Climate Variability, Climate Change in MO, and an Early Weather Outlook – Summer 2025

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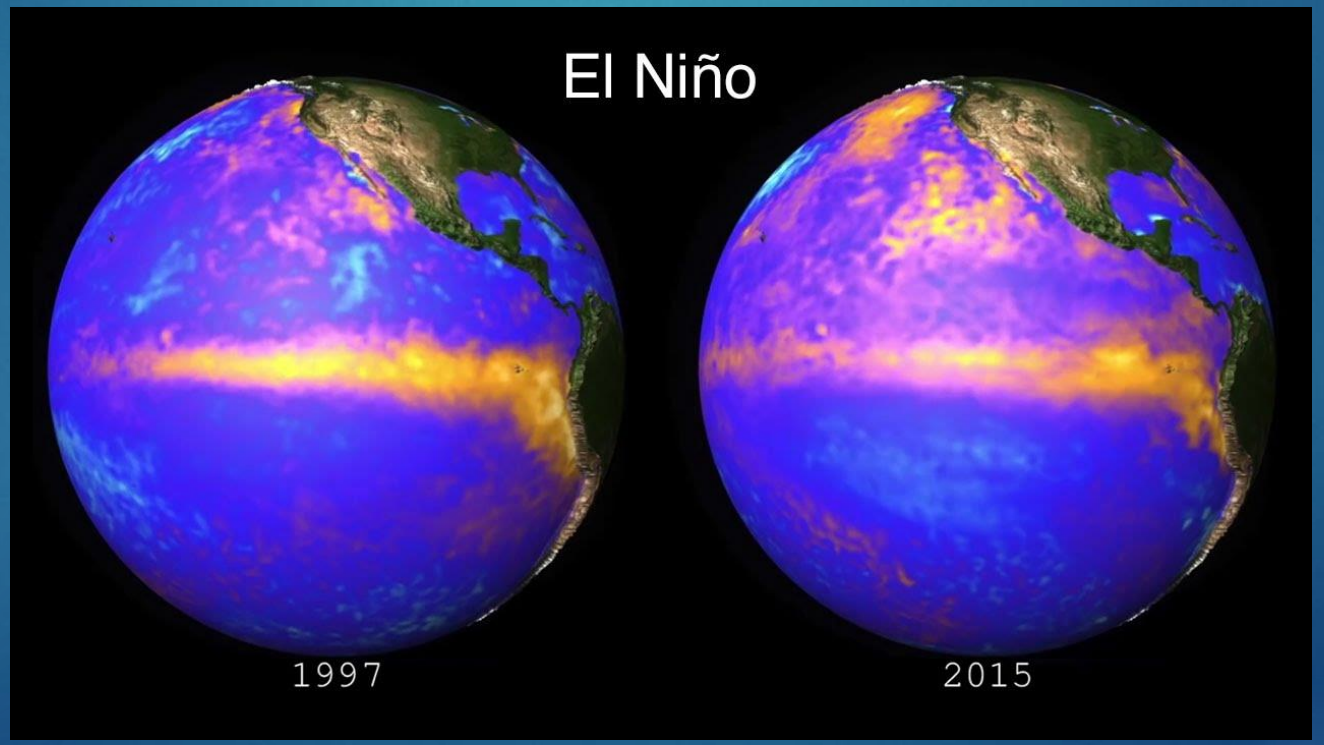
Sub-seasonal and Seasonal Forecasting

- In this part of the world – there are three basic phenomena which drive sub-seasonal (one to four weeks) and seasonal range forecasting:
- El Niño and Southern Oscillation
- Atmospheric Blocking
- Teleconnections

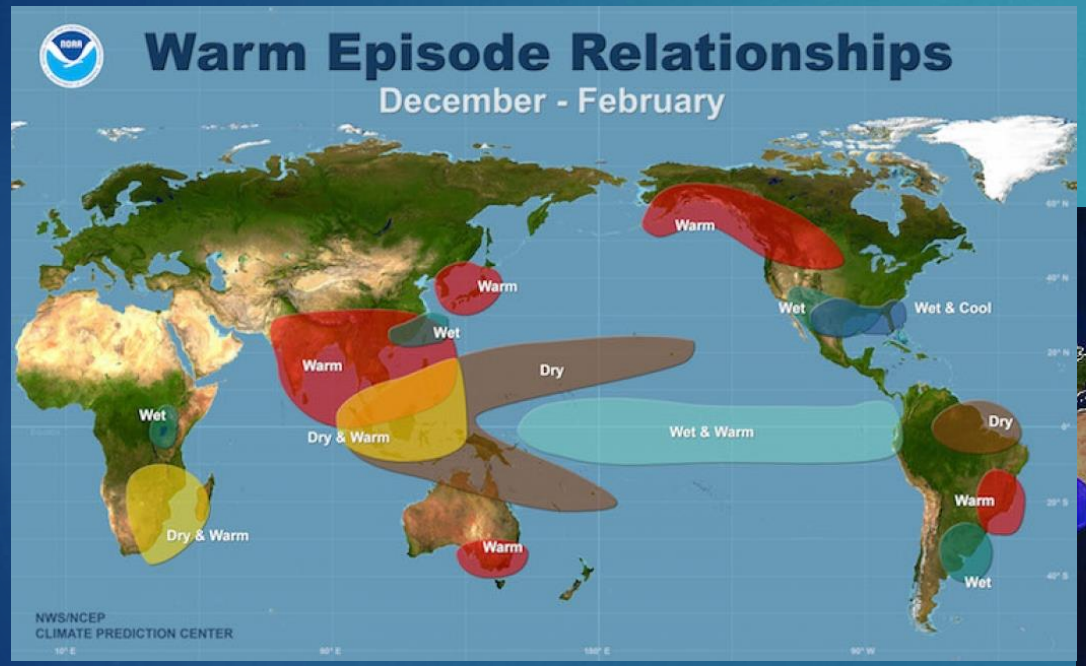
El Niño and Southern Oscillation (ENSO)

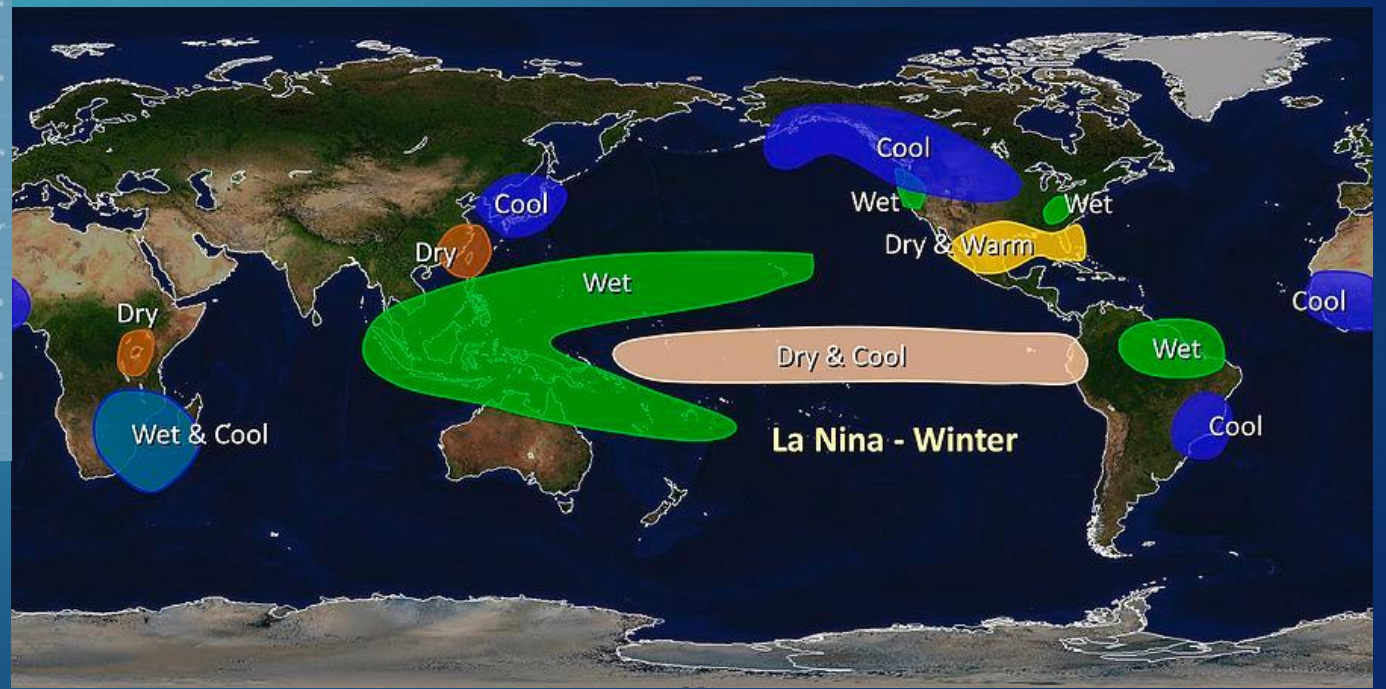
- is a two-to-seven year warming of water in the Eastern Tropical Pacific that impacts weather and climate world-wide.



ENSO Impacts

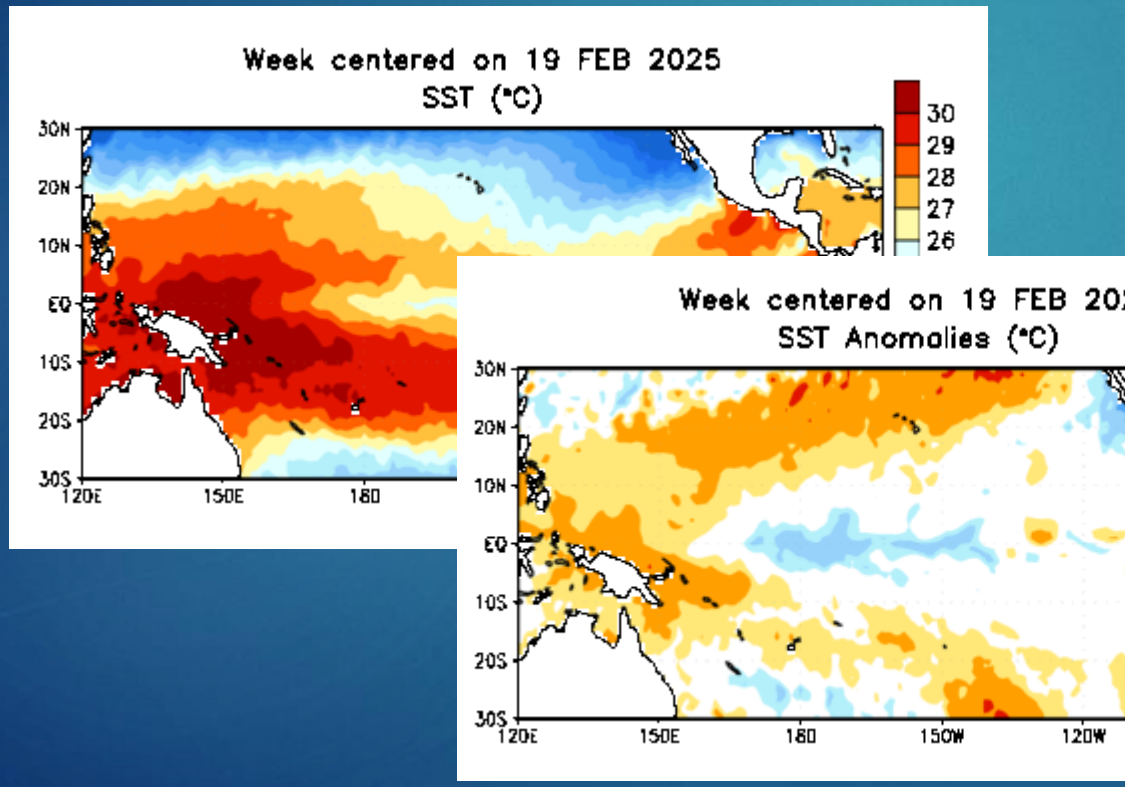
- Influences weather worldwide

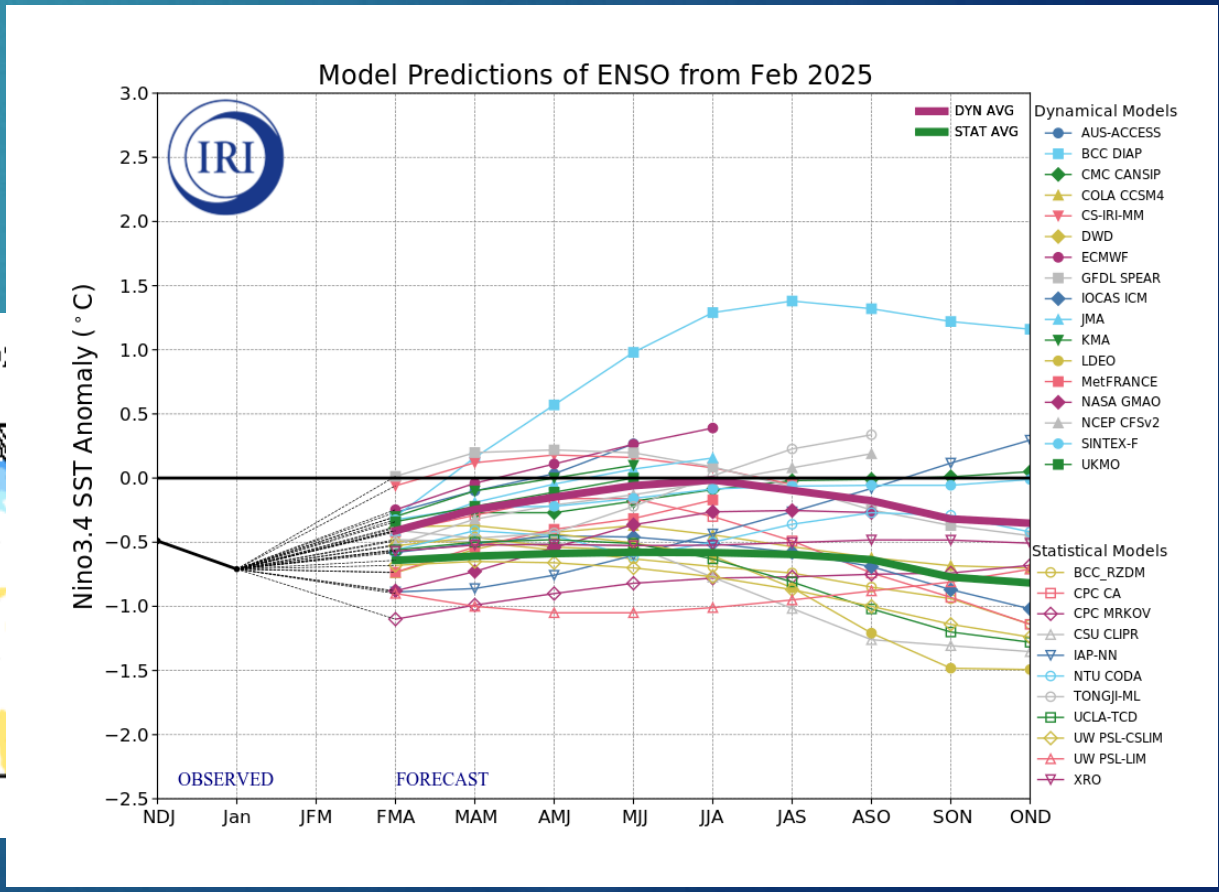




ENSO – Current State – Where are we going?

- February 2025 – La Niña – déjà vu All over Again……?

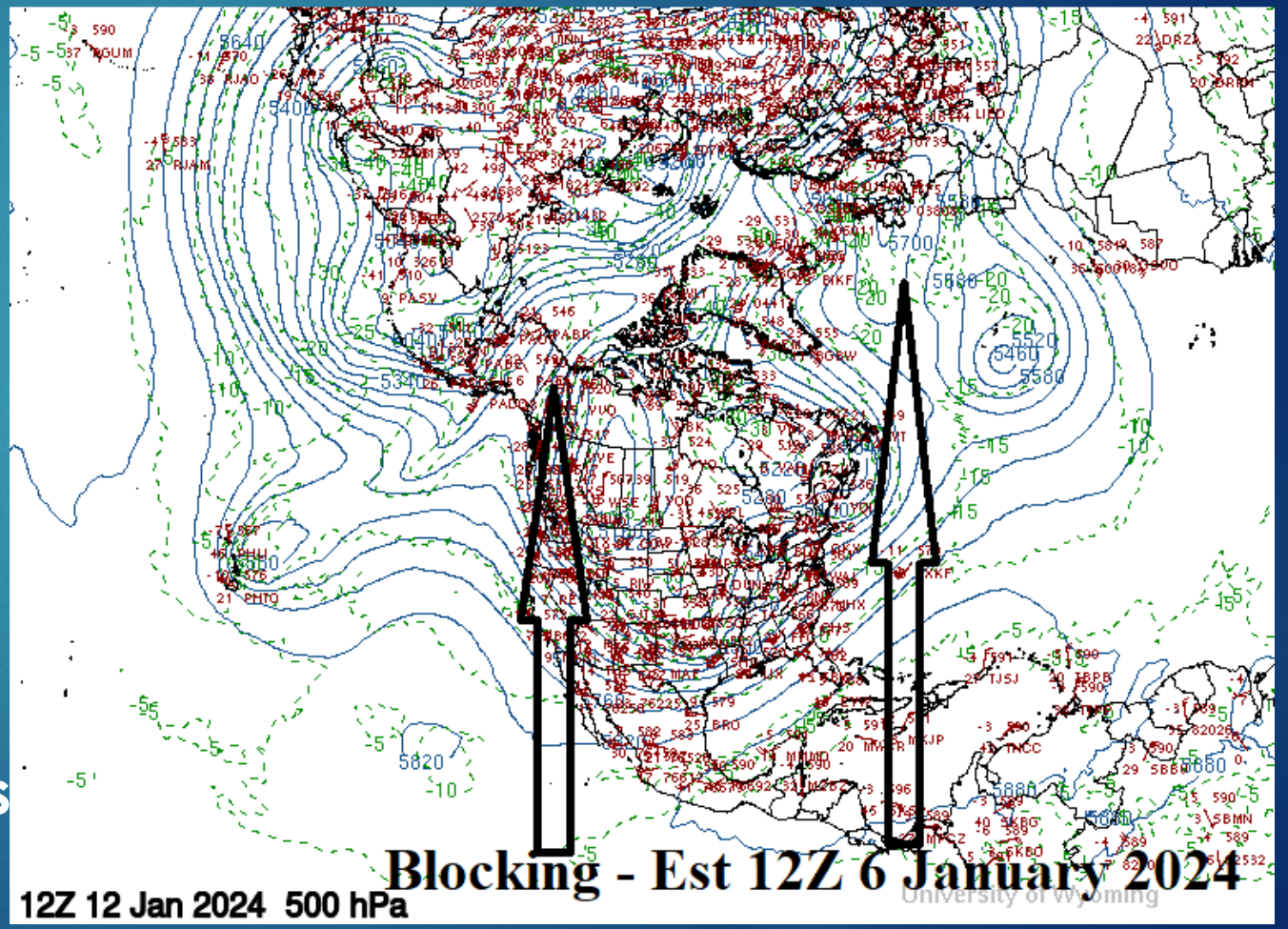




Atmospheric Blocking

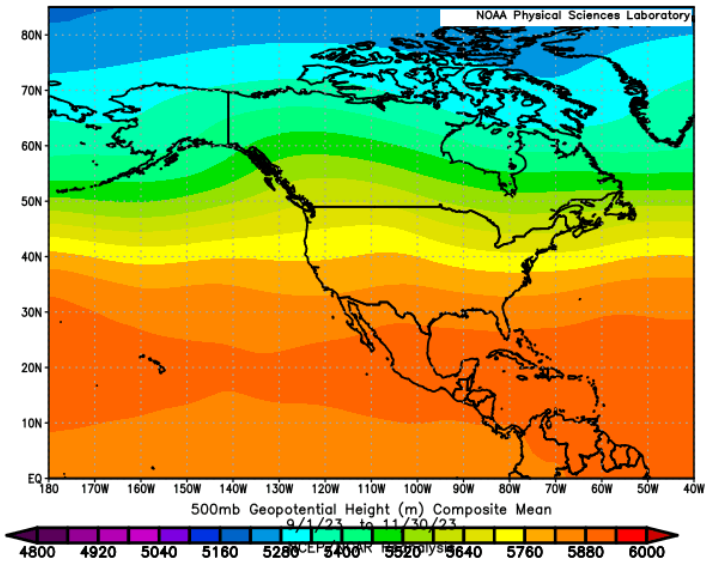
- Atmospheric jet stream

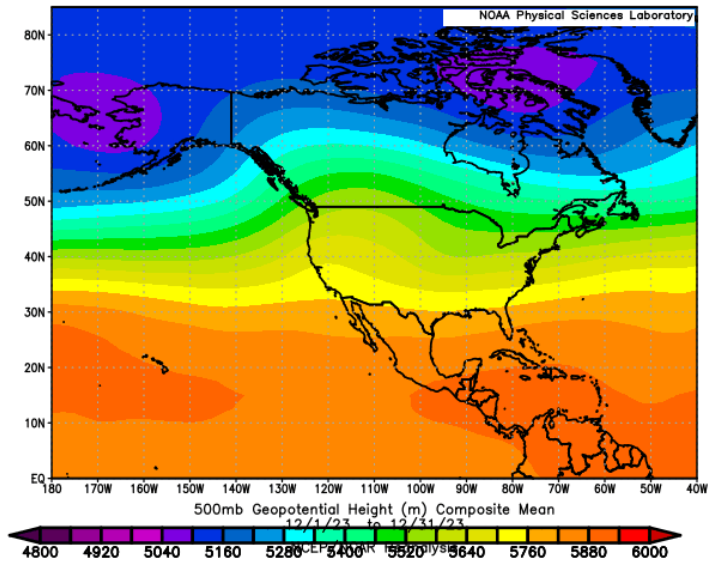
- Blocking - generically – mid-latitude anomalous

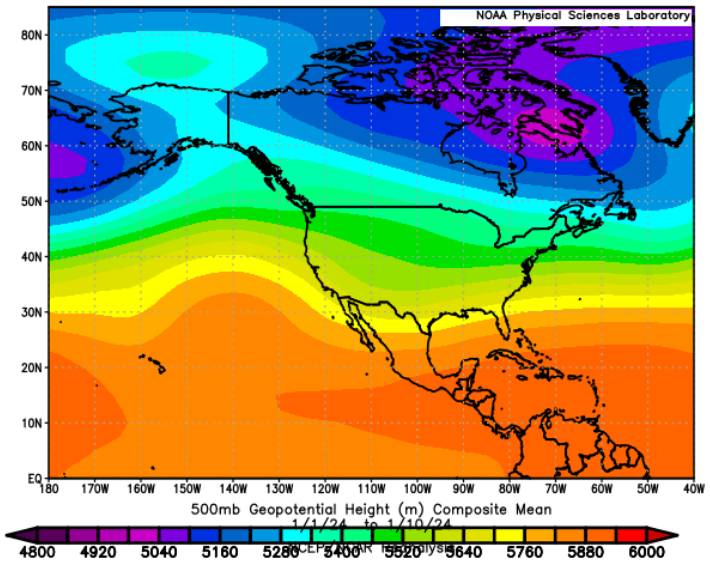


ATMOSPHERIC BLOCKING

- Fall 2023 versus Early Winter 2023 versus Early 2024
- +2.1 (+1.8) F +7.8 (+8.8) F - 4.6 (-5.1) F



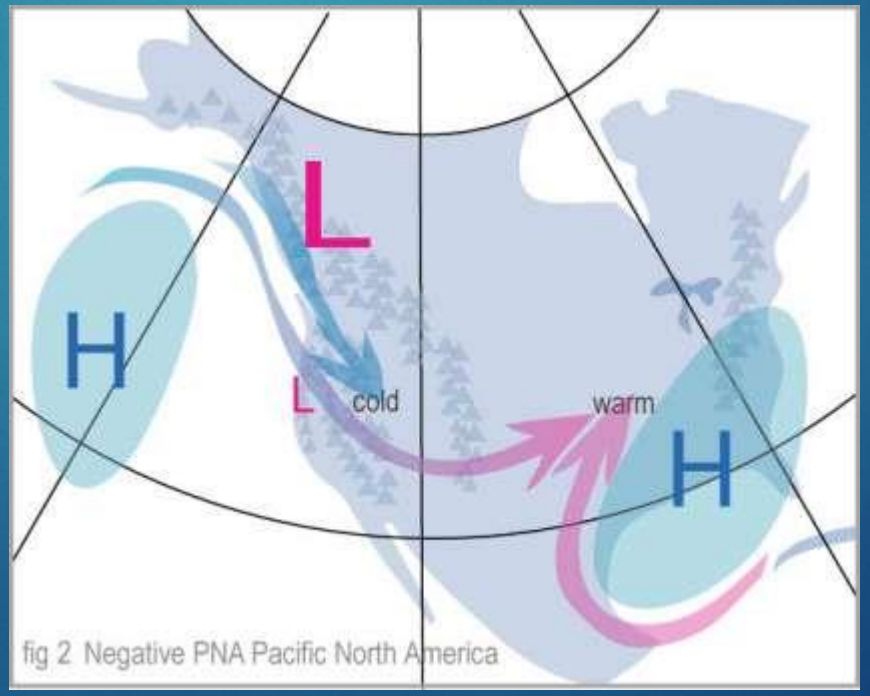


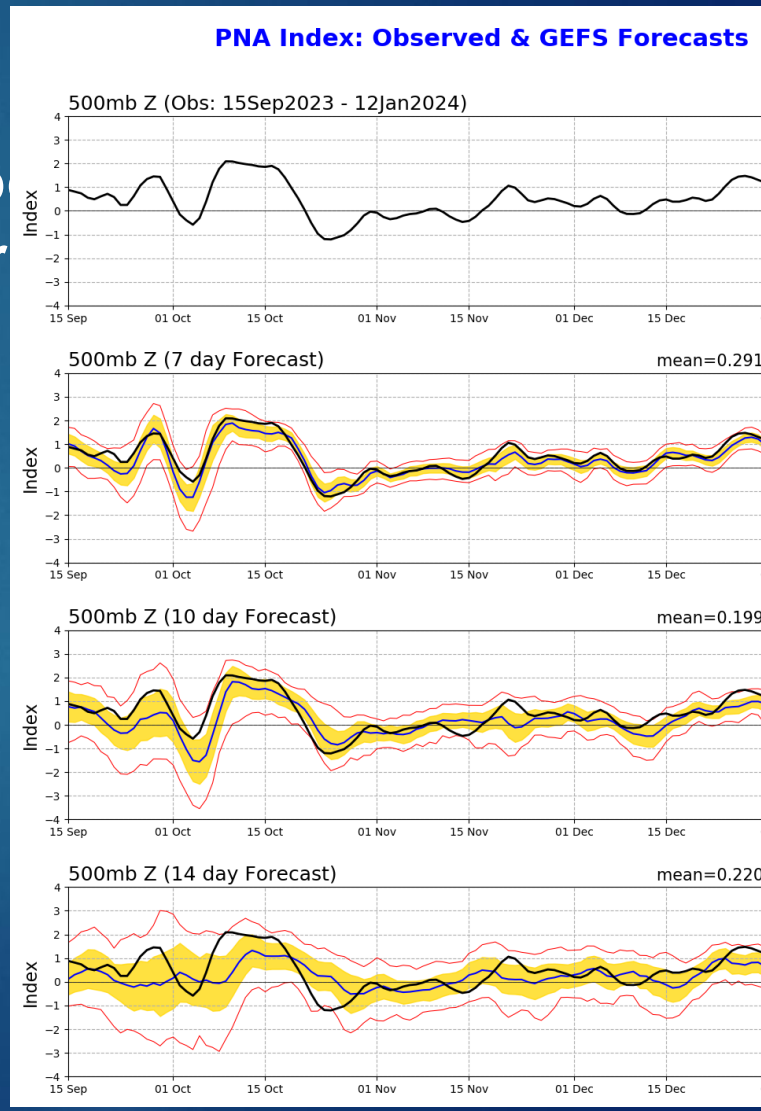


- Temperature versus the 30 year (130 year) average
- Very little blocking until Early 2024

Teleconnections

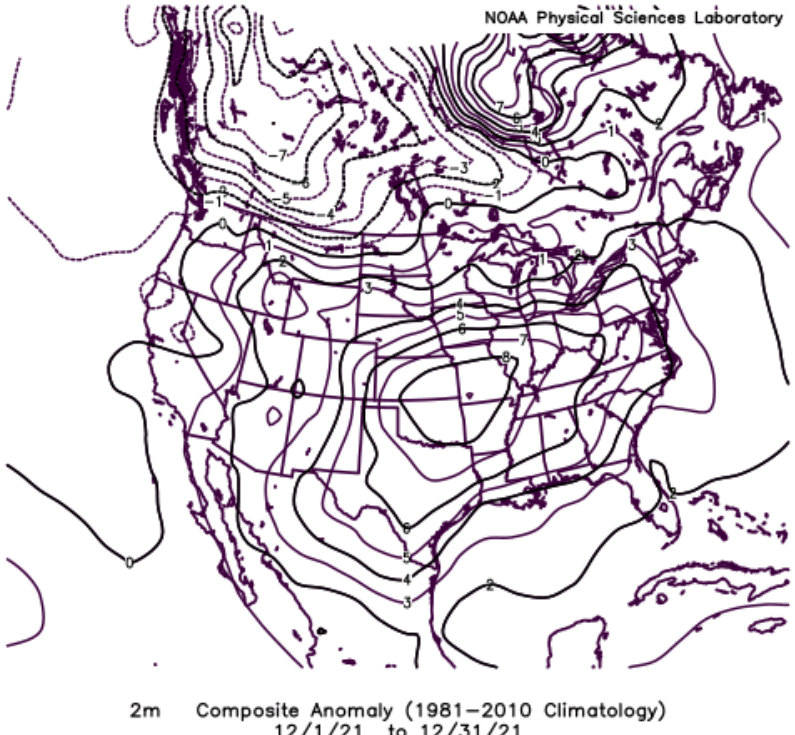
- Teleconnections – are typical jet stream wave p
  that impact certain large-scale areas of the wor
  – 10,000 km, one to two weeks).

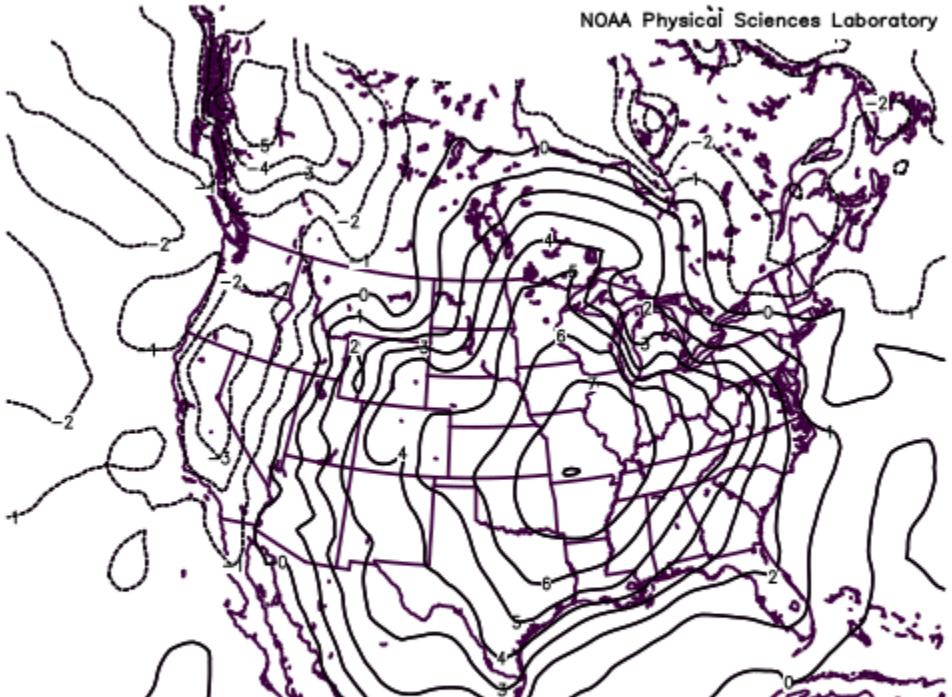




December 2021 versus 1889

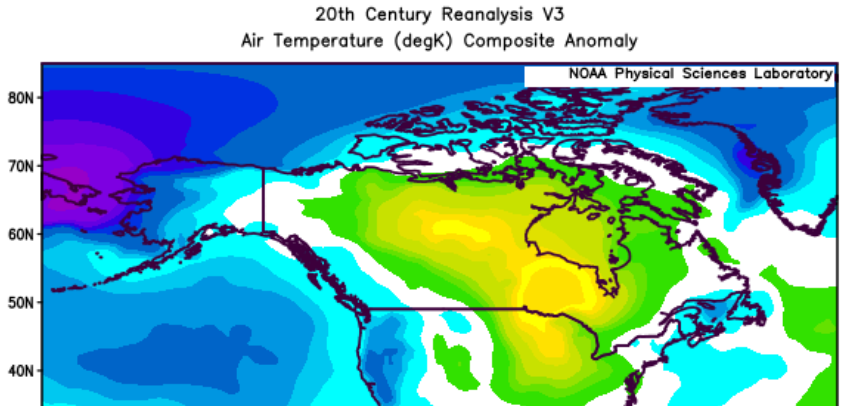
- December 2021 was anomalously warm – but we've seen it before.

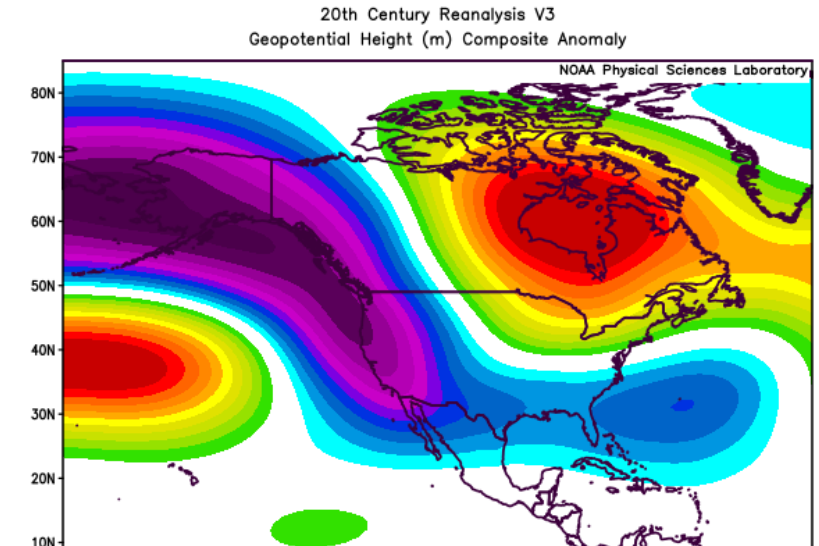


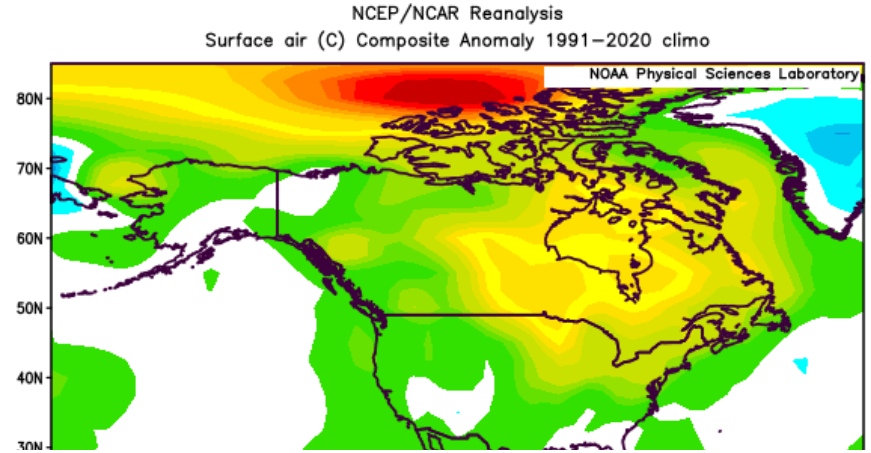


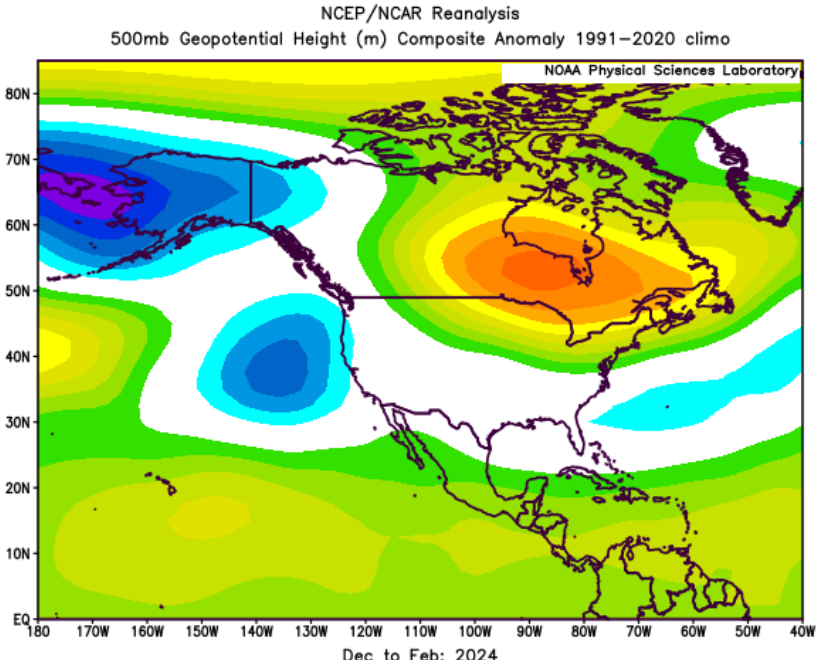
Winter 1877 – 1878 versus 2023 - 2024

- Oh very similar?



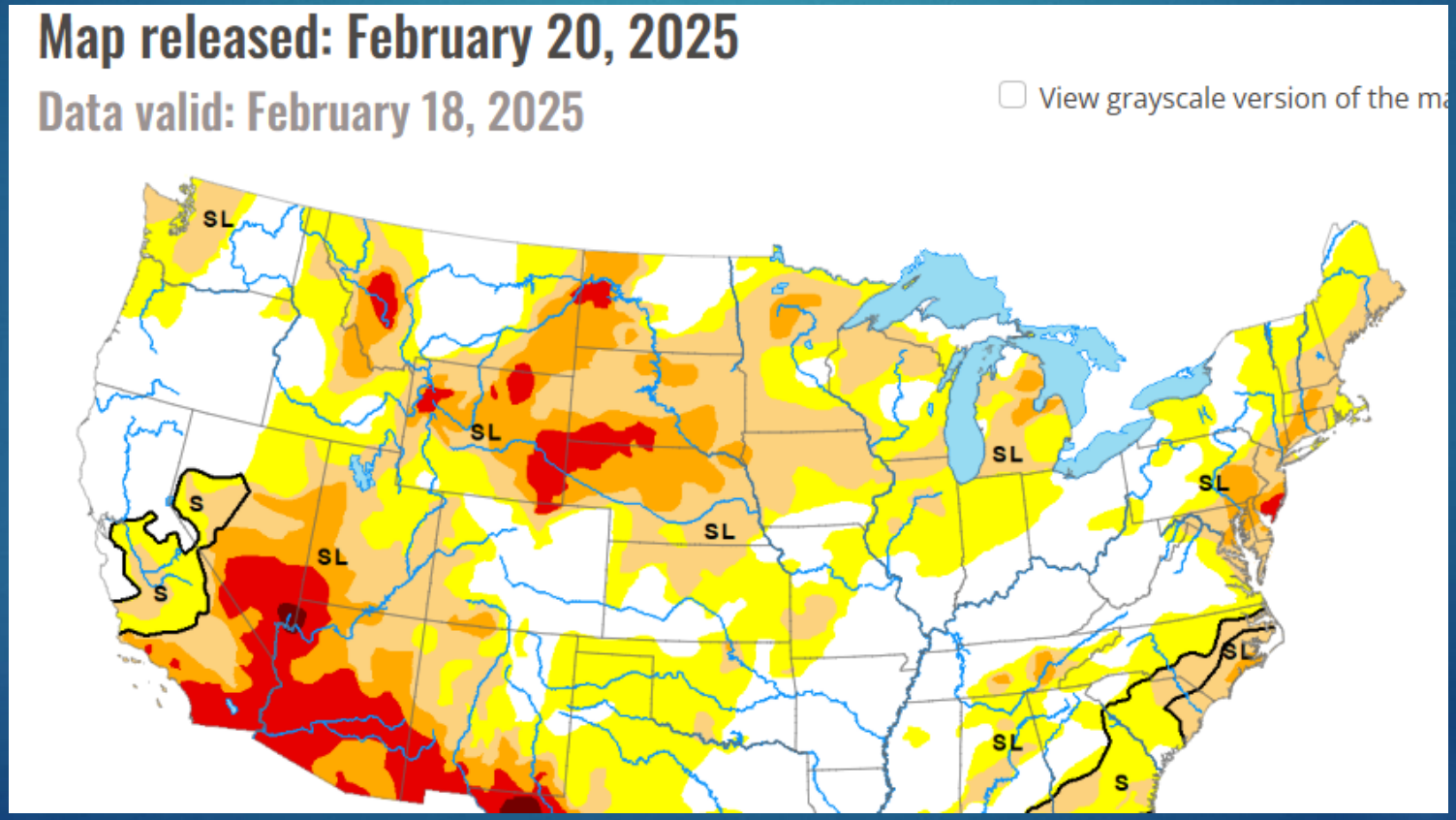






National Drought Monitor

- Current Drought Conditions – short-term no improvement



Our Forecast – Winter 2024 - 2025

- We're going to go with a cooler winter than normal. We're looking at the recent "classic" La Ninas of 2007, 2010, 2017, 2020, and 2021. Temperature will be within 0.5 sigma of normal which is -1.5 to +1.5F, I like the lower end of the range.
- As of 28 February -2.1 F - looks like coldest since 2013 – 2014 and a W! NCEP normal 0.

- We're going to lean toward precipitation being above normal which tends to associate with recent La Ninas. We'll also forecast snow to be around 15 – 20 inches this winter a little more than the last few years, but not horrible. We forecast a few moderate snowfall, probably not one big one.
- As of today -2.08 inches, WE'll say no on this. But 19.3 inches of snow is a W! Ncep normal 1.

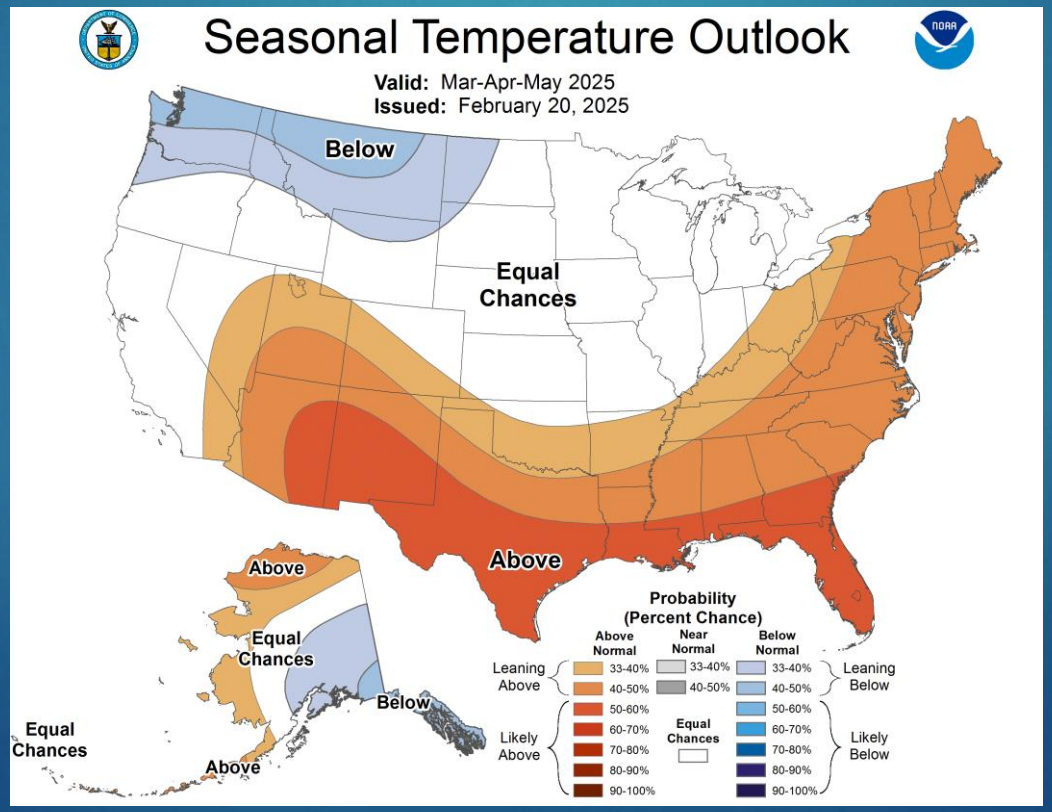
Our Forecast – Winter 2024 - 2025

- Reasoning: (Reasoning was dead on!)

- La Nina is coming in slowly. The dynamic models think it emerges but is weak. The statistical models keep us in Neutral conditions. This after we were El Nino last year. I see fall starting warm and dry but trending toward a cooler second half of winter with a little more precipitation. Early 2021 and 2022 showed similar conditions. Remember Early 2021 was the Great Polar Vortex of February. I don't see this happening, but the last two years, the second half of winter has been warm. The last few weeks have seen the emergence of strongly meridional patterns. I think this continues. I see a winter with alternating warm and cool conditions as we'll be on the "node" of the waves. The wild card in all of this is blocking. We've seen some this summer. If blocking happens frequently in the east Pacific / West North America, those periods will be cooler.

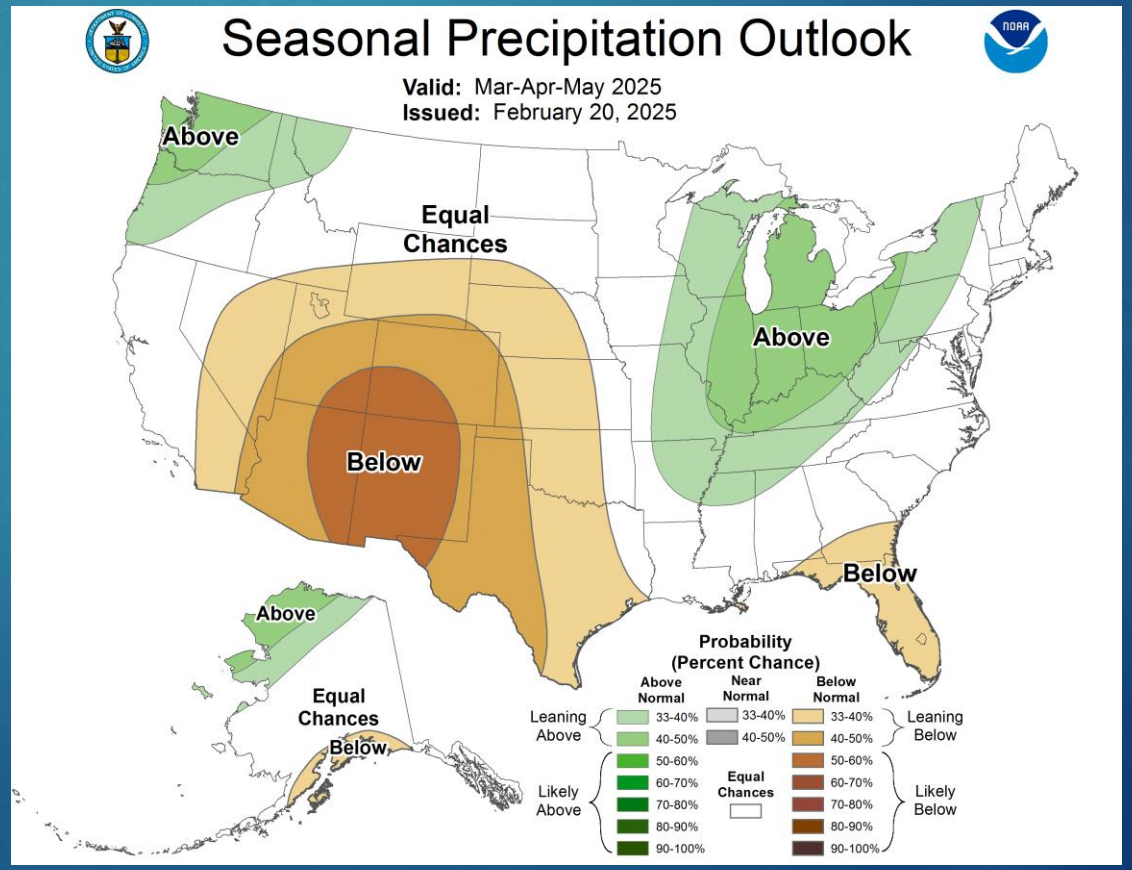
Spring 2025 – CPC outlooks

- Temperature – projections are for below normal temperature across the northern and northwestern USA – Opposite of last year and typical of a Classic La Nina.



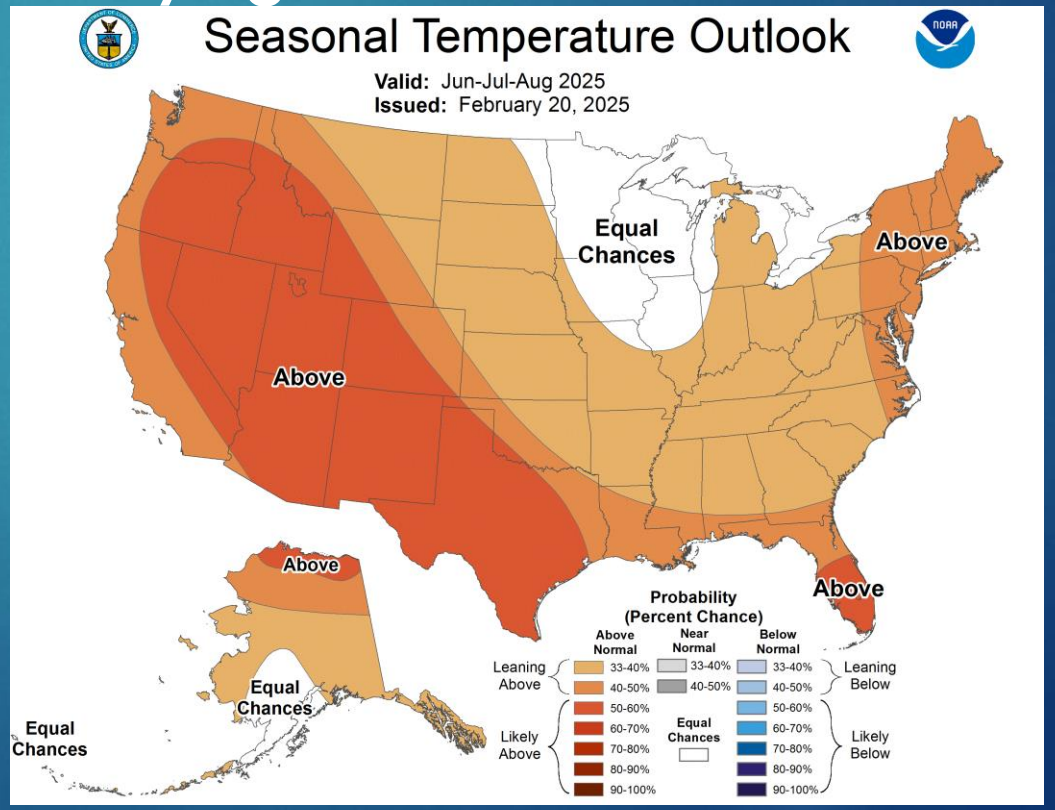
Spring 2025 – CPC Outlooks

- **Precipitation – look for drought to improve?**



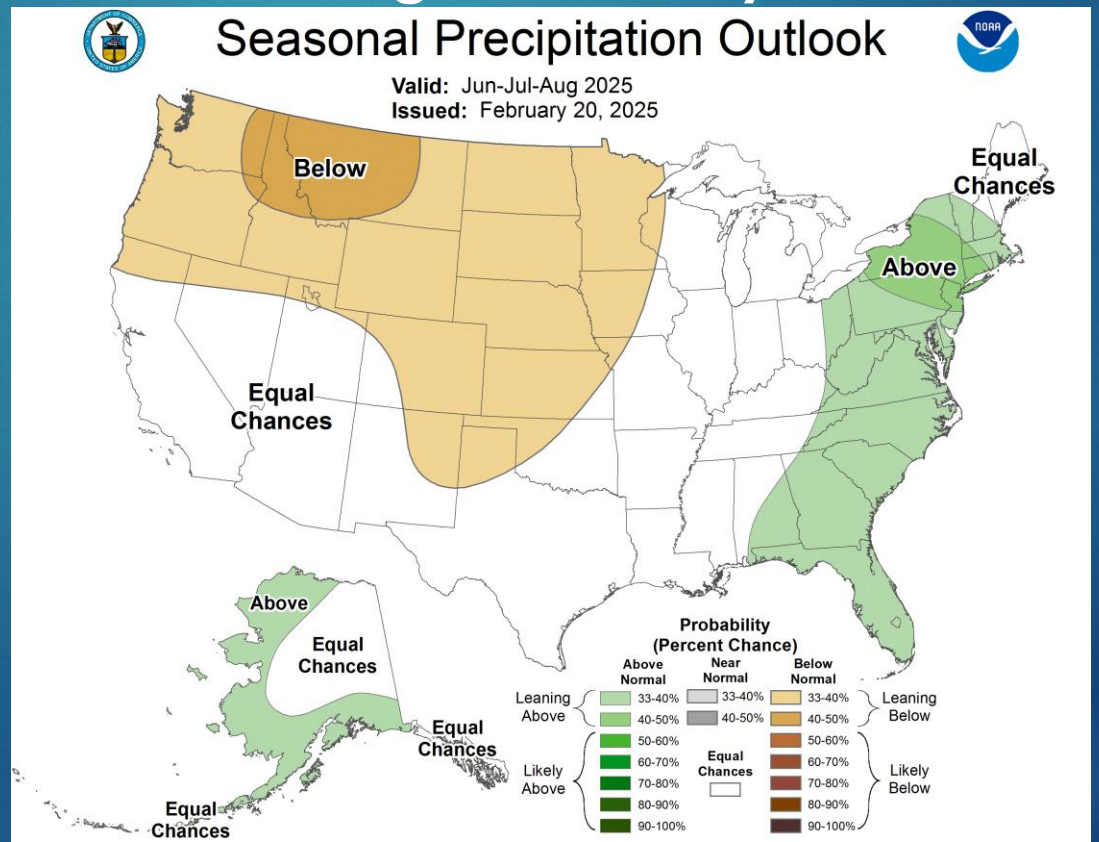
CPC Summer Outlook – 2025

- **Temperature – the sixth straight year the forecast has look like this. We're not even trying……..**



CPC Summer Outlook 2024

- Precipitation – again consistent with dry conditions across the north and central USA, but wet in the Ohio valley and east? Looks enough like last year and four of the last five.



Summer 2025 Outlook

- CPC forecast is for a warm spring across the south and east coast and equal chances for the upper midwest. They are going for continued drought in the southern plains states and southwest but wet in the middle Mississippi and into the Ohio Valley and east. But, we're in a La Niña and the projection is going toward Neutral (dynamic) or staying La Niña. and last year is looking like a good analog where MO is trapped between dry conditions west and wet conditions east.

- El Niño conditions were in place this time last year.

Summer 2025 Outlook

- A third factor has been in the fray for twnty two months, but if that was a factor – it should be on the wane – the Tonga – Hunga Volcano. This belched a lot of water vapor into the stratosphere. A greenhouse gas. See this link:

- https://scitechdaily.com/massive-tonga-volcano-eruption-blasted-enough-water-to-fill-58000-olympic-size-swimming-pools-into-stratosphere/?fbclid=IwAR2YO0fOm9fs-8tQNMQ_xQE-tmBwv4GgvpJyroGjWUAmBcKjuBMxtEli5GQ

Our Forecast – Summer 2025

- Reasoning:

- We think that the current weak La Niña (which the jury is still out on it) will fade somewhat but slowly. We'll probably move toward Neutral Conditions but we could remain in La Niña. This means the La Niña and La Nina - neutral years are good analogs.

- So we're going to say that summer will be in on the warm side of normal (one half to one sigma of normal or +1.2 – 2.4 F and the will be within the range of normal (+/- 2.5 inches above normal).

Community Collaborative Rain, Hail, and Snow Network

- Please consider joining CoCoRaHS. This data is used by agencies to decide crop loss information. It's worth it to you to join Missouri CoCoRaHS. (State Climatologist Zachary Leasor). MO has been a CoCoRaHS state since 2006.

- http://cocorahs.org

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Missouri Climate Center

- Missouri Climate Center
- http://climate.missouri.edu/change.php

Climate Change

- **U.S Global Change Research Program:** http://www.globalchange.gov/
- **2018 National Climate Assessment:** https://nca2018.globalchange.gov/
- **2014 National Climate Assessment:** http://nca2014.globalchange.gov/
- **National Oceanic and Atmospheric Administration (NOAA):** http://www.noaa.gov/climate
- **NOAA Climate Portal:** https://www.climate.gov
- **NOAA U.S. Climate Resilience Toolkit:** https://toolkit.climate.gov
- **Midwestern Regional Climate Center's Climate Trends Tool:** http://mrcc.isws.illinois.edu/mw_climate/climateTrends.jsp
- **USDA Midwest Regional Climate Hub:** https://www.climatehubs.oce.usda.gov/hubs/midwest
- **National Centers for Environmental Information State Climate Summaries:** https://statesummaries.ncics.org
- **NASA Global Climate Change:** http://climate.nasa.gov/
- **US EPA Climate Change:** https://19january2017snapshot.epa.gov/climate-impacts/climate-change-impacts-state_.html
- **Real Climate:** http://www.realclimate.org/
- **Climate Science Centers:** http://www.doi.gov/csc/index.cfm
- **Landscape Conservation Cooperatives:** http://www.fws.gov/landscape-conservation/lcc.html