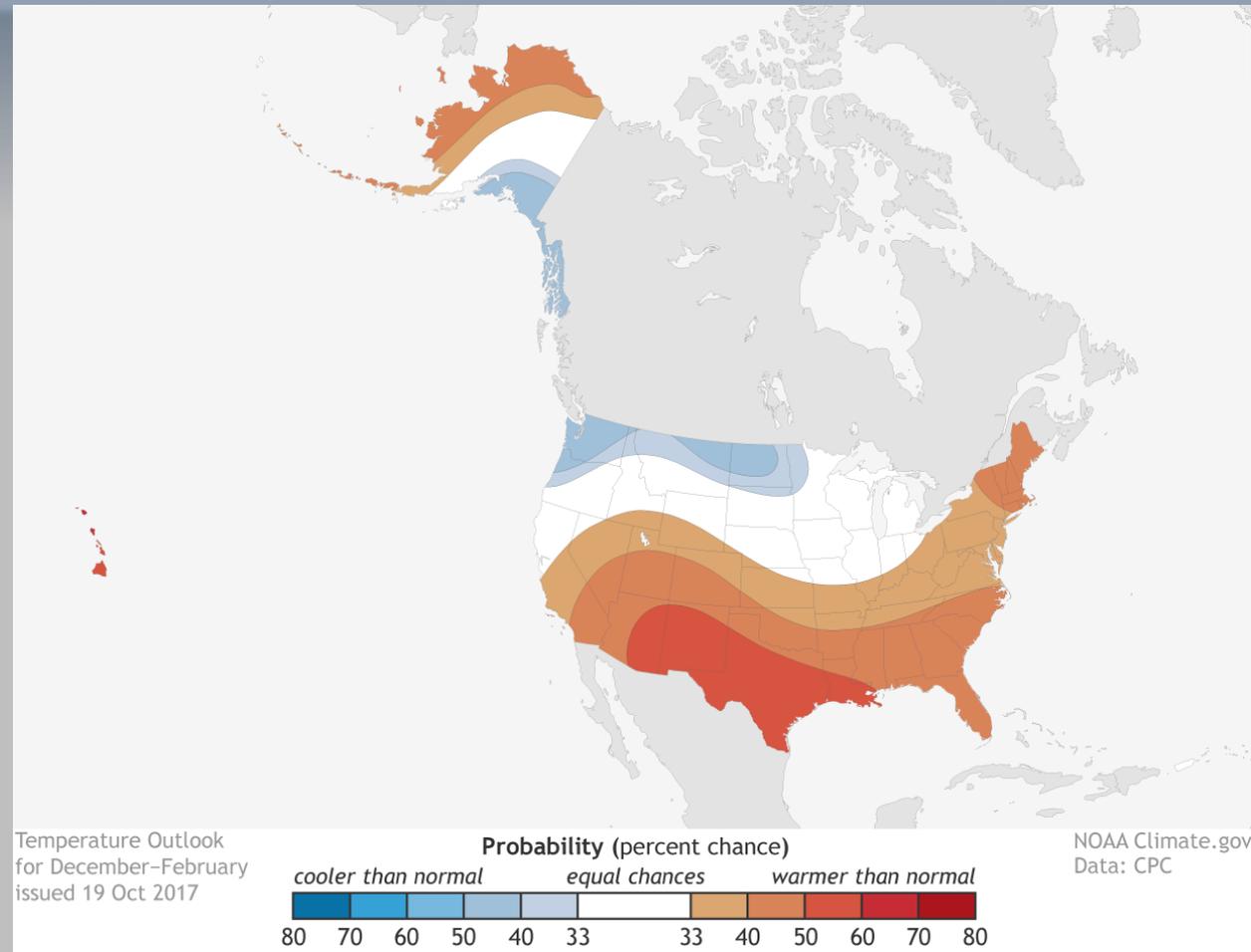
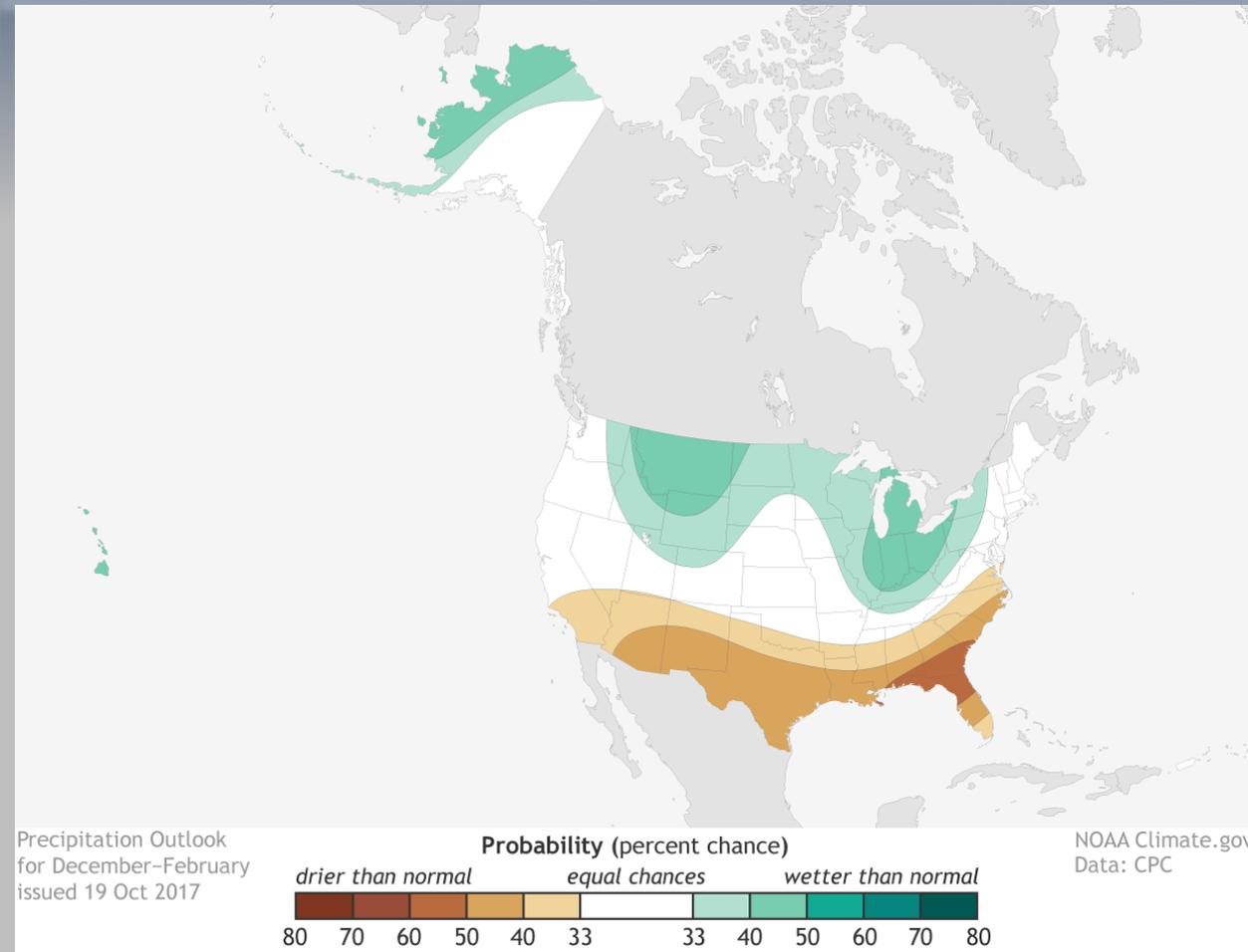


Figure 34. Vast majority of climate models keep a weak La Niña ($\sim -0.5^{\circ}\text{C}$) in place during the Northern Hemisphere winter (DJF) 2017-18.



Climate Prediction Center's Official 2017-18 Winter Outlook



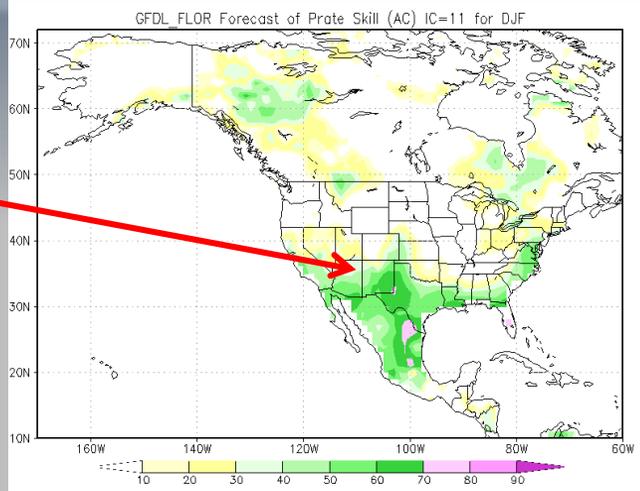
Figures 35 & 36. CPC's DJF 2017-18 precipitation and temperature forecasts favoring below average precipitation and above average temperatures for much of New Mexico.



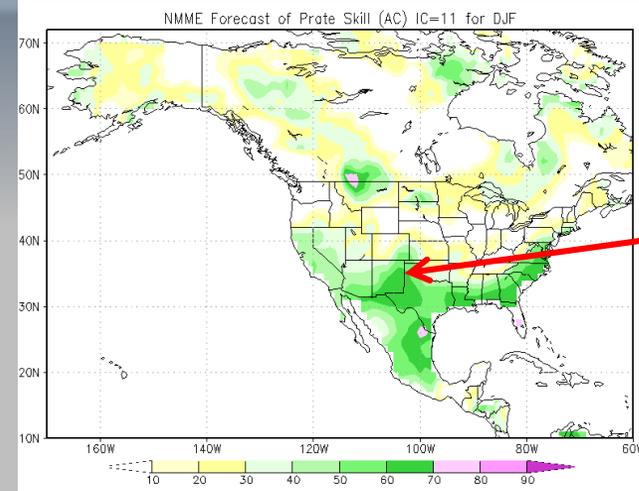
Numerical Climate Prediction Model Precipitation for DJF



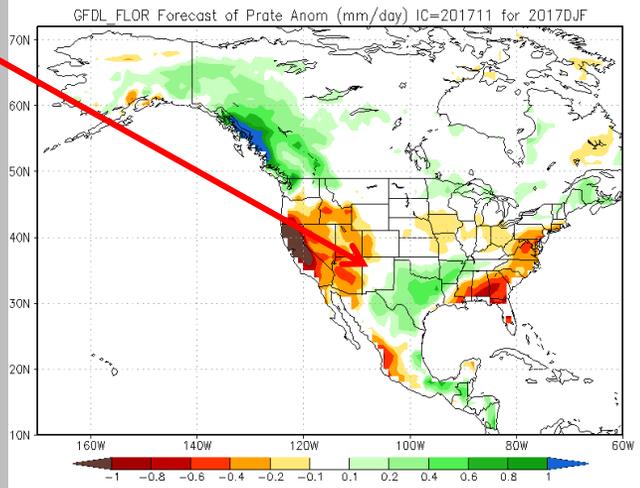
Highest model skill in DJF across southern NM.



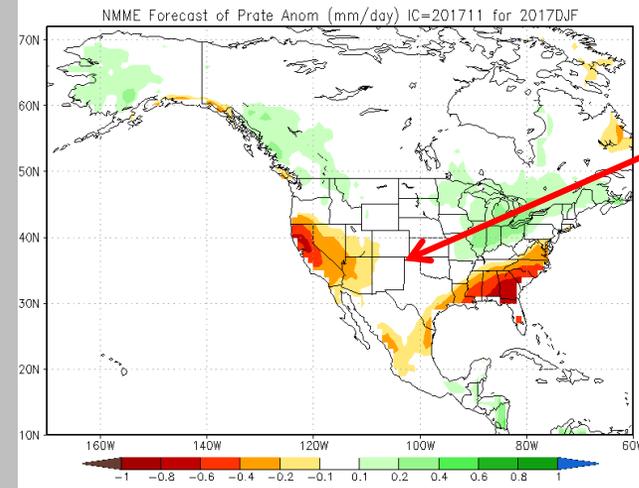
Highest model skill in DJF across southeastern NM.



White equates to average precipitation rates.



White equates to average precipitation rates.



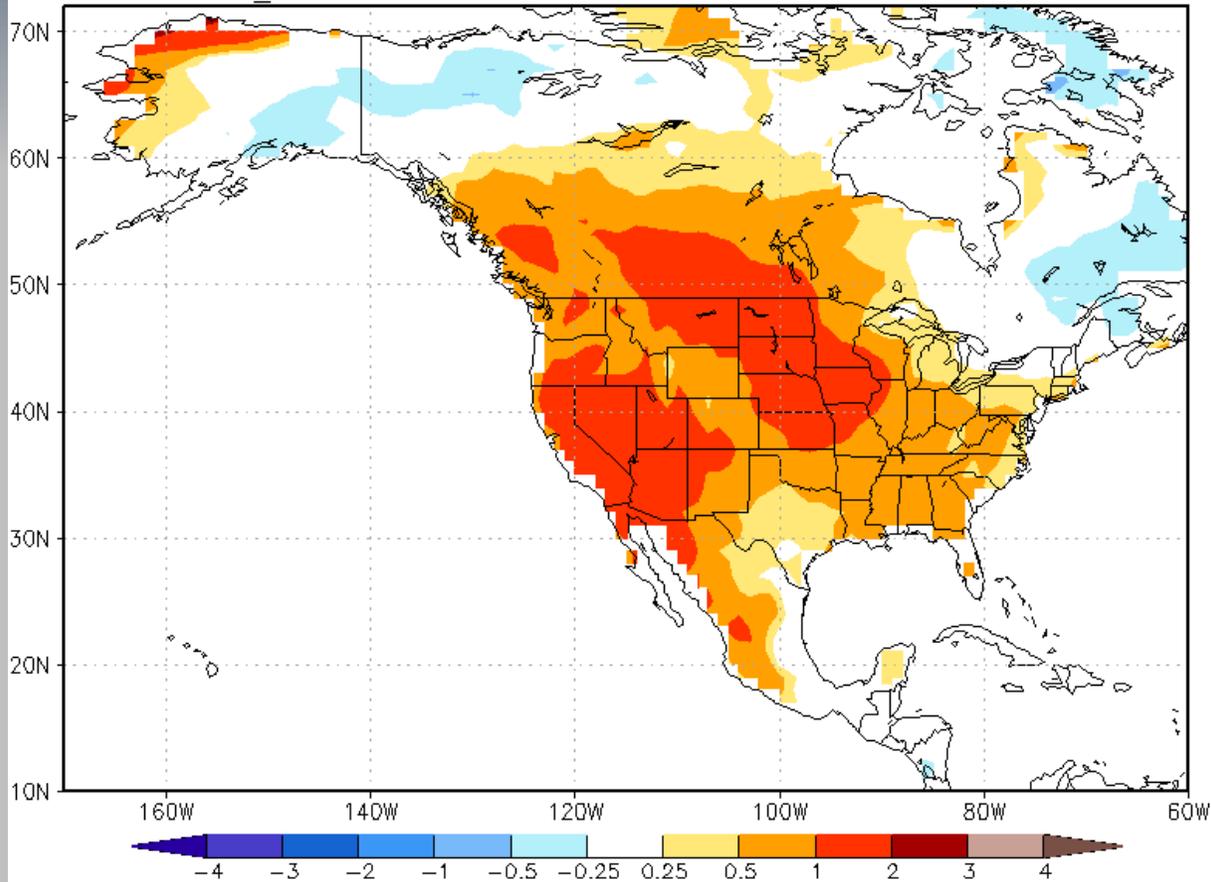
Figures 37-40. Model precipitation rate anomaly plots from the two climate models which have the highest skill percentages (top two images), the North American Multi-Model Ensemble (NMME) and the Geophysical Fluid Dynamics Laboratory (GFDL_FLOR) model. Both model forecasts are predicting average precipitation for DJF 2017-18 across New Mexico.



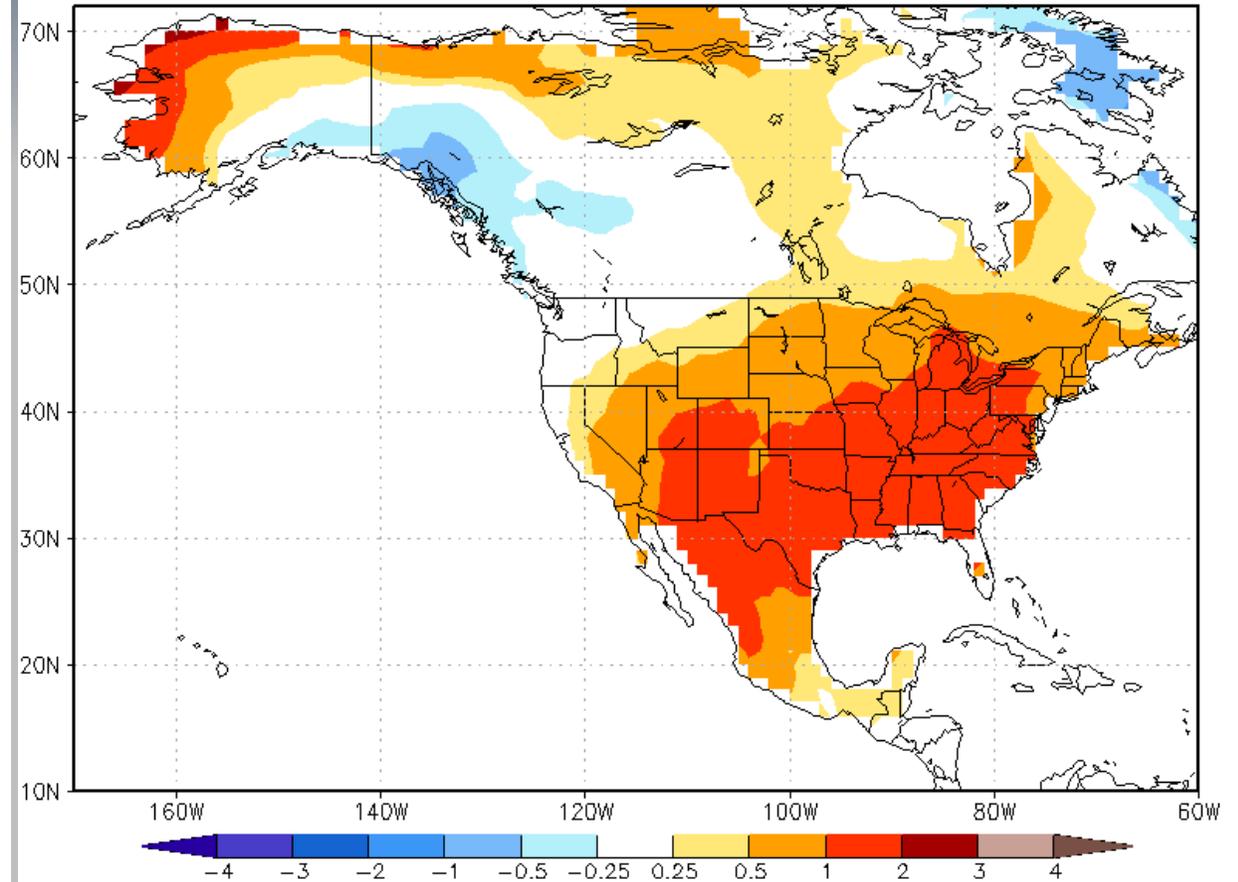
Numerical Climate Prediction Model Temperatures for DJF



GFDL_FLOR Forecast of TMP2m Anom IC=201711 for 2017DJF



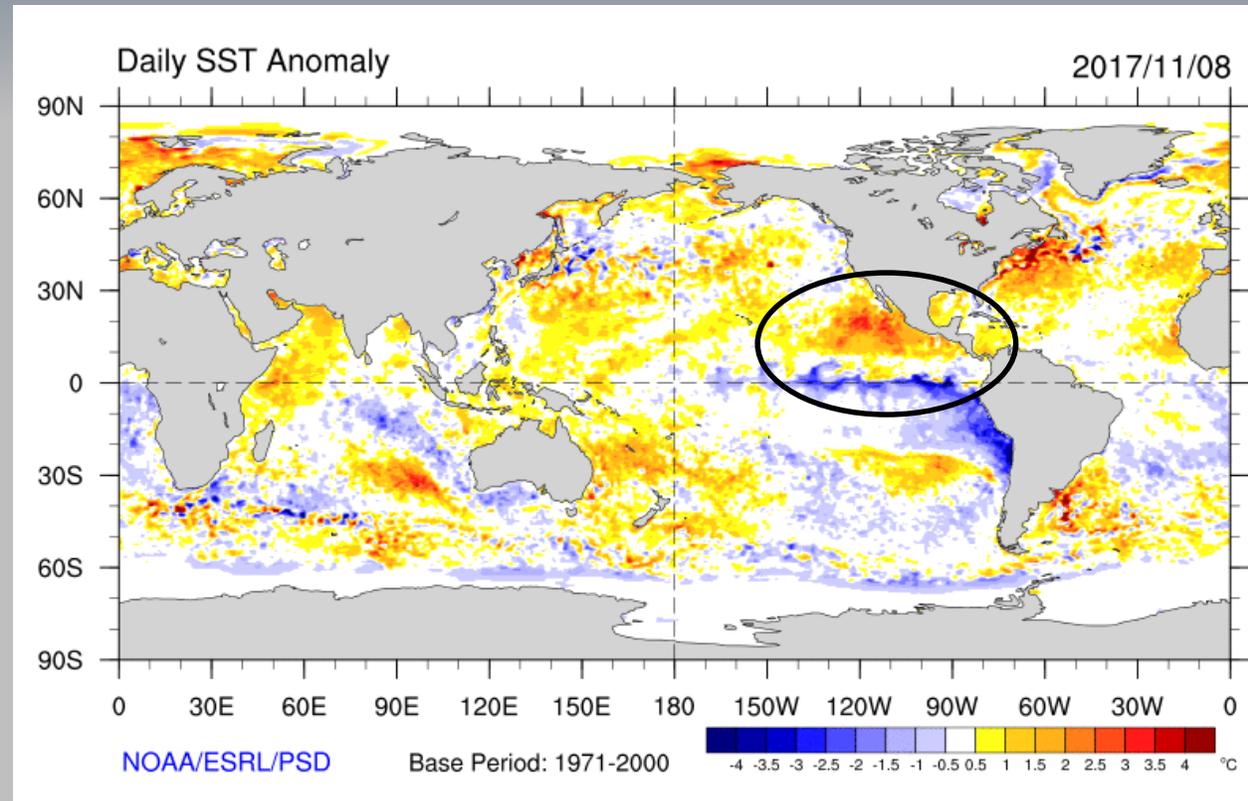
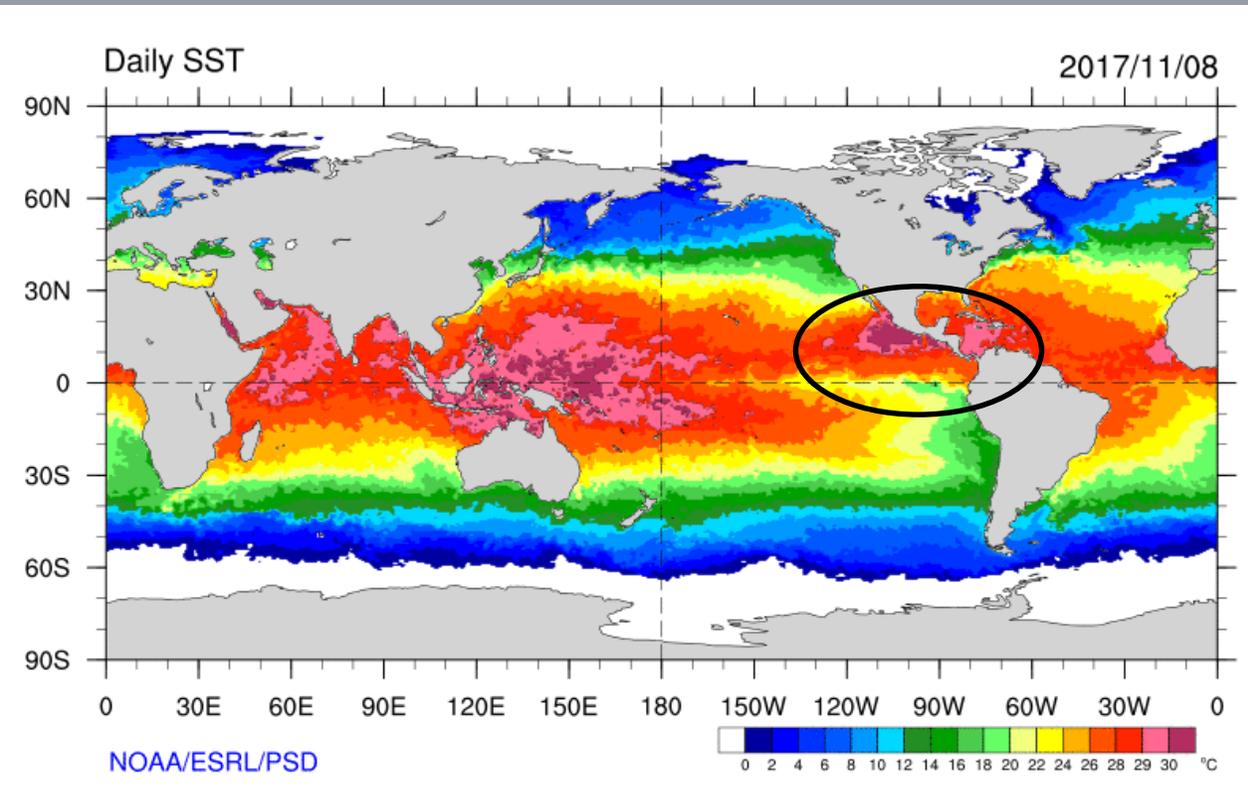
NMME Forecast of TMP2m Anom IC=201711 for 2017DJF



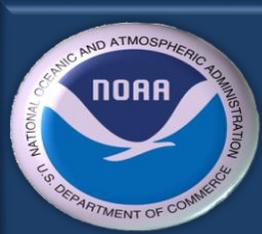
Figures 41 & 42. Two meter (6.5 feet above ground level) temperature anomaly forecasts from the two climate models which have the highest forecast skill percentages, the North American Multi-Model Ensemble (NMME) and the Geophysical Fluid Dynamics Laboratory (GFDL_FLOR) model. Both models forecast slightly above to above average temperatures during DJF 2017-18 across New Mexico and much of the U.S.



Noteworthy SST Trends During the Past Few Days



Figures 43 & 44. SSTs along the west coast of Mexico southwest of Puerto Vallarta have warmed rapidly over the past several days. If the SST gradients that are generated by this scenario continue, so will the deep convection, potentially drawing the jet stream farther south across the southwest U.S. during late November.



Summary



- Precipitation in previous winter (DJF) seasons during a weak La Niña since 1950 ranged from slightly above to below the 1981-2010 climatological averages at sites throughout northern and central New Mexico. Past precipitation data also suggests that the northern third of New Mexico stands the best chance of being near to slightly above average during a weak La Niña event.
- Precipitation data from seven previous weak La Niña events (1954-55, 1964-65, 1971-72, 1974-75, 1983-84, 2000-01 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) 2017-18 will most likely range from slightly below to near average 1981-2010 climatological averages.
- Snowfall data from the seven previous weak La Niña events suggest that snowfall will range from slightly below to below average amounts in DJF 2017-18. Greatest chances for near average snowfall is across the northern third of the state. During the 2016-17 La Niña event, snowfall was below average throughout much of the northern two-thirds of New Mexico despite precipitation being slightly above average.
- Temperatures trends from the past 10 La Niña events (slide 14) combined with forecast from the most highly skilled climate models suggest temperatures will range from slightly above to above average in DJF 2017-18.
- Each weak La Niña event is different. The two closest analog years when considering the MEI alone, 2000-01 and 2016-17, precipitation was near to slightly above average but snowfall was below average. Current climate model forecasts suggest that this La Niña will be short-lived.



Outlook Information



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