

Understanding ENSO Weather Patterns and Their Impact on Oklahoma

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How most people see ENSO



NO! It's more than just El Nino

What is ENSO?

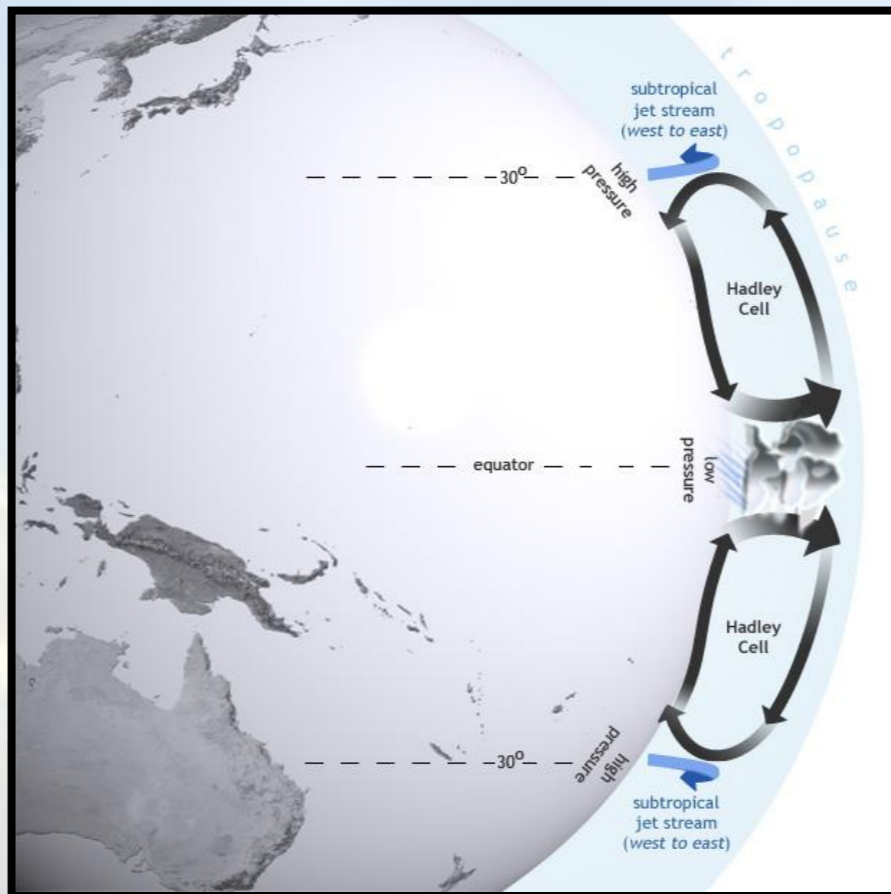
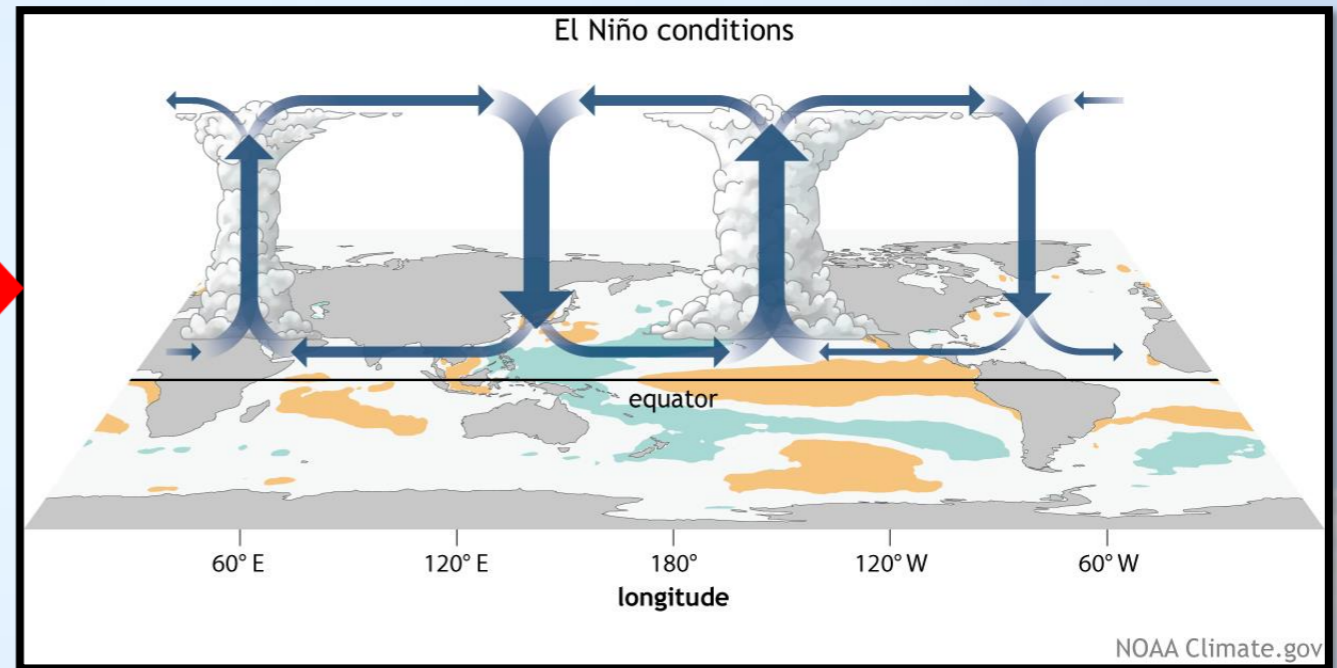
- ENSO stands for El Nino/Southern Oscillation
 - 3 phases: El Nino, La Nina, and Neutral Conditions
 - Southern Oscillation refers to seesaw changes in equatorial pacific surface pressures
- ENSO is one of the most important climate phenomena on Earth since it can change the global circulation pattern (i.e., the planet's temperature and precipitation patterns)
- Why scientists like it? It can be predicted several months (even seasons) in advance of its possible impacts
- Switches irregularly between the 3 phases every 2-7 years

El Nino-Southern Oscillation (ENSO)

- ENSO actually has THREE phases, based partly on the sea surface temperature changes in the equatorial Pacific
 - El Nino (warm anomaly, $>0.5\text{C}$)
 - La Nina (cool anomaly, $<-0.5\text{C}$)
 - Neutral (the “middle” phase, within $\pm 0.5\text{C}$ of average)
- ENSO is a COUPLED phenomenon. Requires certain change in the atmosphere to be classified as El Nino or La Nina (this is the “Oscillation” part)
- SST anomaly WITHOUT the atmospheric component is just an anomaly
- ENSO switches irregularly between the three phases every 2-7 years

HOW DOES ENSO CHANGE WEATHER PATTERNS AROUND THE GLOBE? **TELECONNECTIONS**

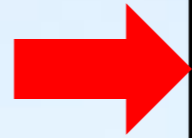
- It changes the pressure and storm patterns along equator, which changes the trade winds (Walker Circulation)



- It then influences the Hadley circulation, which leads to changes in the circulation patterns worldwide, including the position of the jet stream over North America.

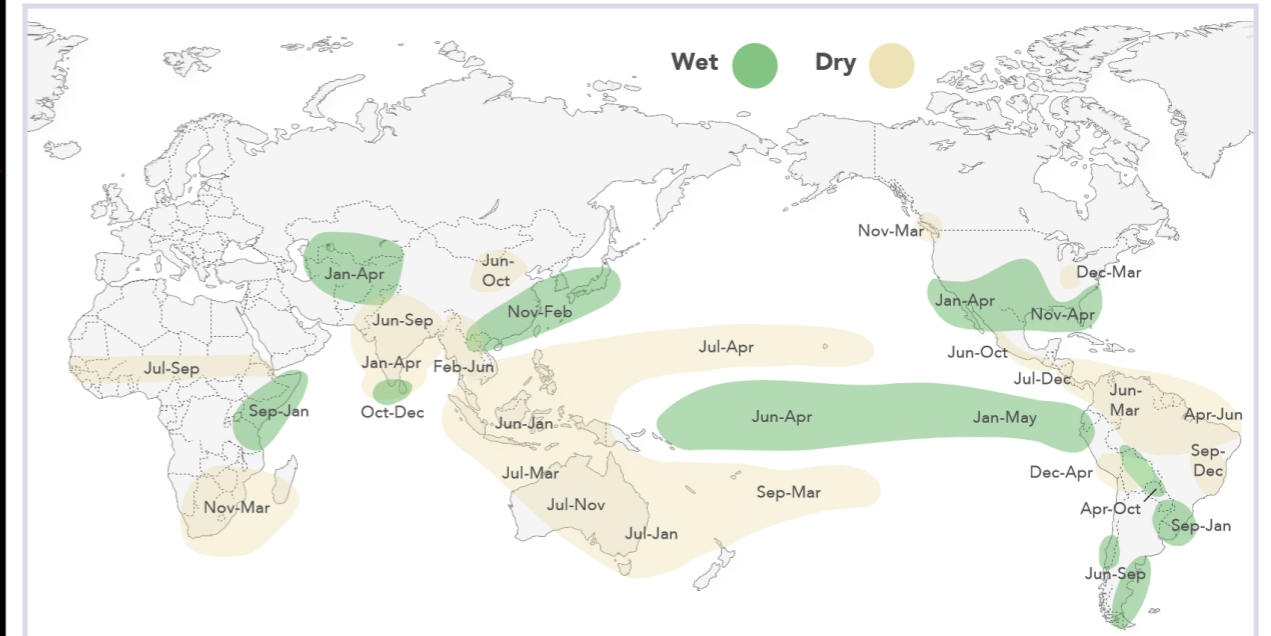
El Nino Impacts

- Bigtime droughts in Australia and northern South America
- Southern US benefits
- Hurricane season is worse in Pacific, better in Atlantic



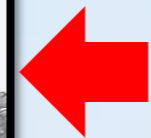
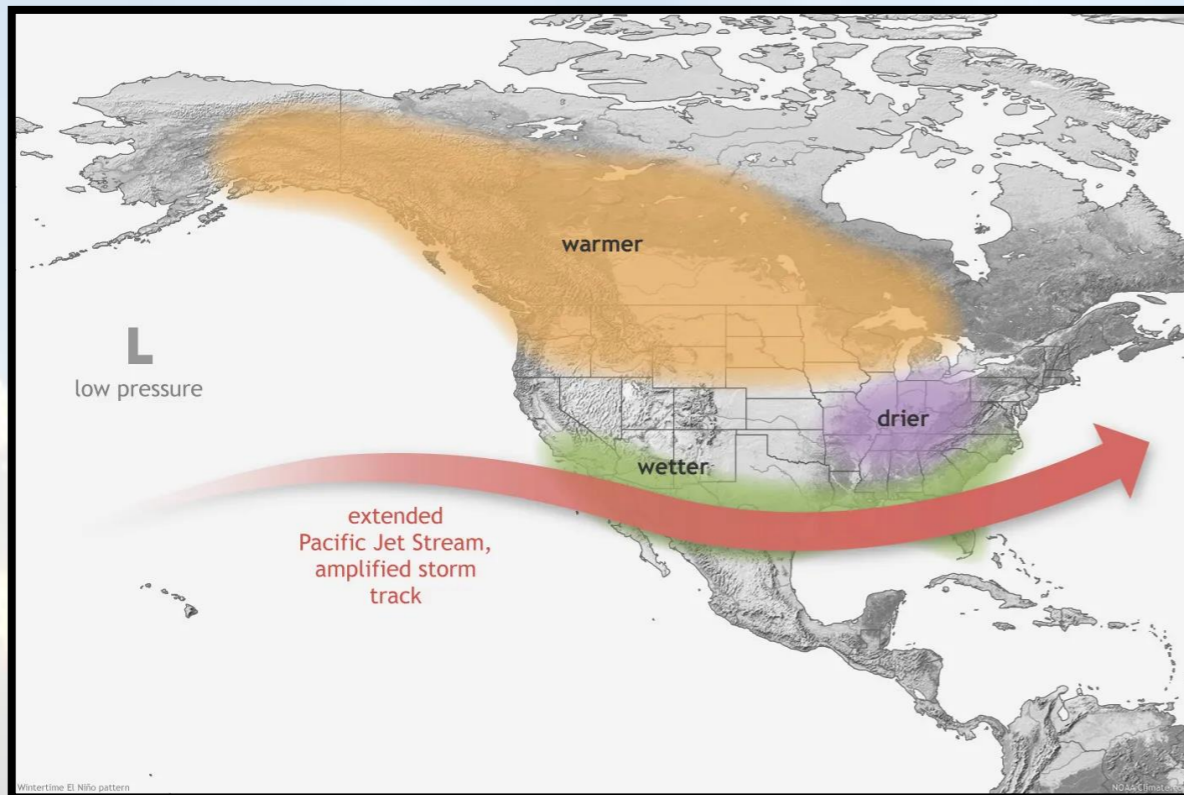
El Niño and Rainfall

El Niño conditions in the tropical Pacific are known to shift rainfall patterns in many different parts of the world. The regions and seasons shown on the map below indicate typical but not guaranteed impacts of La Niña. For further information, consult the probabilistic information* that the map is based on.



*<http://iridl.ldeo.columbia.edu/expert/home/lenssen/ensoTeleconnections/>
For more information on El Niño and La Niña: <http://iri.columbia.edu/enso>

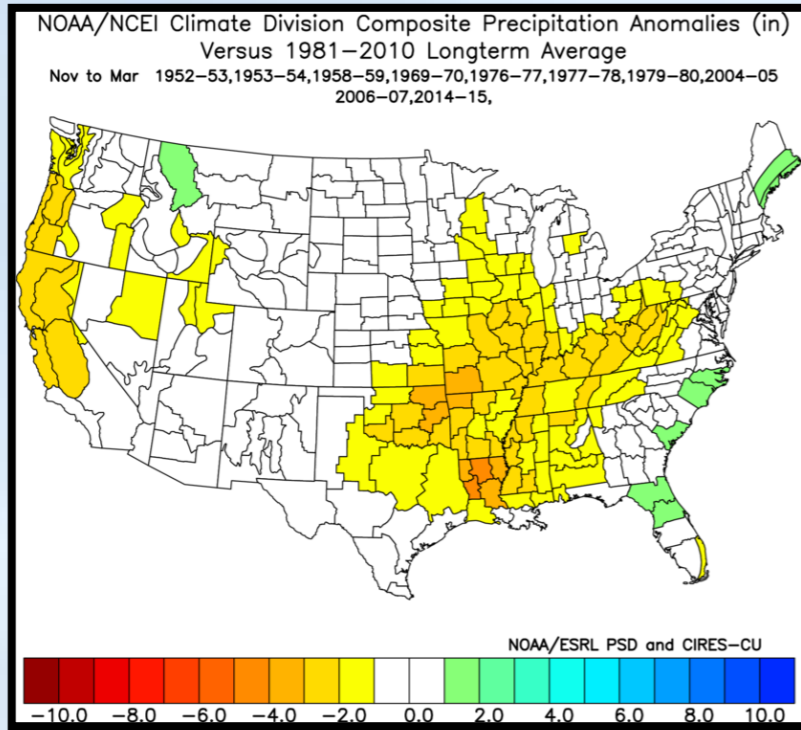
Sources:
1. Lenssen, Goddard and Mason, 2020. Seasonal Forecast Skill of ENSO Teleconnection Maps. Weather Forecasting, 2387-2406
2. Mason and Goddard, 2001. Probabilistic precipitation anomalies associated with ENSO. Bull. Am. Meteorol. Soc. 82, 619-638



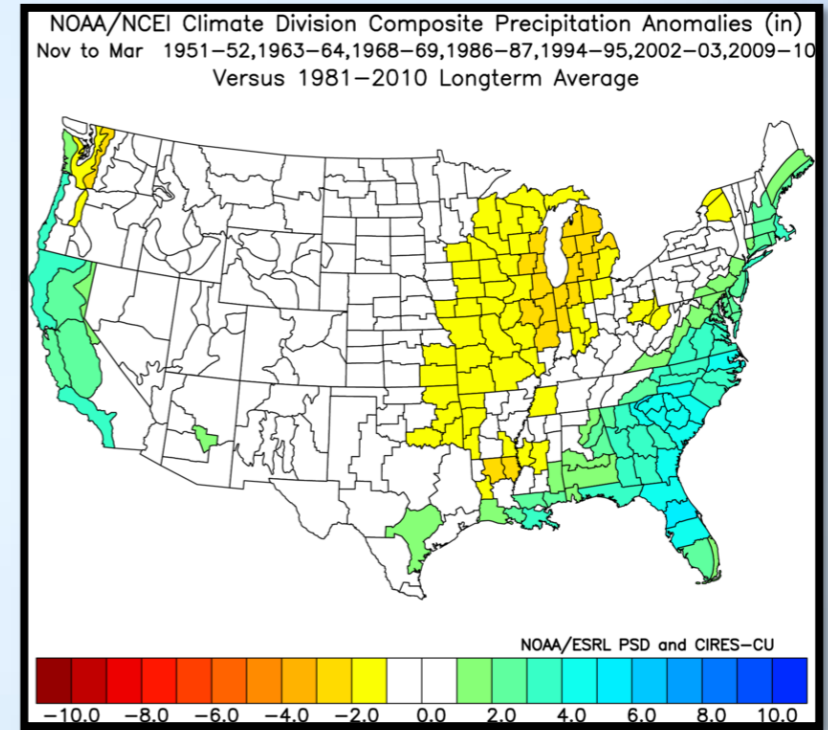
- Warmer across north
- Wetter along southern tier
- Dry in the Upper Midwest into the Southeast
- October through March
- **STRENGTH MATTERS!**

El Nino Precipitation

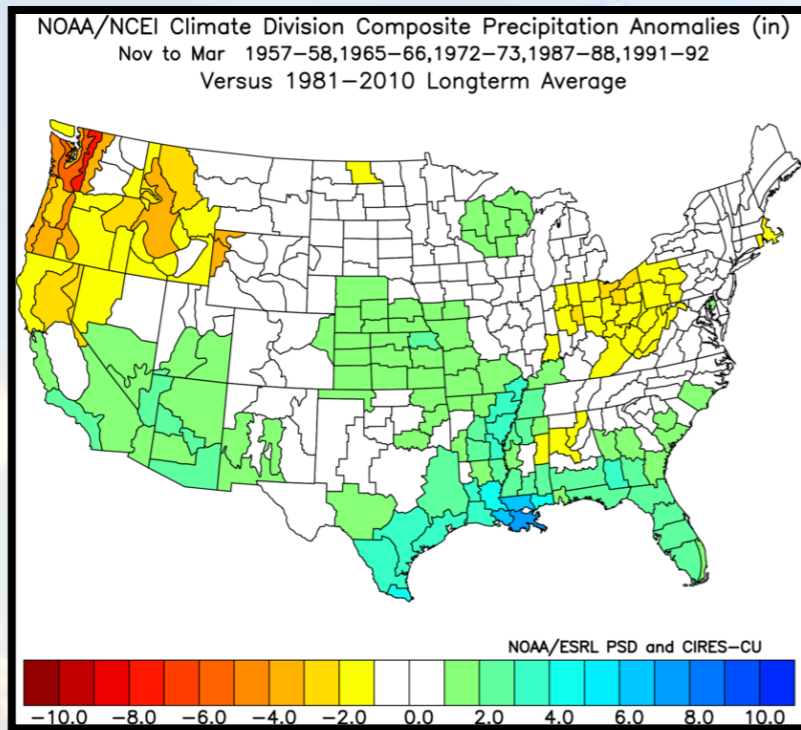
Weak (0.5-0.9C)



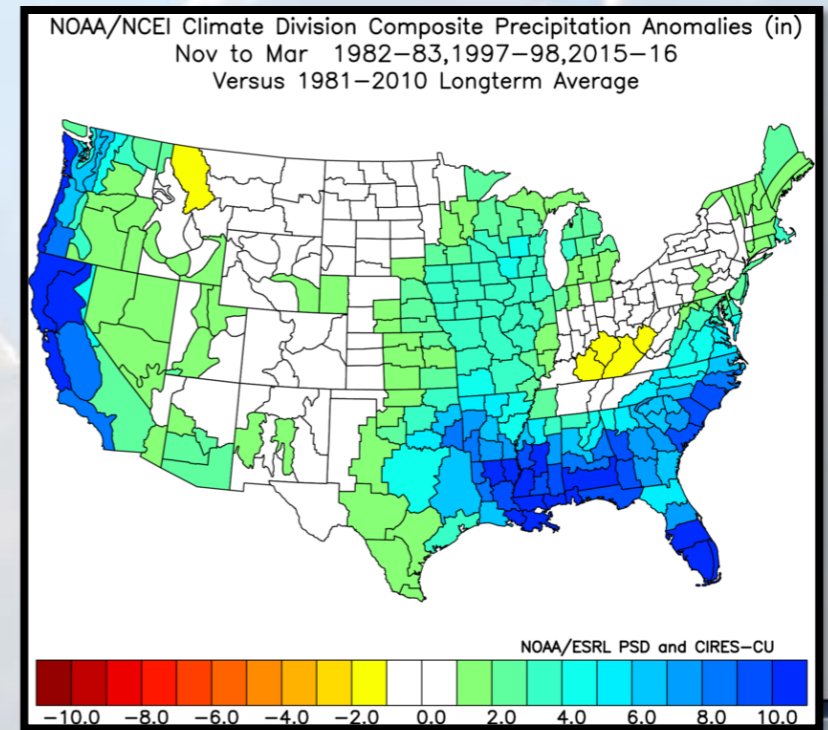
Moderate (1.0-1.4C)



Strong (1.5-2.0C)

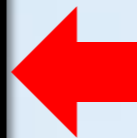
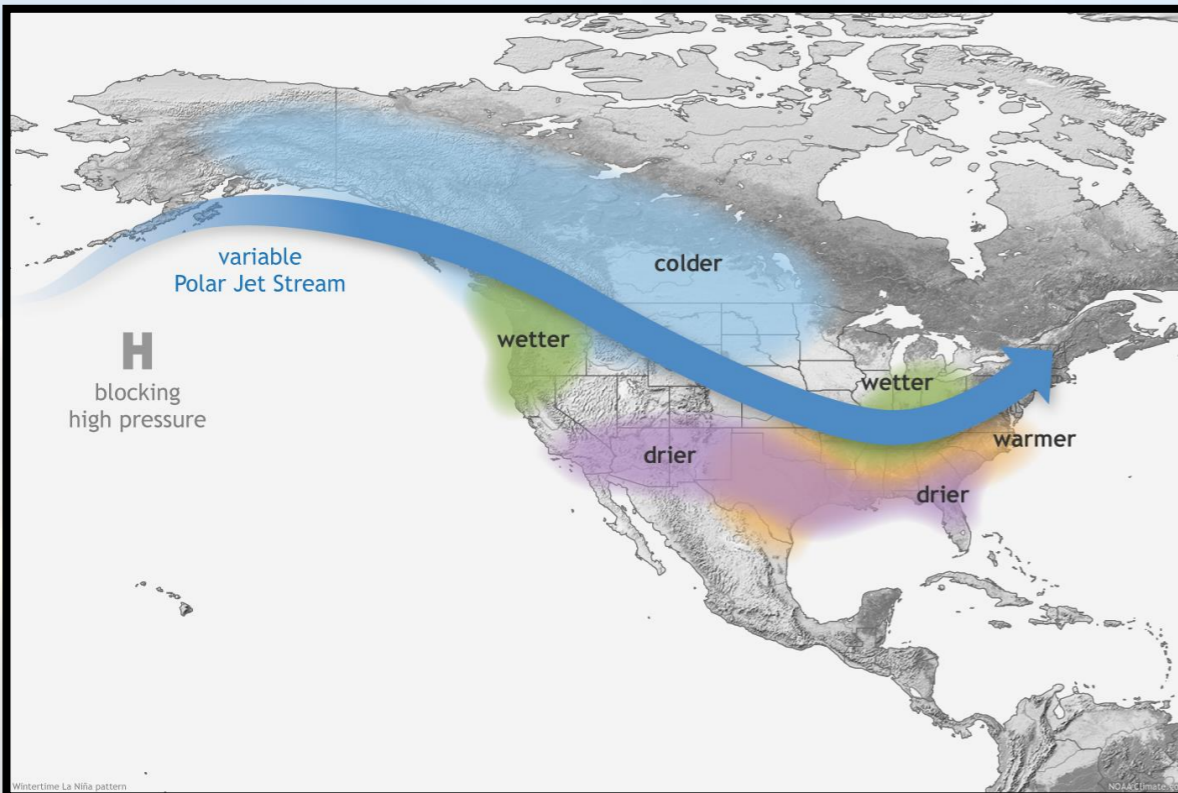
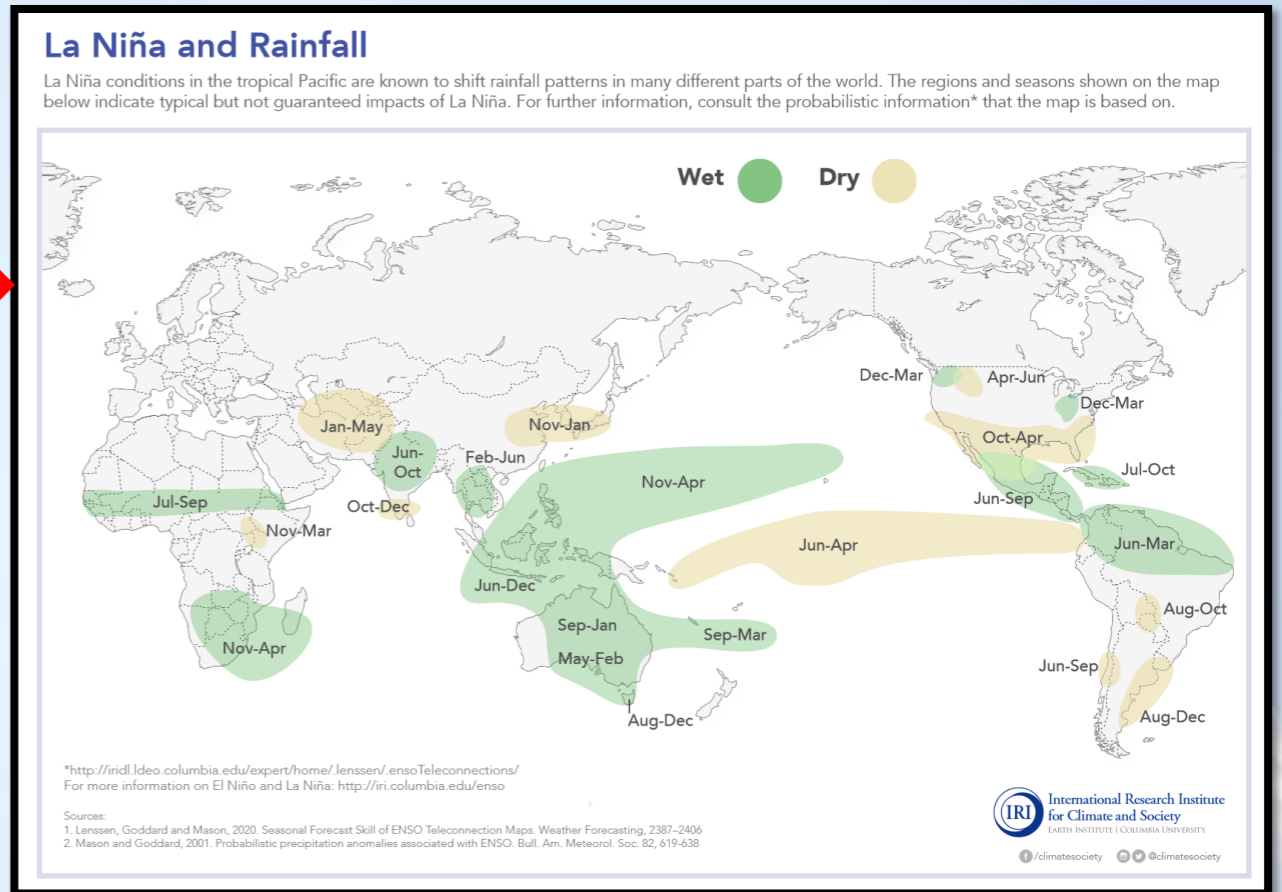
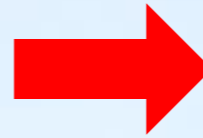


Very Strong (>2.0C)



La Nina Impacts

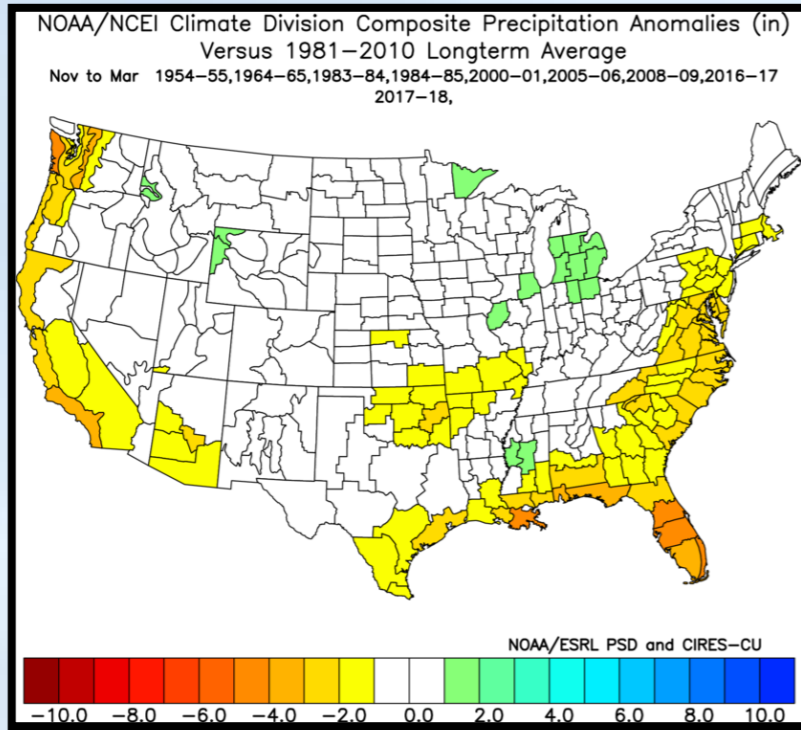
- Australia and Central America benefit
- Southern US and parts of Asia and South America have problems
- Hurricane season is worse in Atlantic, better in Pacific



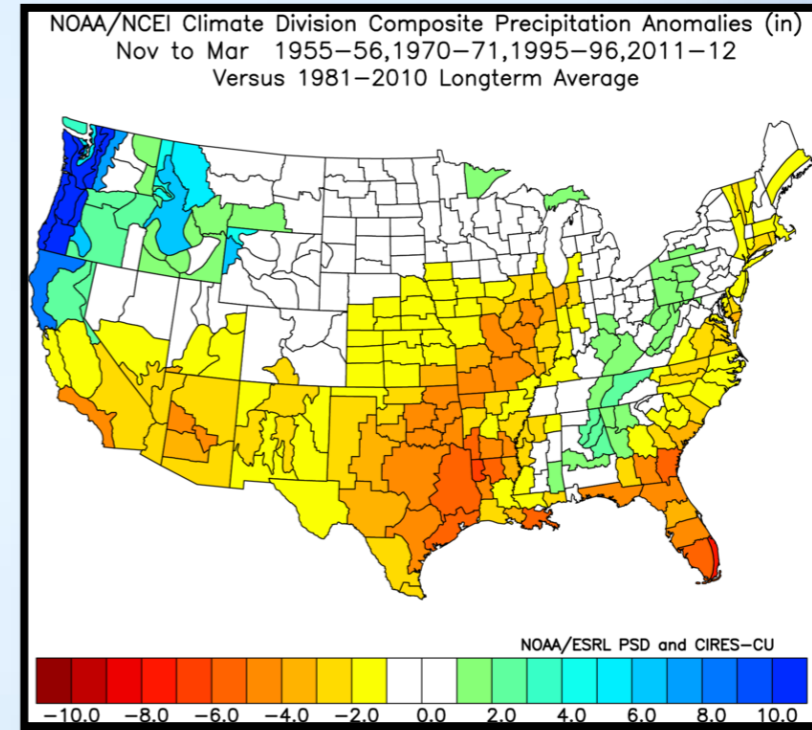
- Drier/Warmer along southern tier
- Wetter in Pac NW and Ohio Valley
- Impacts are Oct-Apr, but strongest Jan-March
- **STRENGTH MATTERS!**

La Nina Precipitation

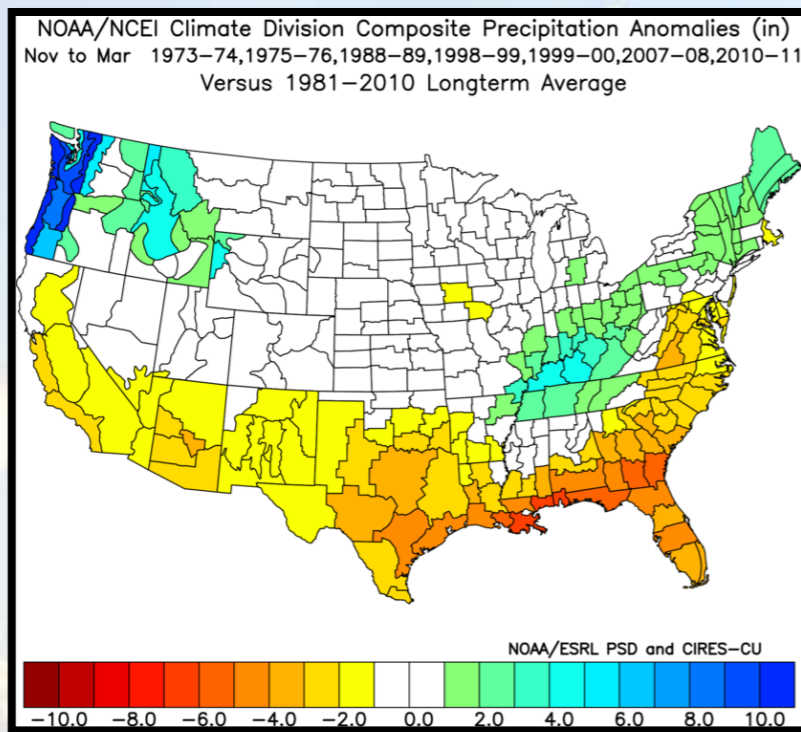
Weak (0.5-0.9C)



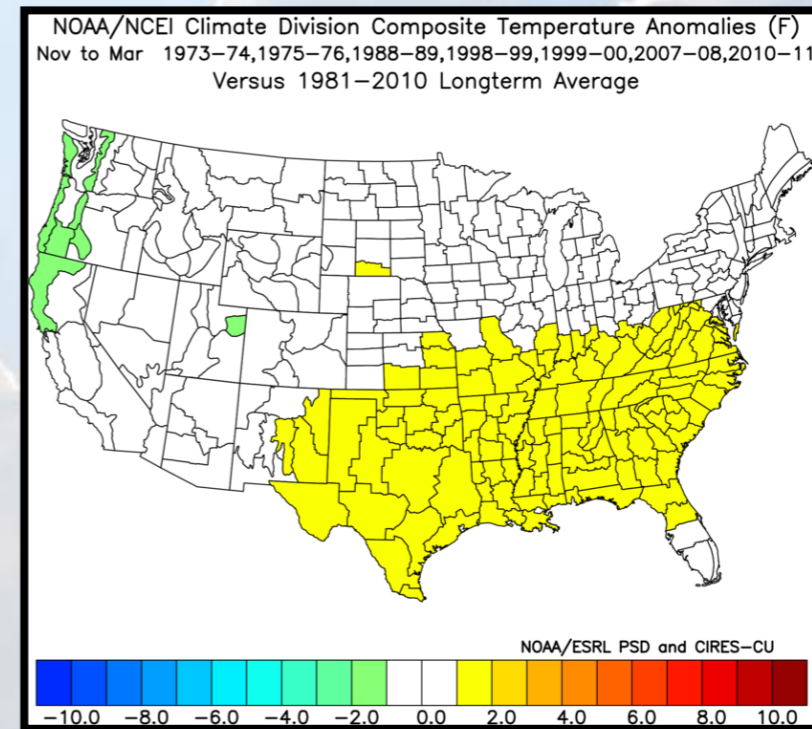
Moderate (1.0-1.4C)



Strong (1.5-2.0C)



Temperatures
Strong (1.5-2.0C)



ENSO: Important points

- Impacts are more likely during ENSO events, but not certain to occur
- The stronger the ENSO event, the more likely the teleconnection impacts become
- There is some correlation between strength of the event and the severity of the effects
- These are generally cool season impacts
- Scientists have LOW confidence in exactly what will happen to ENSO in the future even while they have HIGH confidence that ENSO itself will continue
- Climate change could strengthen or weaken the typical weather patterns associated with ENSO

MORE RESOURCES

- Scientific Mumbo-Jumbo: CPC's ENSO page
 - <https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/enso.shtml>
- Easier to understand: Climate.gov's ENSO blog
 - <https://www.climate.gov/news-features/departments/8443/all>
- CPC's main page: All the outlooks and other info
 - <https://www.cpc.ncep.noaa.gov/>
- The OCS/Mesonet Ticker
 - <http://ticker.Mesonet.org>
 - Or send e-mail to gmcmanus@Mesonet.org