Impacts of ENSO, AO, and Bermuda High on South Carolina Climate Variability

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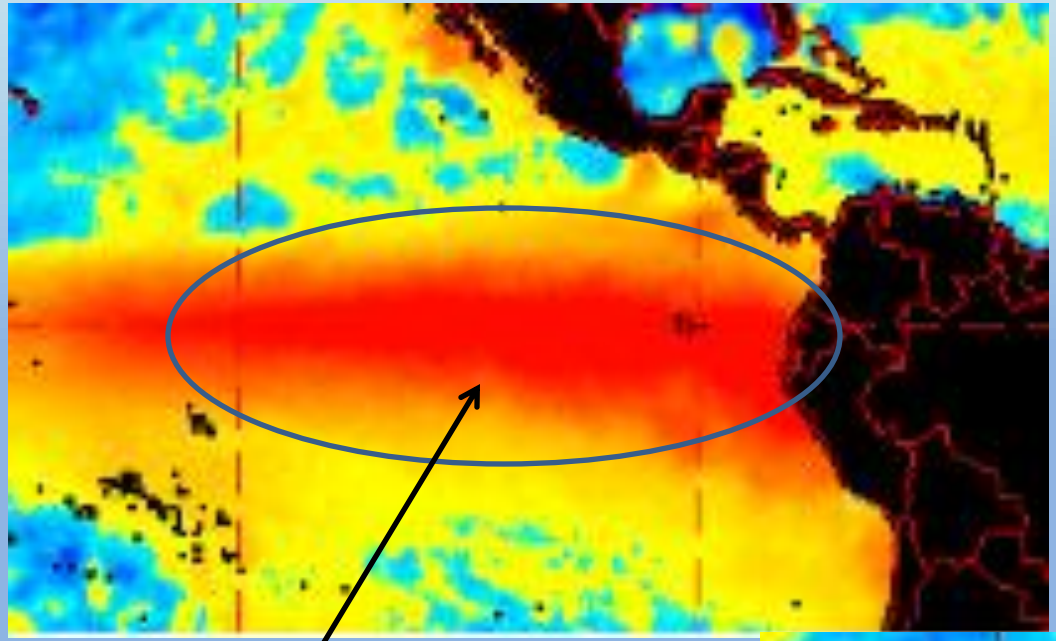
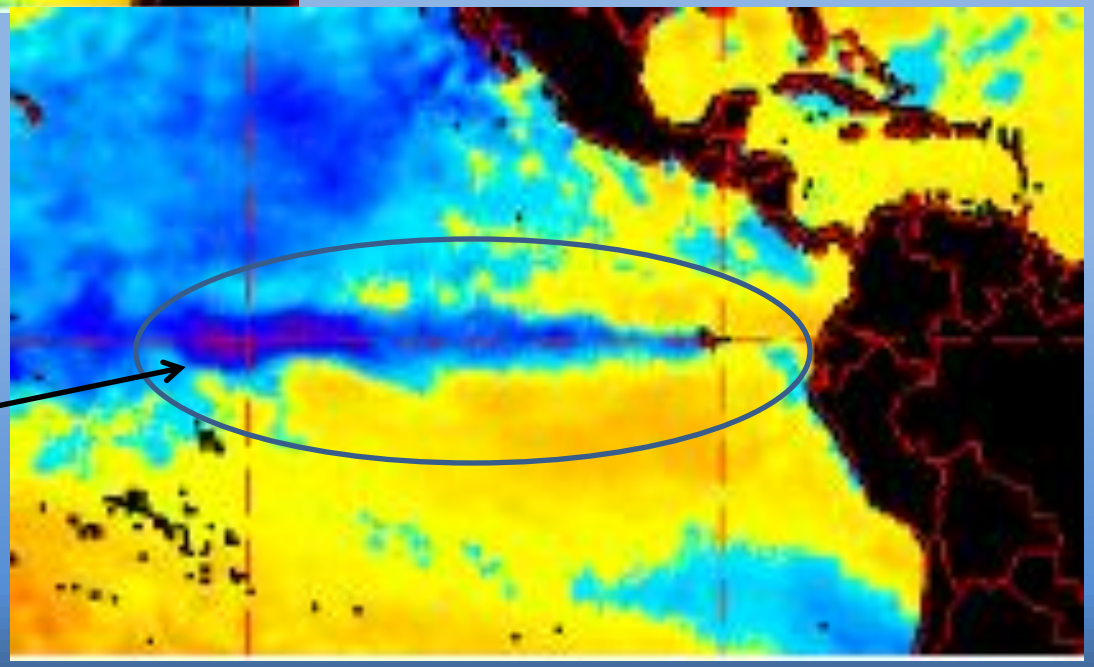
Climate Connection Workshop Series
October 24, 2012

El Niño (December 1997)



- definition of ENSO
- timescale
- climate connection

La Niña (December 1998)

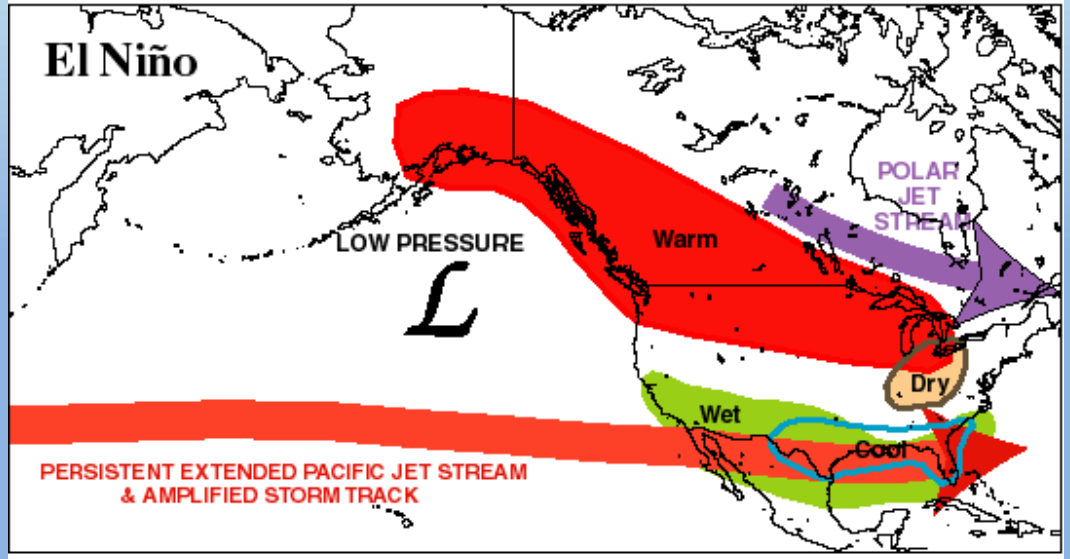


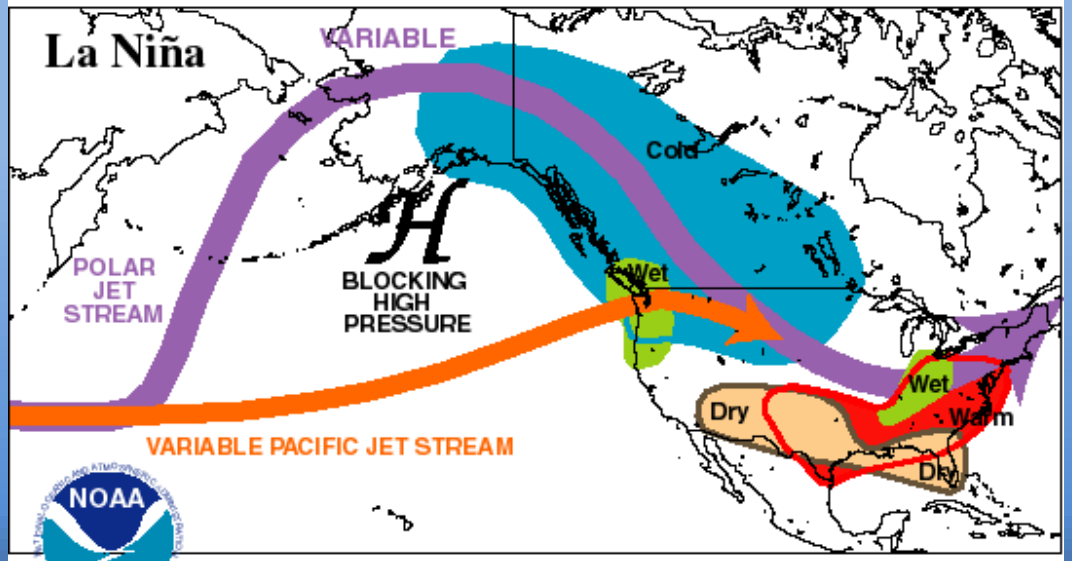
warm SST

cold SST

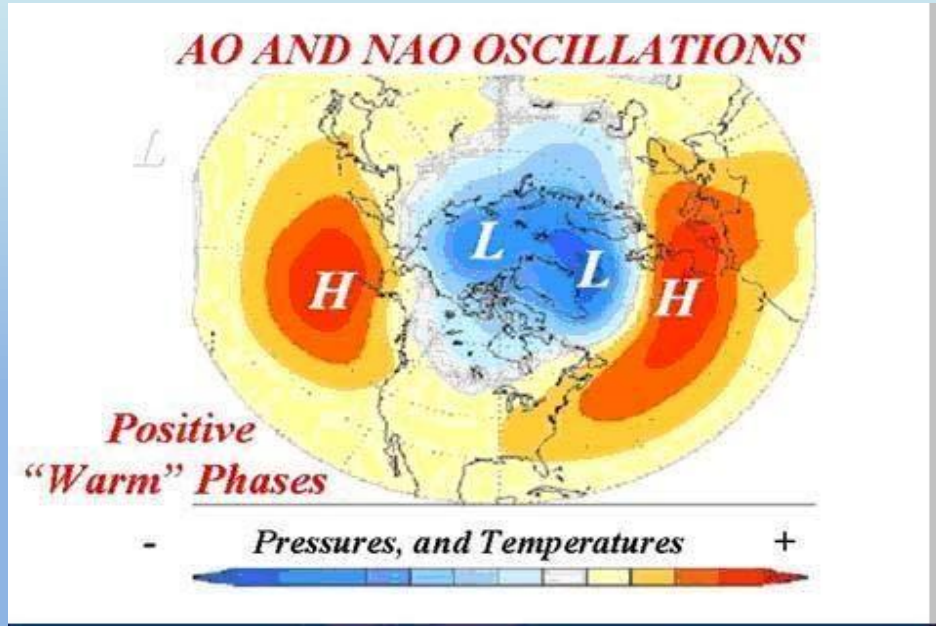
Image Source: http://www.srh.noaa.gov/tbw/?n=tampabayelninopage

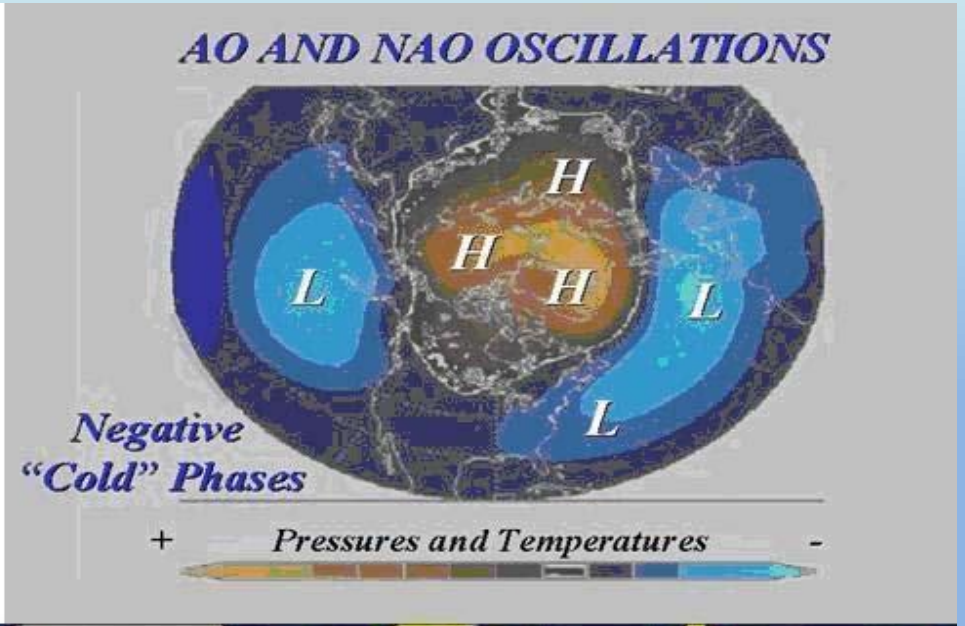
TYPICAL JANUARY-MARCH WEATHER ANOMALIES AND ATMOSPHERIC CIRCULATION DURING MODERATE TO STRONG EL NIÑO & LA NIÑA

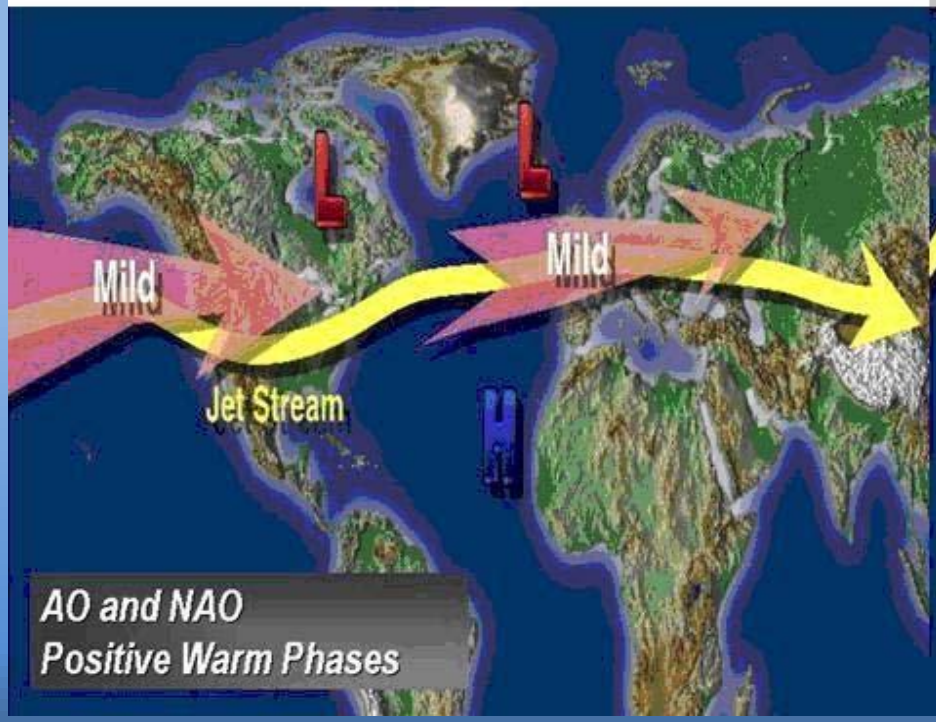




Climate Prediction Center/NCEP/NWS







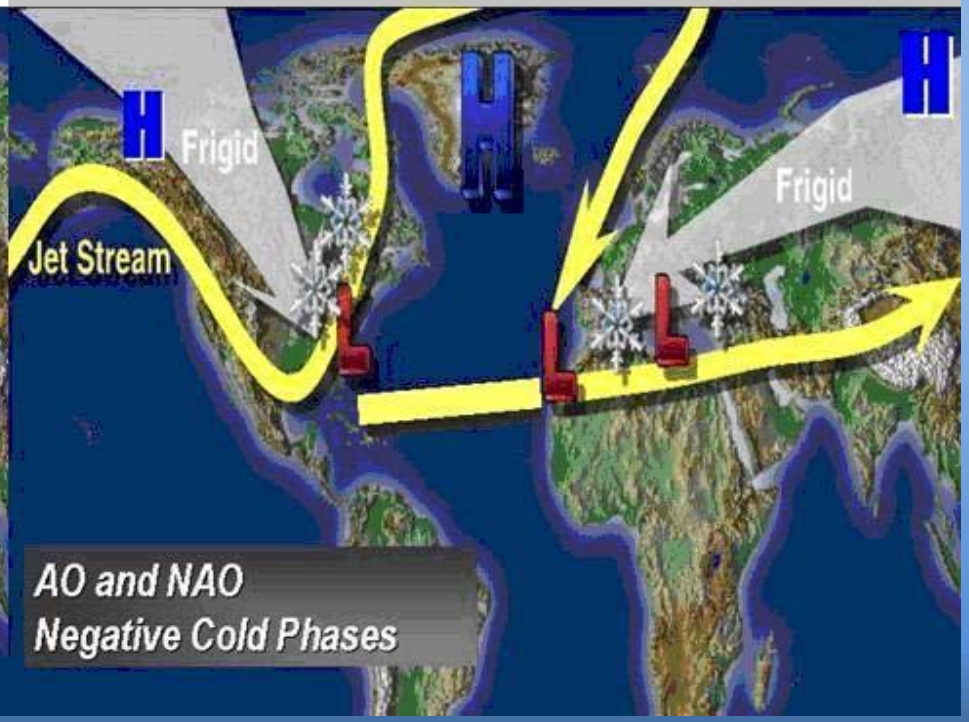


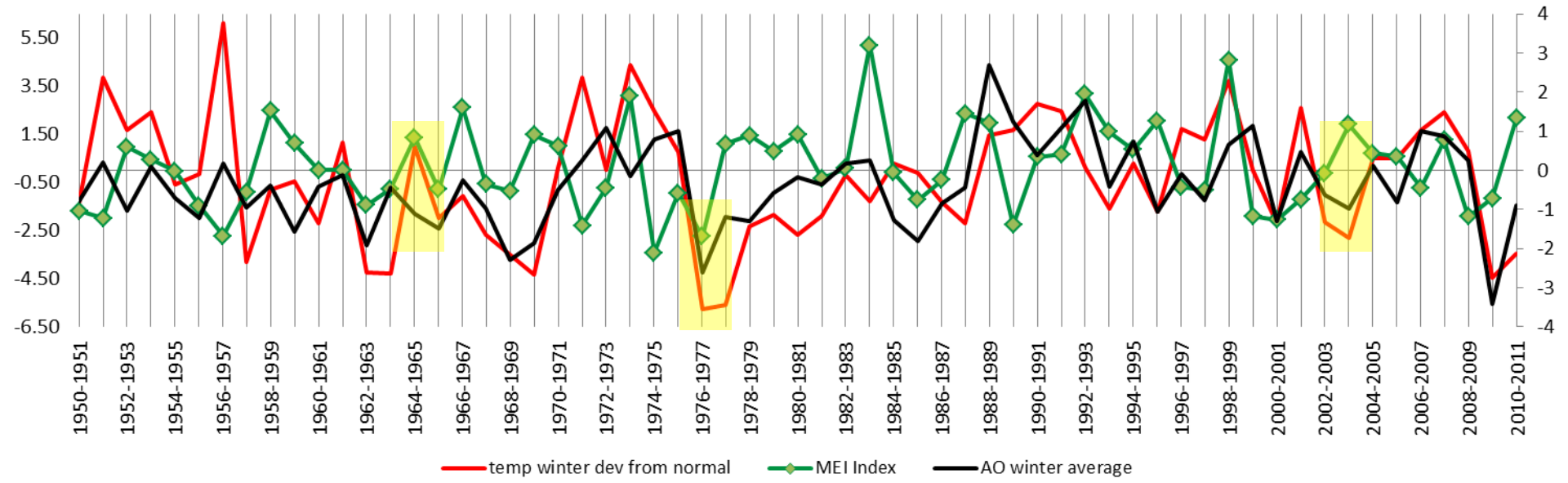
Image Source: icecap.us

Arctic Oscillation (AO)

In South Carolina, the AO has a strong winter temperature signal predominantly yielding colder temperatures in the negative phase and warmer temperatures in the positive phase.

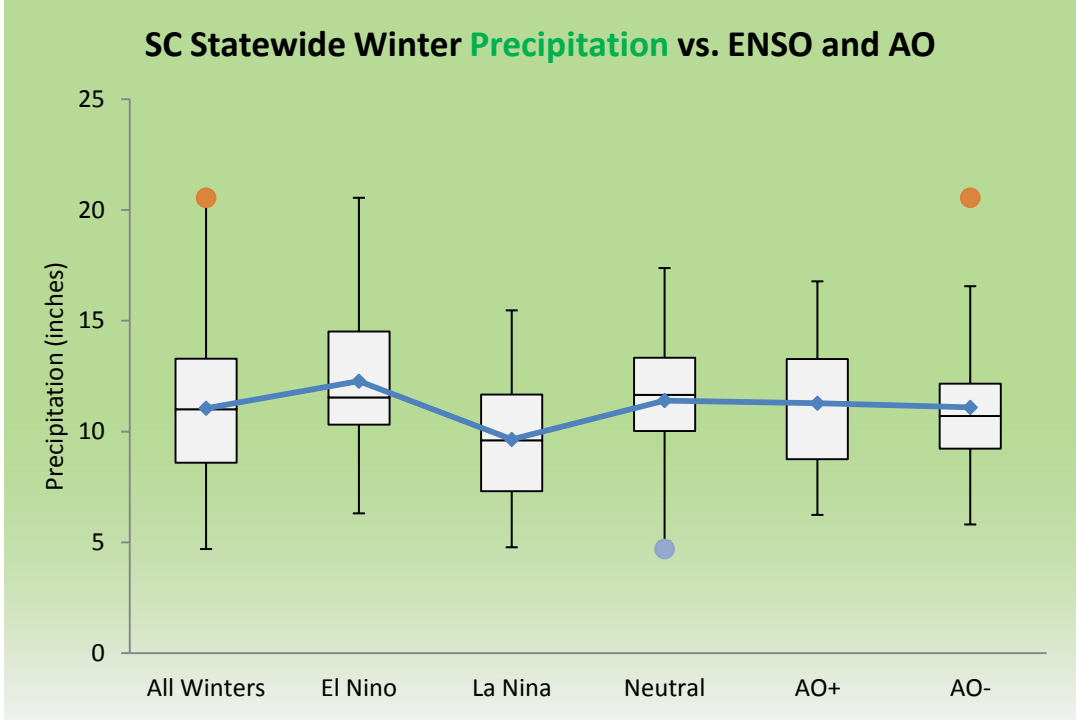
Unlike ENSO, which affects precipitation as well, the AO's precipitation signal is not significant.

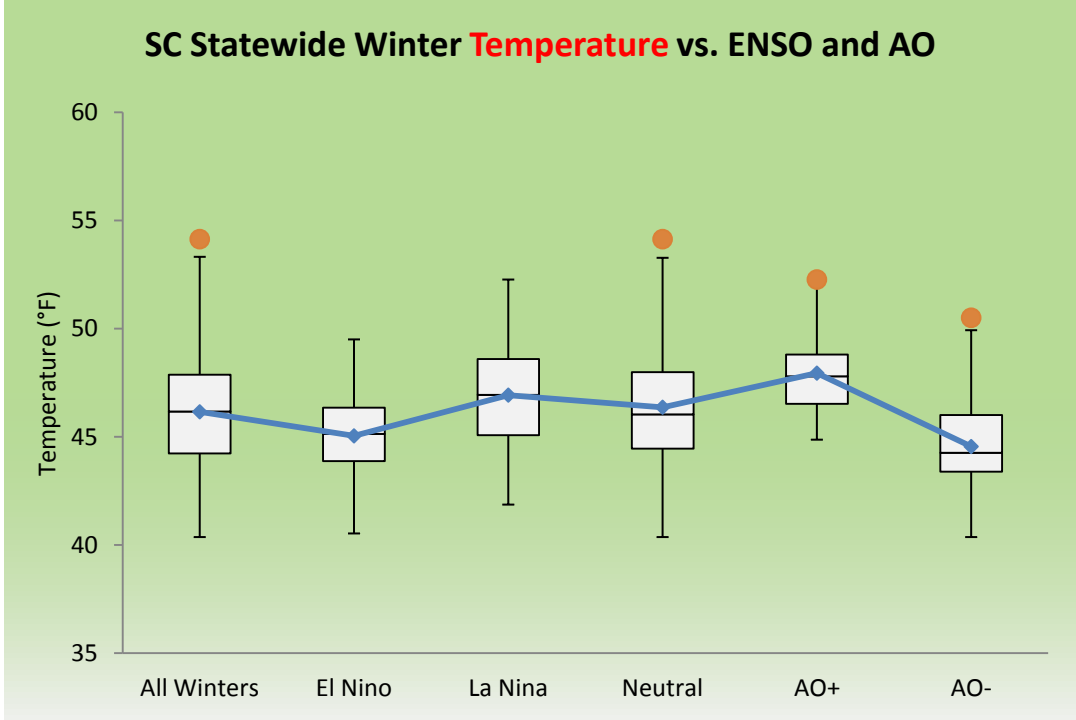
Statewide Winter Temperature vs. ENSO and AO



SC La Niña winters are warmer and drier than El Niño winters.

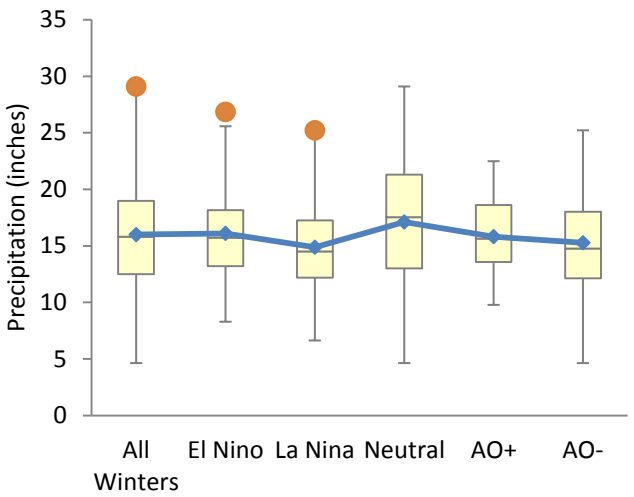
Winter temperatures were lower during the negative AO phase, but the AO phase did not seem to have an effect on winter precipitation.

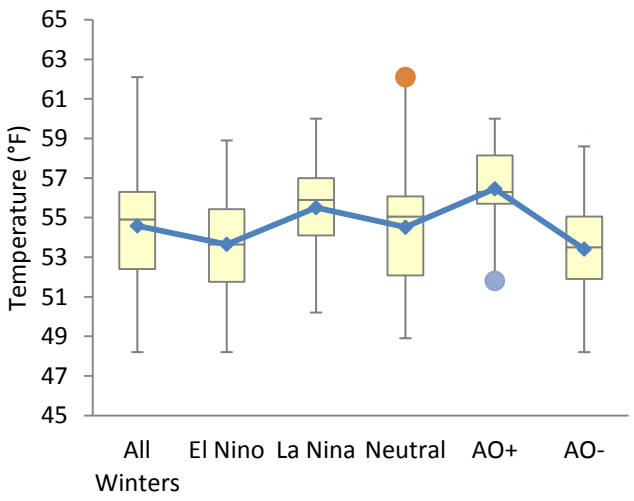


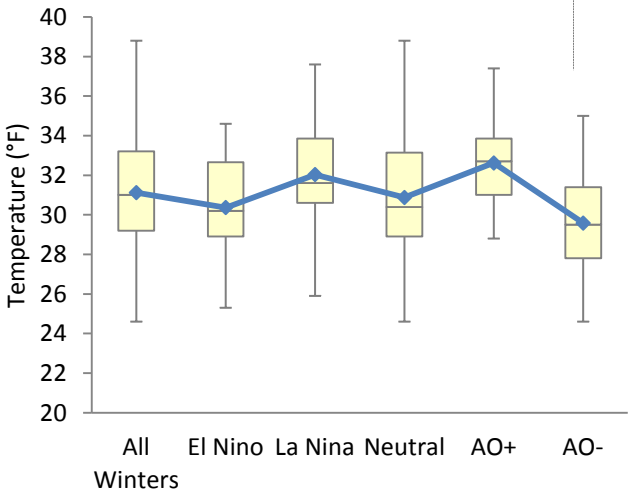


*orange (blue) circles on chart indicated upper (lower) outliers

Walhalla, SC: 1896-2012 (winter)



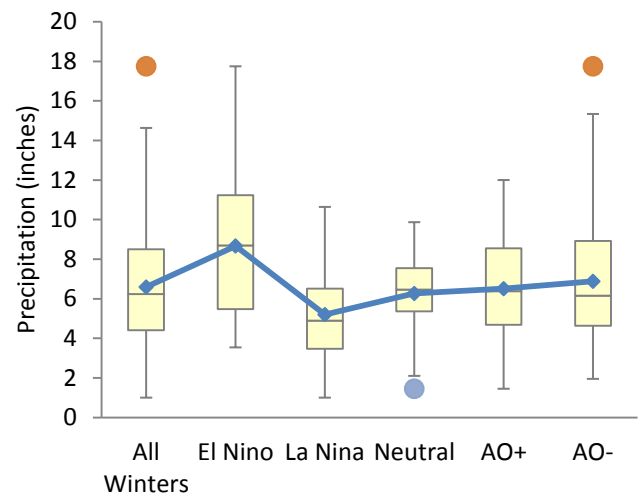


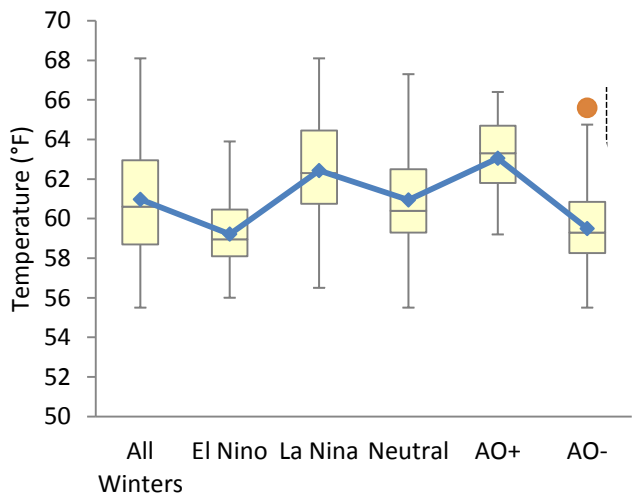


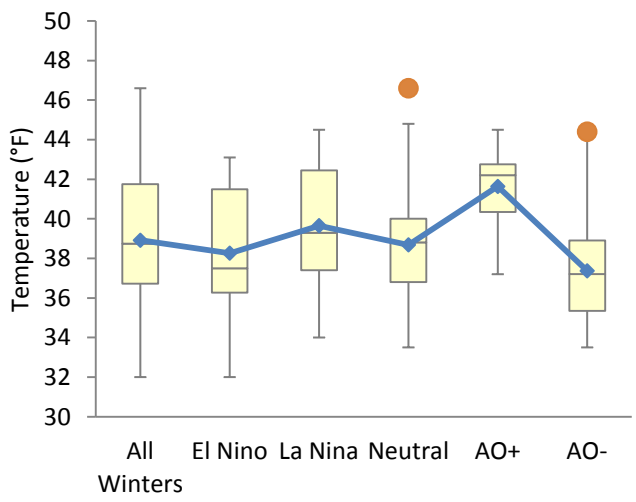
The min and max temp for Walhalla both reflect what we would expect to see for winter, with warmer temperatures associated with La Niña and a positive AO phase.

The variations in precipitation are not as pronounced for Walhalla, with only a slight decrease in La Niña winters.

Charleston, SC: 1938-2012 (winter)





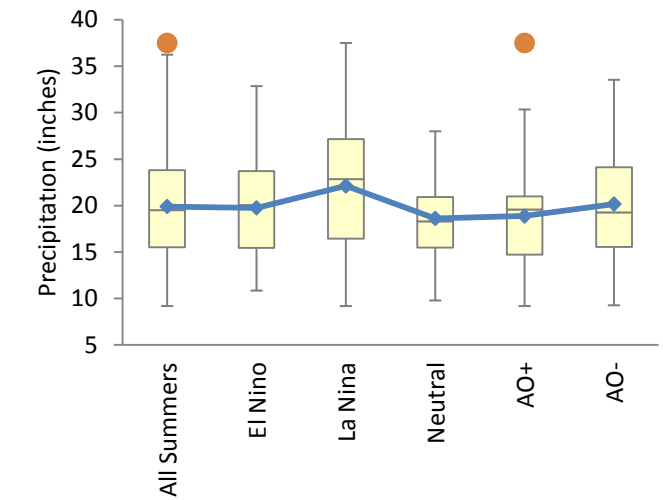


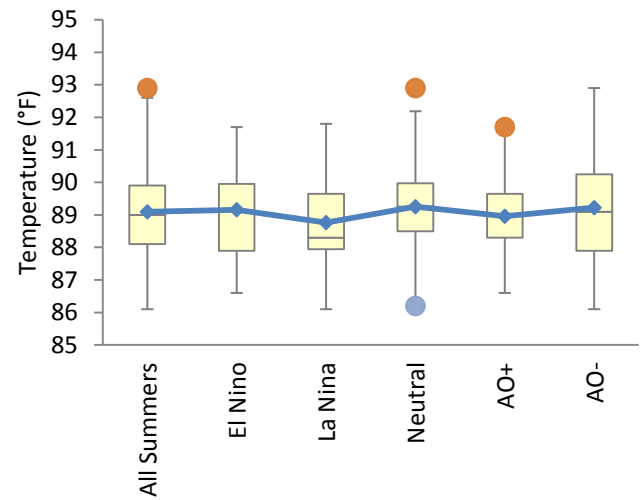
The max temp for Charleston shows a larger difference between El Niño and La Niña winters than the min temp.

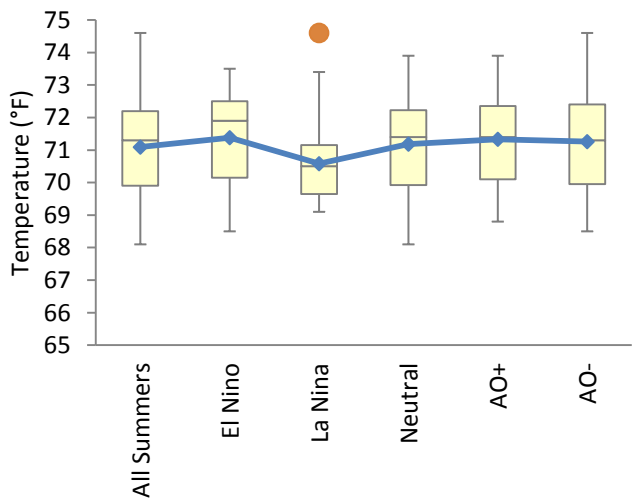
There is an even greater difference between the AO positive and AO negative winter temperature signal for Charleston, with colder max and min temperatures in the negative AO phase.

The variations in Charleston precipitation between La Niña and El Niño are more pronounced than in Walhalla, with a substantial decrease in La Niña winters.

Charleston, SC: 1938-2012 (summer)



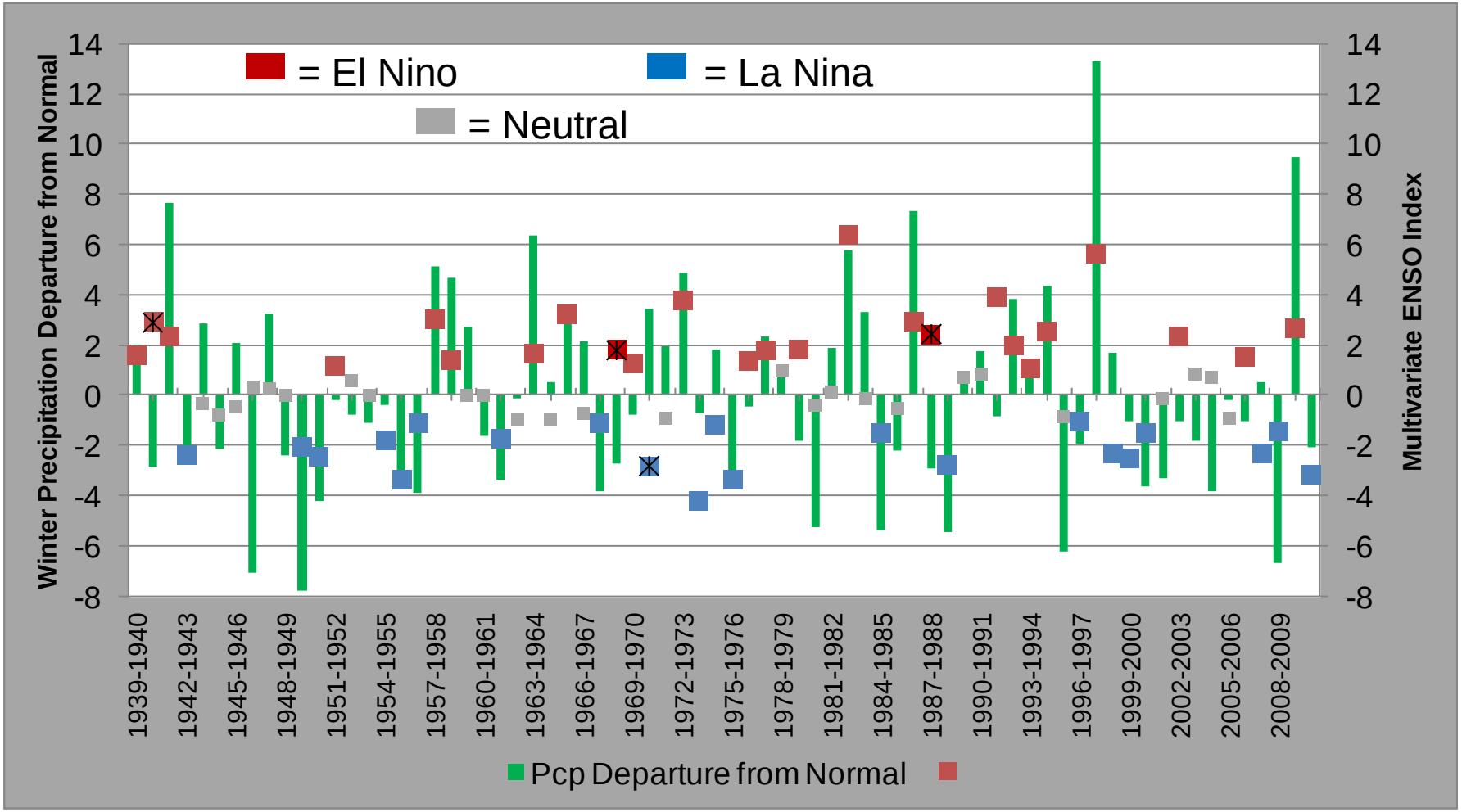




Both max and min temperature plots for Charleston show minor differences between El Niño and La Niña summers, with La Niña effects slightly more pronounced in min temps. La Niña summers are slightly wetter than El Niño summers.

The AO phase does not seem to play a significant role in summer temperatures or precipitation.

ENSO's Impact on Charleston's Winter Precipitation (inches)



Score Card (72 winters):

24 Homeruns (86%)

4 Strikeouts (14%)

18 Foul Balls

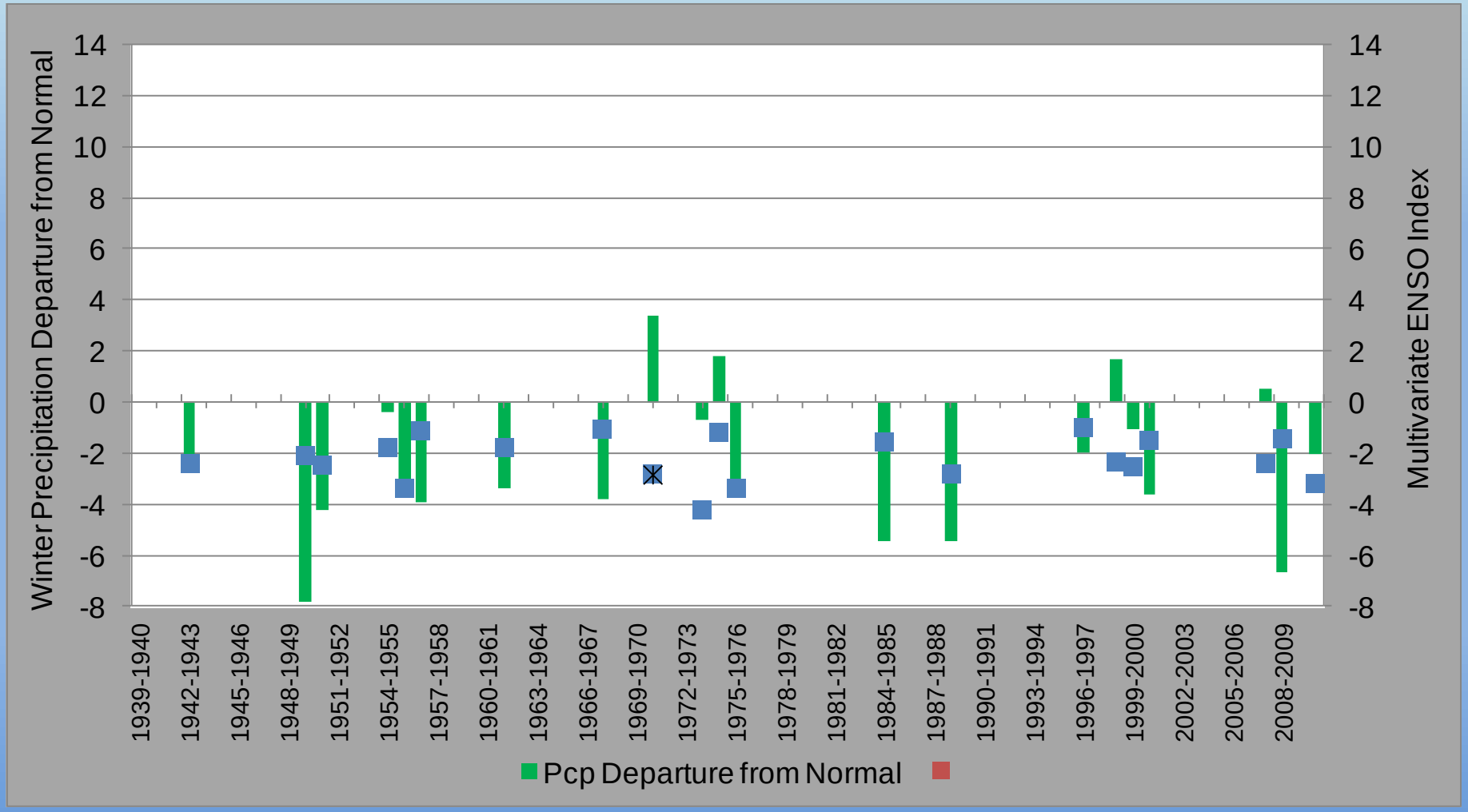
26 Seasons Didn't Play (Neutral)

Avg Winter Precip. Dev. From Norm.

Mod. to Strong La Nina: -2.51"

Mod. to Strong El Nino: +2.67"

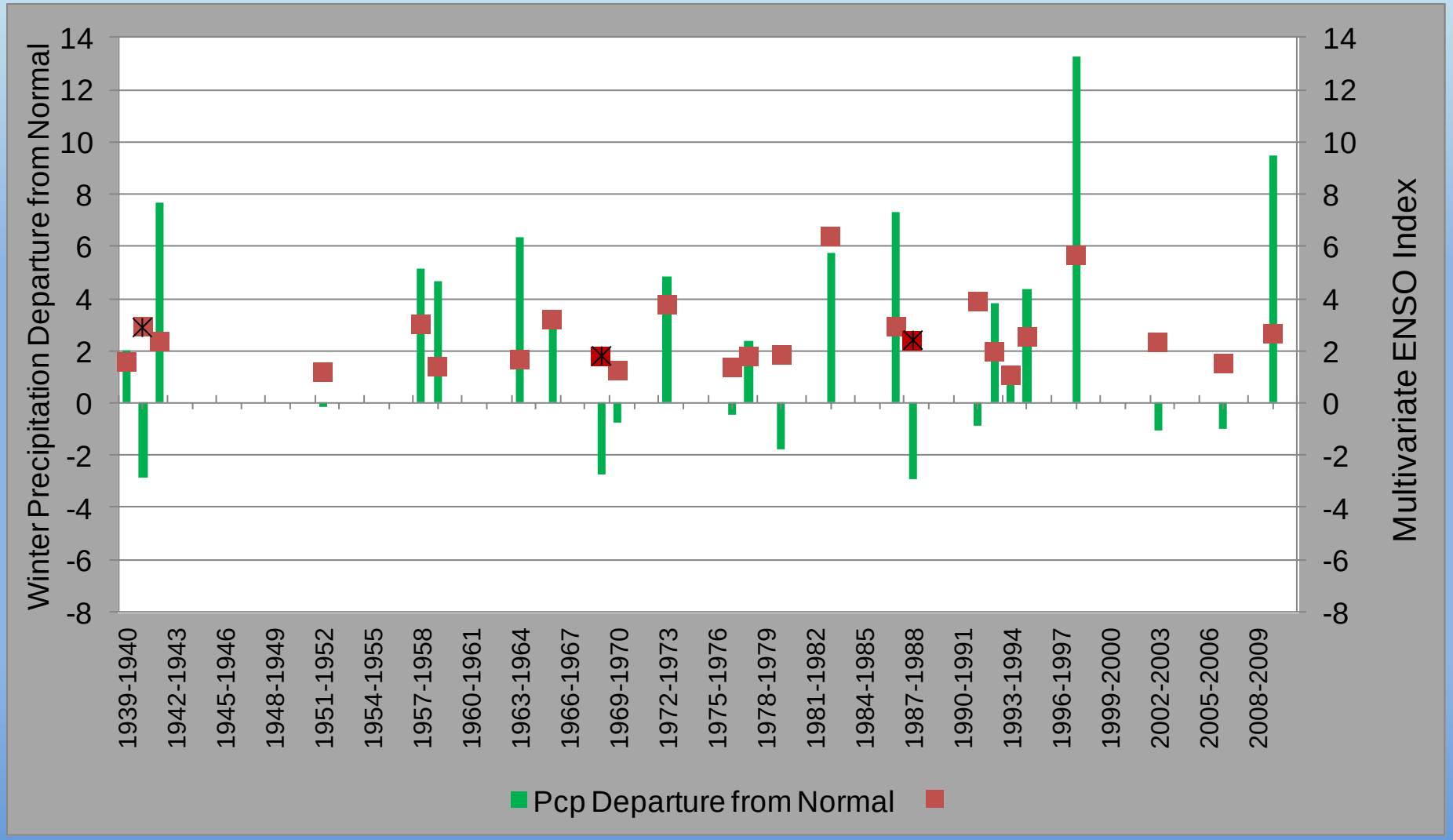
La Nina and Charleston's Winter Precipitation (inches)



<u>Avg Winter Precip. Dev. From Norm.</u>

Mod. to Strong La Nina: -2.51"

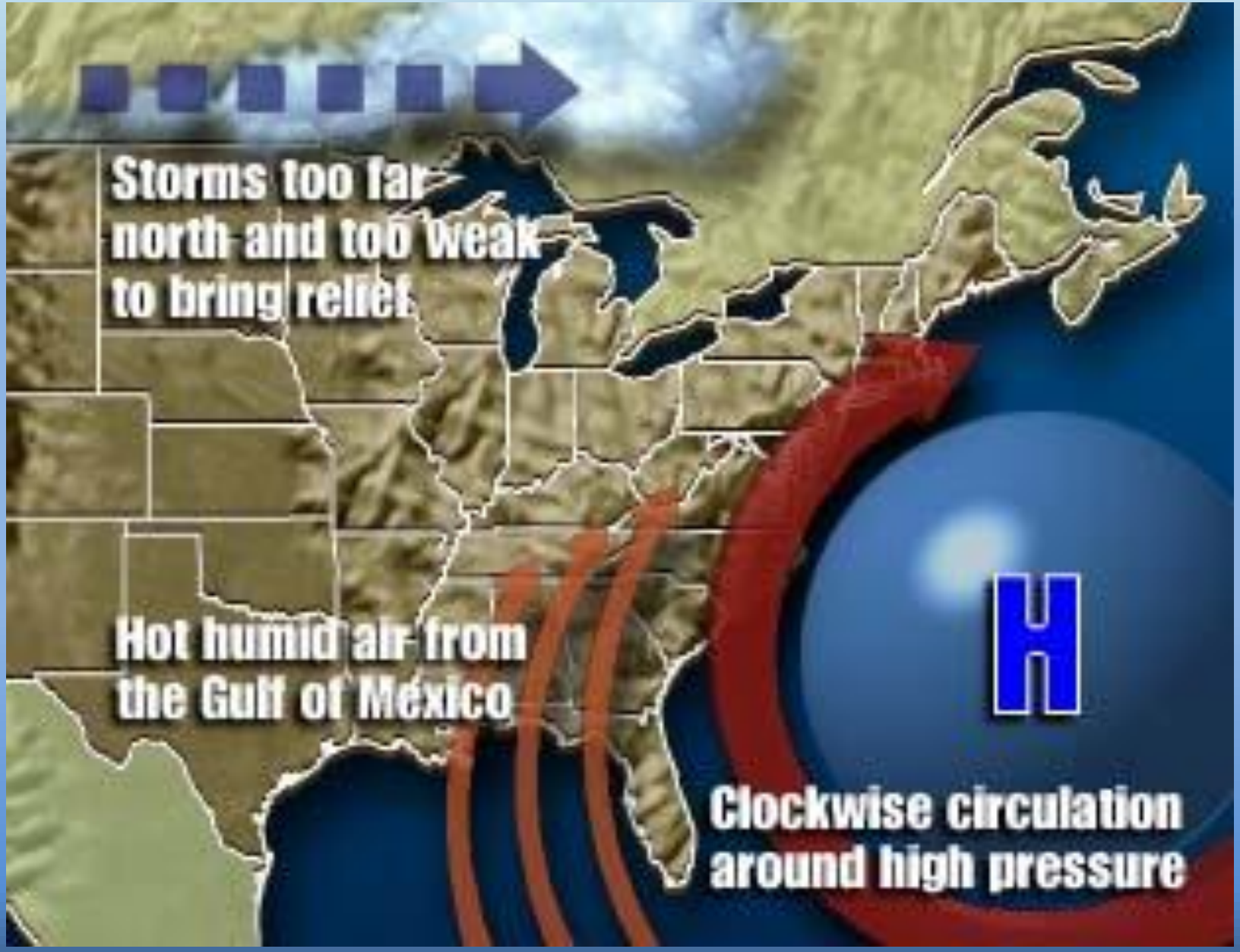
El Nino and Charleston's Winter Precipitation (inches)



<u>Avg Winter Precip. Dev. From Norm.</u>

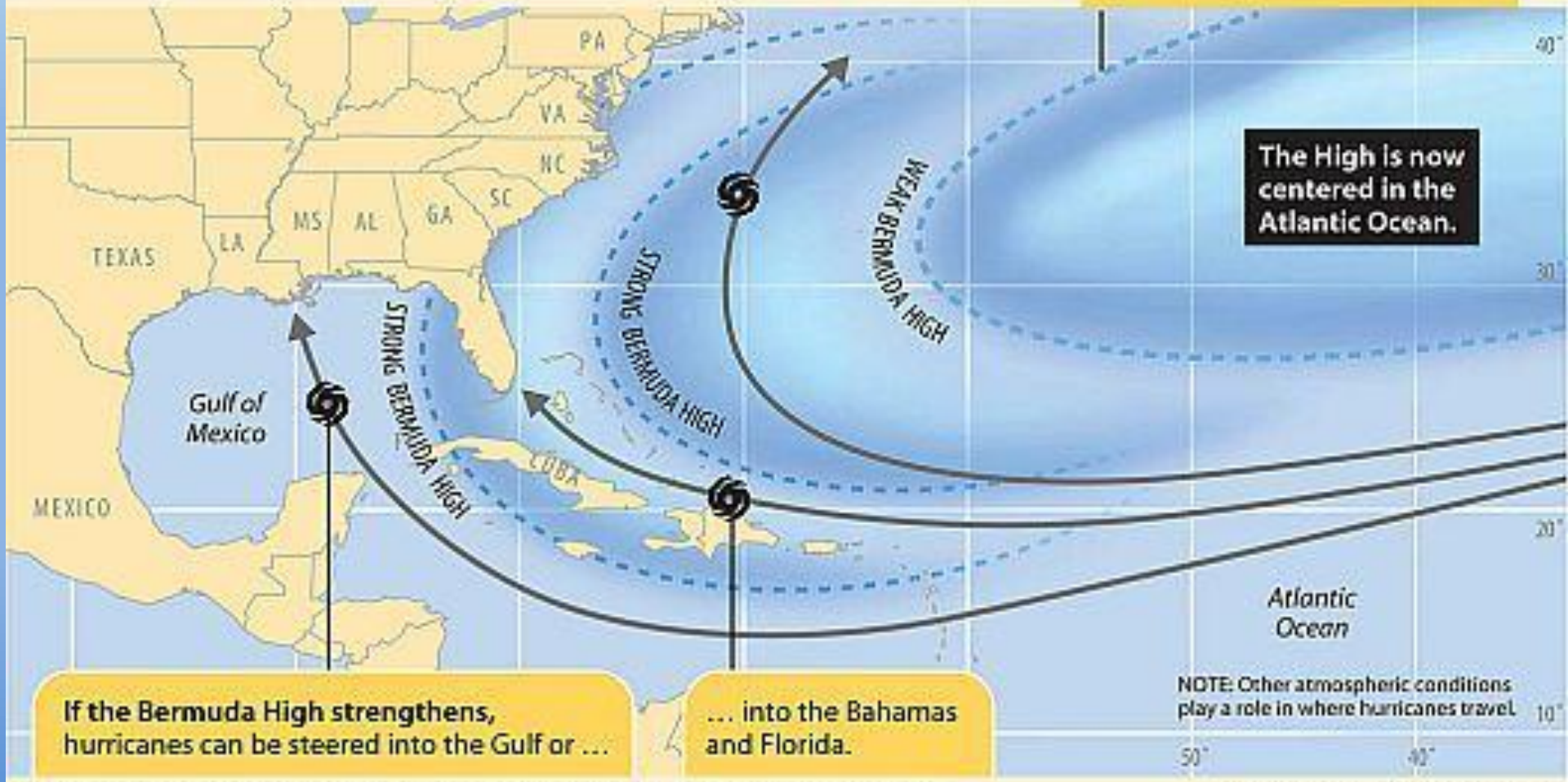
Mod. to Strong El Nino: +2.67"

Bermuda High Pressure



The Bermuda High: Navigator of hurricanes

The location and strength of the Bermuda High, a ridge of high pressure, is a major factor in determining whether South Florida is besieged with hurricanes.



SOURCES: The National Weather Service, The Weather Underground; NASA, Goddard Space Flight Center

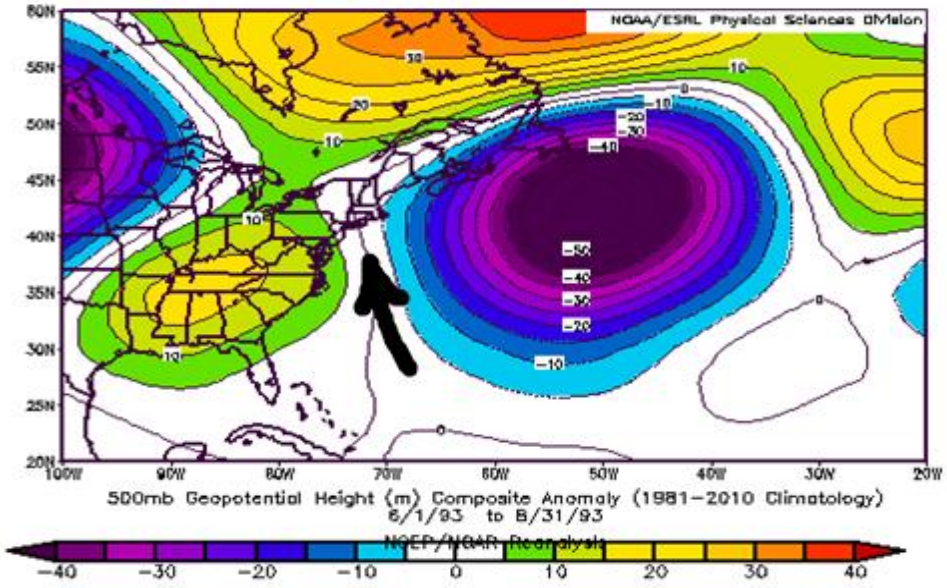
Staff graphic/Cindy Jones-Hulfachor

A Tale of Two Summers

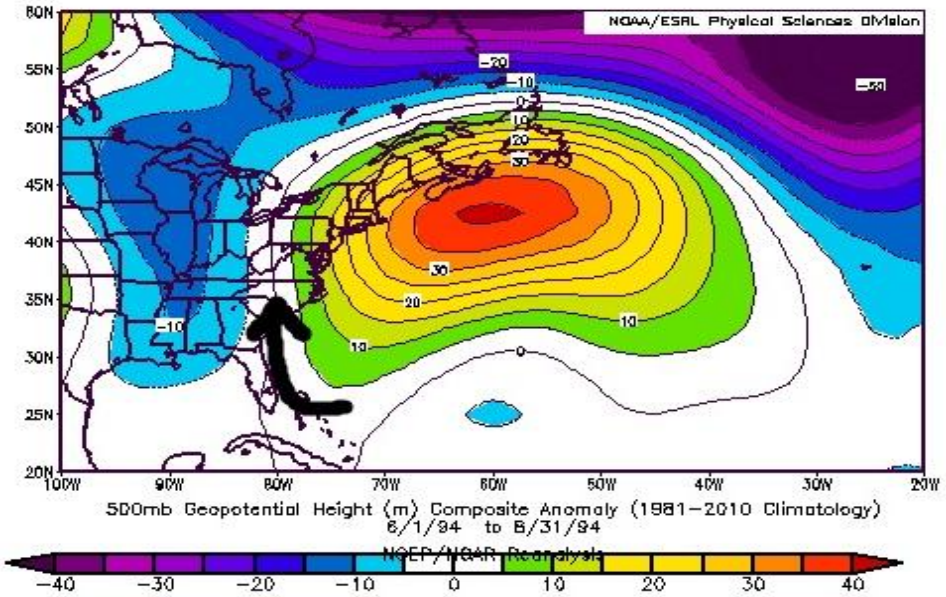
- geopotential height is the actual height (m) of a pressure level

- negative geopotential height anomaly means pressure high pressure was weaker than usual

1993 – 4th driest summer on record
16 consecutive days in July ≥100°F



1994 – Wetter than average
Tropical Storm Beryl – 11” in 4 days (Walhalla)



Thank You

"CURTIS, I WANT YOU TO FIND A WAY TO BLAME ALL THIS ON EL NINO."

http://www.dnr.sc.gov/climate/sco