Impacts of ENSO, AO, and Bermuda High on SC Climate Variability

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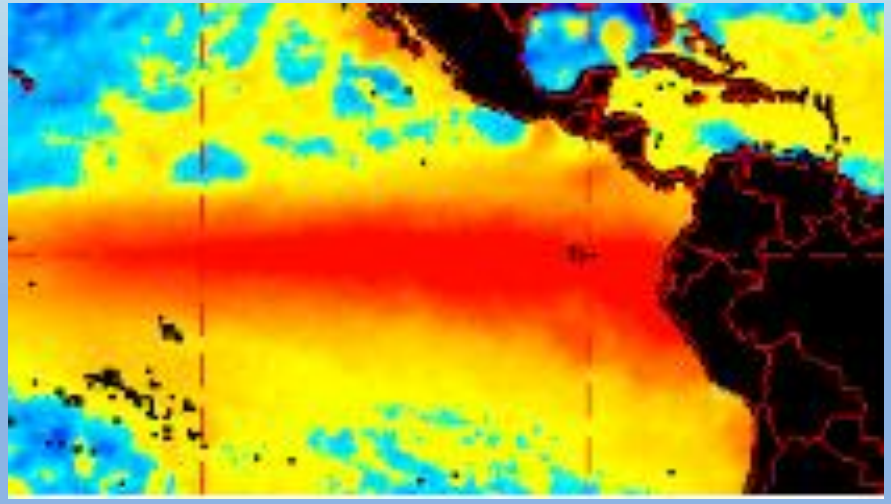
Climate Connection Workshop Series
September 13, 2012

El Niño (December 1997)



La Niña (December 1998)

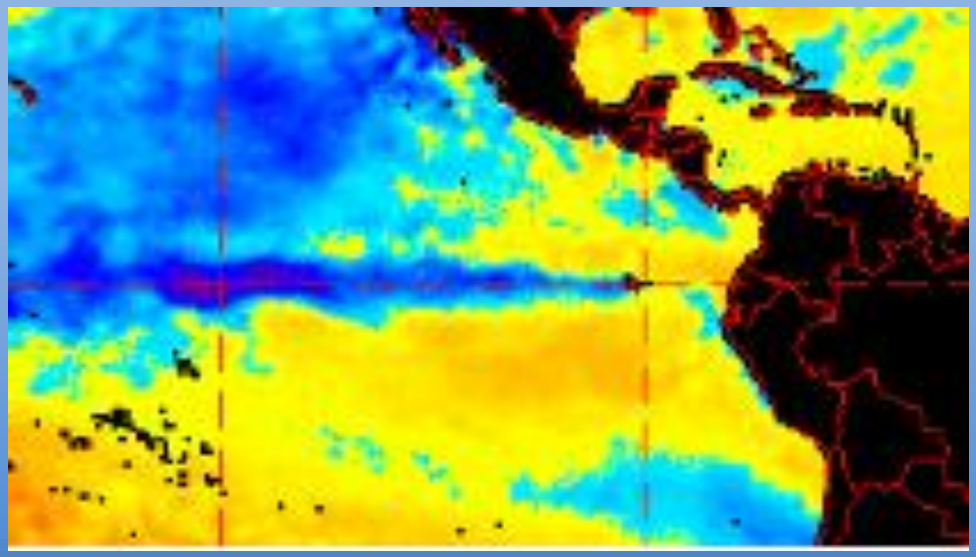
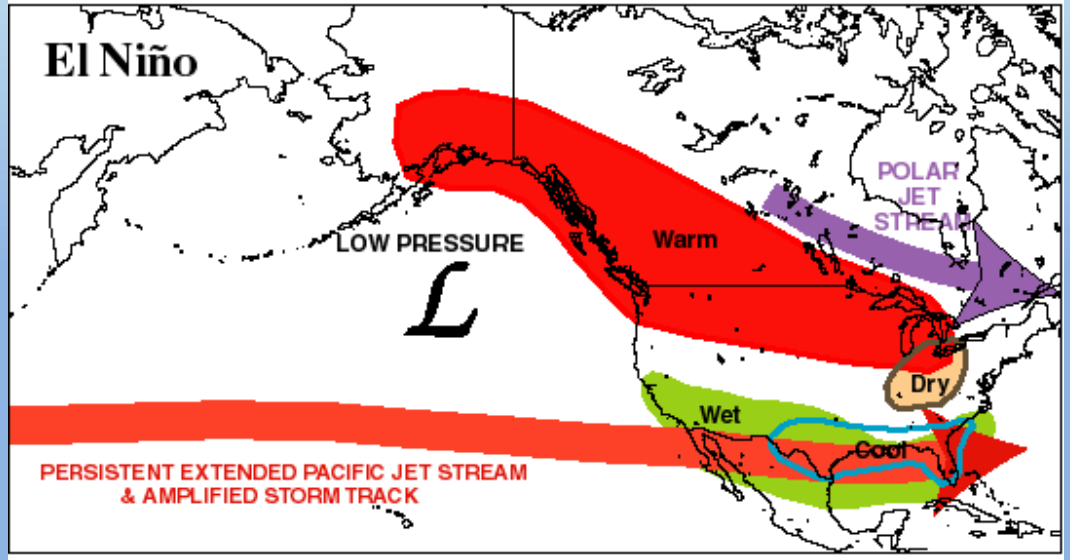
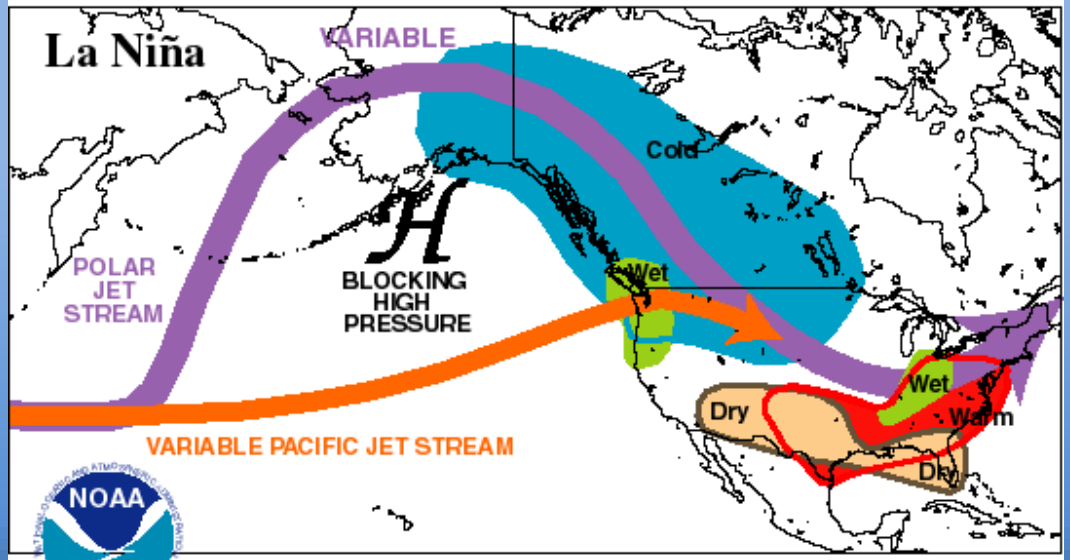


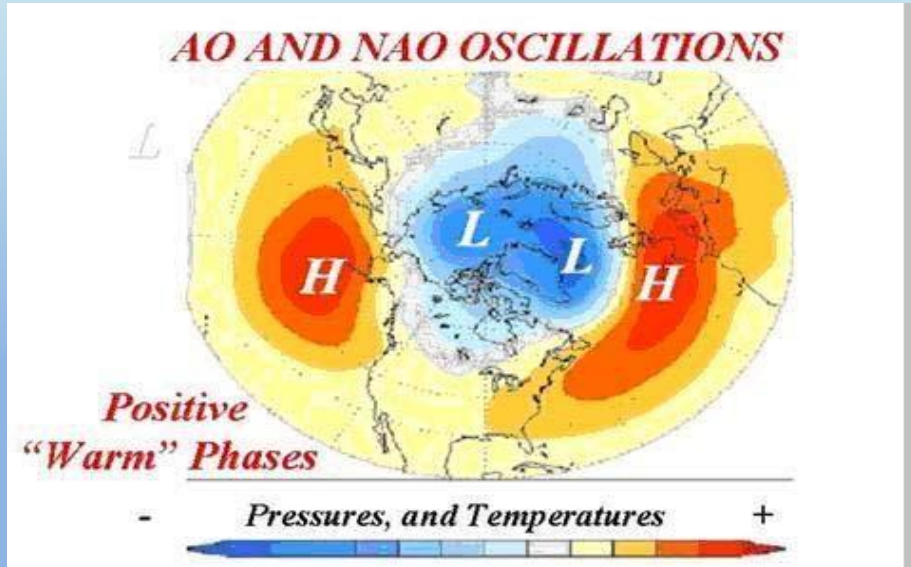
Image Source: http://www.srh.noaa.gov/tbw/?n=tampabayelninopage

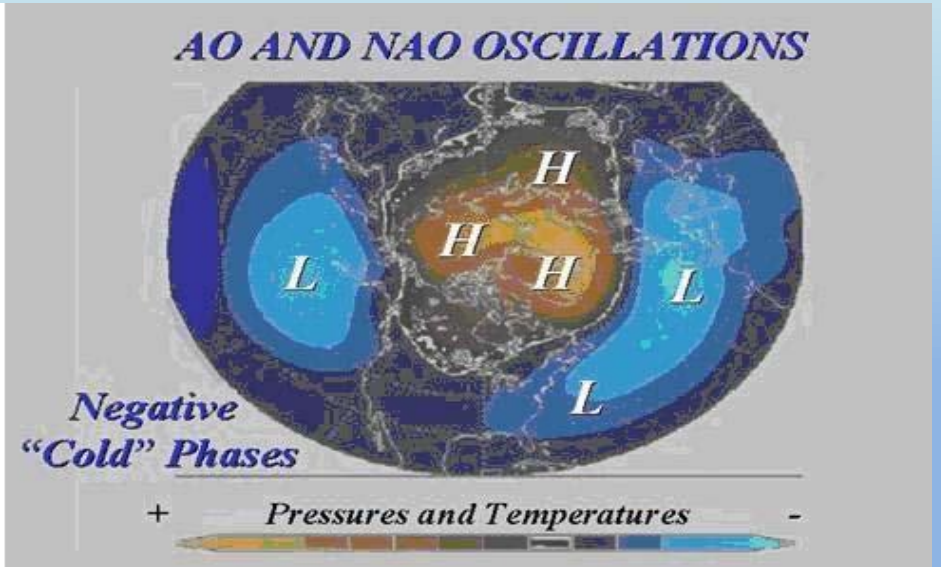
TYPICAL JANUARY-MARCH WEATHER ANOMALIES AND ATMOSPHERIC CIRCULATION DURING MODERATE TO STRONG EL NIÑO & LA NIÑA





Climate Prediction Center/NCEP/NWS





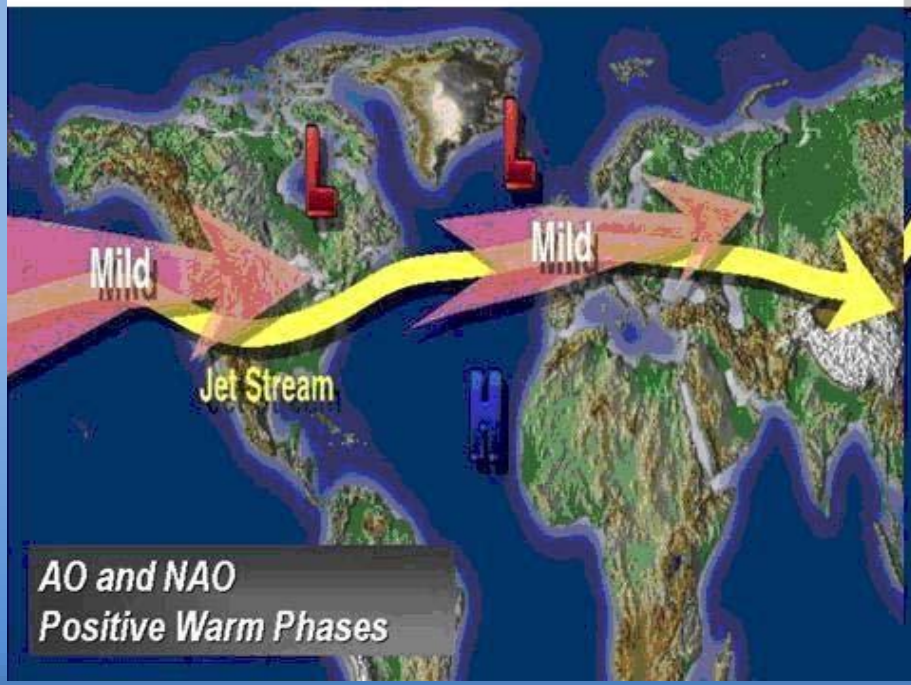


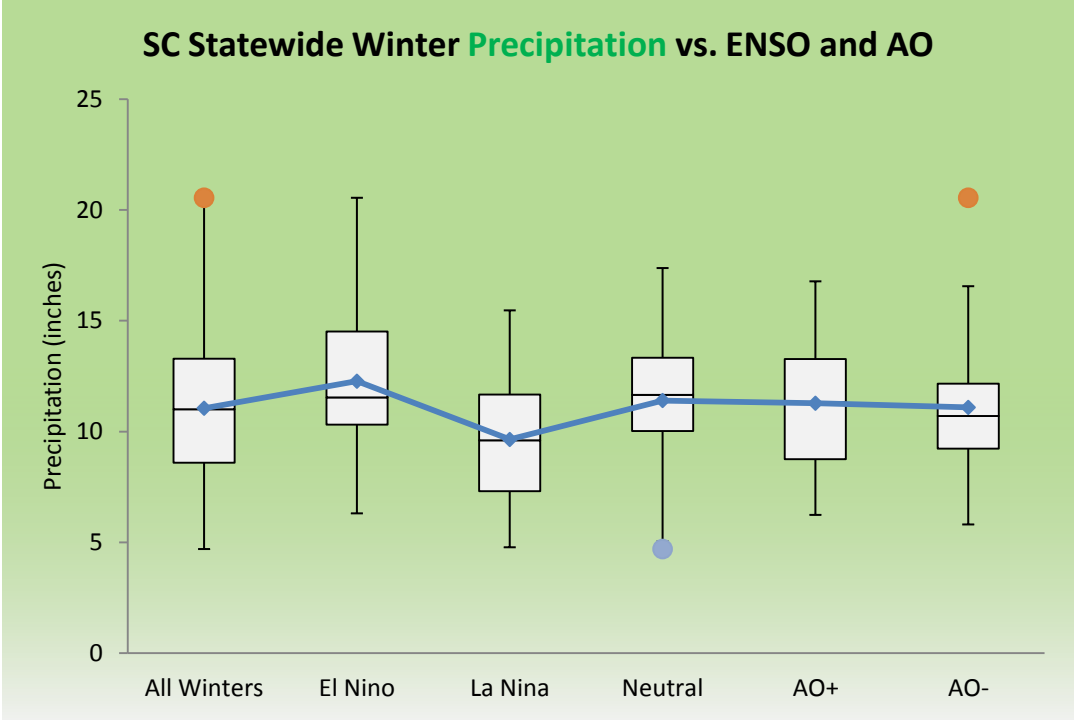
Image Source: icecap.us

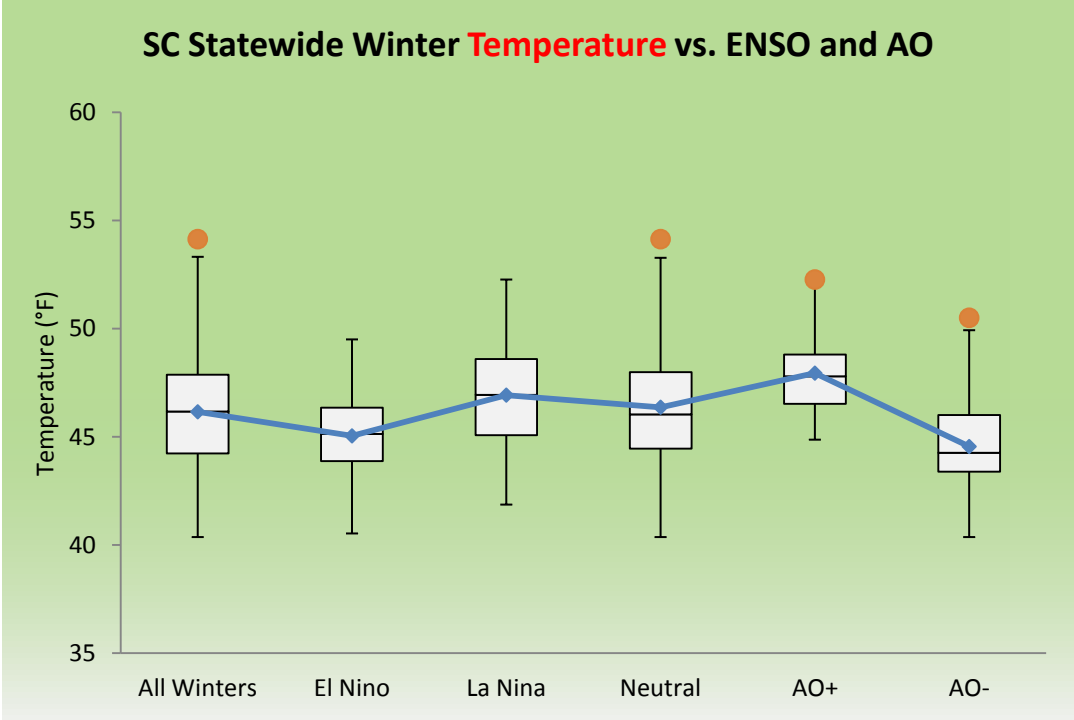
Box-and-whisker plots for the SC statewide total winter precipitation and average winter temperature, broken down into ENSO and AO phases for the period (1895-2012) for ENSO and (1950-2012) for AO.

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

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

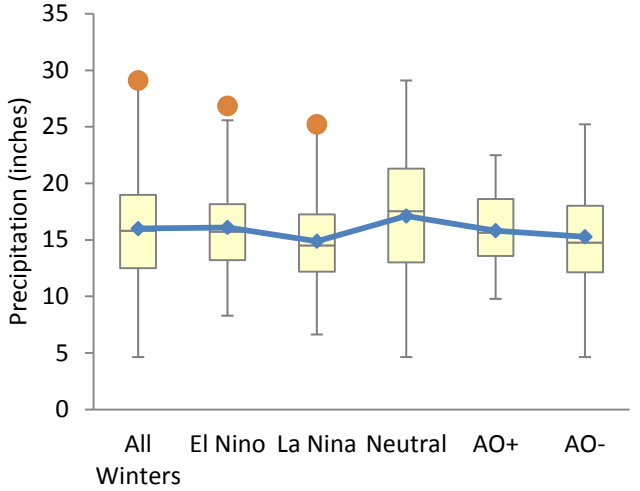
*orange (blue) circles on chart indicated upper (lower) outliers



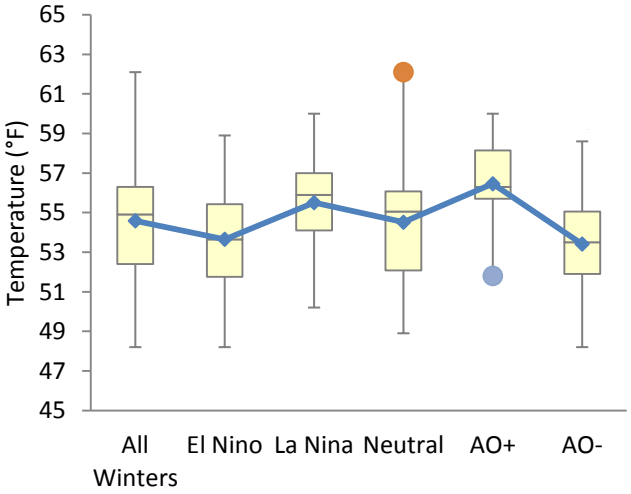


Walhalla, SC: 1896-2012 (winter)

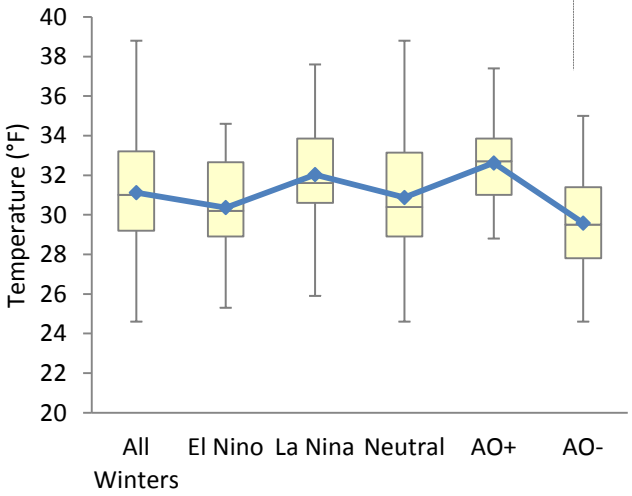
Total Winter Precip vs. ENSO and AO



Avg Winter Max Temp vs. ENSO and AO



Avg Winter Min Temp vs. ENSO and AO



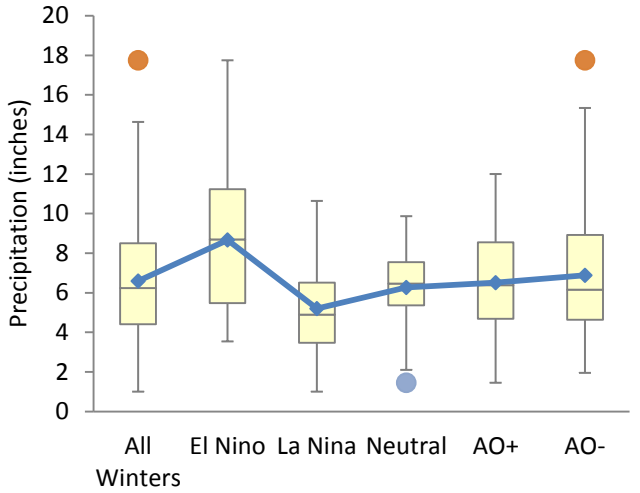
Included are specific examples for Charleston, SC and Walhalla, SC to compare the geographic as well as seasonal differences in precipitation and temperature with respect to ENSO and AO.

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.

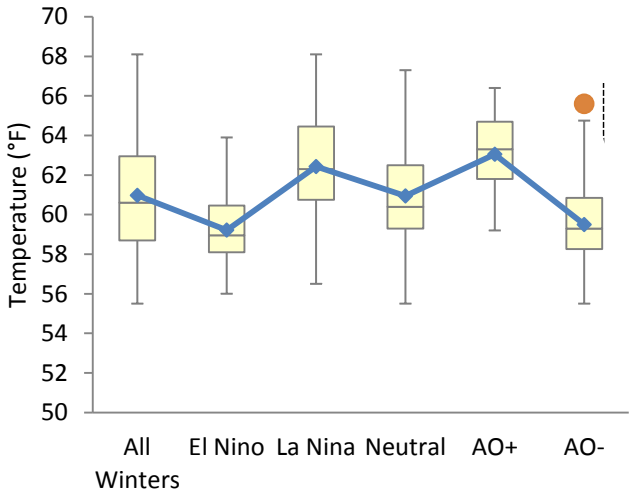
The variations in precipitation are not as pronounced for Walhalla, with only a slight decrease in La Niña winters.

Charleston, SC: 1938-2012 (winter)

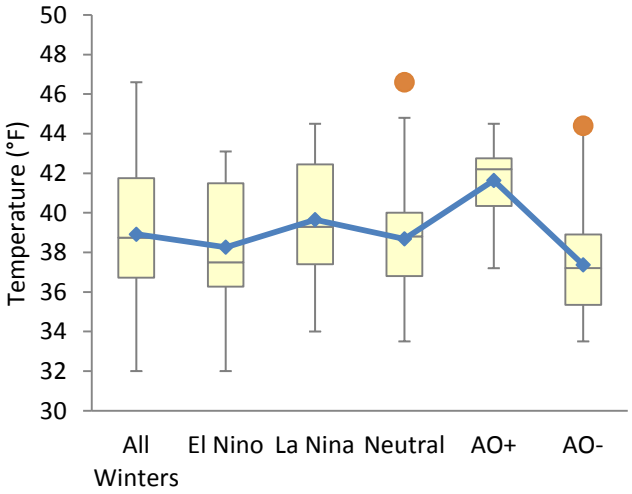
Total Winter Precip vs. ENSO and AO



Avg Winter Max Temp vs. ENSO and AO



Avg Winter Min Temp vs. ENSO and AO



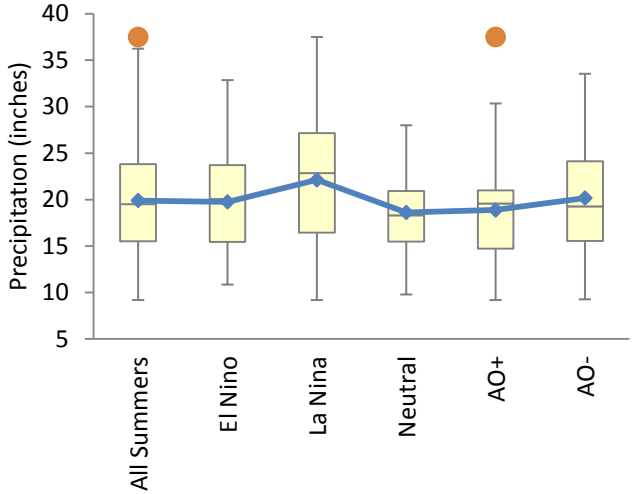
The max temp for Charleston shows a larger difference between El Niño and La Niña winters than the min temp.

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.

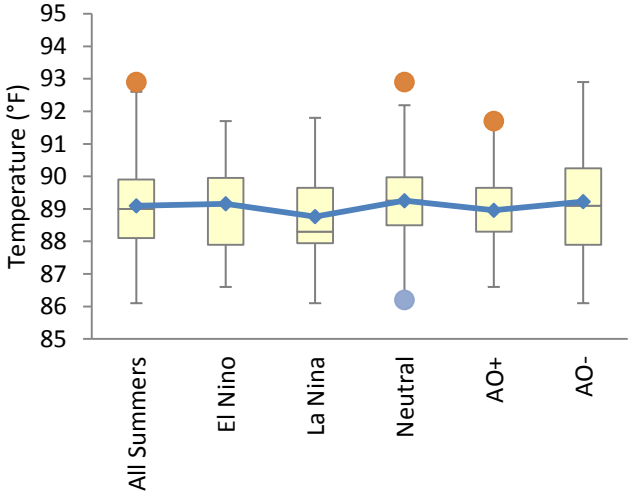
The variations in Charleston precipitation between La Niña and El Niño are more pronounced than in Walhalla, with a substantial decrease in La Niña winters.

Charleston, SC: 1938-2012 (summer)

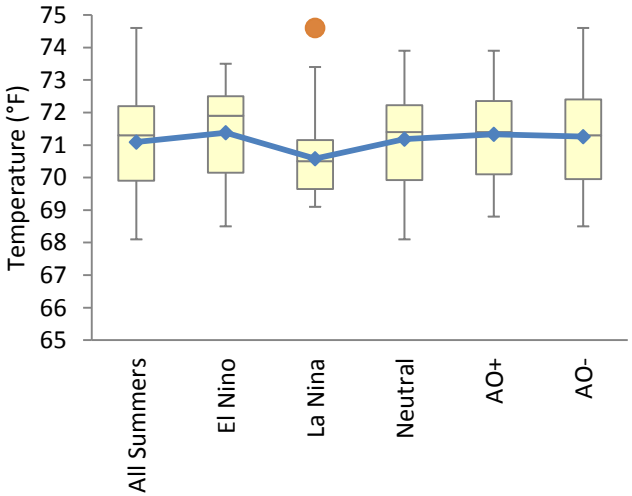
Total Summer Precip vs. ENSO and AO



Avg Summer Max Temp vs. ENSO and AO



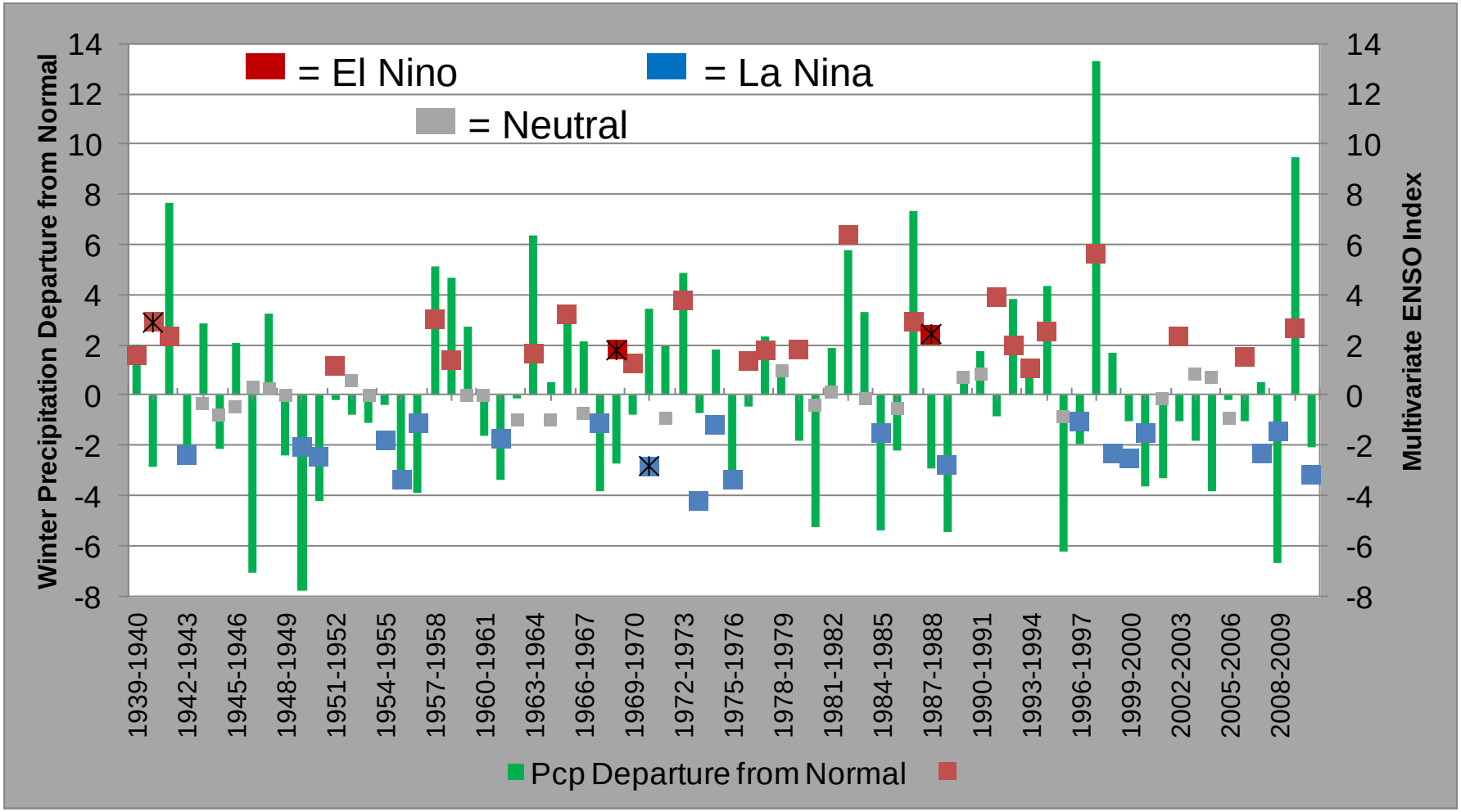
Avg Summer Min Temp vs. ENSO and AO



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)



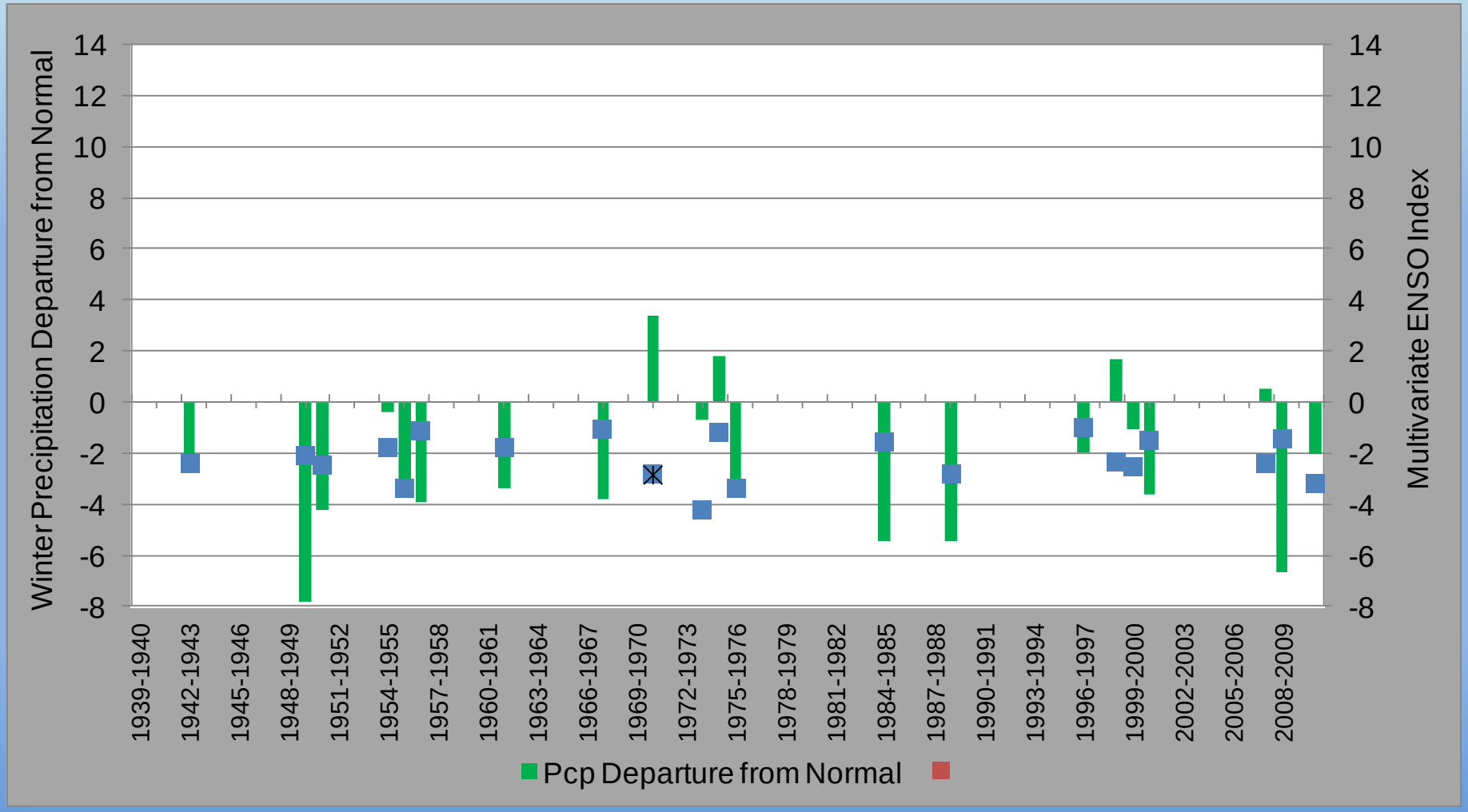
Score Card (72 winters):

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"

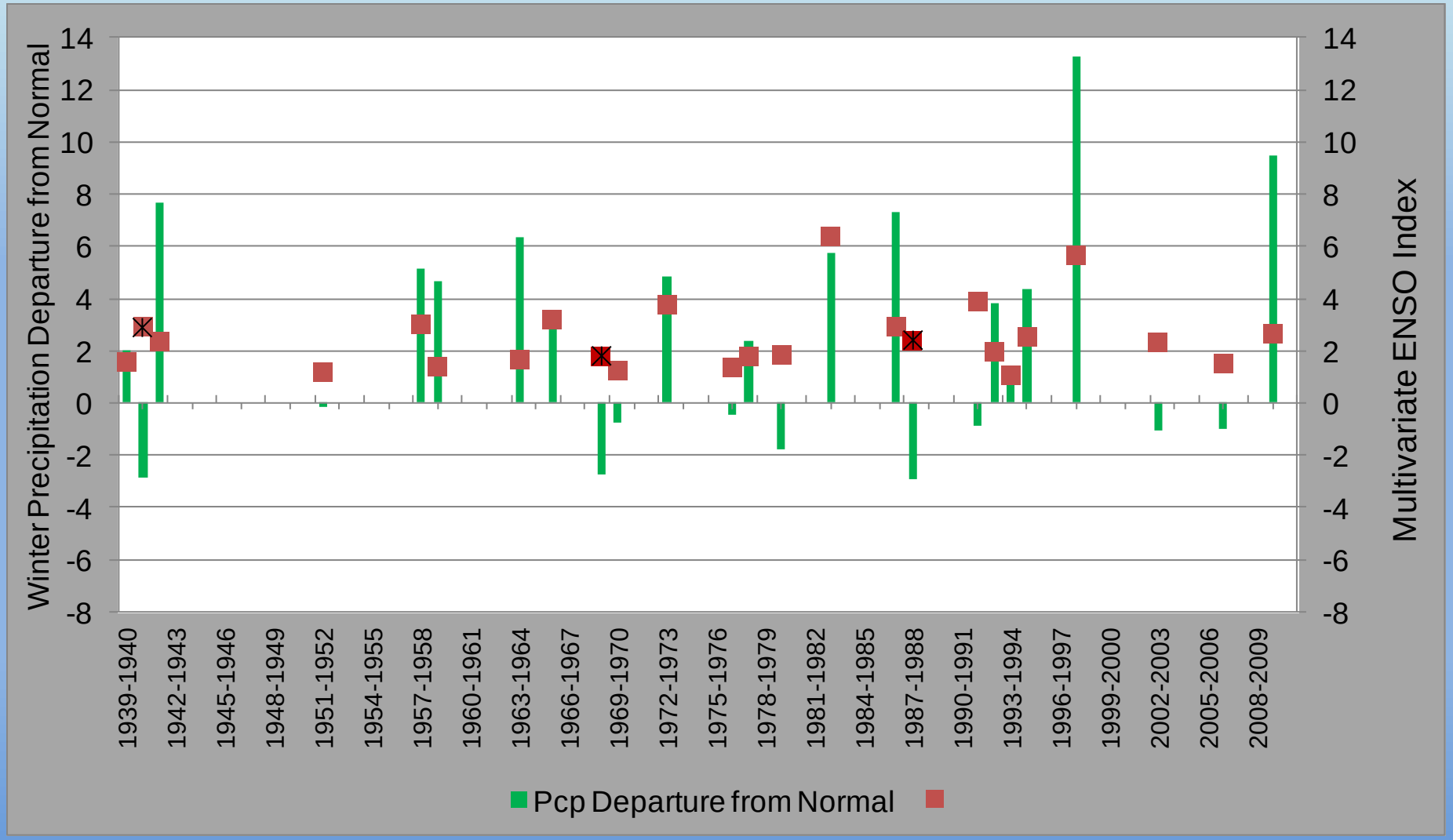
La Nina and Charleston's Winter Precipitation (inches)



Avg Winter Precip. Dev. From Norm.

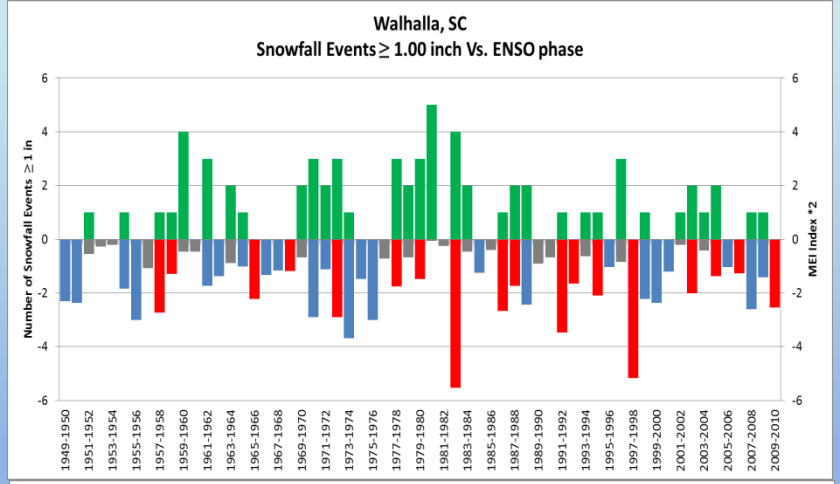
Mod. to Strong La Nina: -2.51"

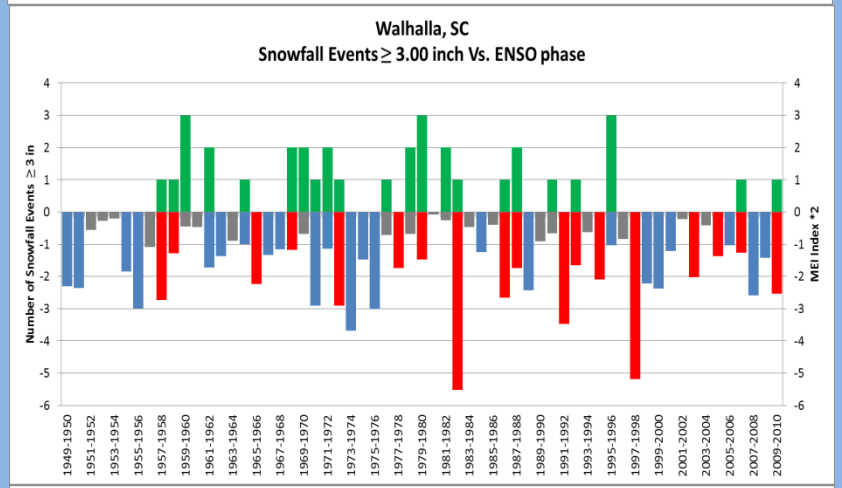
El Nino and Charleston's Winter Precipitation (inches)

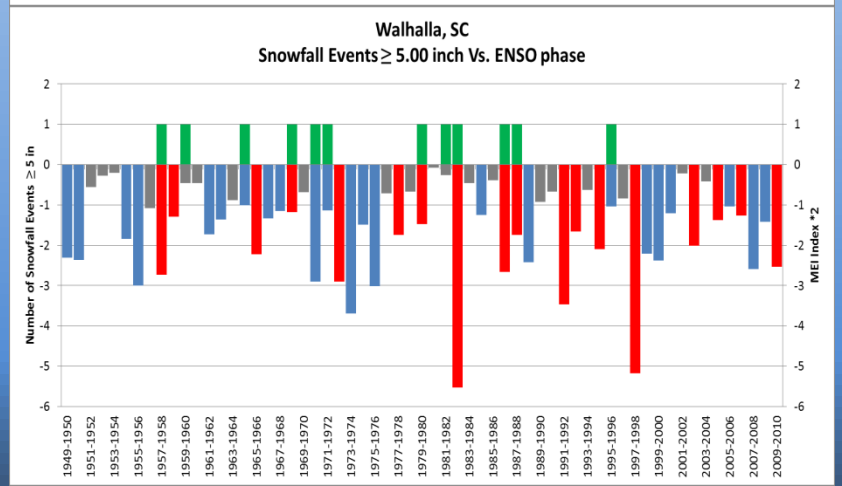


Avg Winter Precip. Dev. From Norm.

Mod. to Strong El Nino: +2.67"







Walhalla, SC – Snowfall Events vs. ENSO phase

El Nino – 12/33 – 36%
La Nina – 10/33 – 30%
Neutral – 11/33 – 33%

Events ≥ 1 inch are dispersed almost equally with about ⅓ of the events occurring in each phase.

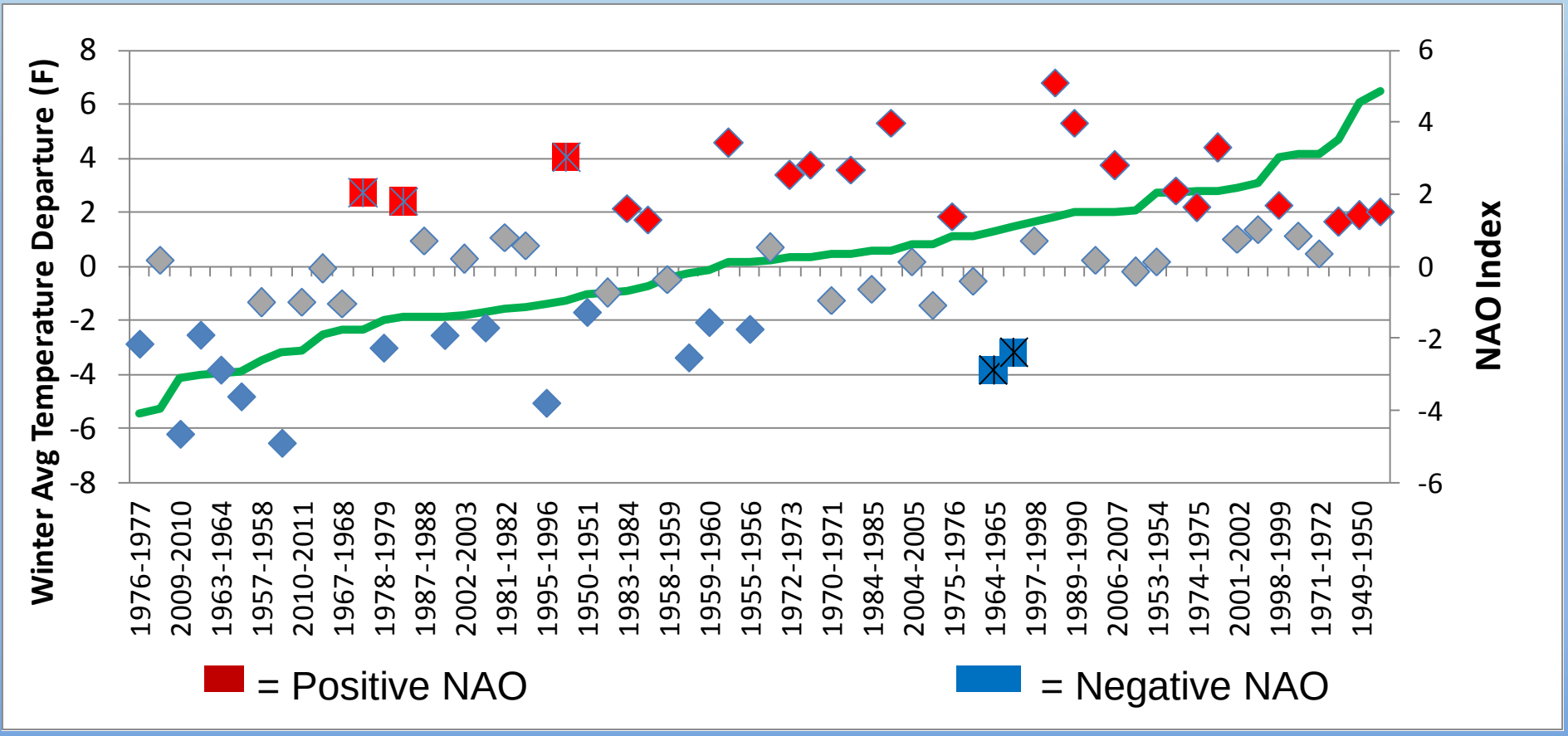
El Nino – 11/22 – 50%
La Nina – 5/22 – 23%
Neutral – 6/22 – 27%

Events ≥ 3 inches occur in the El Niño phase 50% of the time and in the La Niña phase 23% of the time.

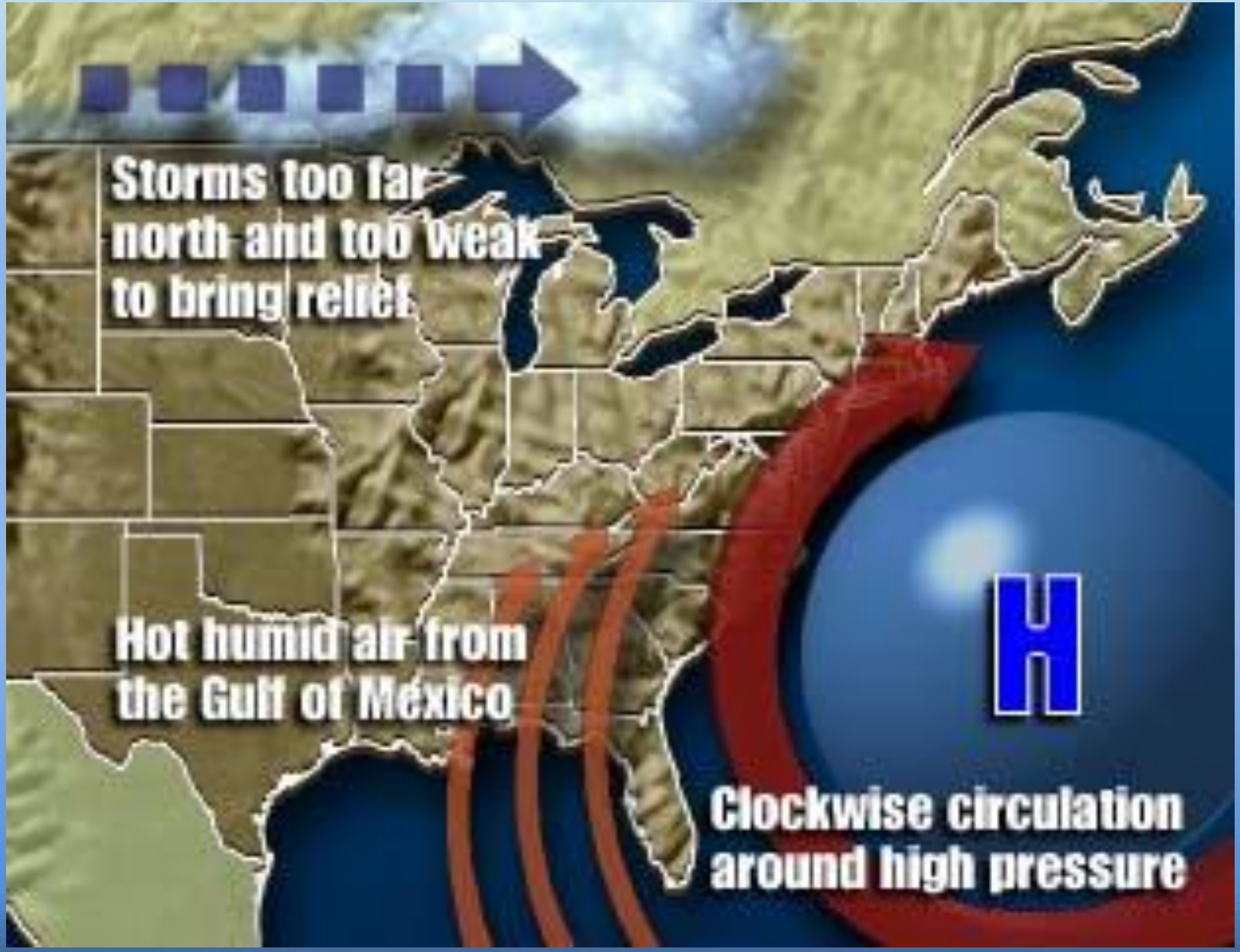
El Nino – 6/12 – 50%
La Nina – 4/12 – 33%
Neutral – 2/12 – 17%

Events ≥ 5 inches occur in the El Niño phase 50% of the time and in the La Niña phase 33% of the time.

North Atlantic Oscillation and SC's Winter Temperature (º F)

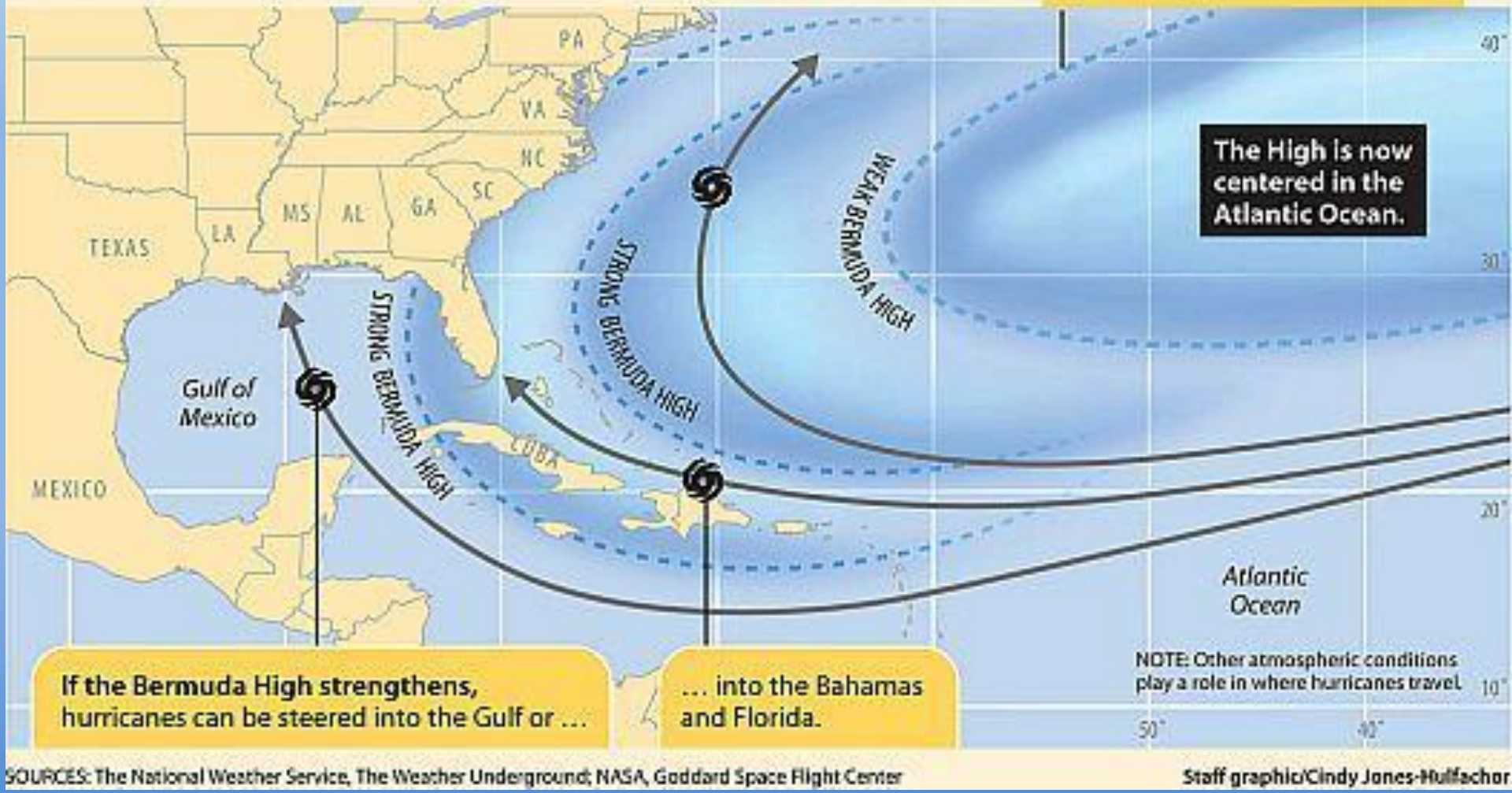


Bermuda High Presssure



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

Thank you

Hope Mizzell
SC State Climatologist
SC Department of Natural Resources

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