

Viva La Niña!

How The Tropical Pacific Impacts Our Weather

Charlie Phillips



Photo: Hubert the Snowman, 2/20/2018



About me

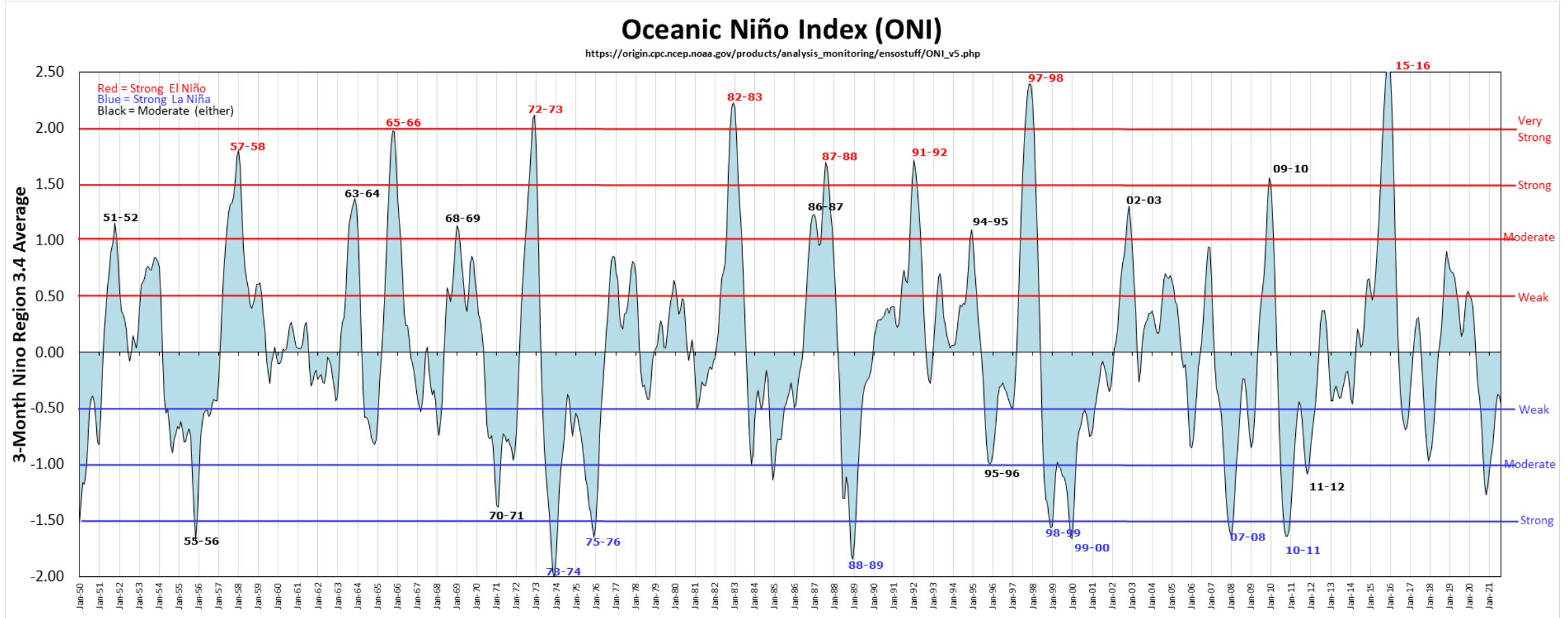
- Graduated from UW with B.S. in Atmospheric Sciences in 2015
- Moved to Portland to work as a meteorologist in 2016
 - 2016-2018: Avangrid Renewables
 - 2018-2021: Portland General Electric
- Recently moved back to Seattle to work as energy trader for Puget Sound Energy
- Avid weather blogger! I've been blogging since 2008 and founded WeatherTogether, an online blogging community, in 2016
 - Blog: [Charlie.weathertogether.net](http://charlie.weathertogether.net)

ENSO (El Niño Southern Oscillation) 101

ENSO 101

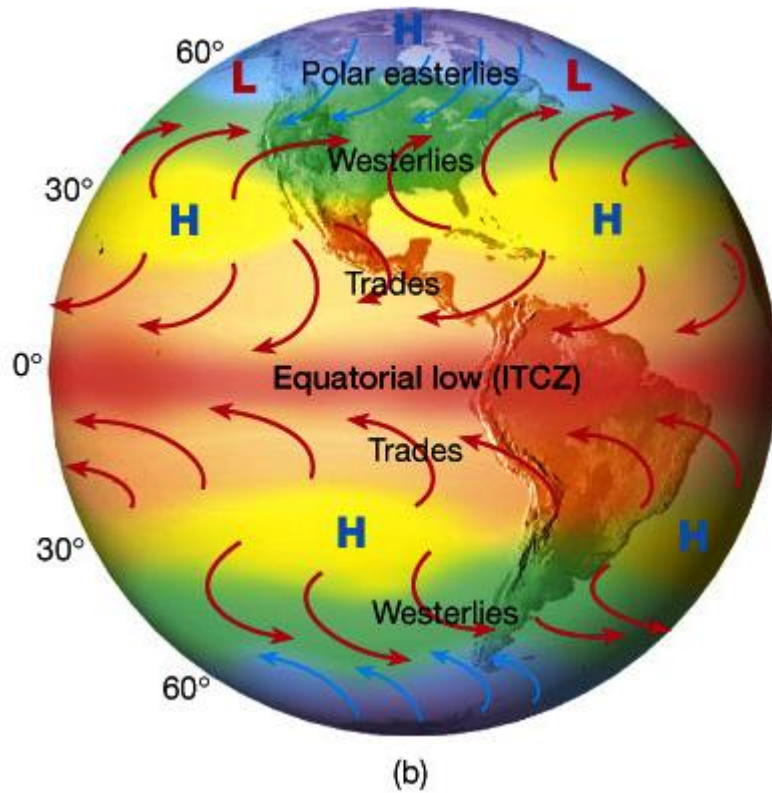
- ENSO, or El Niño Southern Oscillation, refers to the periodic variation in winds and sea-surface-temperatures over the equatorial Pacific Ocean
- There are three phases to ENSO: La Niña (cool), Neutral, and El Niño (warm)
- La Niña and El Niño occur every ~2-7 years, at irregular intervals.
- La Niña and El Niño have impacts to weather all around the globe.

ENSO Events



- 26 El Niño and 23 La Niña events since 1950
- Strongest El Niños are stronger than strongest La Niñas
- Of the 12 first year La Niñas, 8 were followed by a subsequent La Niña (“double dip”)
 - Of those 8, 2 were followed by *another* La Niña (triple dip!)

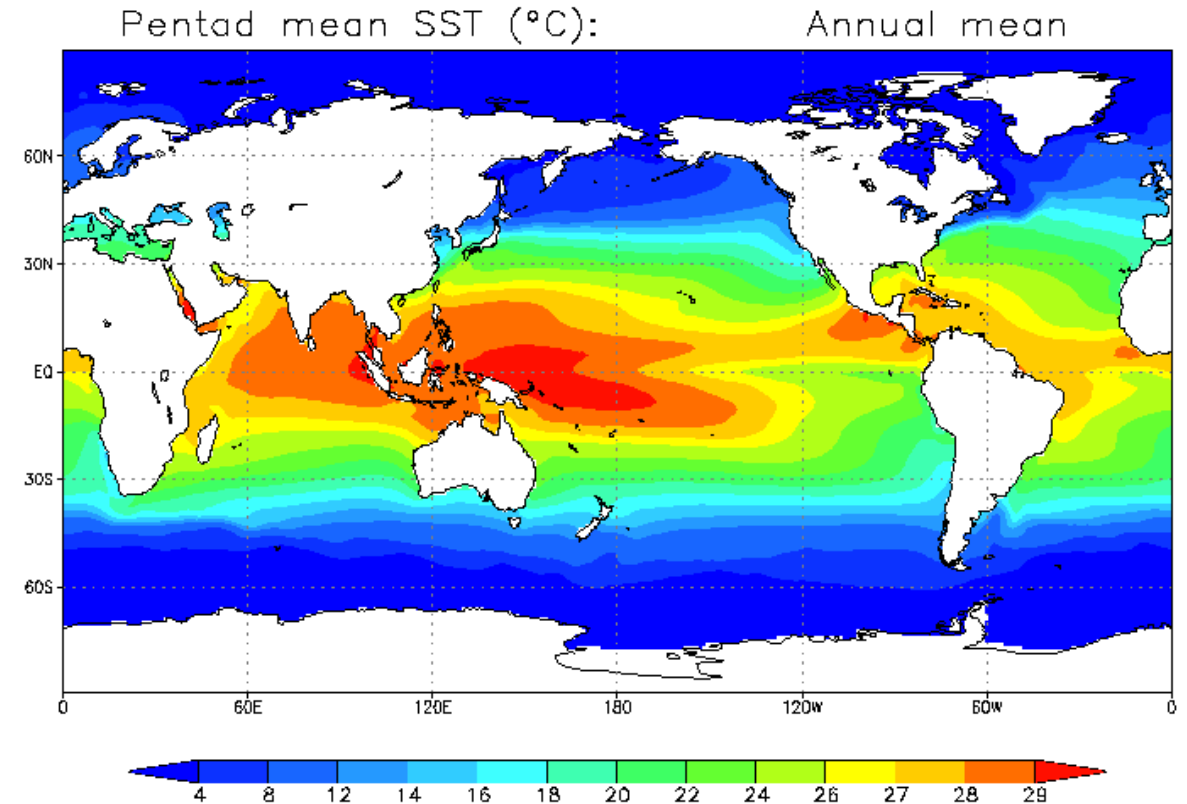
Average Circulation



Global Wind Belts (approximate)

- Trades: 0-30°
- Westerlies: 30°-60°
- Polar Easterlies: 60°-90°
- “Doldrums” (ITCZ) – near equator
- “Horse Latitudes” – between westerlies & trades

Average Sea-Surface-Temperature

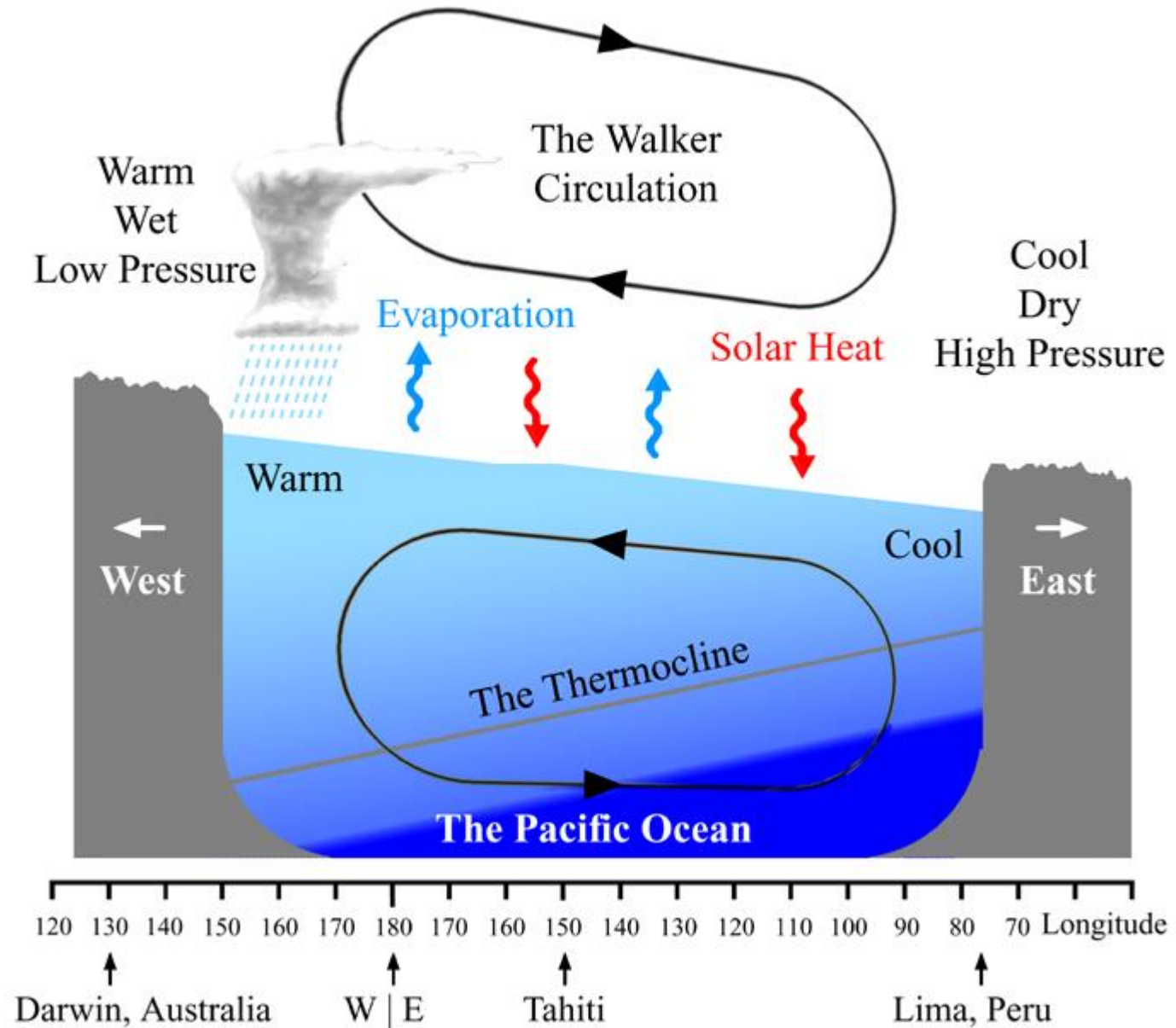


Sea-Surface Temperatures

- Trade winds push warm water & convection to western equatorial ocean basins
- Impact is most pronounced in Pacific Basin

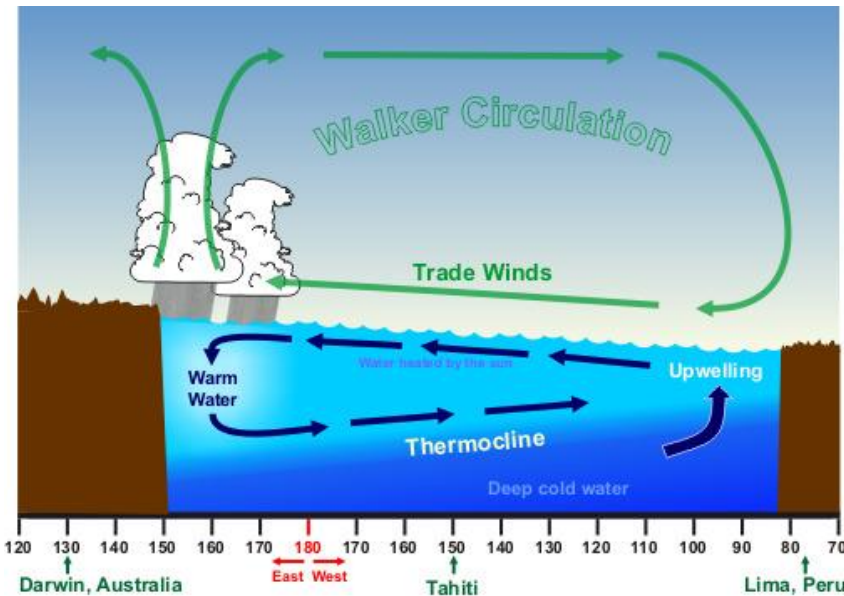
The Walker Circulation

- Easterly trades push warm water & moisture to western ocean basins, where convection occurs
- Dry, westerly return flow sinks over eastern ocean basins
- Different phases of ENSO are caused by changing strength in Walker Circulation
 - Neutral: average
 - La Niña: stronger-than-average
 - El Niño: weaker-than-average (or reversed in some cases)



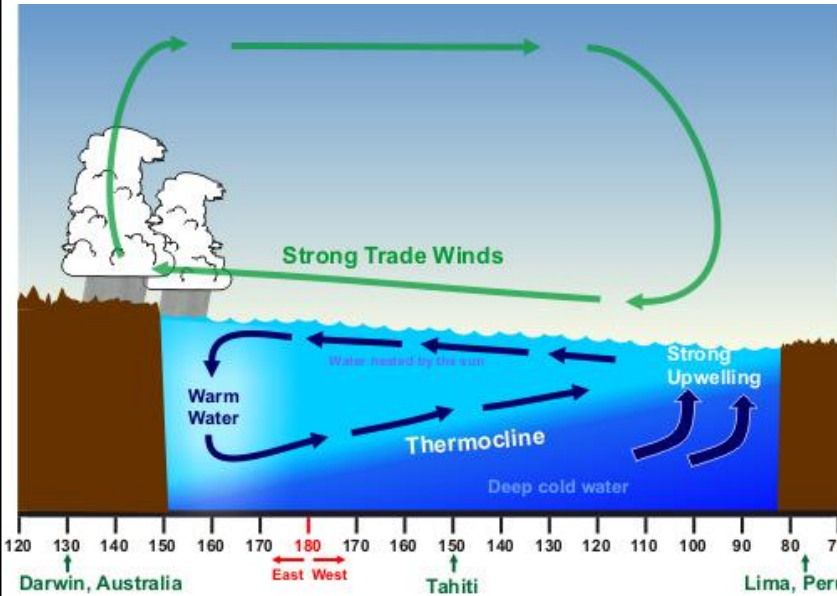
Walker Circulation & ENSO Phases

Neutral



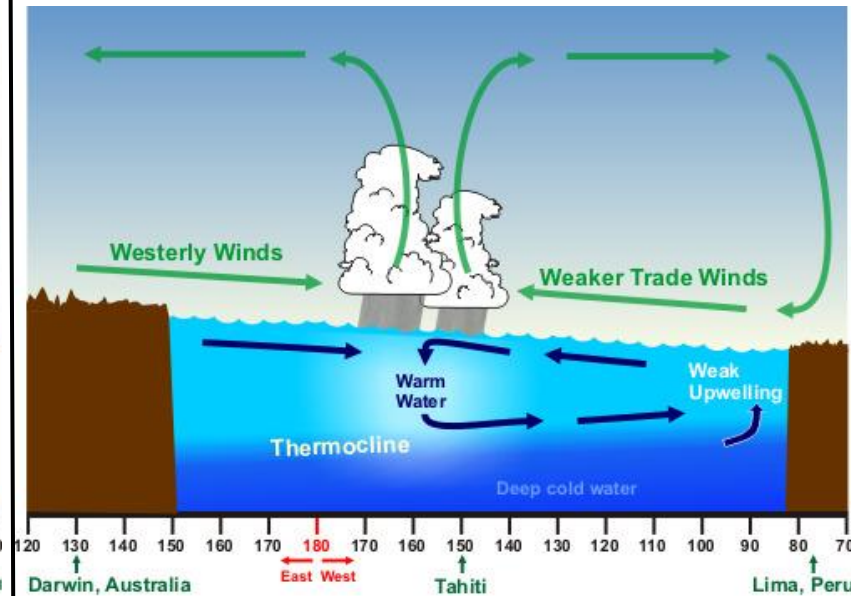
- “Average” Walker circulation
- Convection over Maritime Continent, dry over East Pacific
- Warm water West Pacific, cool water East Pacific

La Niña



- “Turbocharged” circulation
- Convection over Maritime Continent and drying over East Pacific is stronger and displaced west
- Cooler in Central/East Pacific due to strong upwelling

El Niño



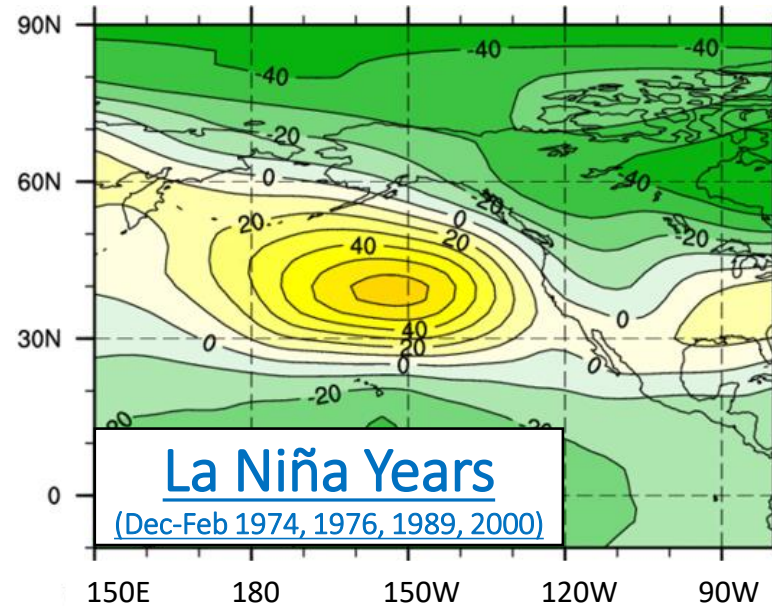
- “Weakened/Reversed” Walker Circulation
 - Trade weaken in East Pacific
 - Trades reverse in West Pacific
- Convection is displaced east over Central Pacific. Drought/fires occur over Maritime Continent.
- Warmer in Central/East Pacific due to weak upwelling

Impacts to Midlatitudes

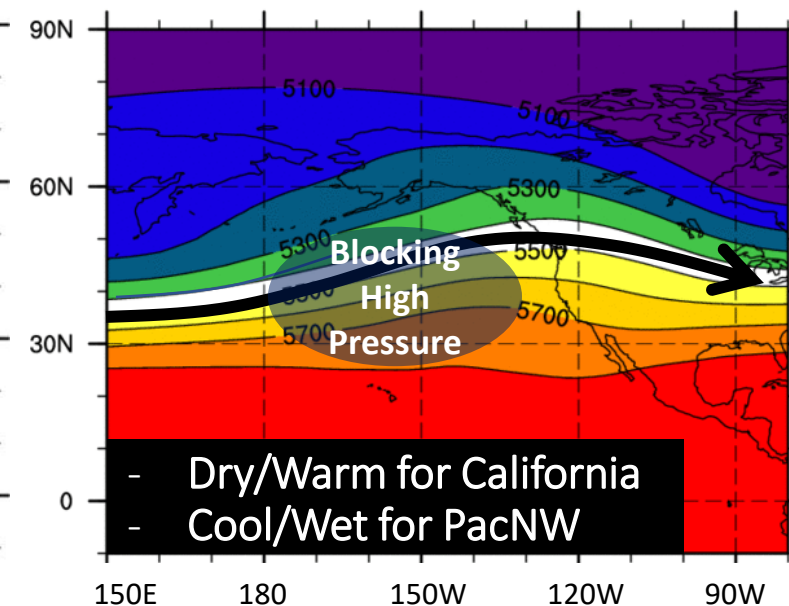
La Niña:

- West Pacific jet moves west in response to changes in Walker Circulation
- With jet retracted west, blocking ridge forms over North Pacific
- Ridge prevents storms from reaching California, but downstream troughing keeps PacNW cool & wet

500mb Anomalies

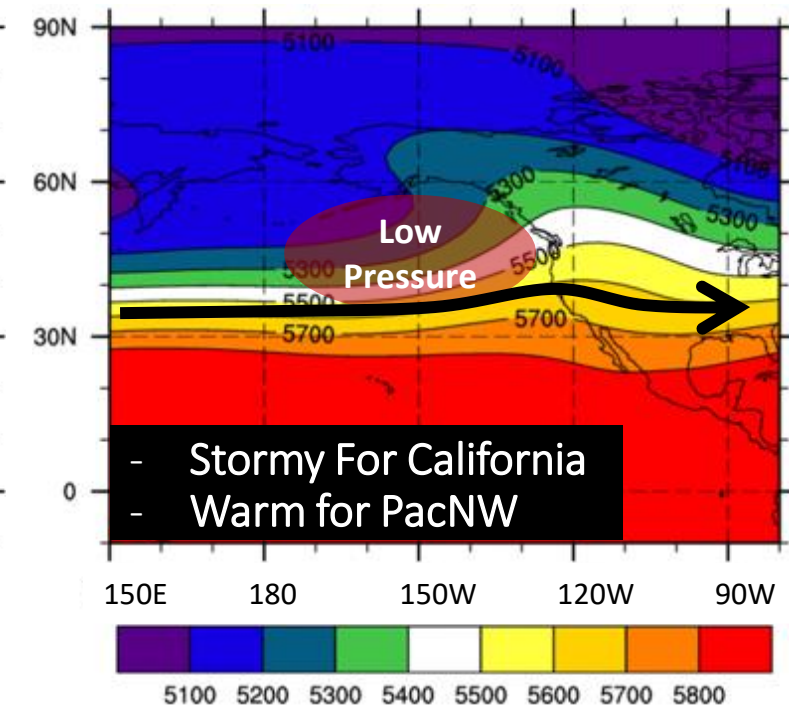
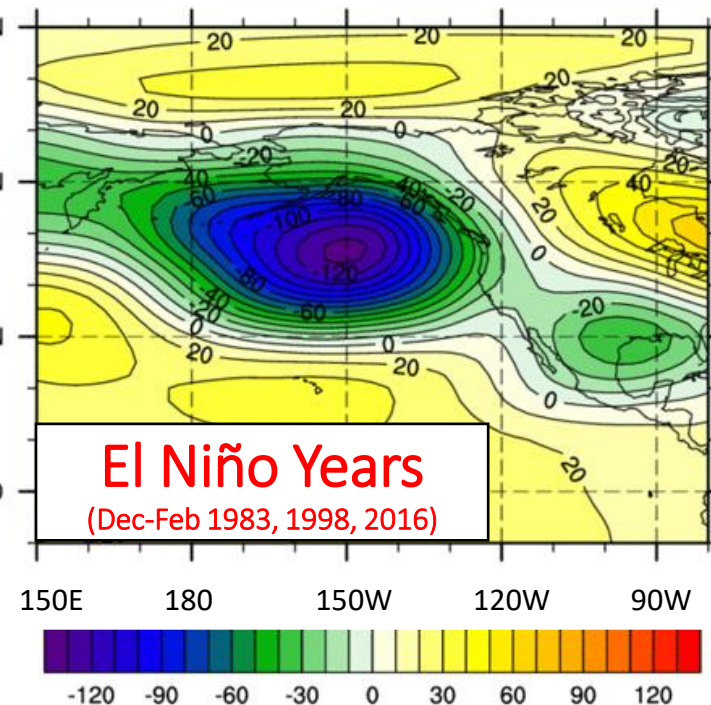


500mb Heights & Typical Pattern



El Niño:

- West Pacific Jet moves east, resulting in lower pressure over the North Pacific
- California is stormy much of winter.
- PacNW is warmer-than-avg with little mountain snow



La Niña: Current Status and Forecast

Current Conditions – Moderate La Niña in Effect

Ocean:

- Tropical Pacific SST now nearly 1 degree below avg

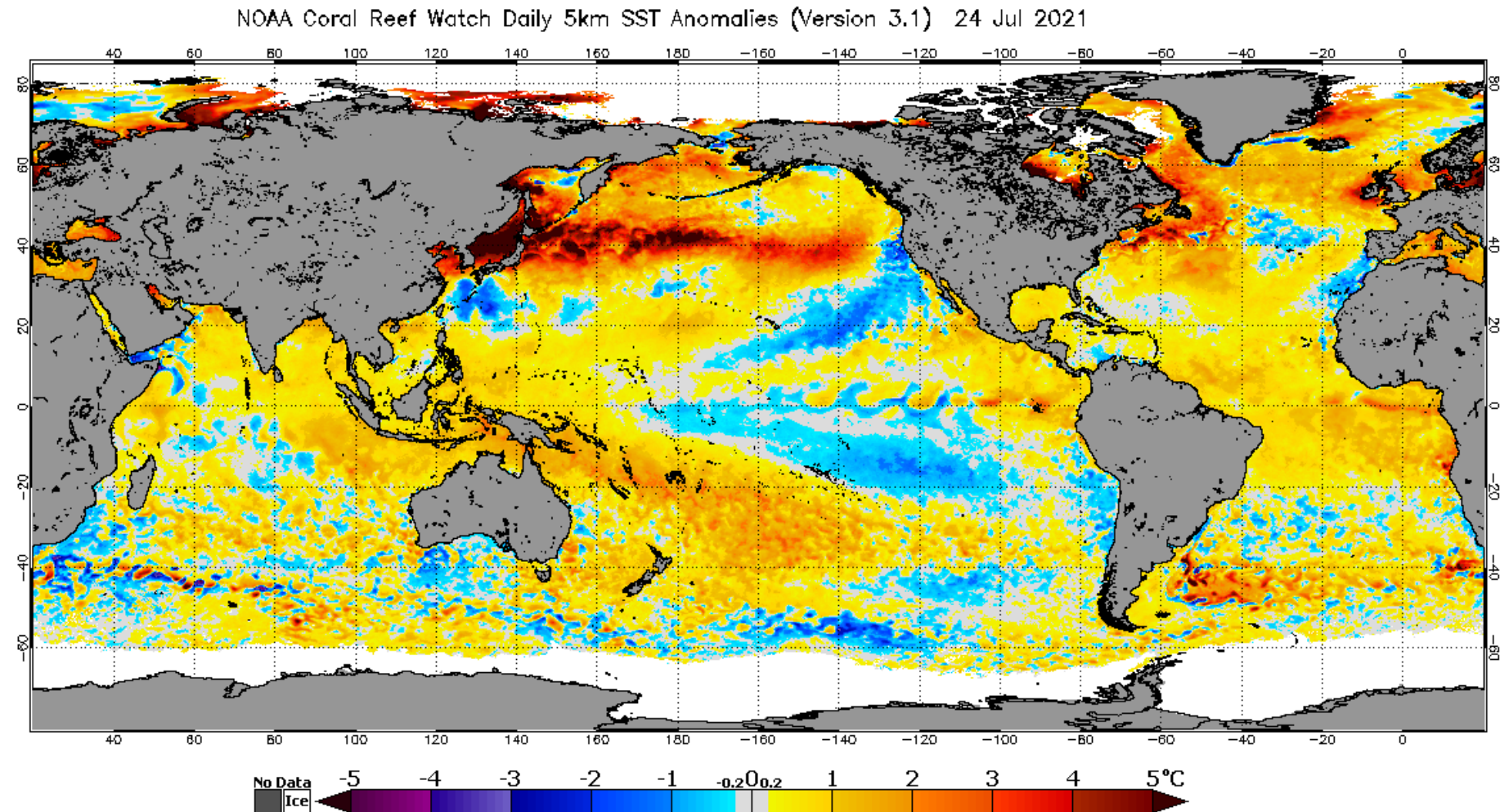
Atmosphere:

- Stronger-than-avg trade winds
- Enhanced convection over Maritime Continent
- Suppressed convection over Tropical Pacific

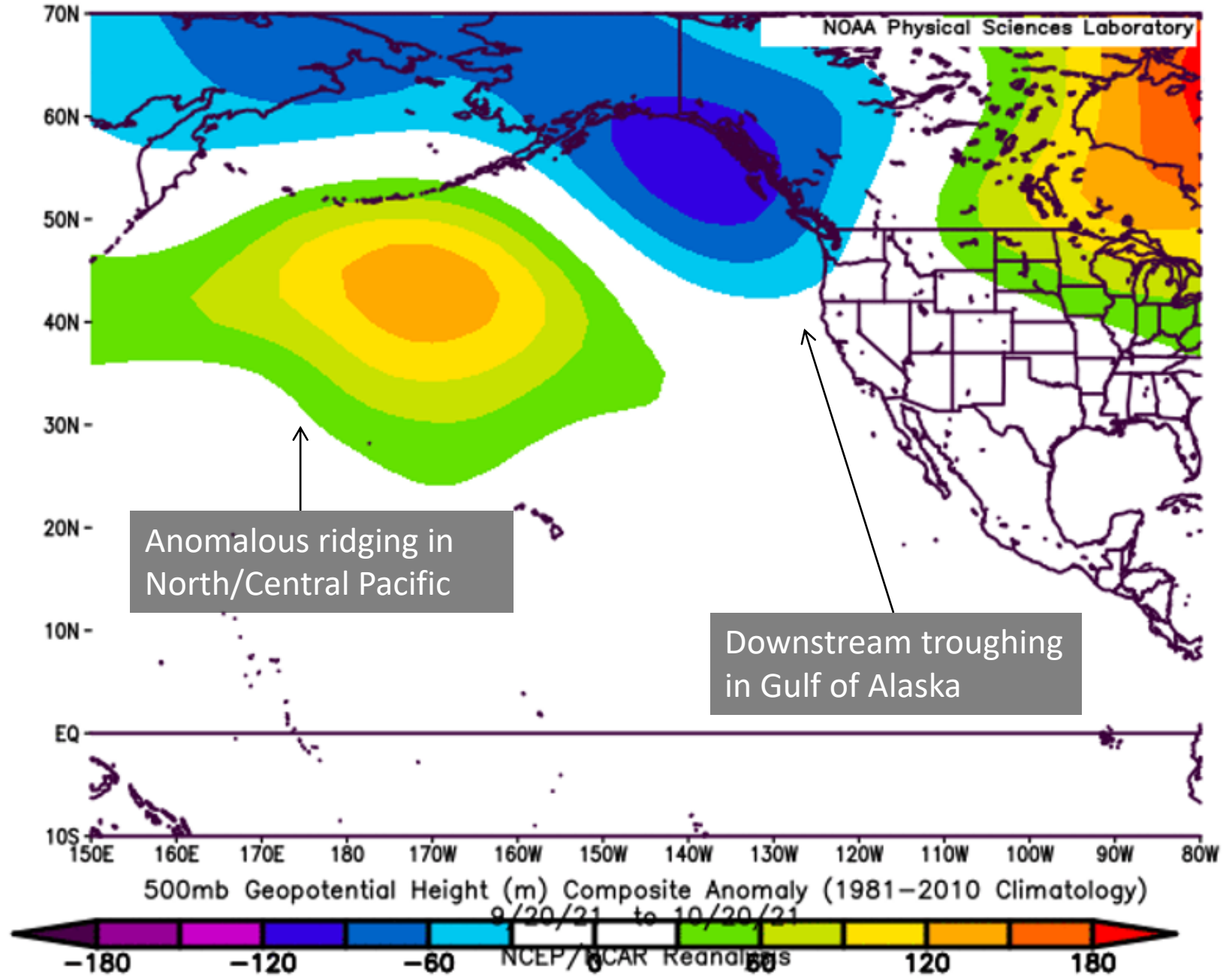
Blob Status:

- SST off West Coast *cooler*-than-avg (anti-blob)

7/24/ - 10/21/2021 SST Anomaly Animation

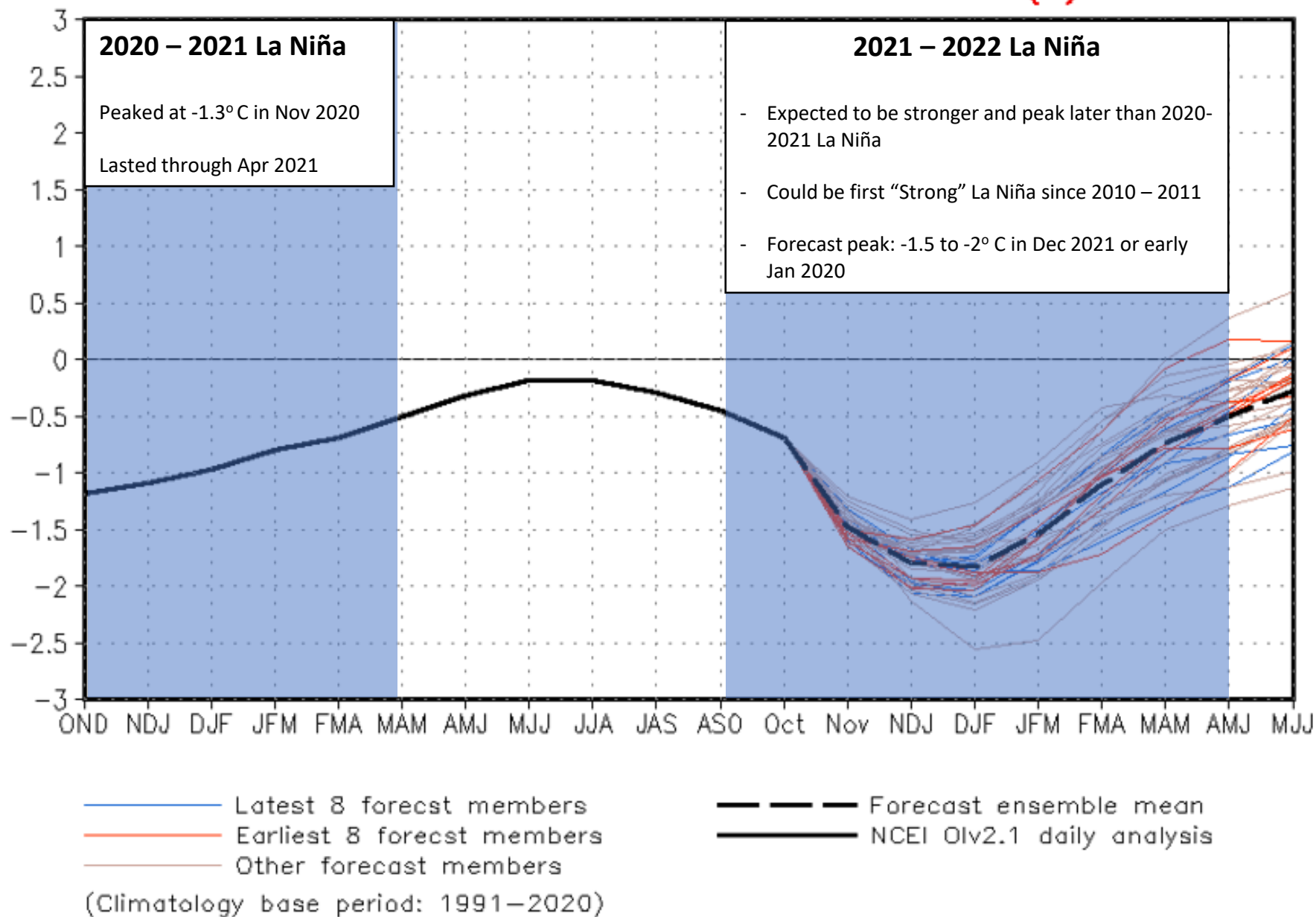


500mb Height Anomalies 9/20 - 10/20/2021

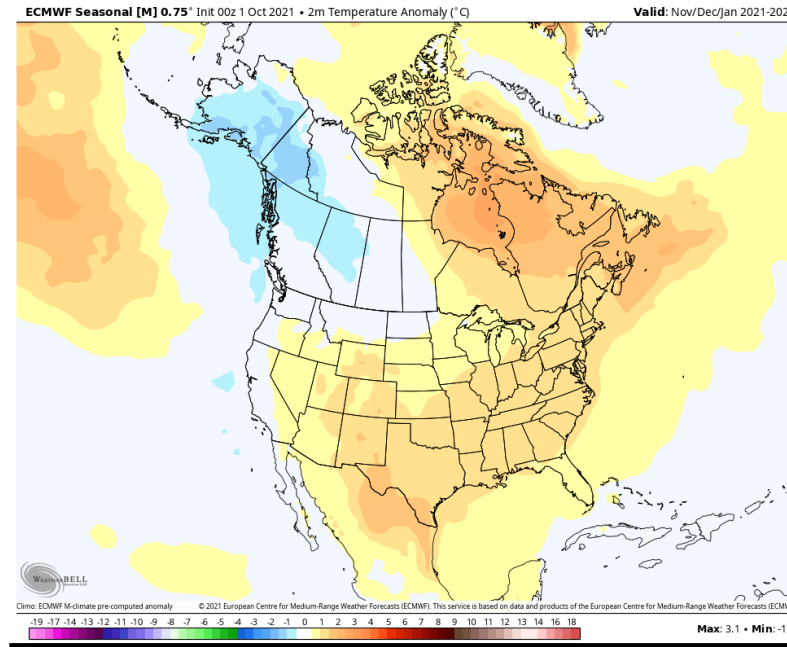




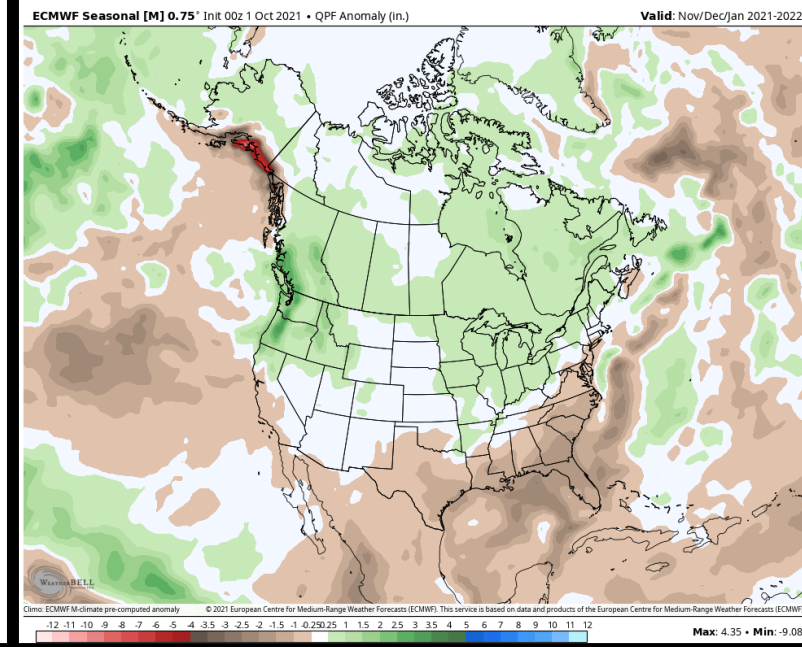
CFSv2 forecast Nino3.4 SST anomalies (K)



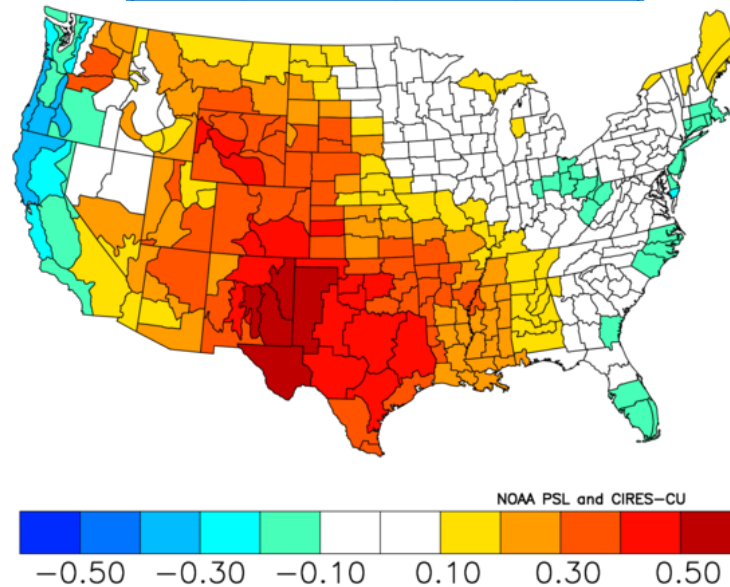
Nov – Jan ECMWF Temp Anomalies



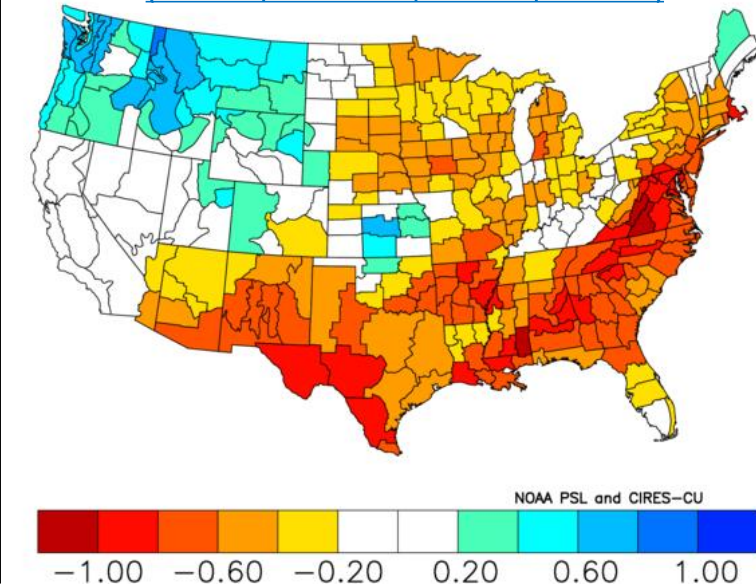
Nov – Jan ECMWF Precip Anomalies



Strong La Niña Temp Anomalies (1998-99, 1999-2000, 2007-08, 2010-11)



Strong La Niña Precip Anomalies (1998-99, 1999-2000, 2007-08, 2010-11)



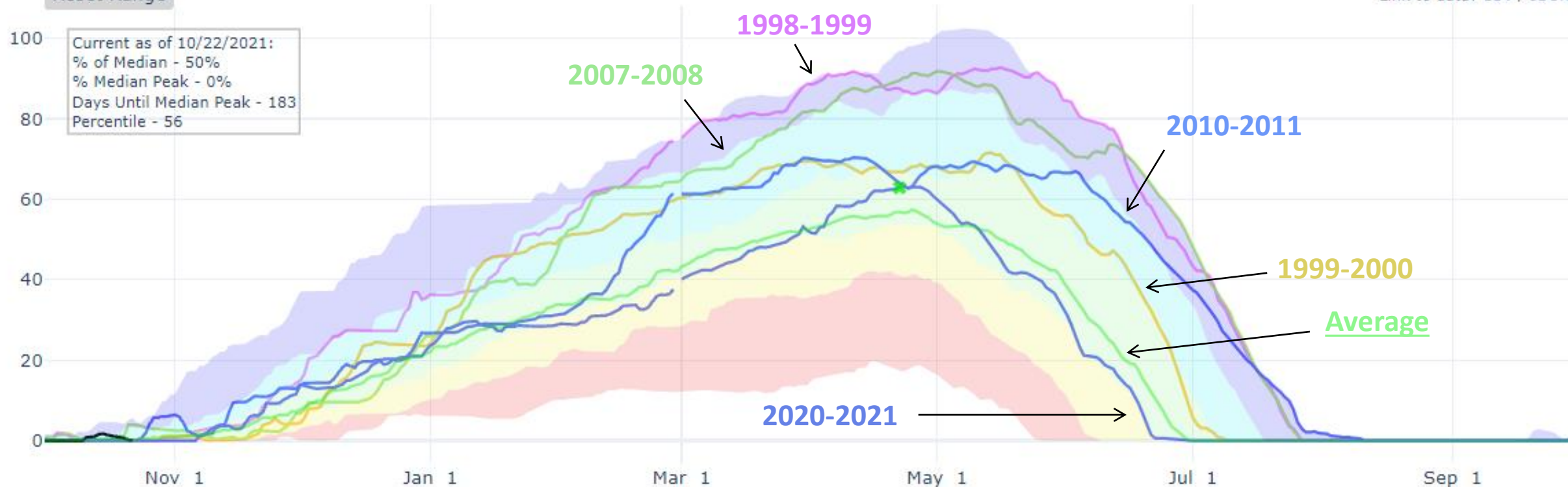
- ECMWF model shows typical La Niña pattern
 - Wet/cool Pacific NW
 - Dry/warm Desert SW
- Model is similar to observed temp/precip from the four most recent Strong La Niñas
 - *Exception: previous strong La Niñas were drier for Great Lakes/Ohio River Valley*

Mountain Snowpack

SNOW WATER EQUIVALENT AT MT HOOD TEST SITE

Reset Range

[Link to data: CSV / JSON](#)



- Strong La Niñas are reliable mountain snow producers throughout the season
- I expect ample snowpack this year for the Pacific NW, especially for Washington and British Columbia

Summary

- The 2021-2022 La Niña expected to be stronger and peak later than 2020-2021 La Niña
- High confidence in above-average mountain snow for the Pacific NW
- Moderate confidence in cooler-than-average temps/above-average precipitation for the Pacific NW
- Very unlikely that we'll see a repeat of last year's record-dry spring.
- The NW should get drought relief, but drought may worsen for SoCal and the Desert SW