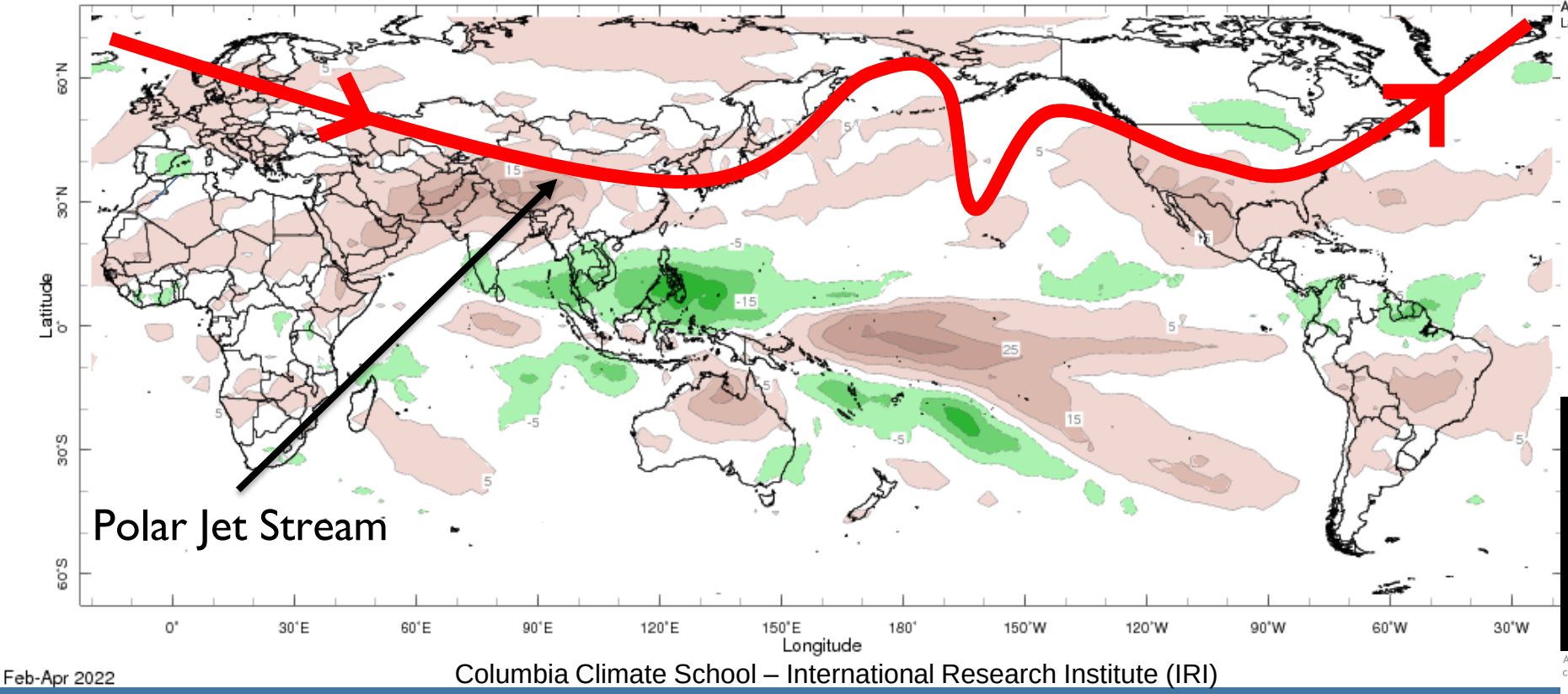
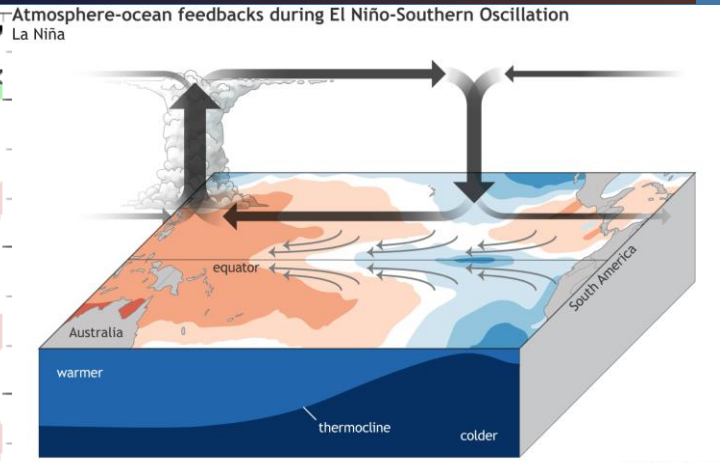
2022 Monsoon Outlook

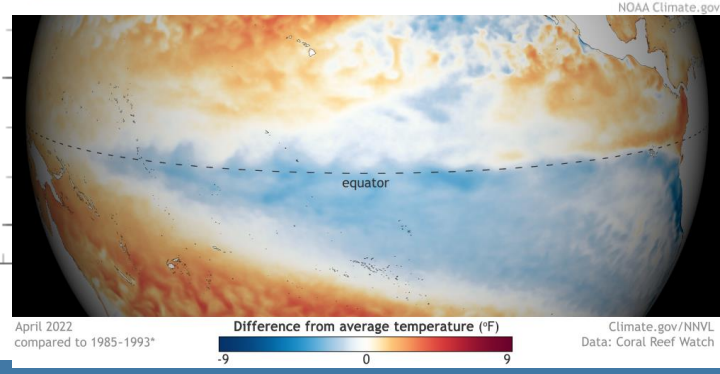
La Niña's Stifling Dry In Spring Can Change Rapidly in June

Albuquerque
WEATHER FORECAST OFFICE



Columbia Climate School – International Research Institute (IRI)





Why has it been so extraordinarily dry this spring? The above image (left) shows outgoing longwave radiation (OLR) difference from average from Feb-Apr 2022. What does it show? The cooler than average waters in the central and eastern Pacific Ocean (EPAC) that define La Niña lead to above average thunderstorm activity in the west Pacific and Maritime Continent (dark green shading). The air associated with these storms rises and is forced to sink to the east (top right image), essentially wiping out thunderstorm potential in the EPAC. It's the lack of these thunderstorms that result in a storm track that remains north of New Mexico during spring. Additionally, the circulation that La Niña creates also negates the effects of the Madden-Julian Oscillation (MJO) as it travels eastward through the eastern Pacific. The MJO in fall and spring often leads to key shifts in the storm track.

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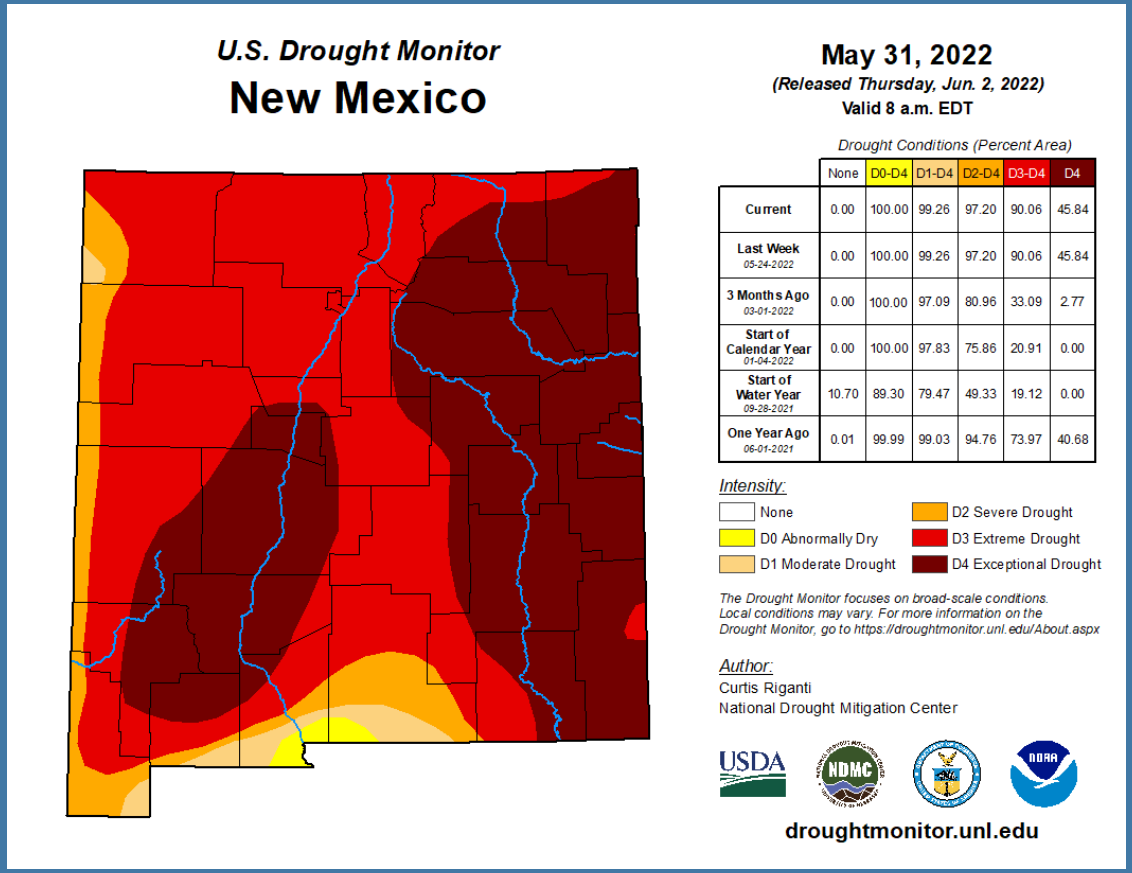
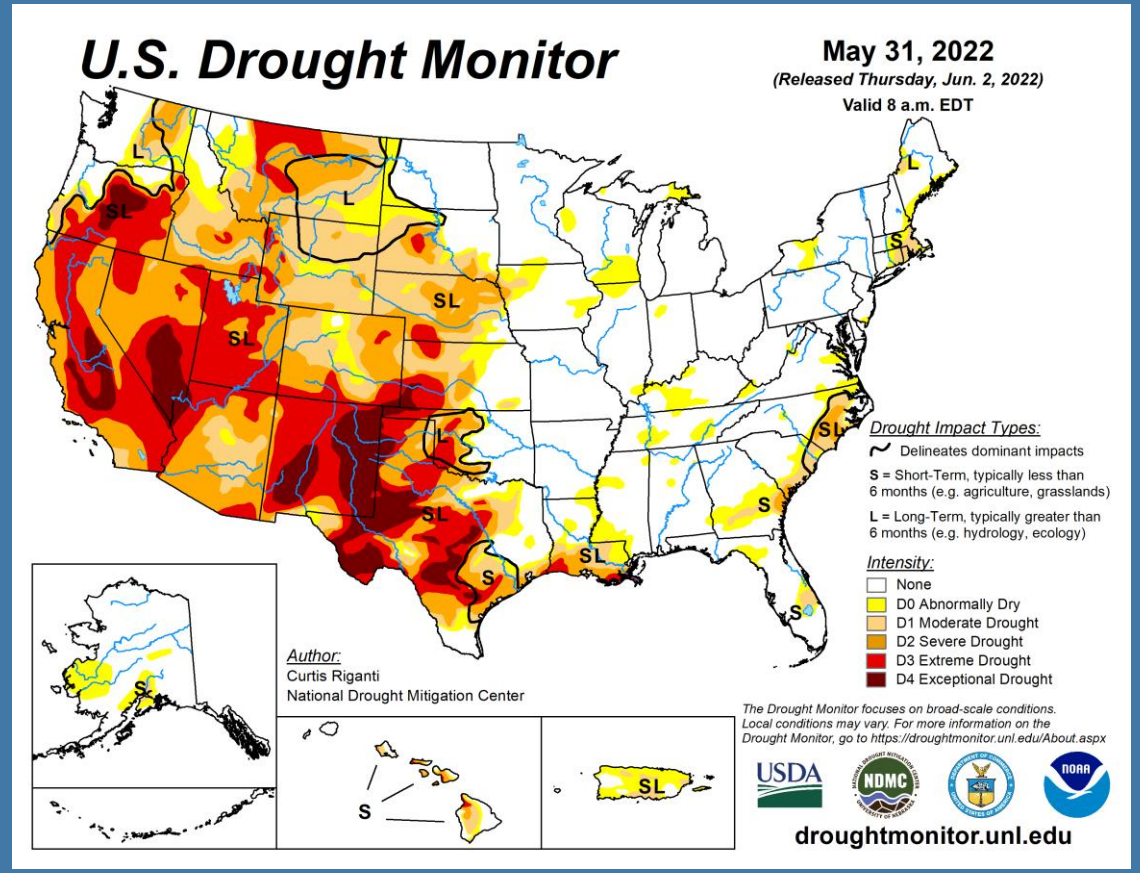


	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	99.26	97.20	90.06	45.84
Last Week 05-24-2022	0.00	100.00	99.26	97.20	90.06	45.84
3 Months Ago 03-01-2022	0.00	100.00	97.09	80.96	33.09	2.77
Start of Calendar Year 01-04-2022	0.00	100.00	97.83	75.86	20.91	0.00
Start of Water Year 09-28-2021	10.70	89.30	79.47	49.33	19.12	0.00
One Year Ago 06-01-2021	0.01	99.99	99.03	94.76	73.97	40.68



U.S. Drought Monitor showing that much of New Mexico remains in Extreme to Exceptional Drought. New Mexico and much of the western half of the country are in a two decade-long plus megadrought. It's considered the most extreme drought in at least the past 1,200 years. By examining tree ring data from Montana to northern Mexico and from the Pacific Ocean to the Rocky Mountains, climate scientists concluded that this is no ordinary drought. Soil moisture deficits doubled since 2000 when compared with levels in the1900s. The study also found that anthropogenic warming contributed to a 42% increase in drought severity.

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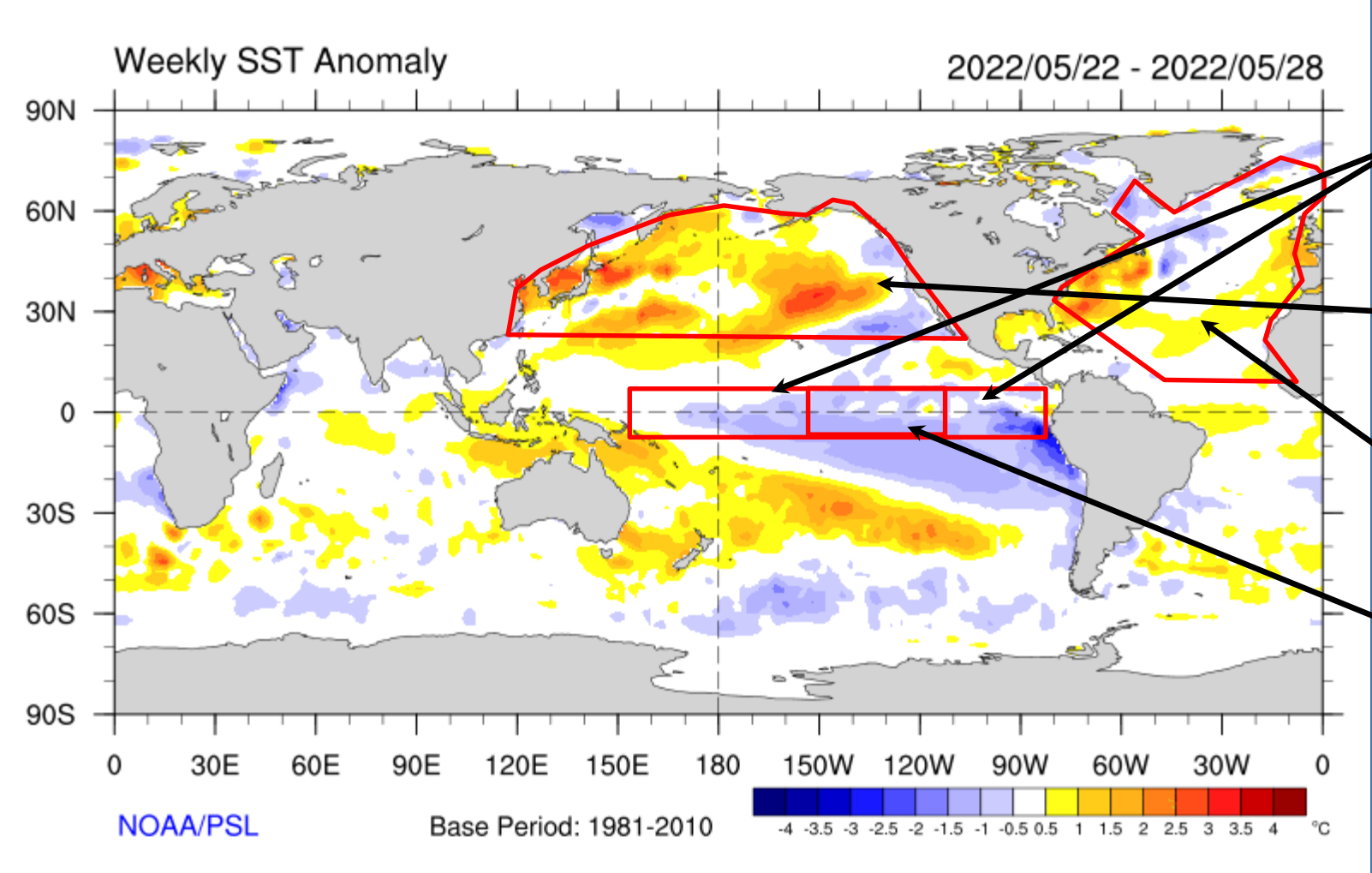

- Multivariate ENSO Index (**MEI**) for MAR-APR 2022: **-1.6**
- Pacific Decadal Oscillation (**PDO**) for APR 2022: **-1.51**
- Atlantic Multidecadal Oscillation (**AMO**) for APR 2022: **+0.116**
- Oceanic Niño Index (**ONI**) (uses Niño 3.4 region - inner rectangle) for FMA 2022: **-1.0**

Latest weekly global SST anomalies showing the area of cooler than average temperatures in the eastern Equatorial Pacific continue to show La Niña hanging on.

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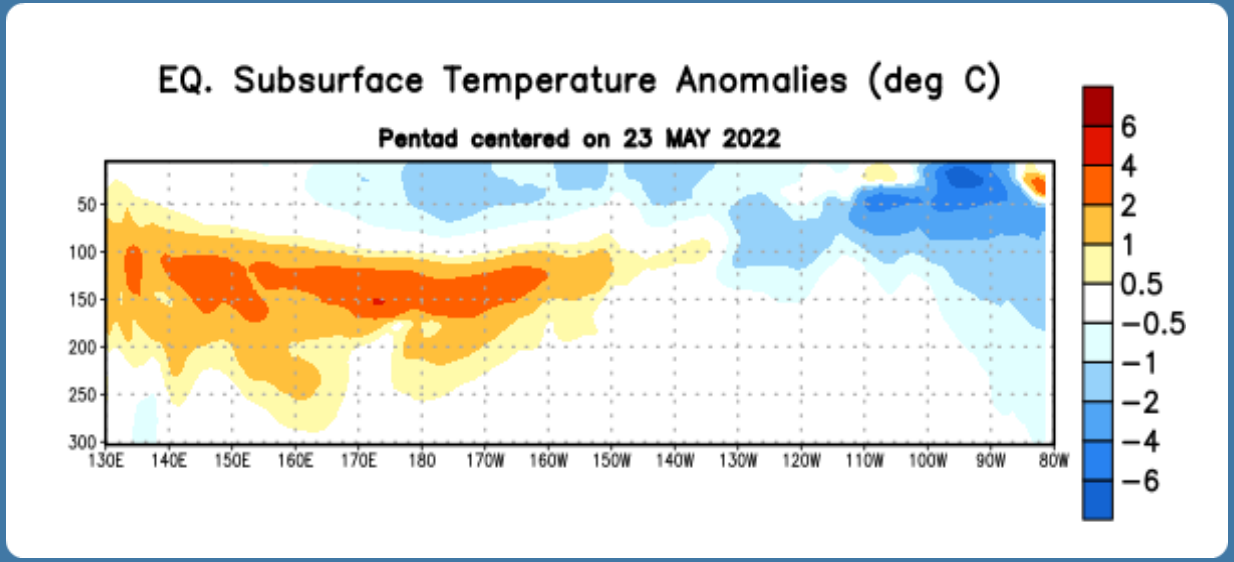

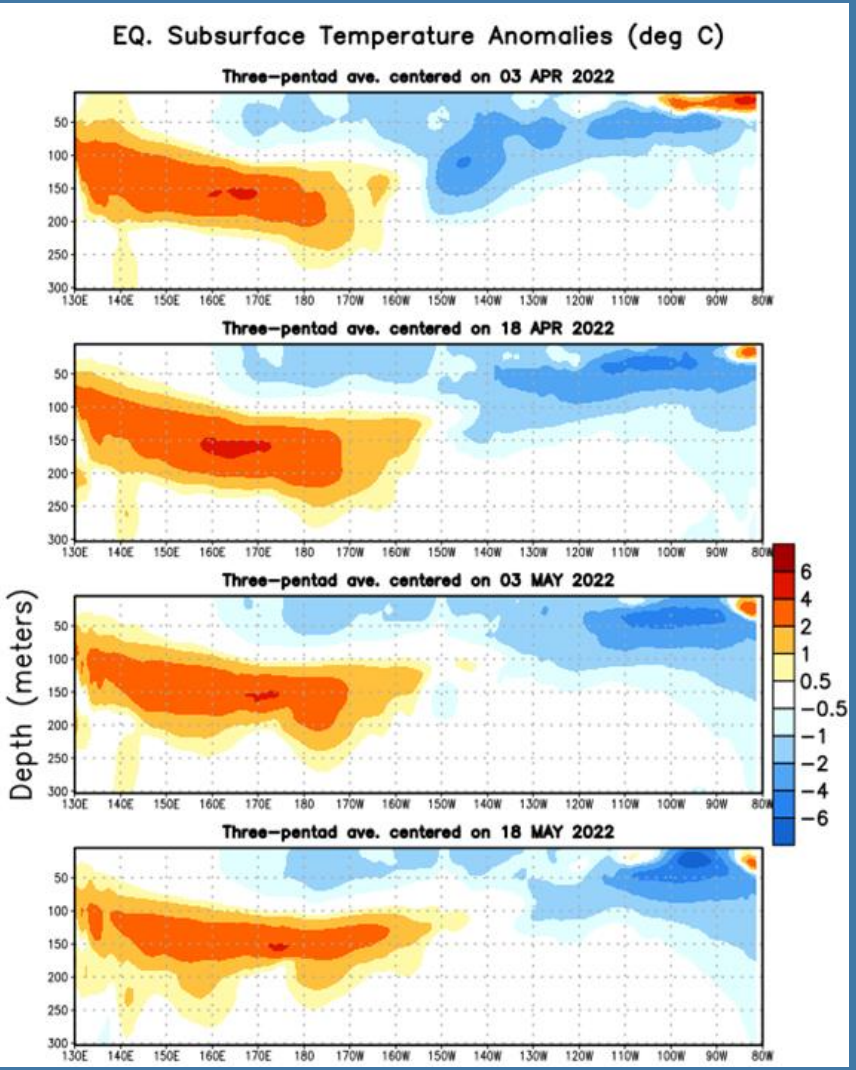

Negative subsurface temperature anomalies prevailed near the surface across most of the equatorial Pacific Ocean in spring. Could a "triple-dip" La Niña be in the cards in fall? It's looking more likely with each model run (slide 15).

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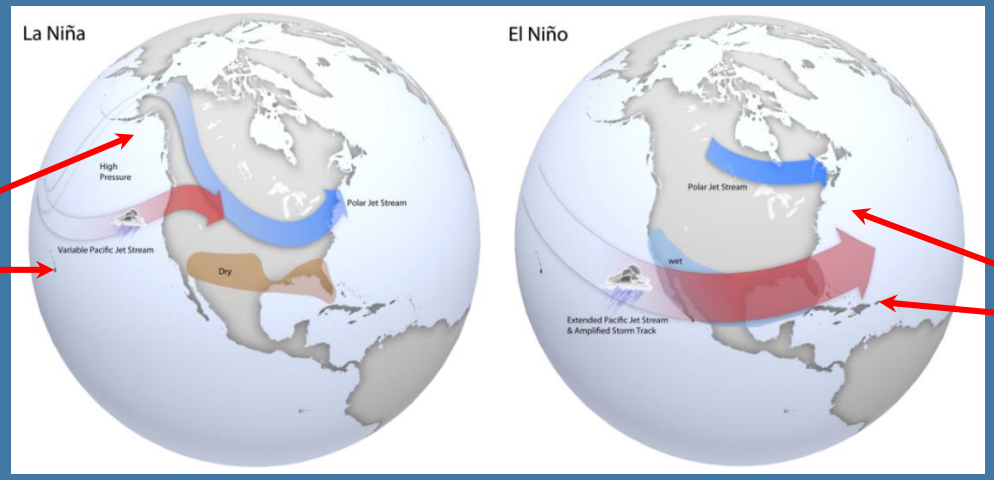
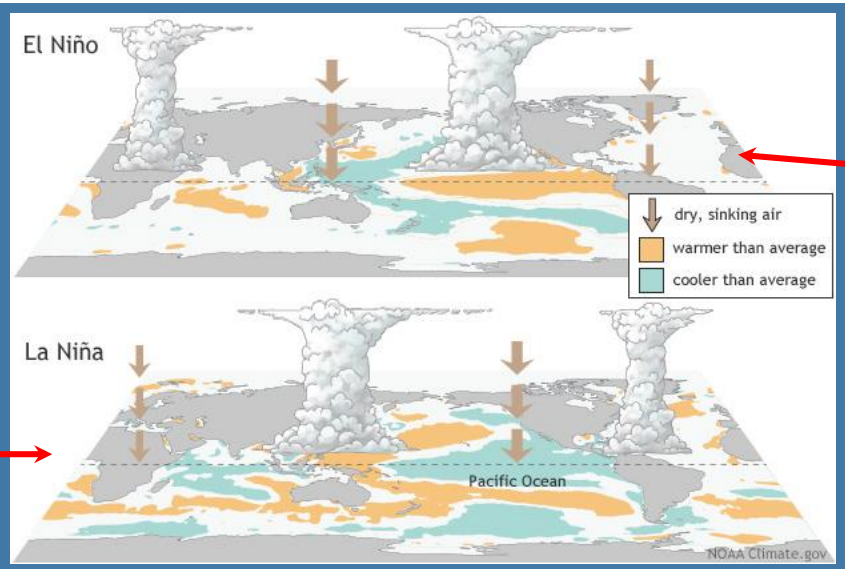
Typical Jet Stream Pattern during La Niña



Typical Jet Stream Pattern during El Niño



Typical Tropical circulations during El Niño

Typical Tropical circulations during La Niña

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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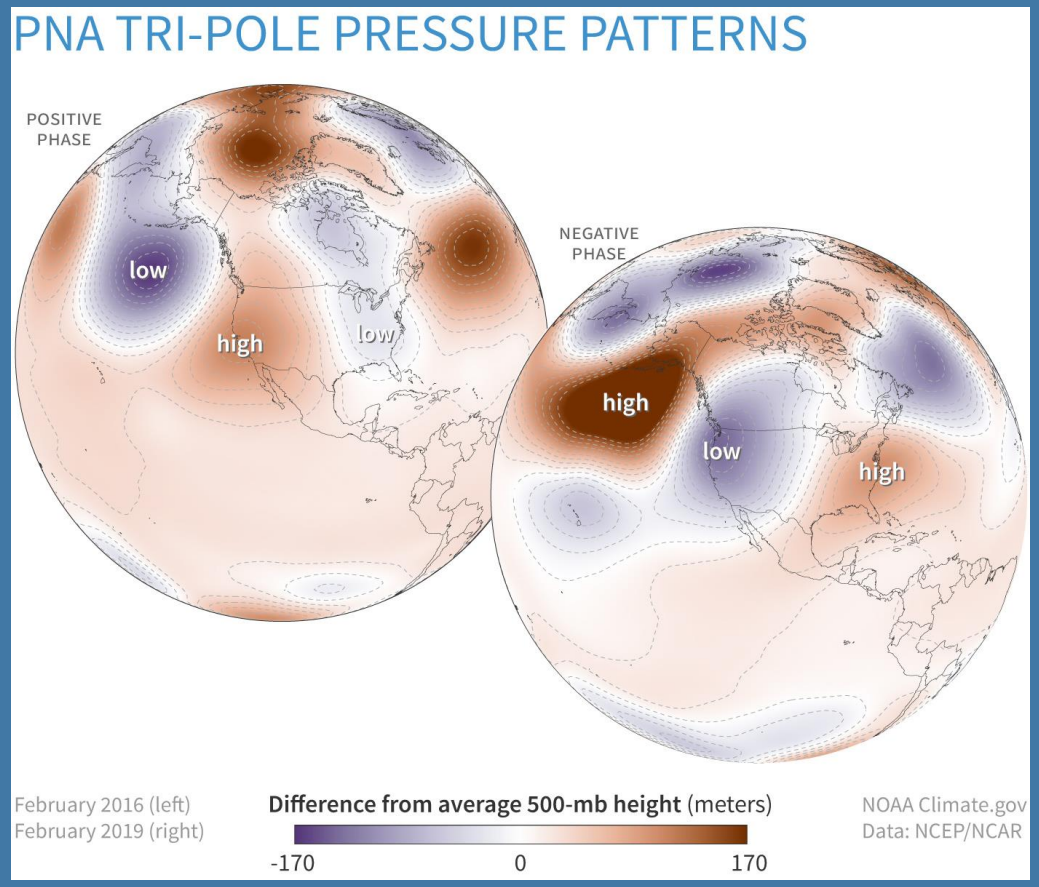
Pacific North American Pattern (PNA)



Air pressure in the lower atmosphere compared to the 1981-2010 average during February 2016 (top), when the PNA was positive, and in February 2019 (bottom), when it was negative. The location of highs and lows and the flow of the jet stream around them often produce a sharp warm-cold split in temperatures in the western and eastern halves of the United States. For New Mexico, often times a negative phase of the PNA leads to upper-level low pressure systems digging southward through the Great Basin, often times accompanied by strong backdoor cold fronts. The long-lived negative PNA this spring has led extraordinarily dry weather for NM and much of the Southwest U.S.

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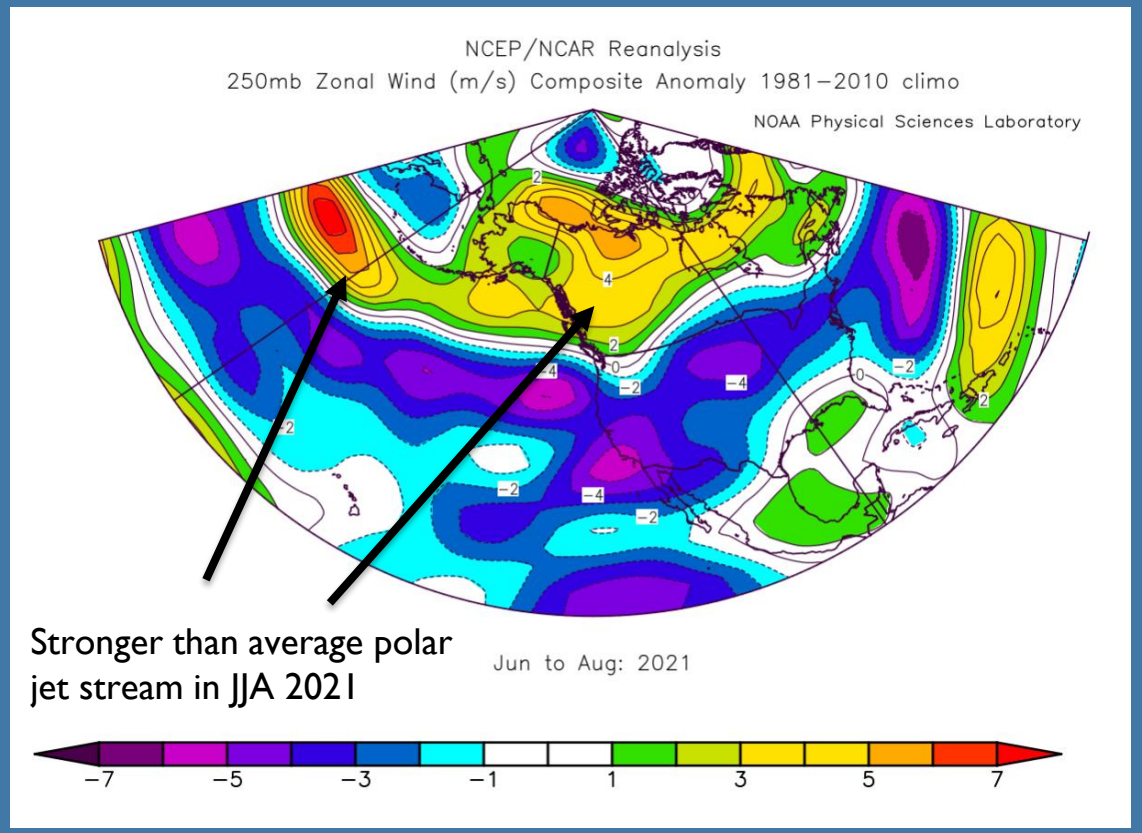

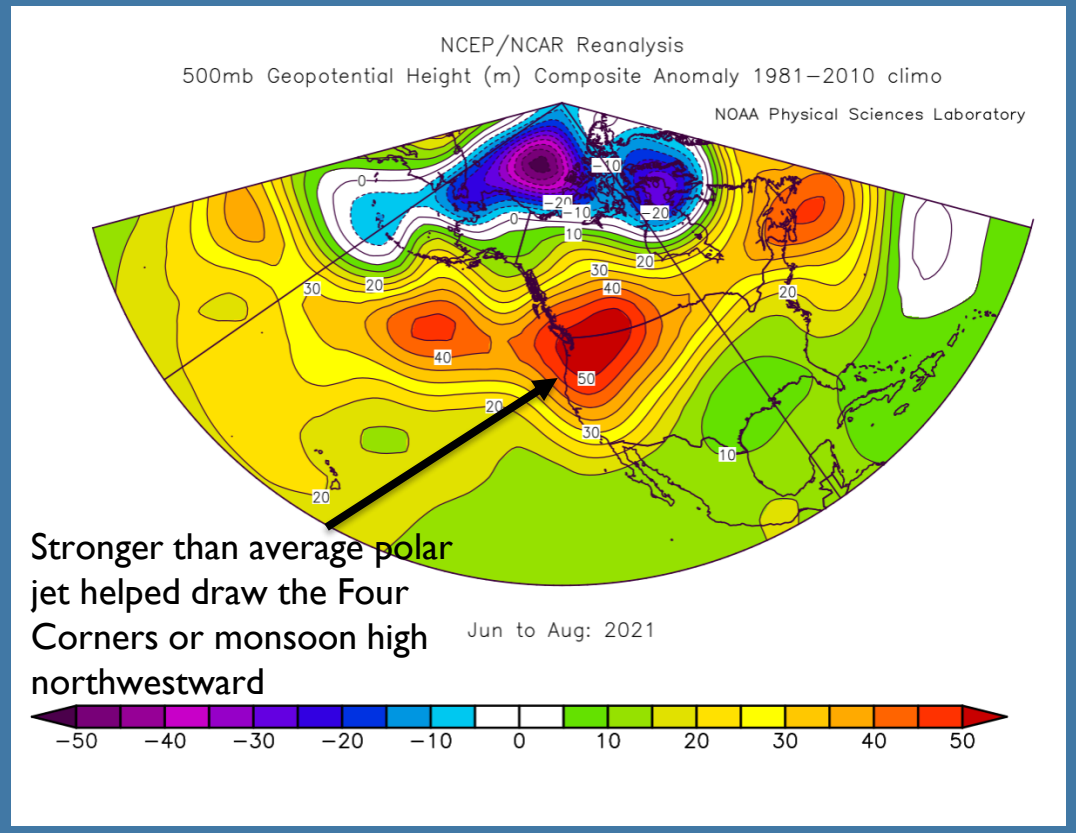

Difference from average zonal (west to east) wind at 250mb or ~43,000 feet MSL along with 500mb or ~18,000 feet MSL showing a stronger (7m/s ~16 mph) than average jet stream across much of Canada. Could 2021 be an analog year? Most definitely. Why? Not much has changed since last summer in the tropics and subtropics over the past year. An above average polar jet remains over Canada and is forecast to continue a through summer. The stronger than average polar jet stream or storm track helped draw the Four Corners' High well northwest of NM last summer, allowing more backdoor fronts to bring Gulf of Mexico moisture into NM from the east and northeast. Expect a similar weather pattern set-up in 2022, but not the same.

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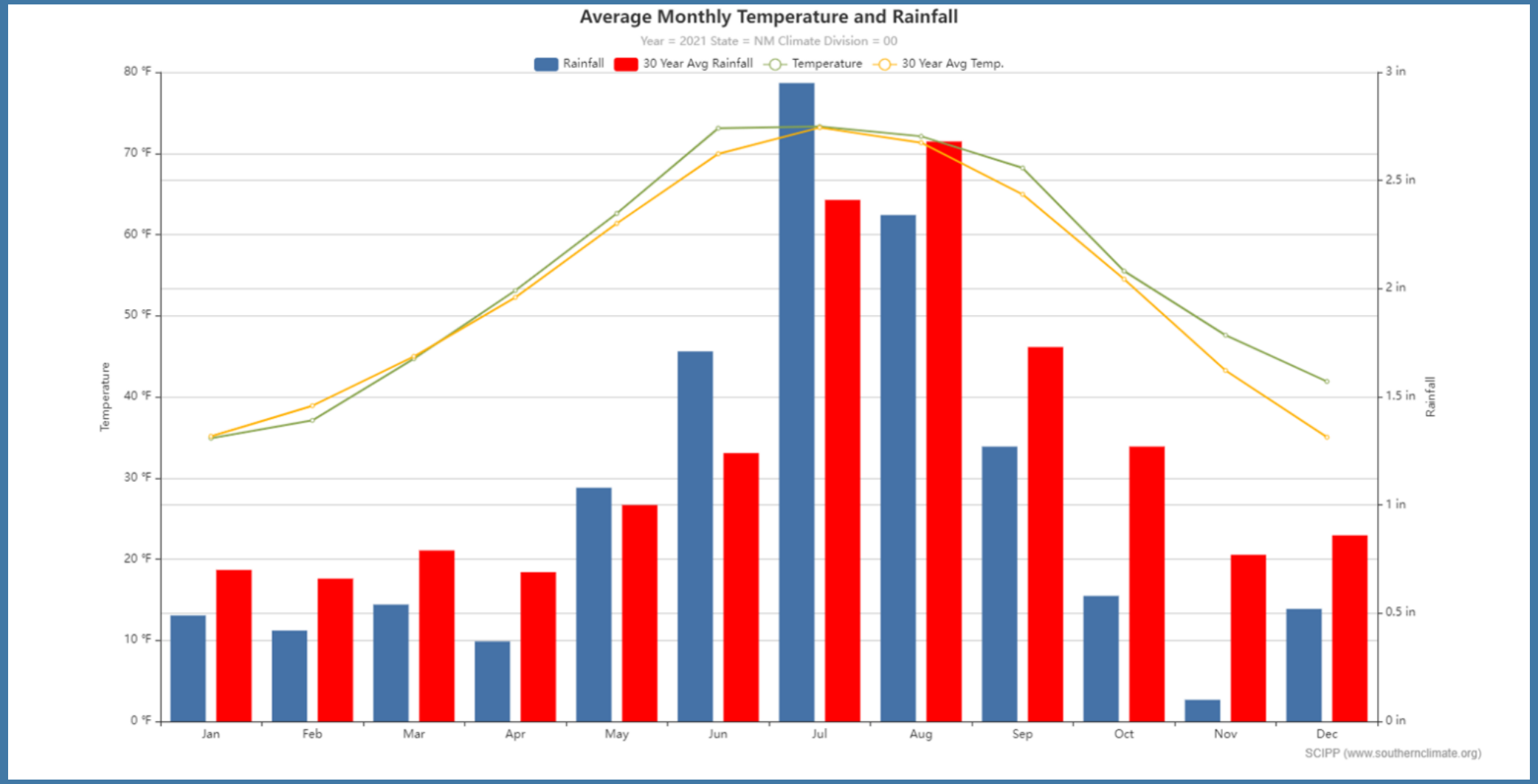

What happened last year? A robust late June and July that waned in August and September. While two monsoon seasons are never the same, this year's set-up looks similar to last year.

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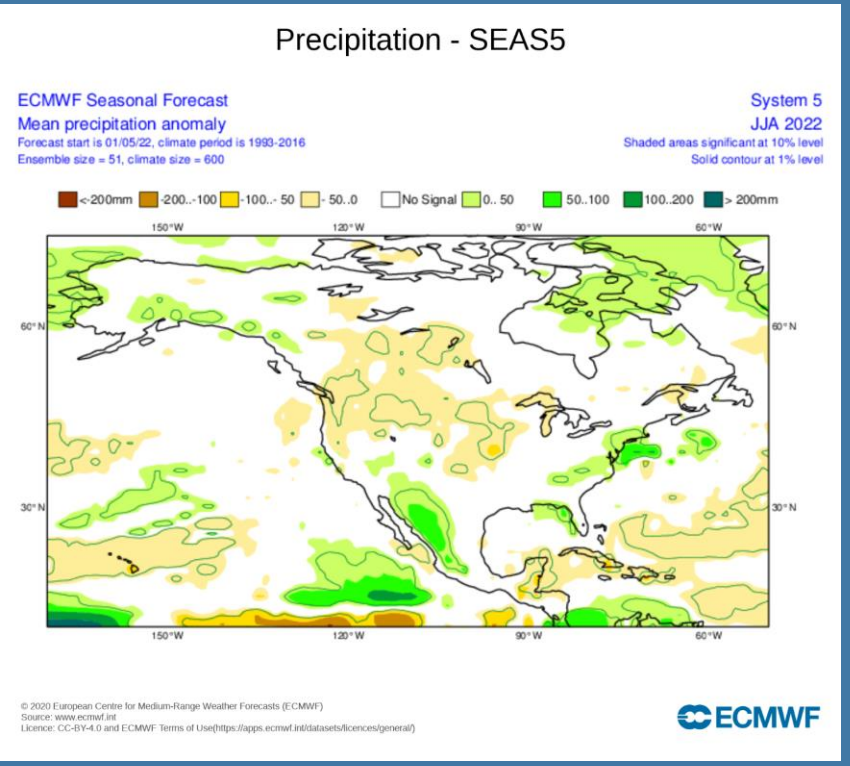

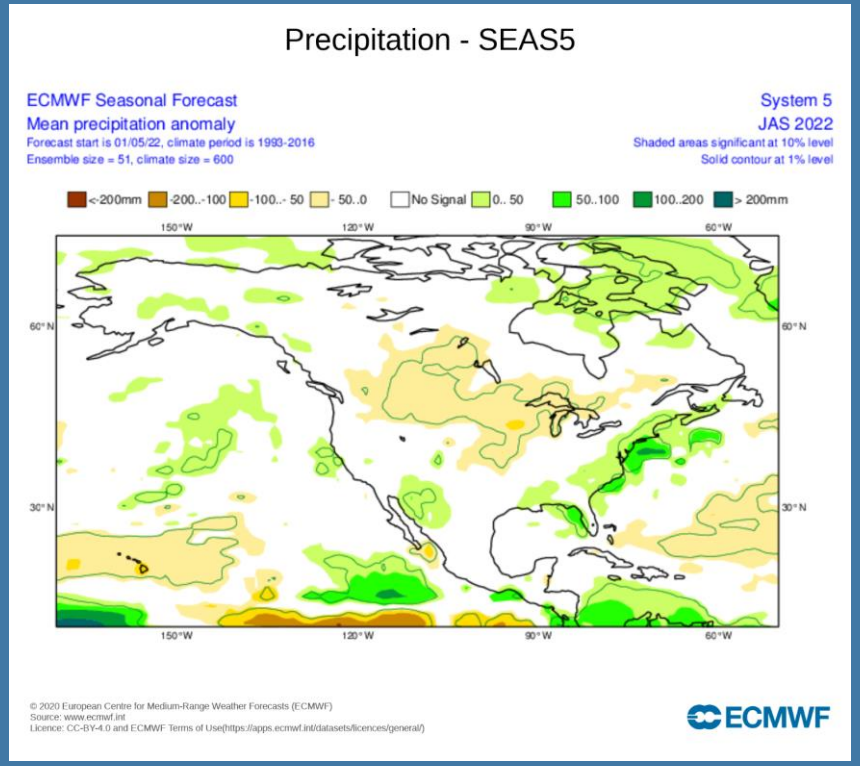

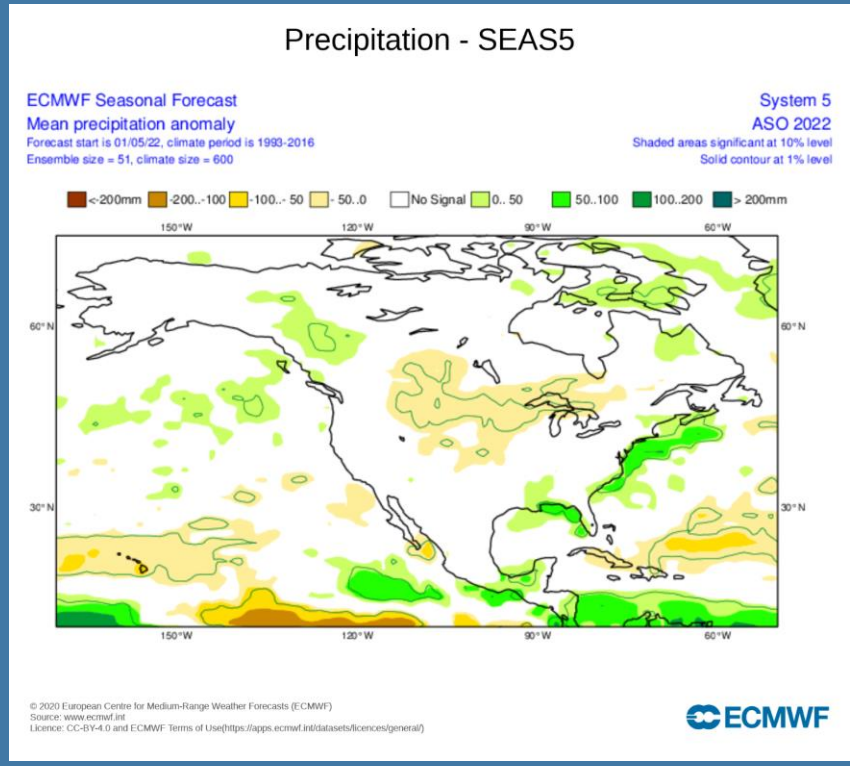

Mean Precipitation Forecasts Difference from Average

A very recent study (March 2022) from scientists at the National Center for Atmospheric Research (NCAR) in Boulder, CO, Bureau of Reclamation (Upper Colorado Region, Albuquerque, NM), and the Bureau of Reclamation (Lower Colorado Region, Boulder, NV) concluded that the European Centre for Medium Range Weather Forecasts (ECMWF) Integrated Forecast System (IFS) model was able to skillfully predict the monsoon. Its superior simulation of the location and seasonal evolution of the Four Corners' High (FCH) or monsoonal high pressure ridge/dome "outperforms the other models in simulating teleconnection patterns that control the position of the monsoon high and the amount of regional precipitation" (Prein et al. 2022).

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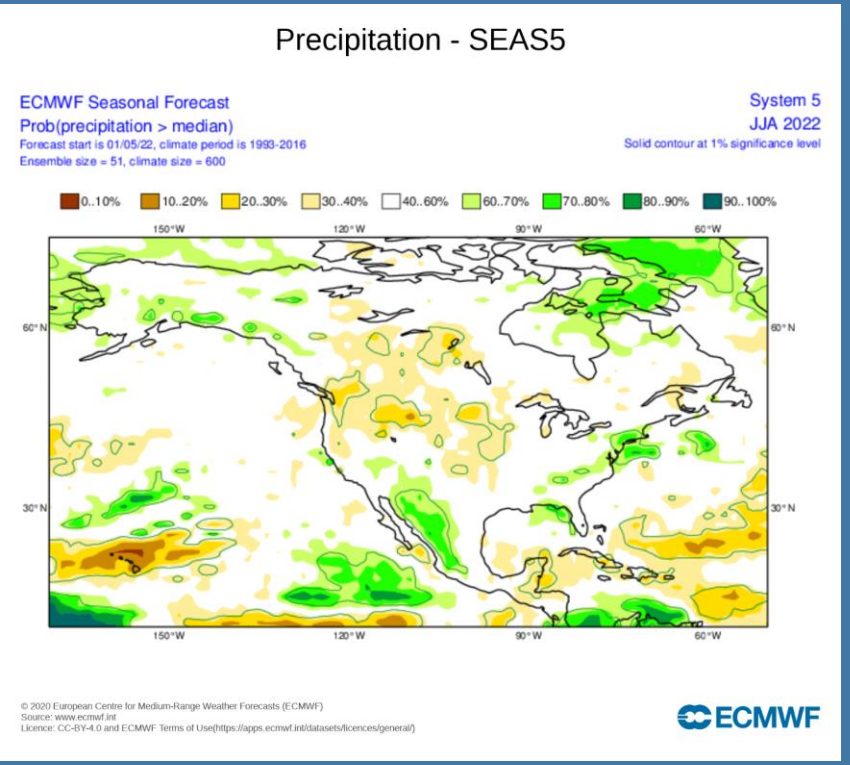

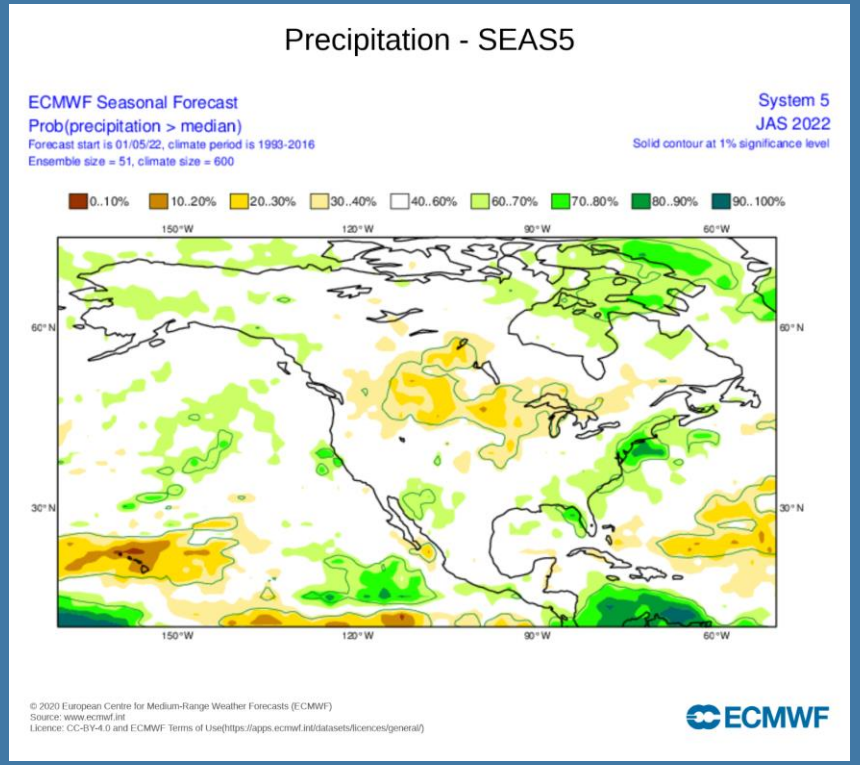

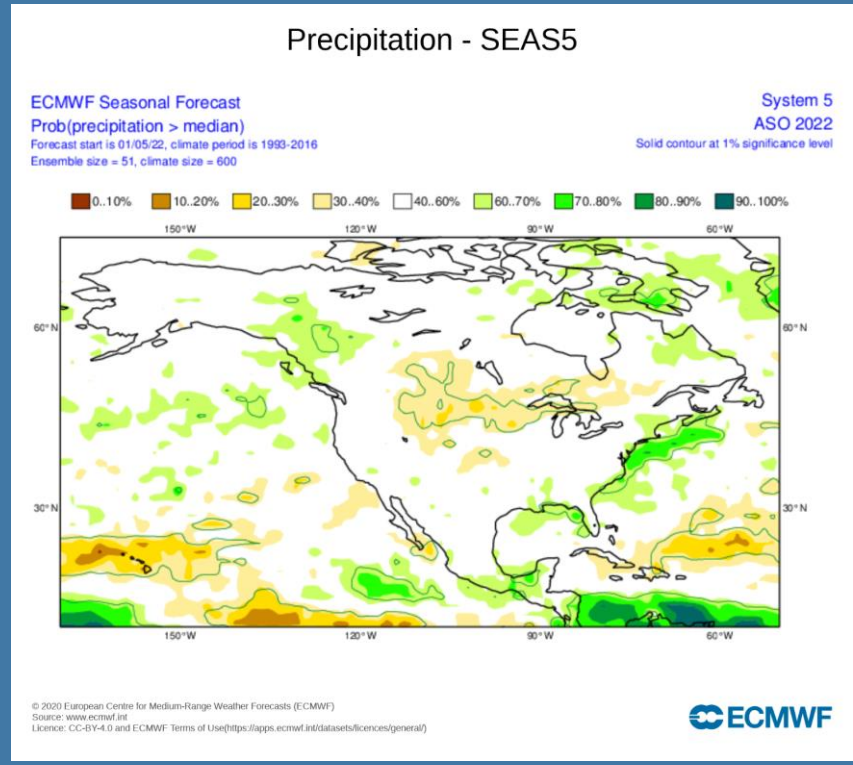

Probability of Precipitation Exceeding Median

Seasonal forecasts from the ECMWF showing the probability of precipitation exceeding a median (middle value vs. average) precipitation value. Median values calculated using a1993-2016 climatology. The most likely time for convective rainfall to exceed the median appears in late June through July.

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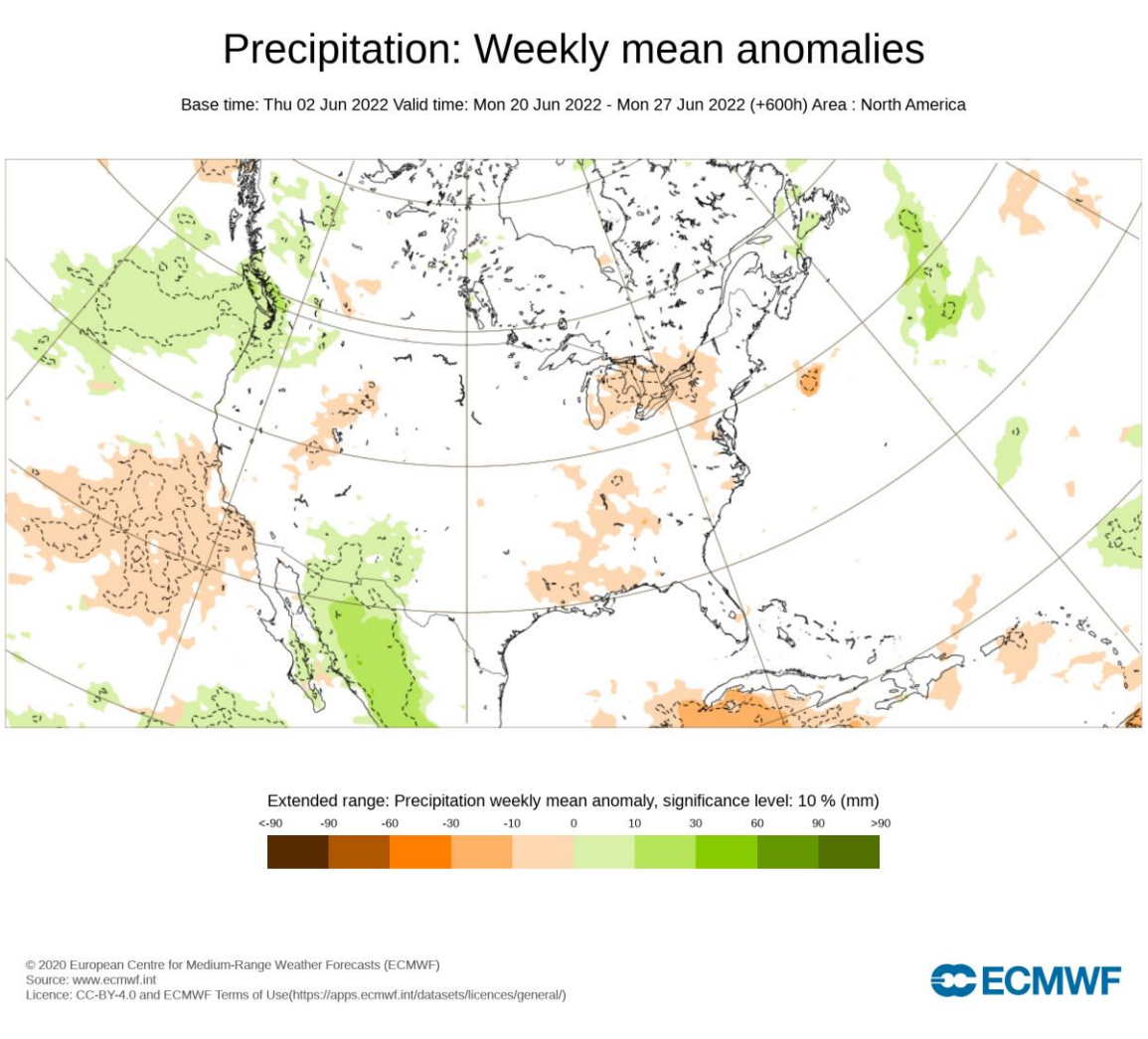

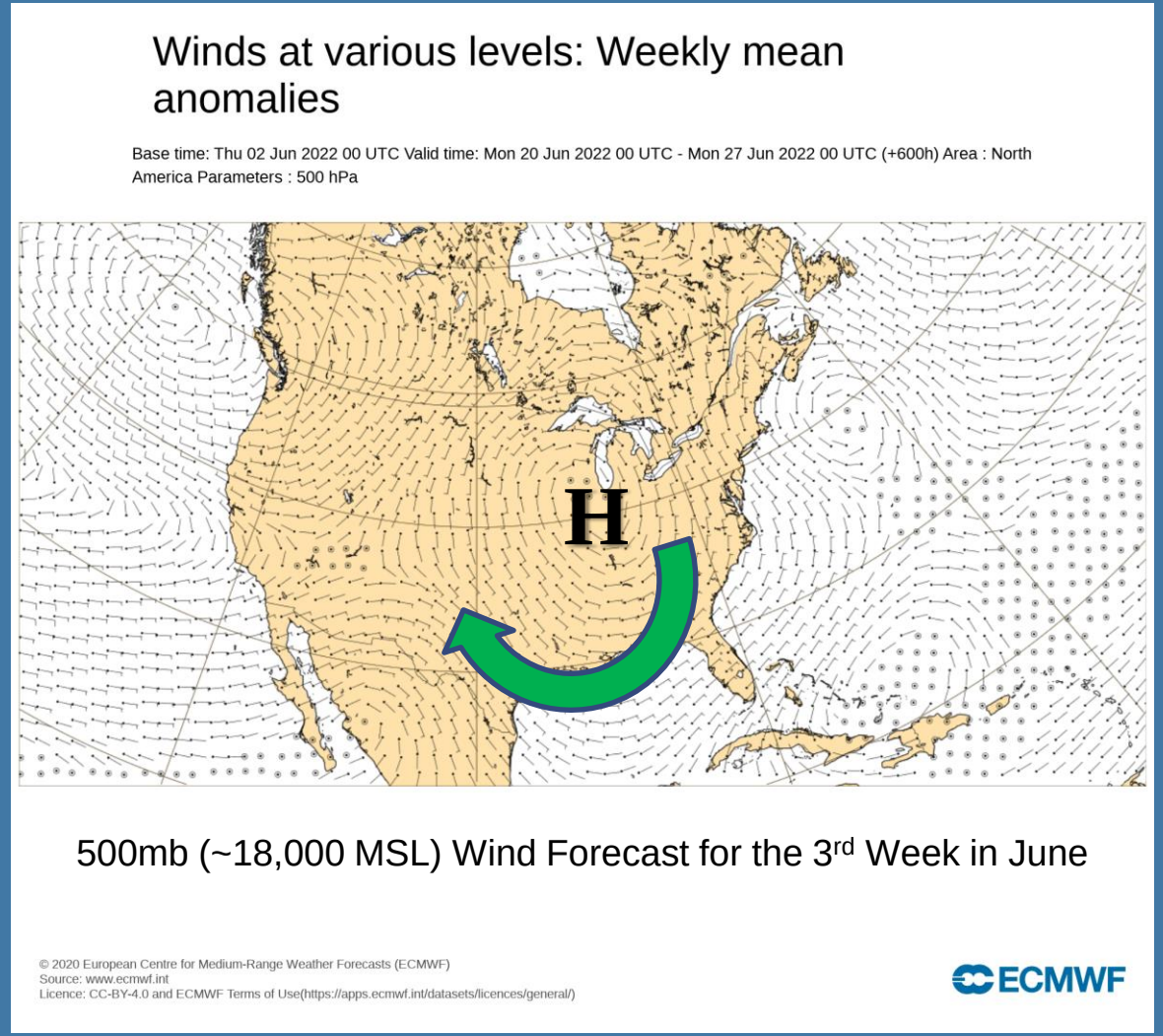

500mb (~18,000 MSL) Wind Forecast for the 3rd Week in June

ECMWF weekly precipitation difference from average forecast, essentially showing the onset of this year's monsoon during the week of June 20, 2022.

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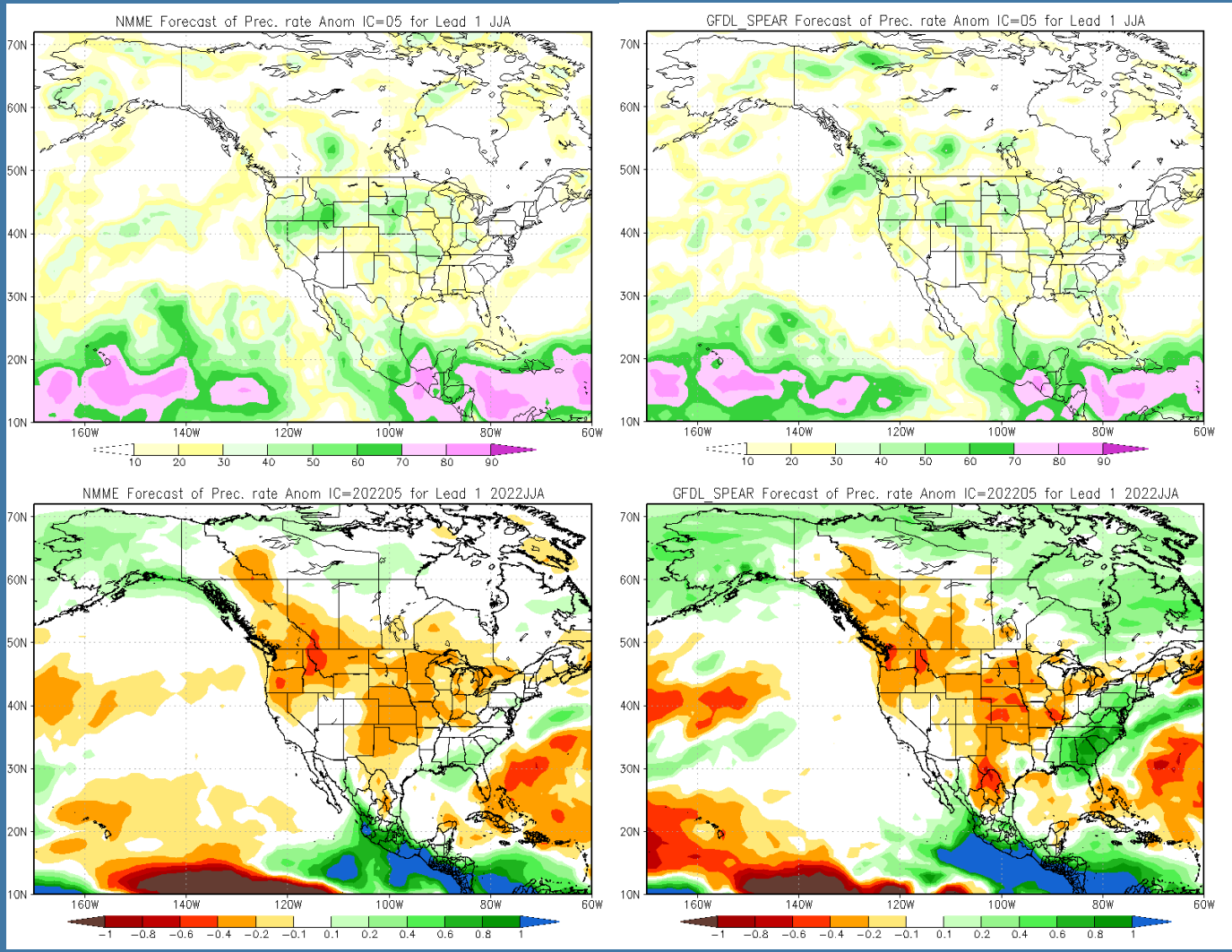

June-August 2022 model precipitation rate anomaly from the two climate models that have the highest forecast skill percentages for NM (top), the North American Multi-Model Ensemble (NMME) and the Geophysical Fluid Dynamics Laboratory (GFDL_SPEAR) model. Both model forecasts are predicting slightly below average precipitation for **JJA 2022**.

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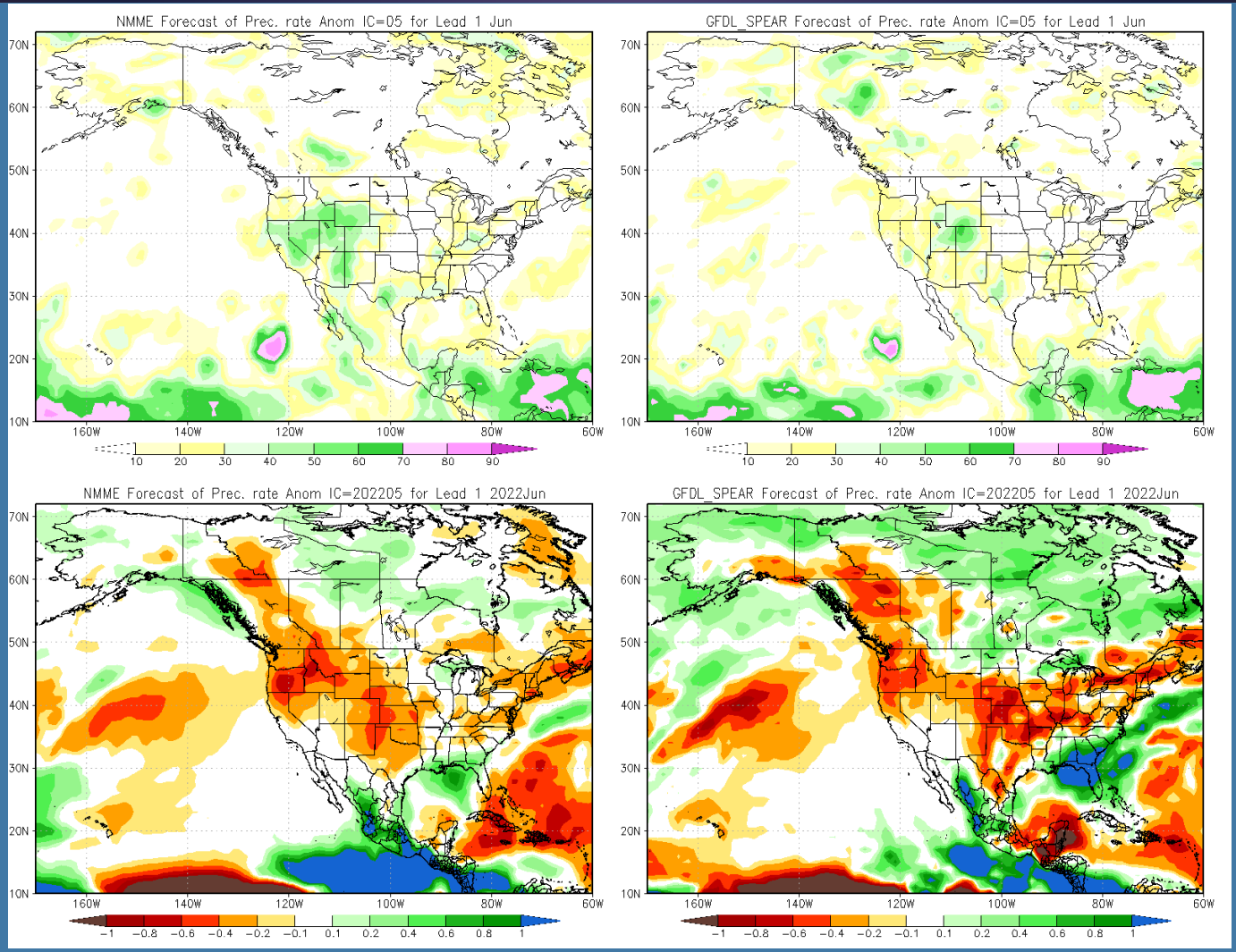

What if the month of June is singled out? Not much changes but average (white) precipitation over much of AZ is encouraging. It's worth reiterating that this year looks similar to last year when climate models were forecasting a very similar summer pattern.

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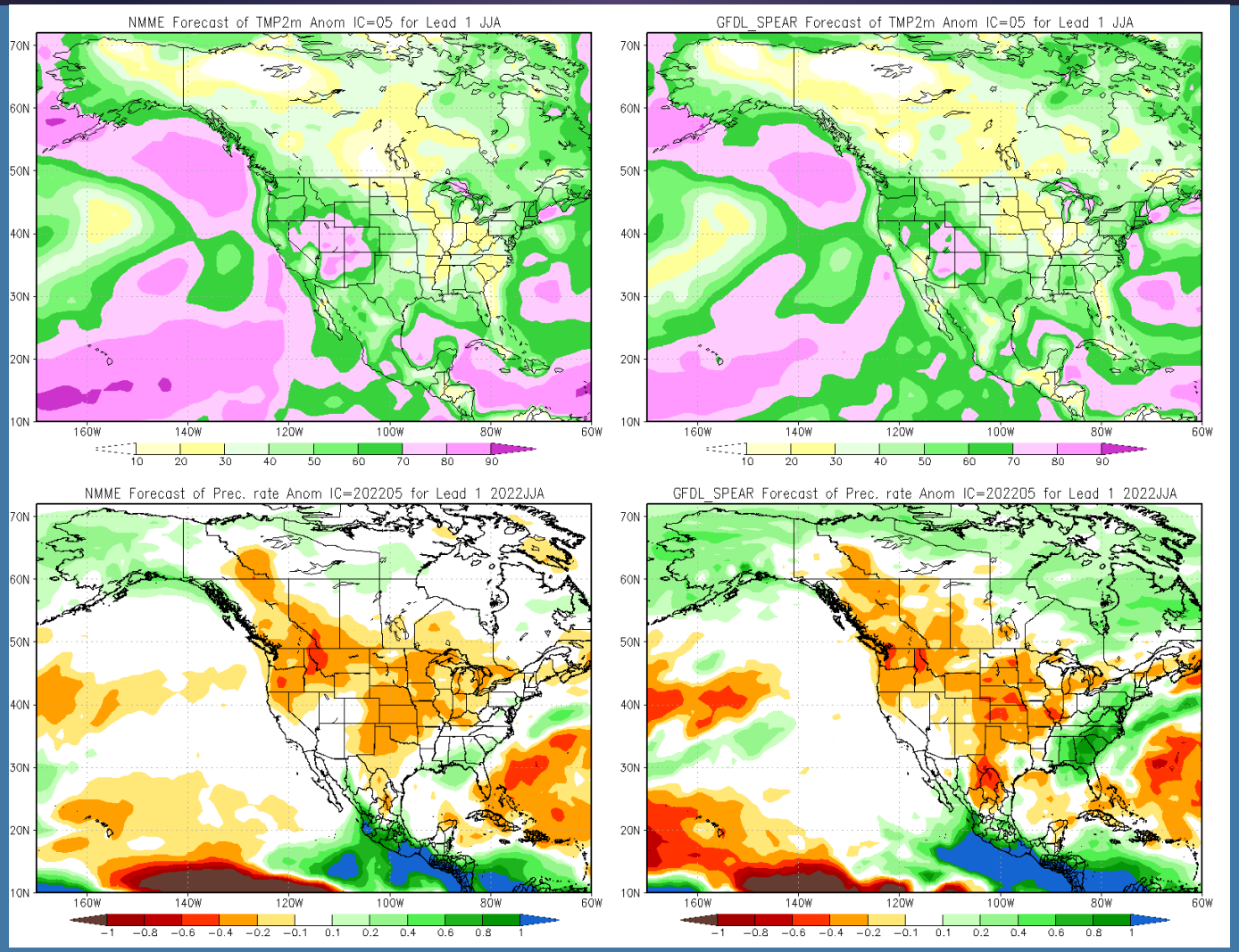

Model temperature anomaly forecasts from the two climate models that have the highest forecast skill percentages (top row), the North American Multi-Model Ensemble (NMME) and the GFDL_SPEAR model. Both model forecasts are predicting slightly above to above average temperatures for **JJA 2022**.

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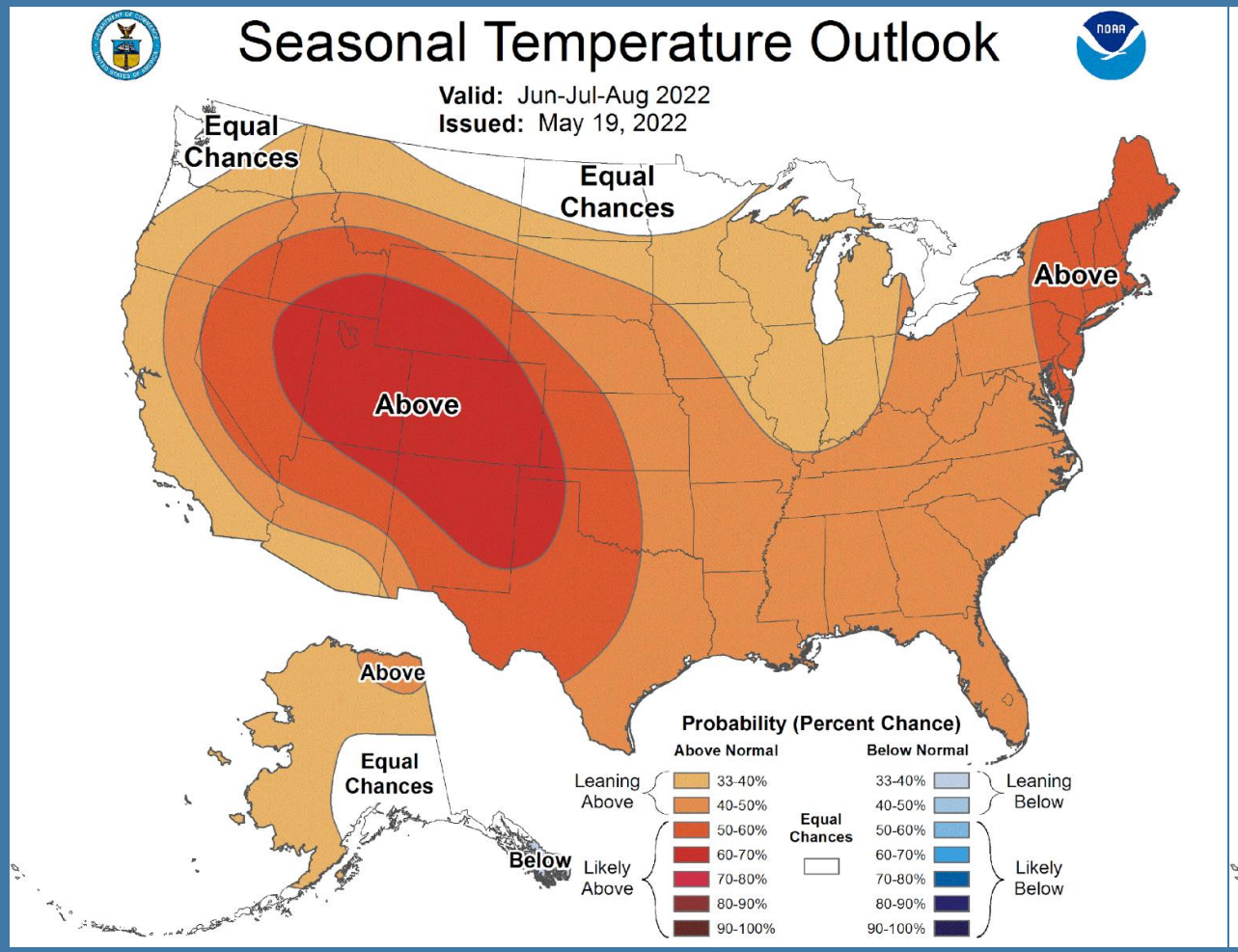

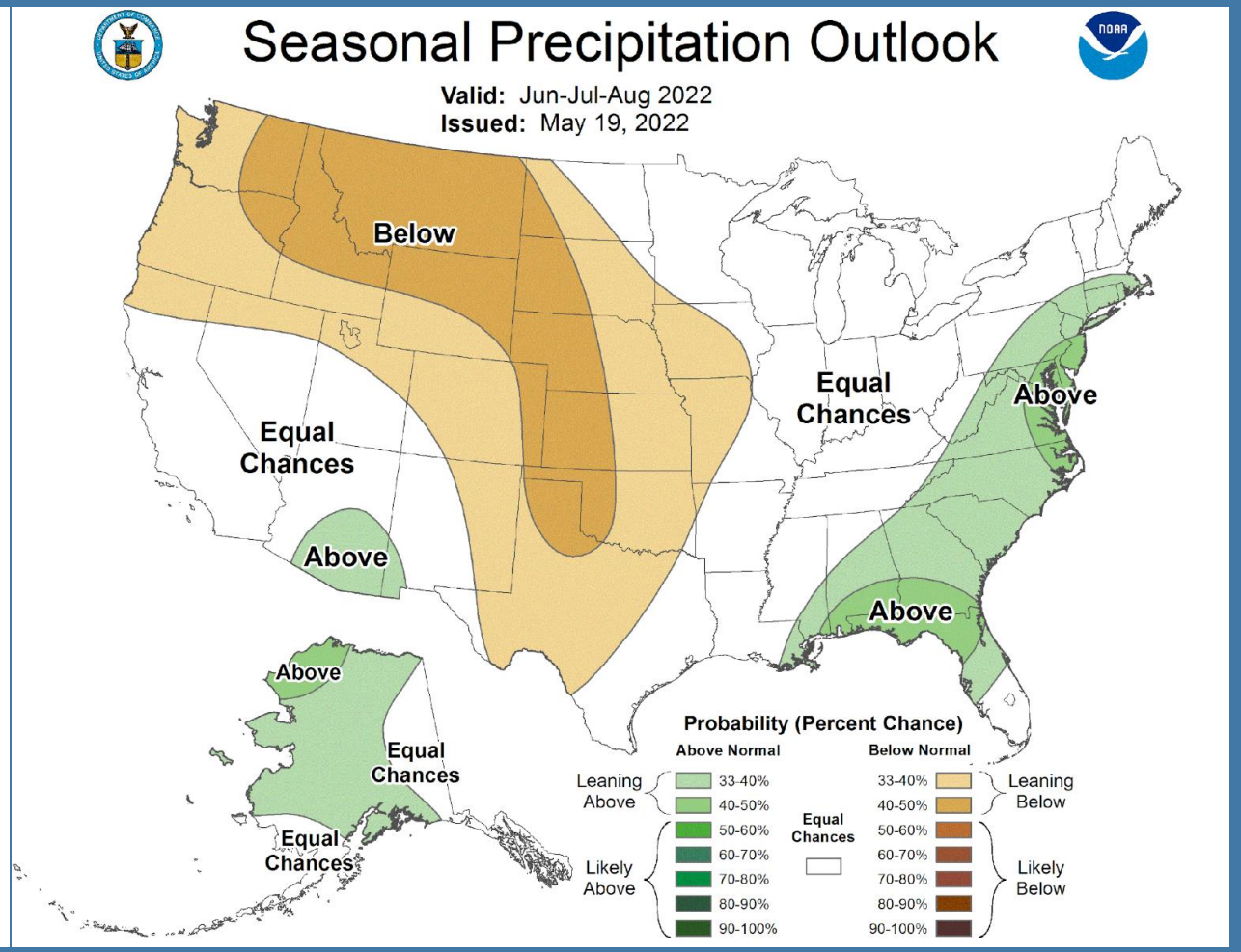

Climate Prediction Center's Official 2022 Climate Outlook for June, July and August showing probabilities favoring above average temperatures and near to slightly below average precipitation.

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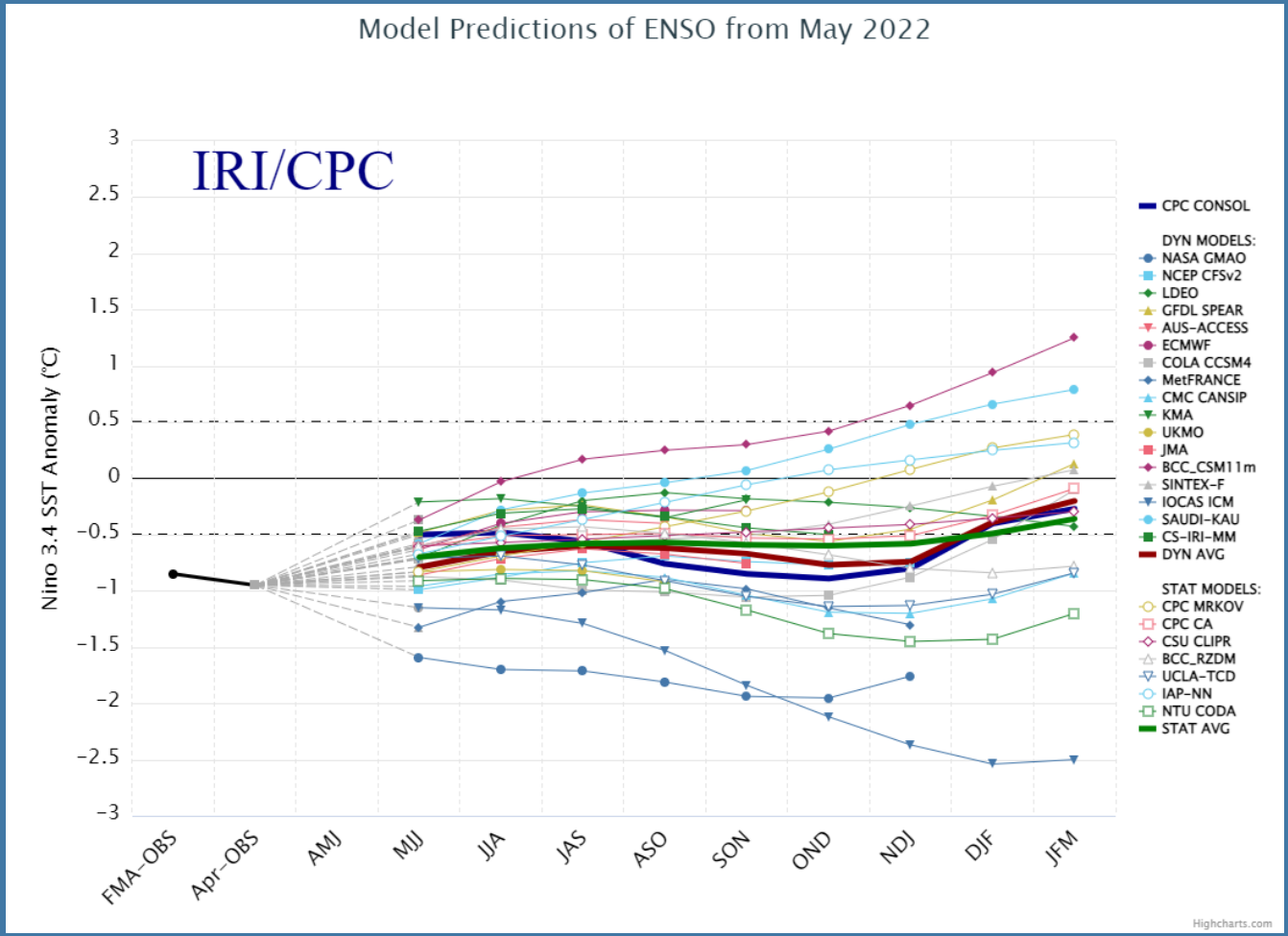

The vast majority of climate model forecasts keep SSTAs in the eastern equatorial Pacific in La Niña territory (-0.5°C or below) during the northern hemisphere summer, transitioning to neutral conditions by late fall or early winter. Is a triple-dip in the cards next fall? Triple dips are a rare occurrence. There have only been 2 "triple-dip" La Niña events since 1950 so probabilities are fairly low but increasing.

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Burn Scars Lead to an Increased Risk of Flash Flooding and Debris Flows

Courtesy: BAER

Courtesy: Paul Jaramillo

The exceptional wildfire season of 2022 will have long lasting effects on the slopes of the southeastern Sangre de Cristo and west slopes of the Black Range in southeast Catron County, both in the immediate area and for locations several miles away. Areas downhill and downstream from burned areas are tremendously vulnerable to **Flash Flooding** and **Debris Flows**, especially near steep slopes. Rainfall that would normally be absorbed by soil and vegetation will run off quickly after a wildfire, as burned soil can be as water repellant as pavement. As a result, much less rainfall is required to produce a flash flood over a burn scar. A good rule of thumb is: "If you can look uphill from where you are and see a burned out area, you are at risk."

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- Forecasts from the ECMWF extended and long-range forecast model along with a very recent analog year (2021) indicate that precipitation in central and northern New Mexico during JJA will range from slightly below to near climatological averages.

  Forecasts from the ECMWF and other climate models along with one very recent analog year suggest temperatures during JJA will be slightly above to above average.

- Prein, A.F., Towler, E., Ge, M., Llewellyn, D., Baker, S., Tighi, S., & Barrett, L. (2022). Sub-seasonal predictability of North American Monsoon precipitation. Geophysical Research Letters, 49, e2021GL095602.

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

- For further information contact Andrew Church: andrew.church@noaa.gov (505) 244-9150