



# *What makes North Carolina's climate unique?*

Type your answer in the chat box

# About the State Climate Office

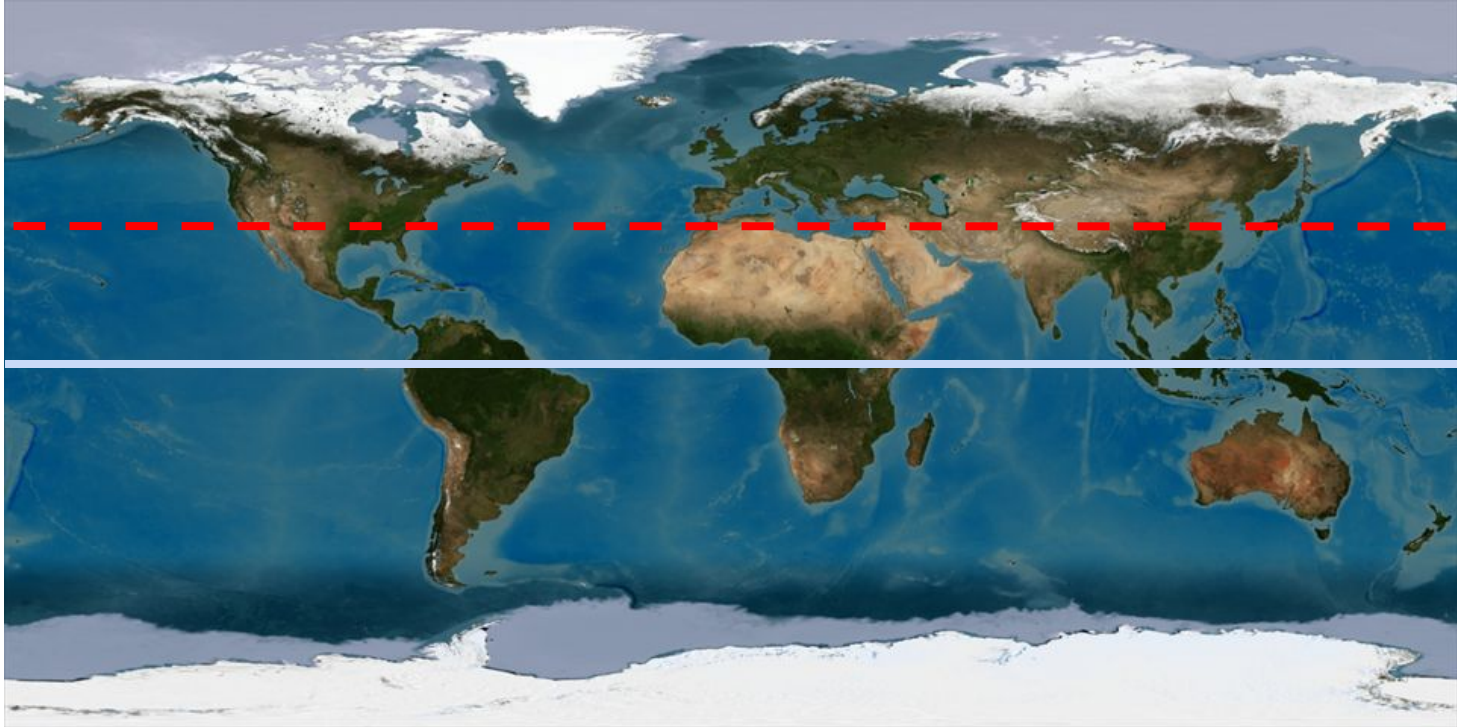
- Based at NC State
- Public service center for North Carolina
- 8 full-time staff + 1 student (@UNCA)



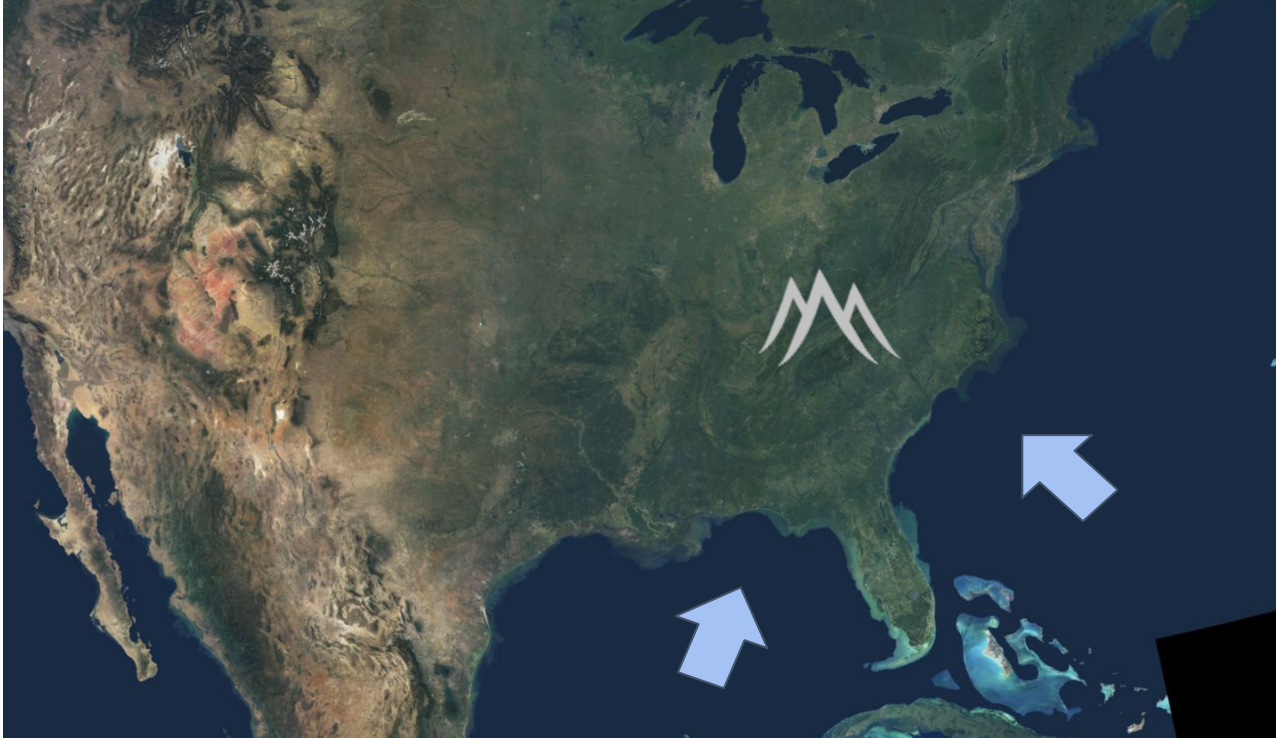
# Presentation Outline

- North Carolina climate overview
- Seasonal aspects of our climate
- Understanding weather forecasts
- Weather data collection and access
- Citizen science and the weather

# Our Geography

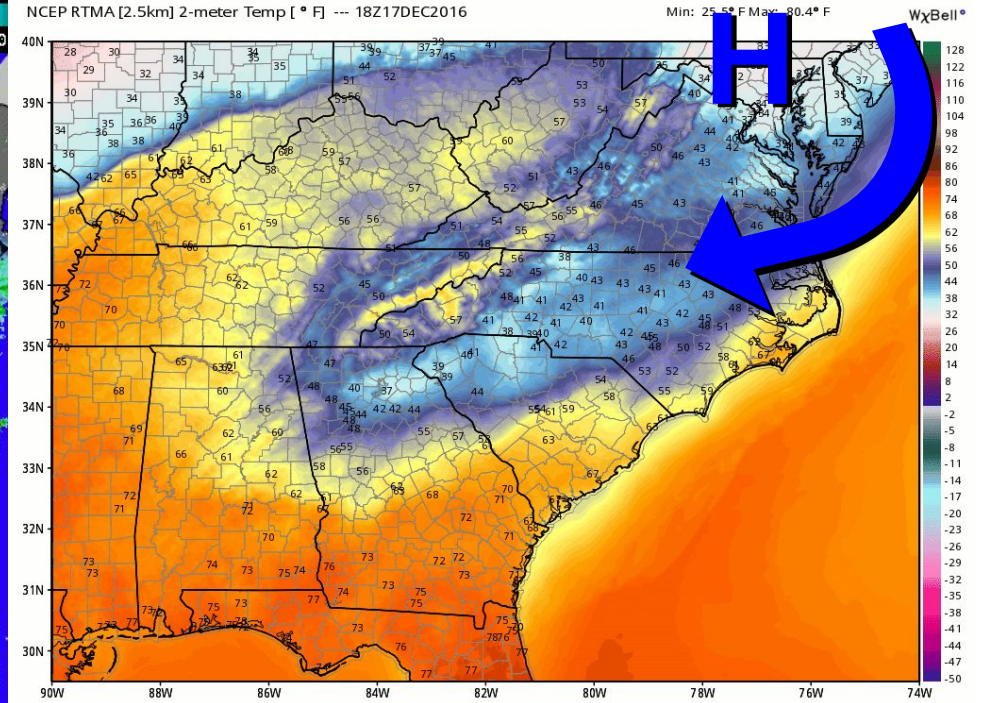
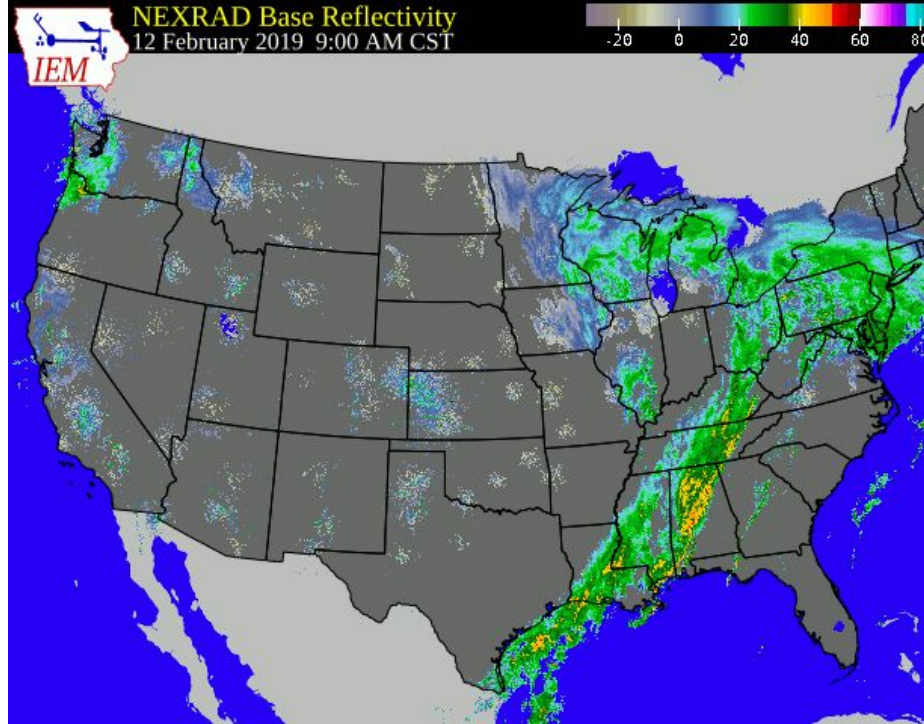


# Our Geography





# The Mountains' Impacts



# Defining Our Climate

- **Climate normals** = 30-year averages of key weather variables (*temperature, precipitation*)
  - Why 30 years?
- This spring, **1991-2020 normals** were calculated and released by NCEI

# Climate Normals

**Monthly** Daily Hourly Annual/Seasonal **1991-2020** 2006-2020 1981-2010

● MAX TEMP (°F) ● MIN TEMP (°F) ● AVG TEMP (°F) ● PRECIP (IN) ● SNOW (IN)

RALEIGH

**US States**

- Alabama
- Alaska
- Arizona
- Arkansas
- California
- Colorado

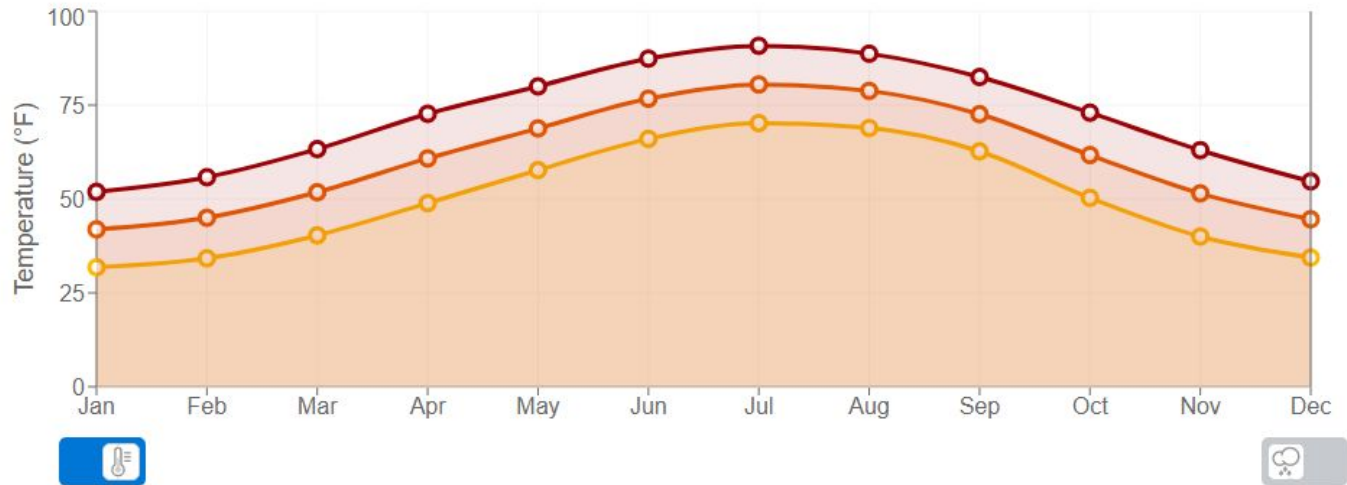
RALEIGH 5.9 ENE, NC  
RALEIGH 6.2 E, NC  
RALEIGH 6N, MS  
RALEIGH 8.4 N, NC  
**RALEIGH DURHAM INTL AP, NC**  
RALEIGH HILLS 0.8 WSW, OR  
RALEIGH HILLS 2.1 ESE, OR  
RALEIGH STATE UNIV, NC



# Climate Normals

RALEIGH DURHAM INTL AP, NC

Get this data as [.csv](#) | [.pdf](#)  
Station info: [USW00013722](#)



# Climate Normals

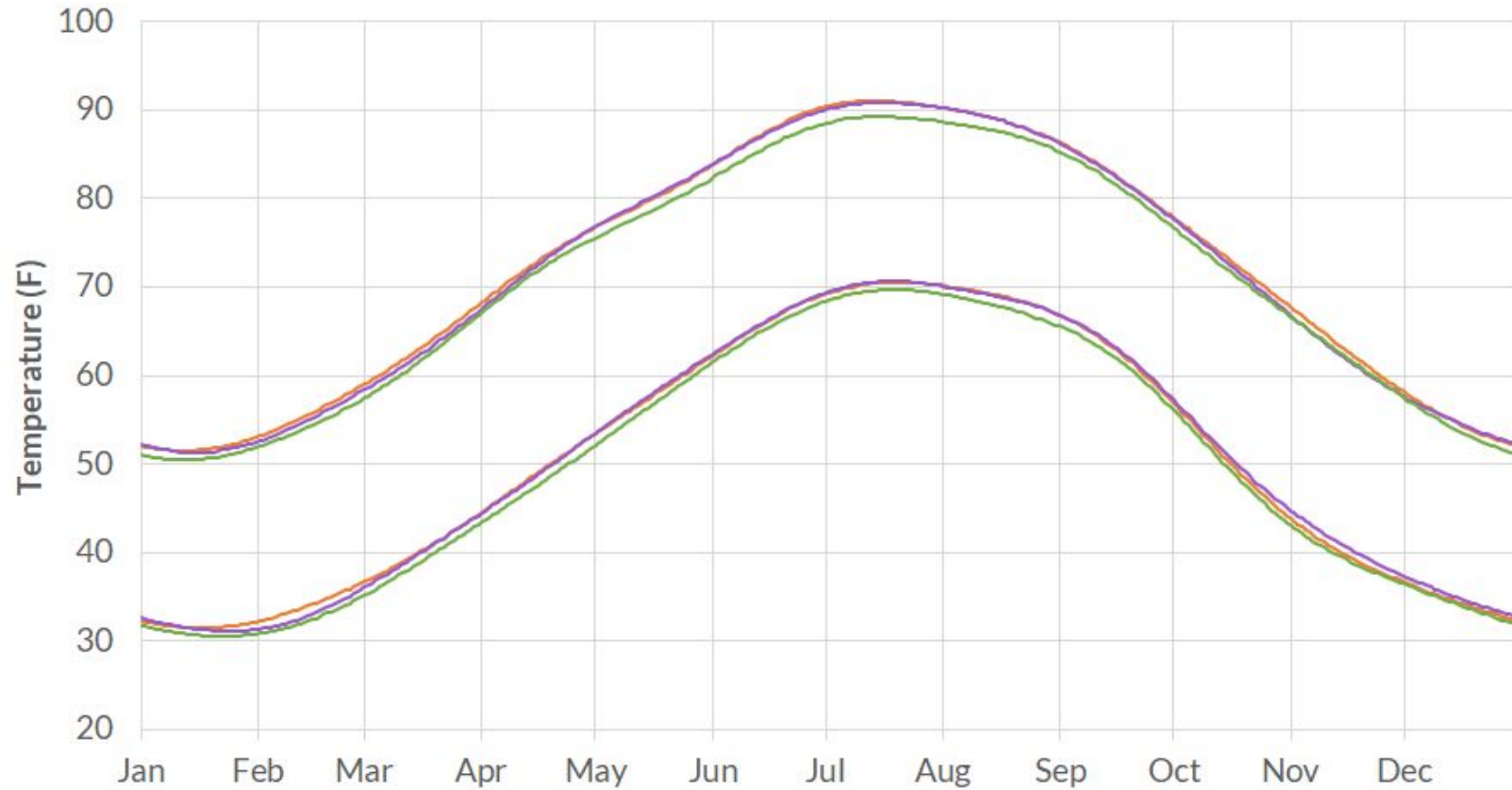
RALEIGH DURHAM INTL AP, NC

Get this data as [.csv](#) | [.pdf](#)  
Station info: [USW00013722](#)





# Normal Maximum and Minimum Temperatures

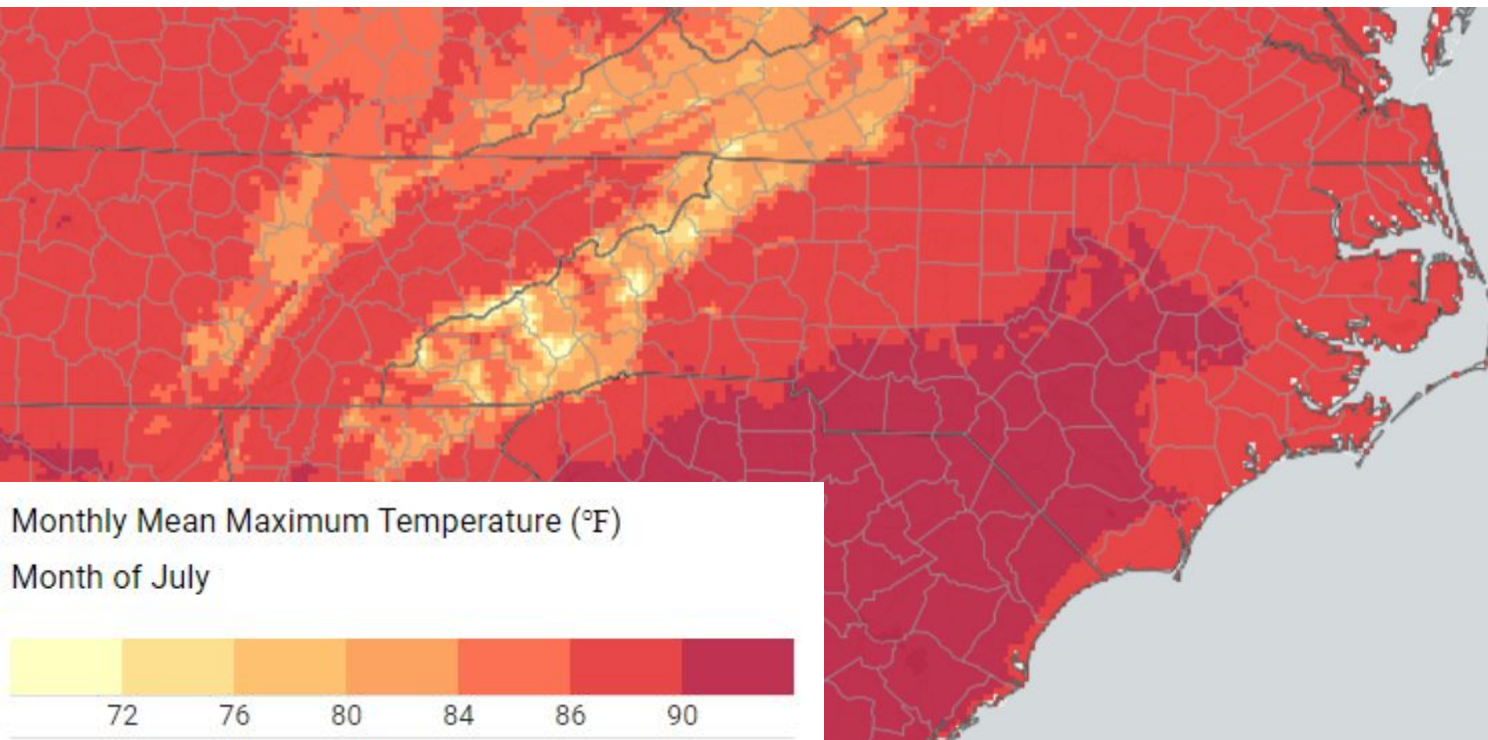


RDU Airport

Raulston  
Arboretum

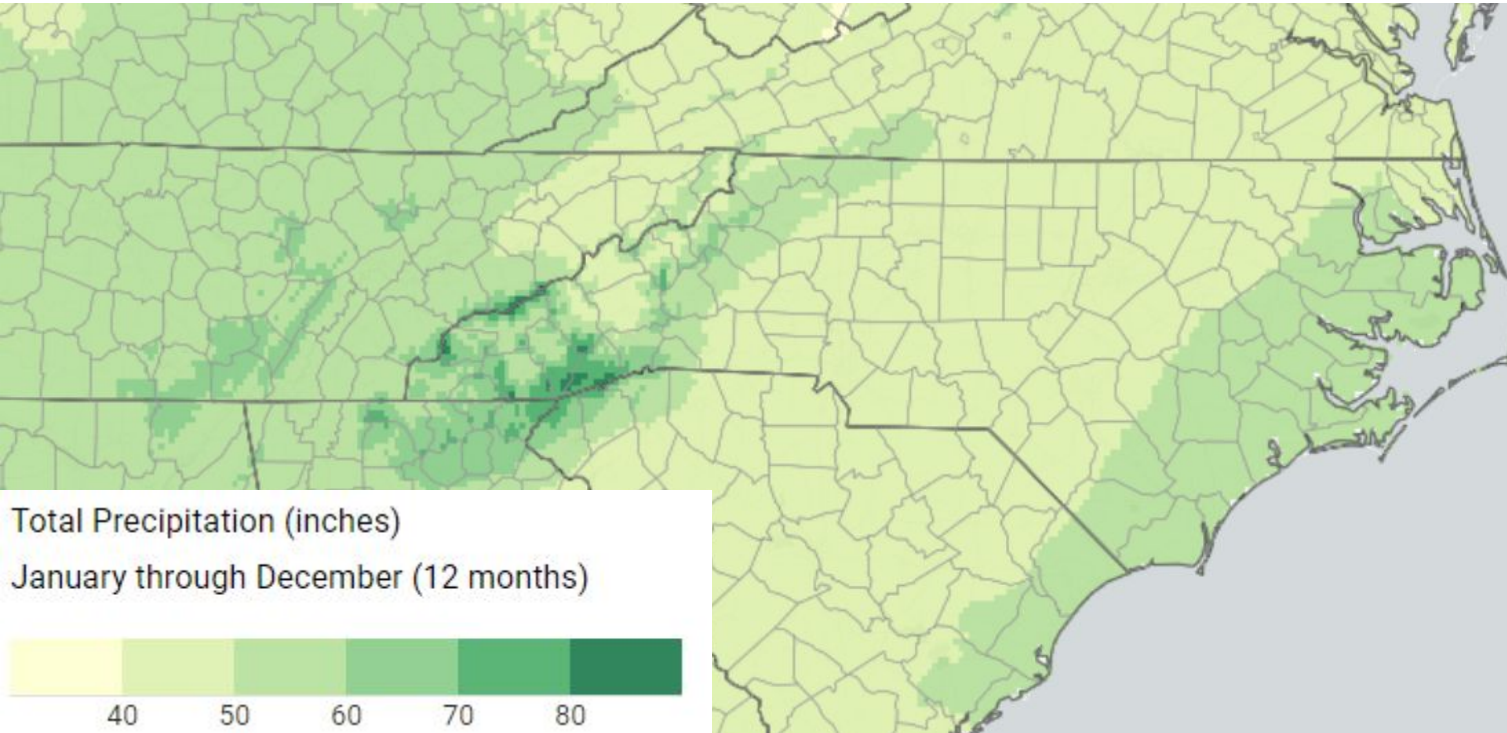
Apex

# July Maximum Temperature





# Annual Average Precipitation

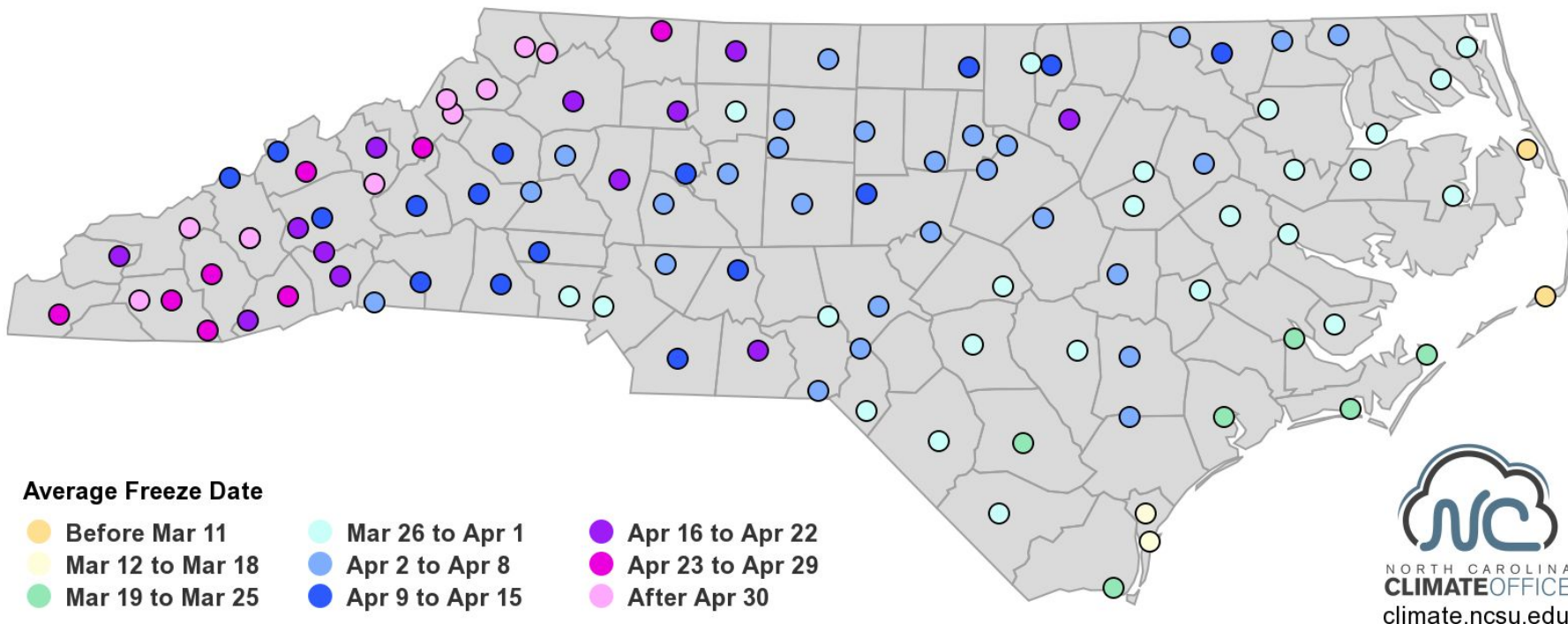


# Ag and Gardening in NC

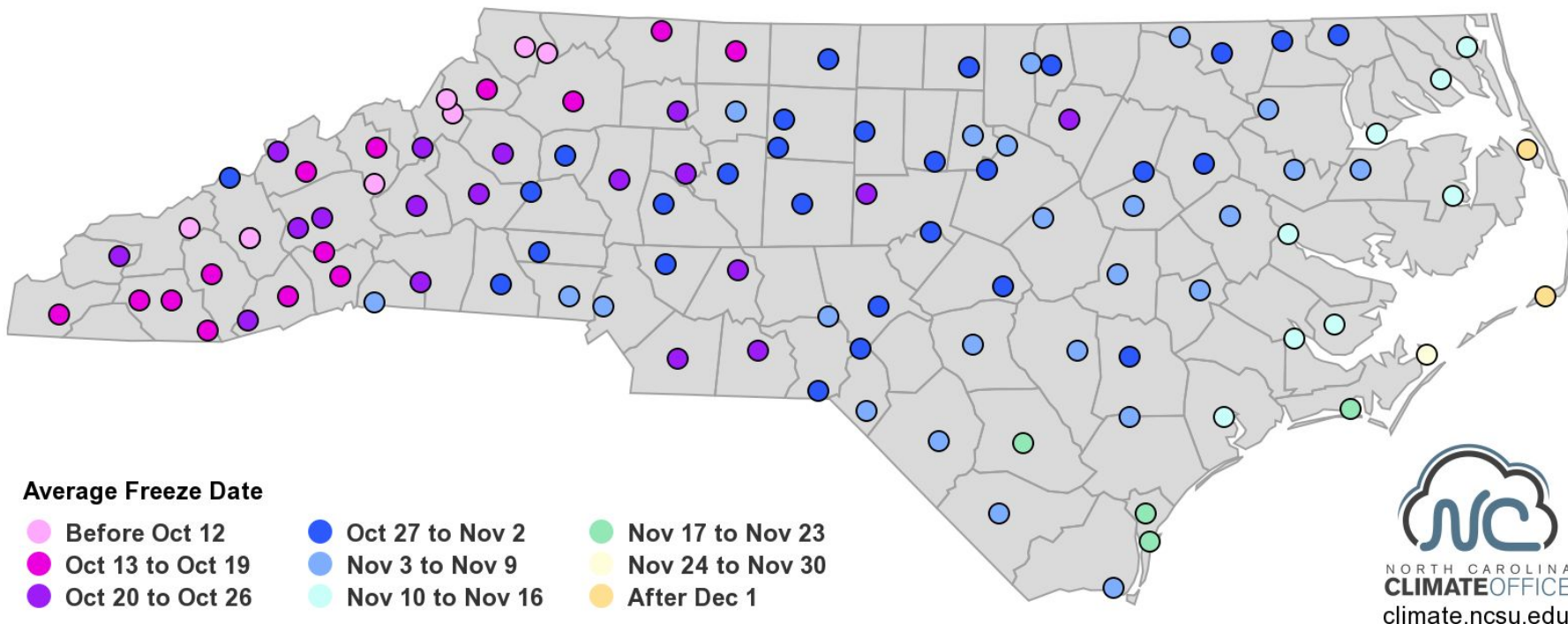
- Generally mild temperatures
- A fairly long growing season
- Roughly even seasonal precipitation



## Average Last Spring Freeze Dates in North Carolina



## Average First Fall Freeze Dates in North Carolina



# Growing Season Length

Location	Avg. Last Freeze	Avg. First Freeze	Growing Season Length
Boone	May 1	Oct. 14	173 days
Asheville	Apr. 11	Oct. 25	197 days
Raleigh	Apr. 8	Oct. 30	205 days
Charlotte	Apr. 1	Nov. 5	218 days
Greenville	Mar. 30	Nov. 4	219 days
Wilmington	Mar. 17	Nov. 18	246 days

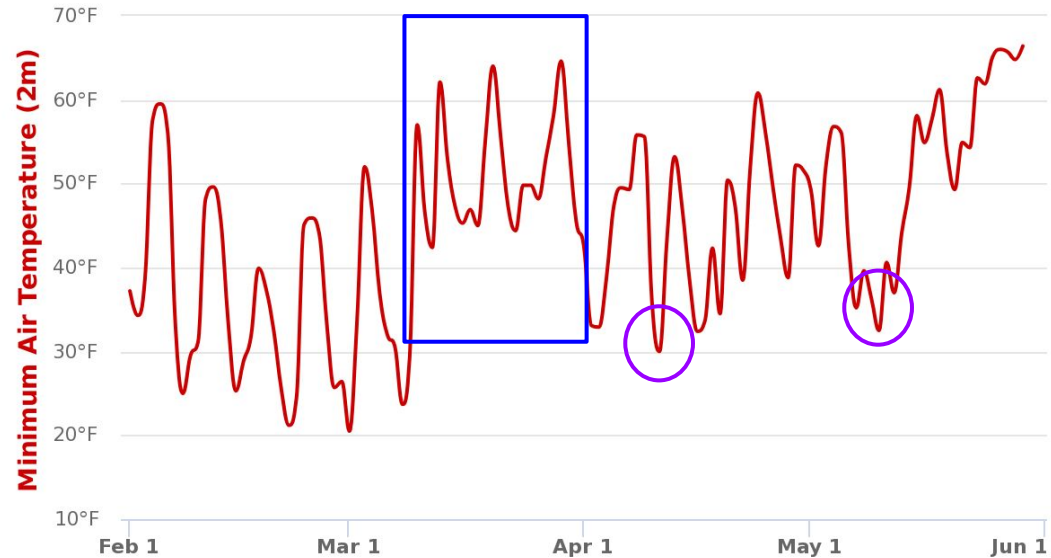


# “False Springs”

*When a few weeks of warm weather is followed by a sudden freeze*

**NC STATE**

## Nighttime Lows in Salisbury, 2020

 NORTH CAROLINA  
CLIMATE OFFICE  
climate.ncsu.edu

# North Carolina climate overview



*Any questions?*

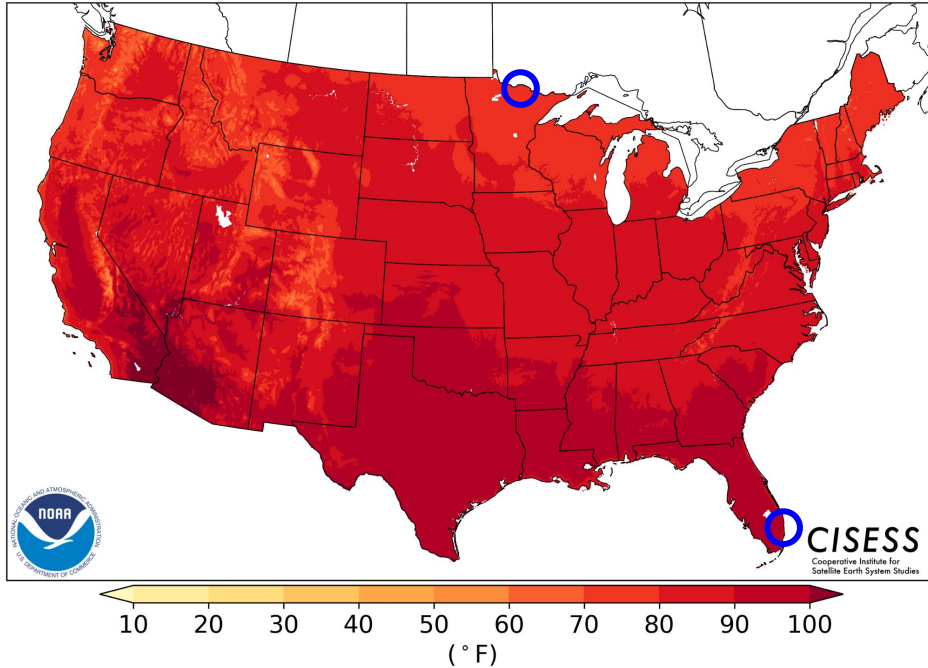


***What's your favorite season in  
North Carolina?***

**Type your answer in the chat box**

# Summer Temperature Differences

Summer (JJA) Maximum Temperature Normal (1991-2020)



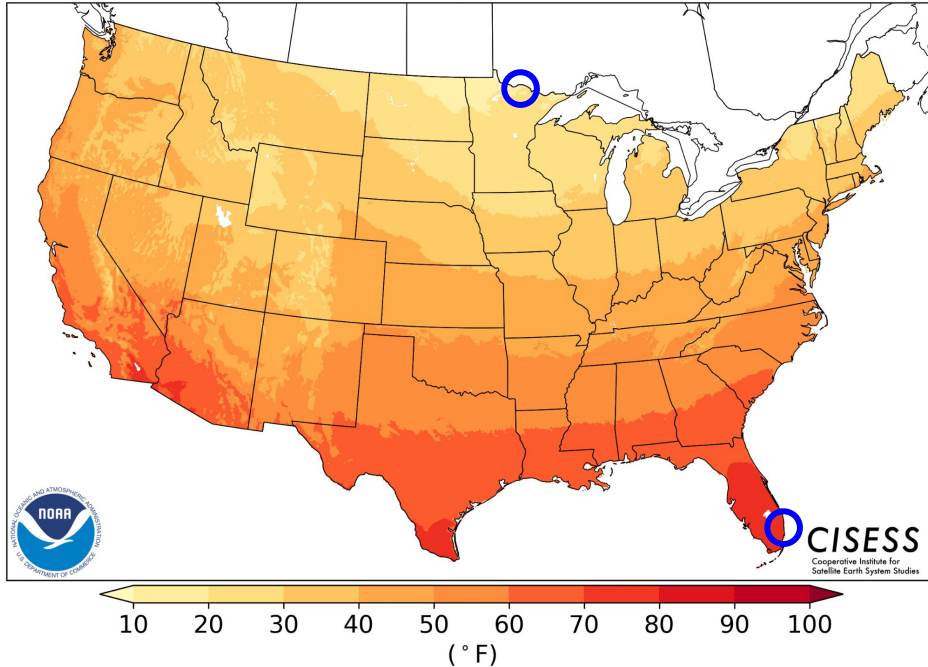
International Falls, MN: 75.7°F

Difference: 14.5°F

Miami, FL: 90.2°F

# Winter Temperature Differences

Winter (DJF) Maximum Temperature Normal (1991-2020)



International Falls, MN: **19.4°F**

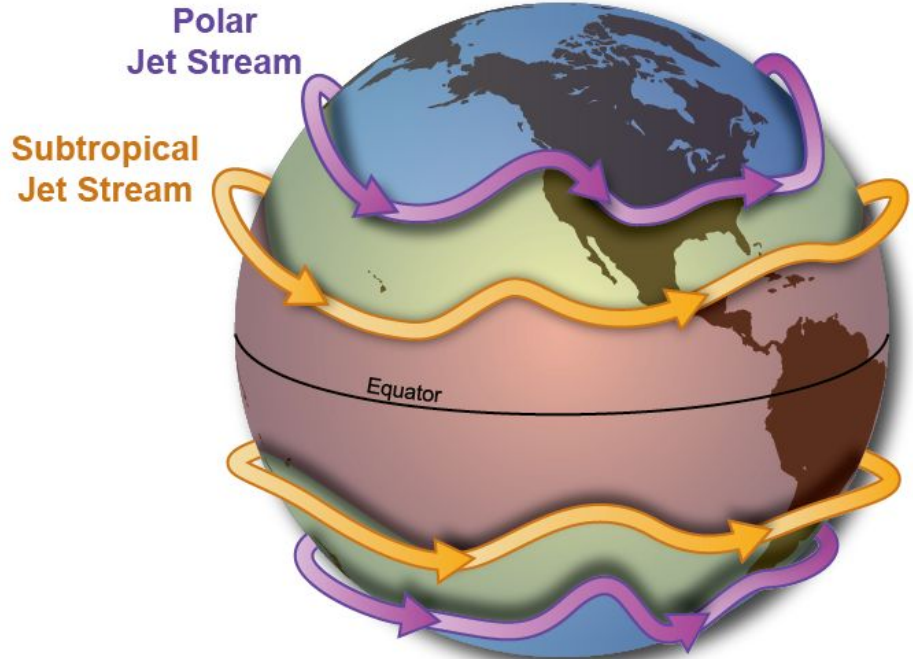
Difference: **58.2°F**

Miami, FL: **77.6°F**



# The Jet Streams

- “Rivers of air” in the upper atmosphere
- Strength comes from north-to-south temperature differences

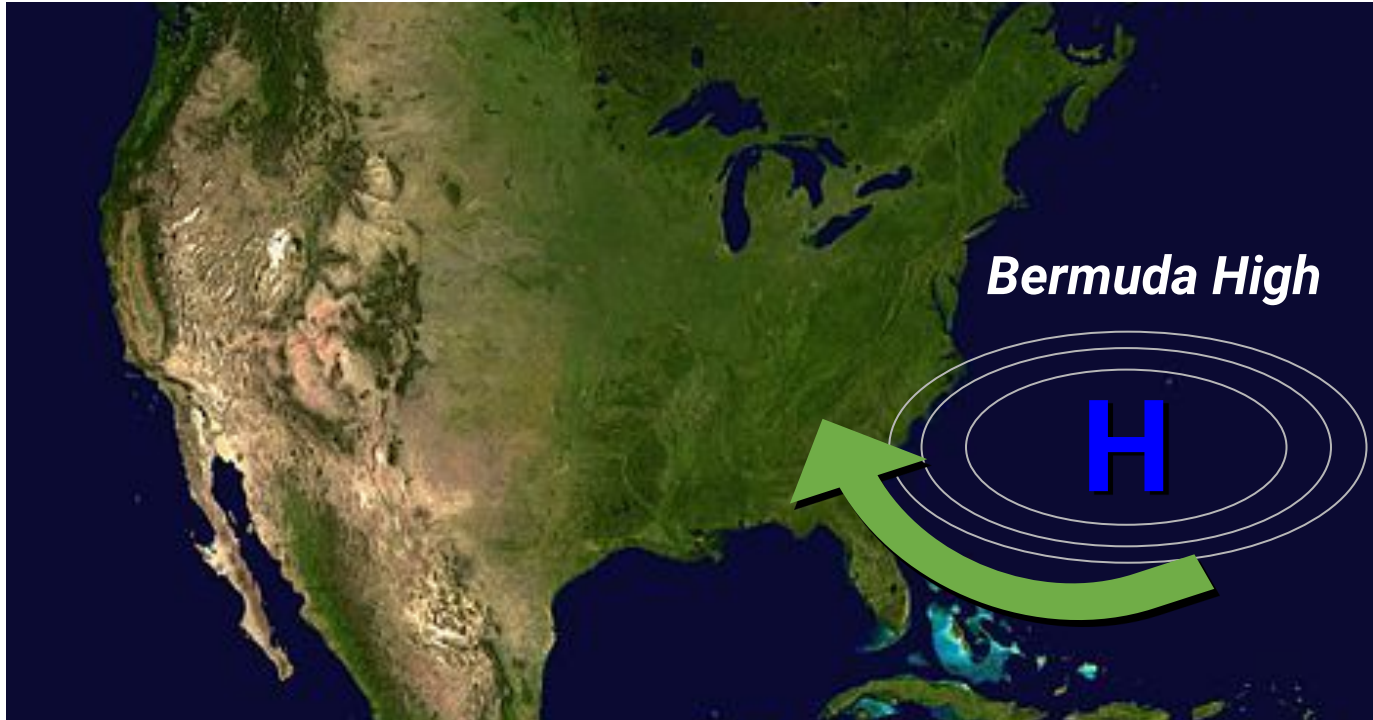


# Summer Weather Features

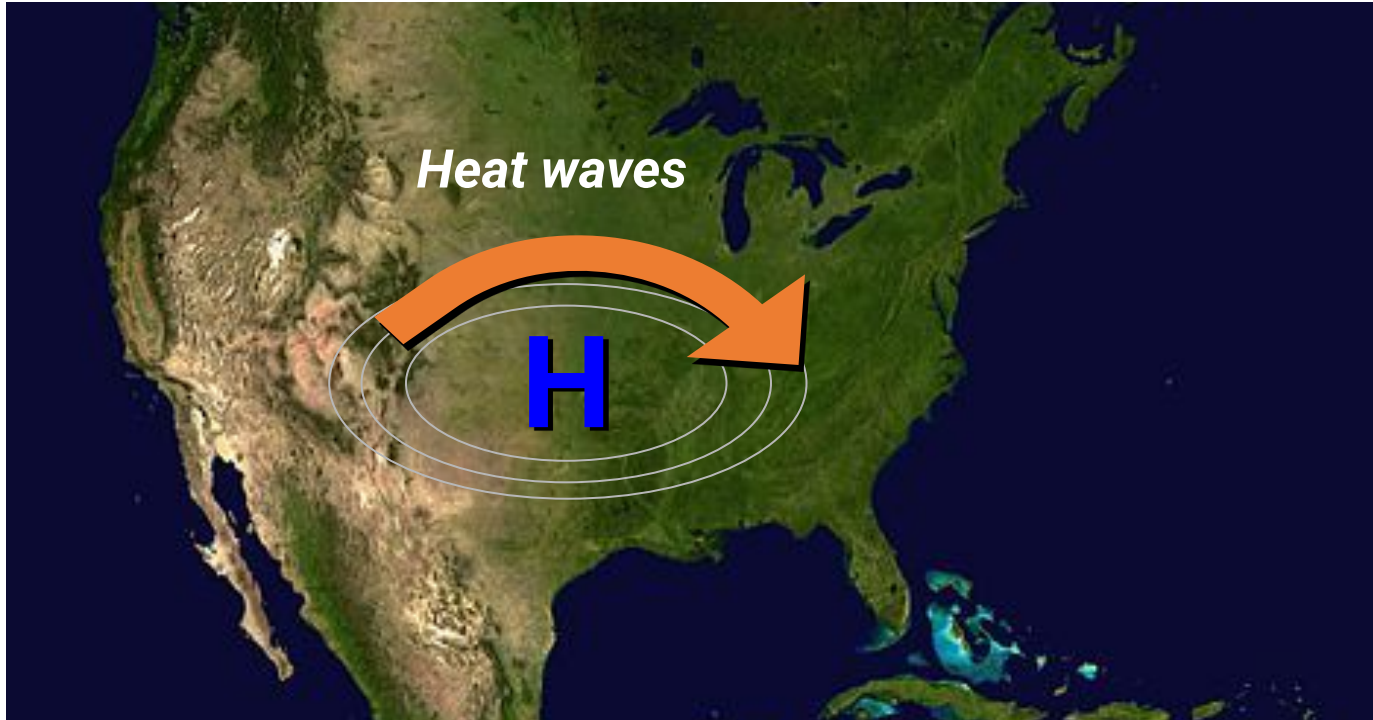
- Temperatures depend on where our winds and weather comes from
- Precip. mostly from ***convection***
  - Limited predictability due to pop-up nature



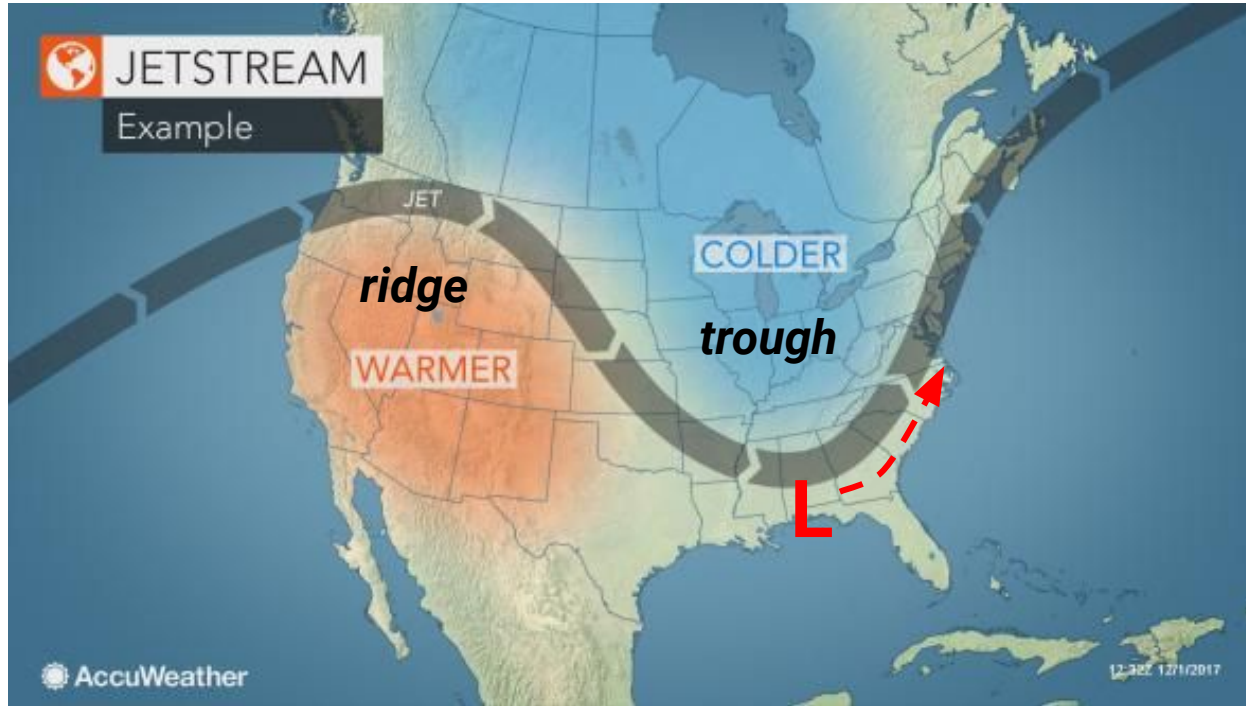
# Summer Weather Features



# Summer Weather Features



# Winter Weather Features



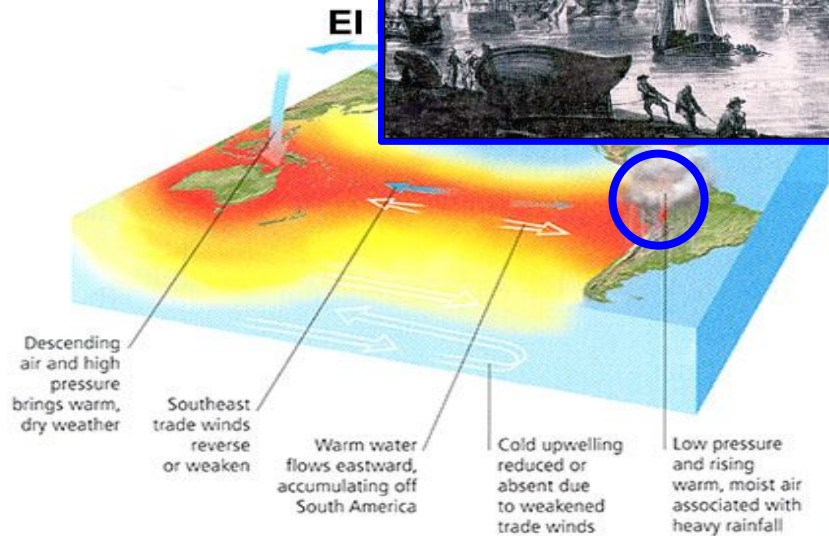


# Wintertime Predictability

- Can generally predict large-scale patterns 5-7 days in advance
  - Not as much for winter storm setups
- Some skill with predicting the jet stream *tendency* going into the winter

# About ENSO

- El Niño/Southern Oscillation
- Cyclical changes in Pacific ocean temperatures

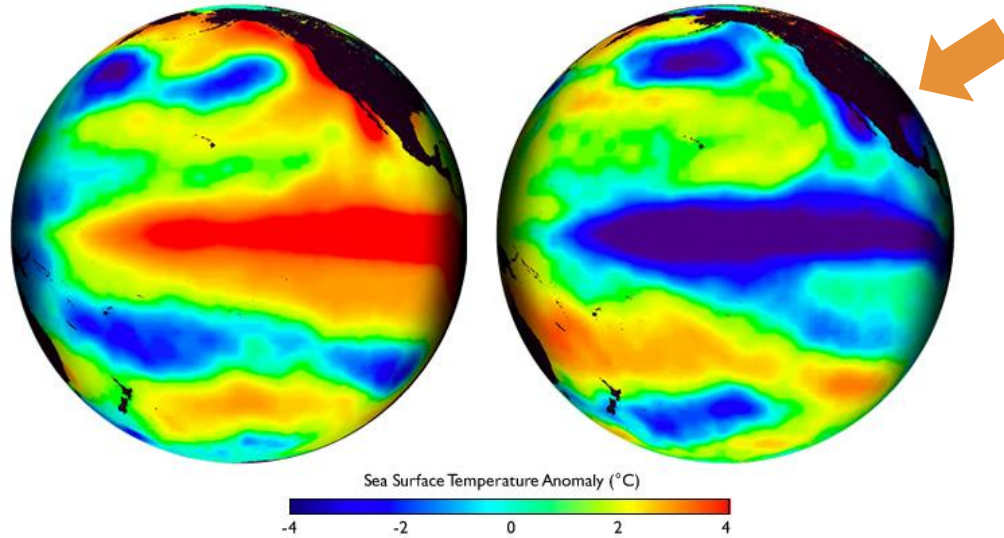


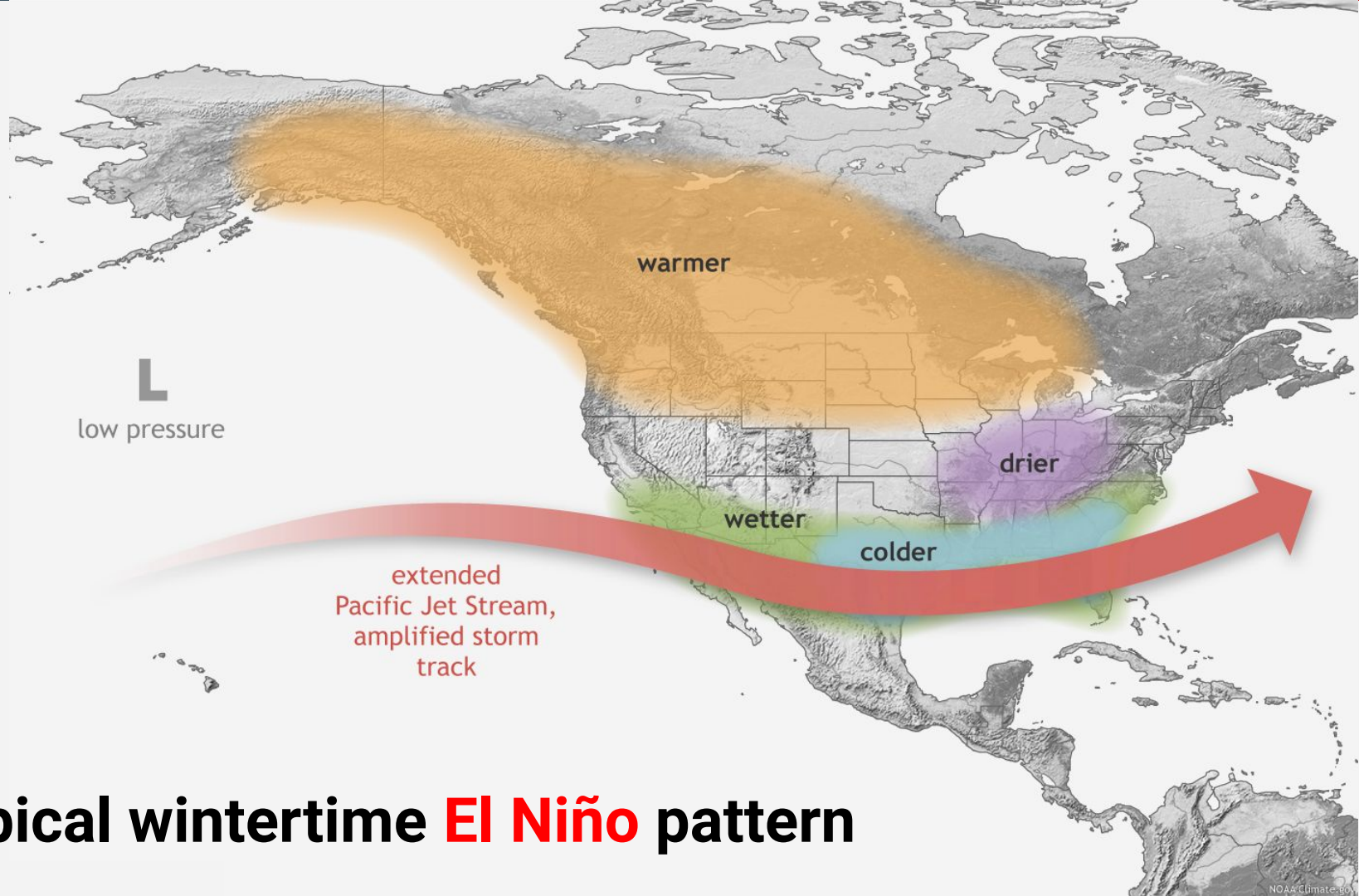
*From Mann & Kump, Dire Predictions: Understanding Climate Change, 2nd Edition*

# ENSO Phases

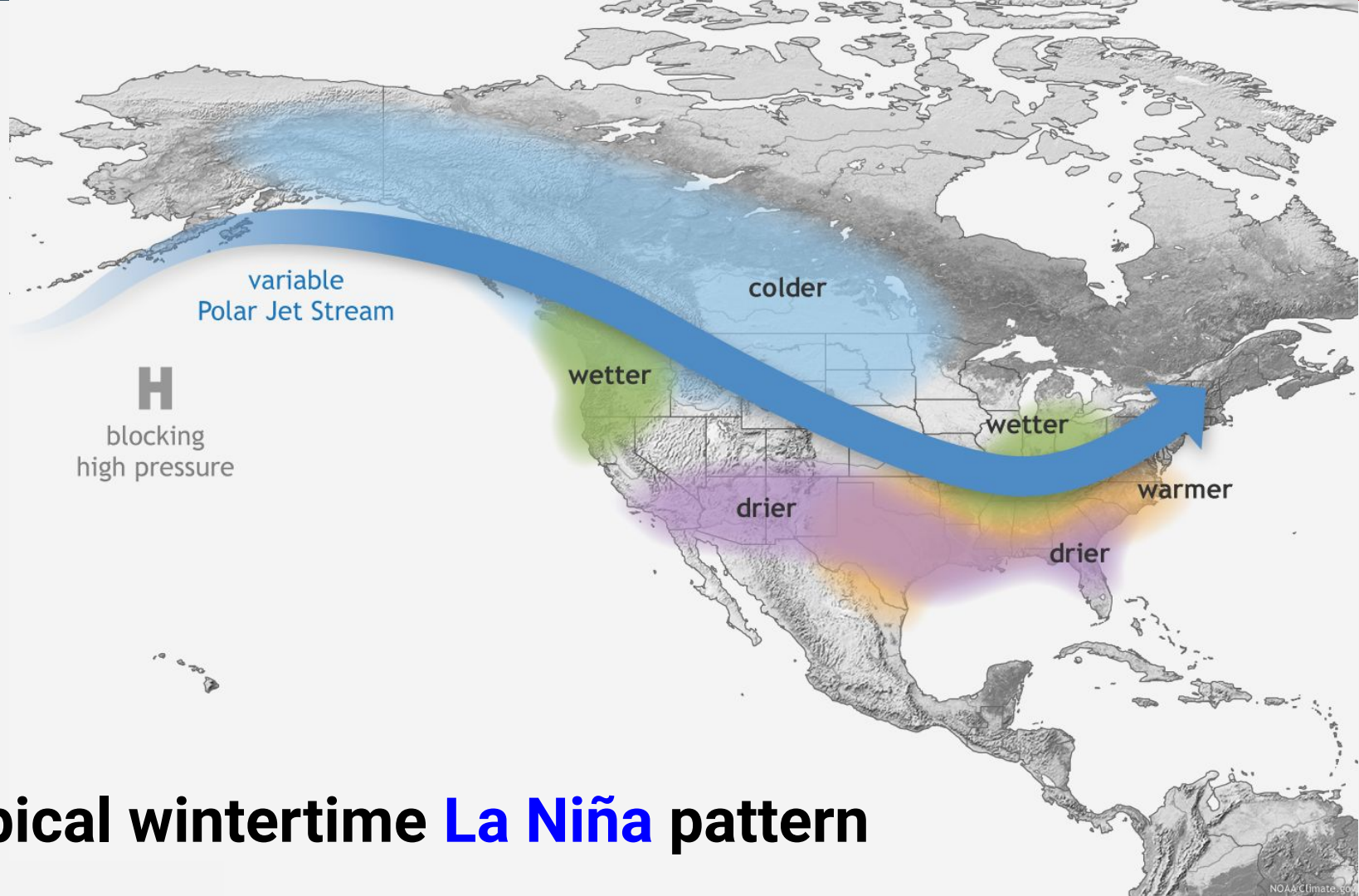
**El Niño** = warm phase

**La Niña** = cool phase





Typical wintertime **El Niño** pattern



Typical wintertime **La Niña** pattern



# How Reliable Are ENSO's Impacts?

ENSO



Carolinas  
Weather





# A “Clear” ENSO Signal

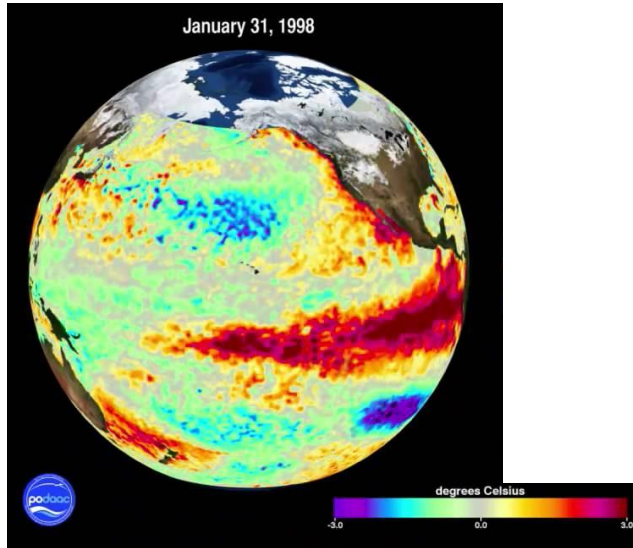
ENSO



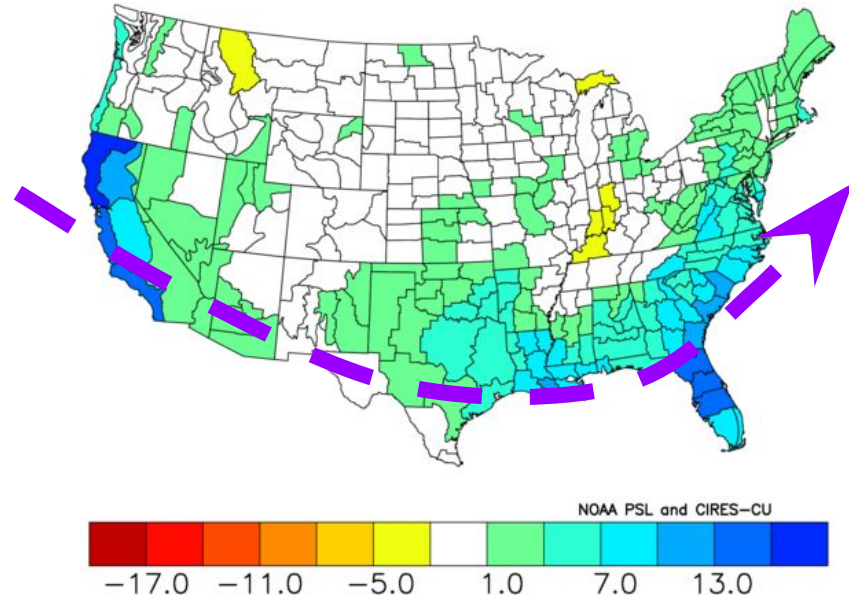
Carolinas  
Weather



# Winter 1997-98: A “Clear” El Niño



NOAA/NCEI Climate Division Precipitation Anomalies (in)  
Dec to Feb 1997-98  
Versus 1981-2010 Longterm Average





# A “Fuzzy” ENSO Signal

ENSO

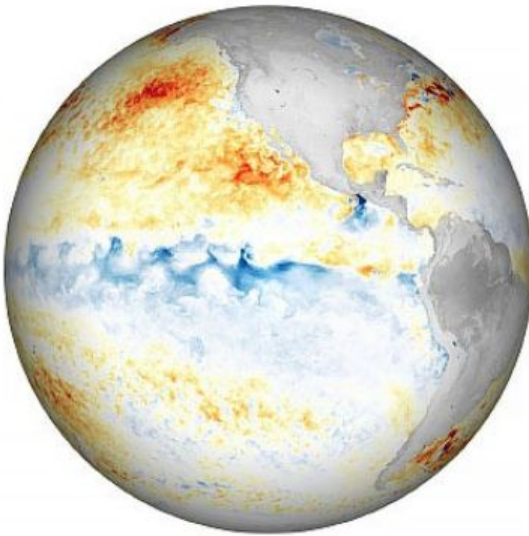


Carolinas  
Weather

Other  
Patterns



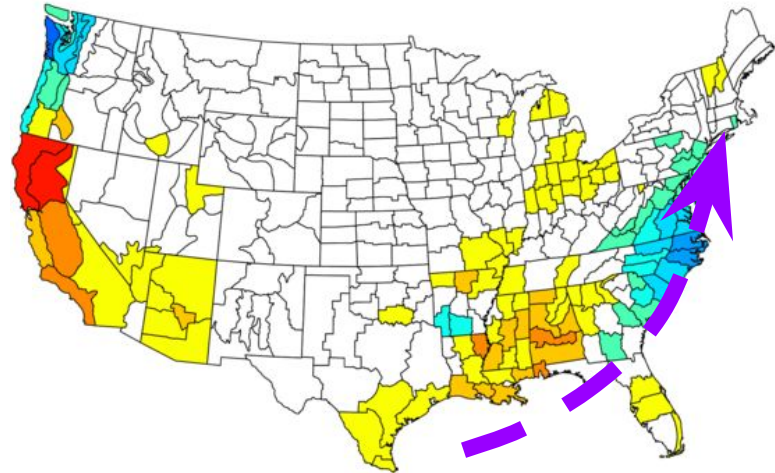
# Winter 2020-21: A “Fuzzy” La Niña



Sea Surface Temperature Anomaly (°C)



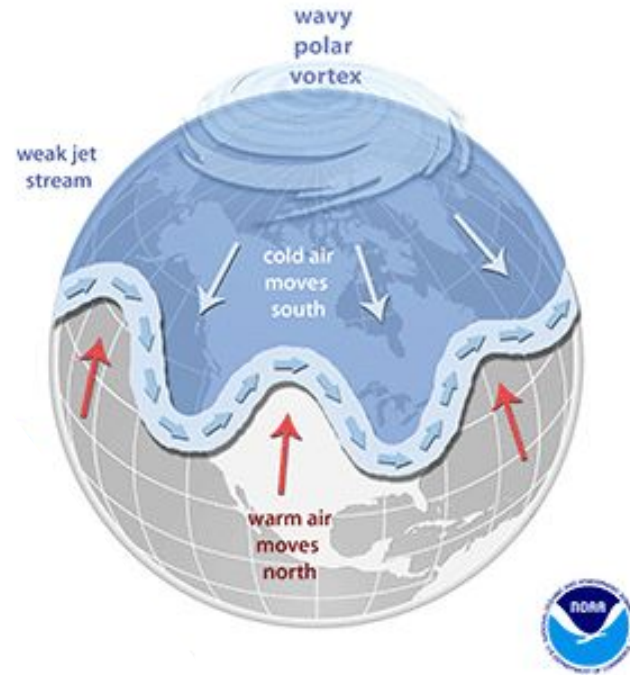
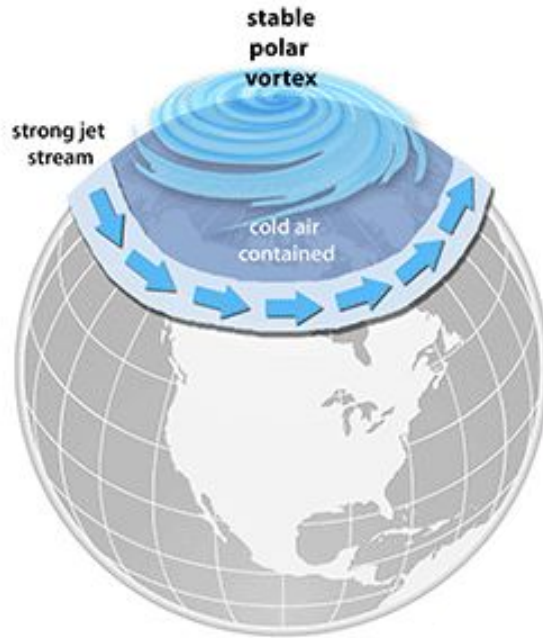
NOAA/NCEI Climate Division Precipitation Anomalies (in)  
Dec to Feb 2020–21  
Versus 1981–2010 Longterm Average



NOAA PSL and CIRES-CU

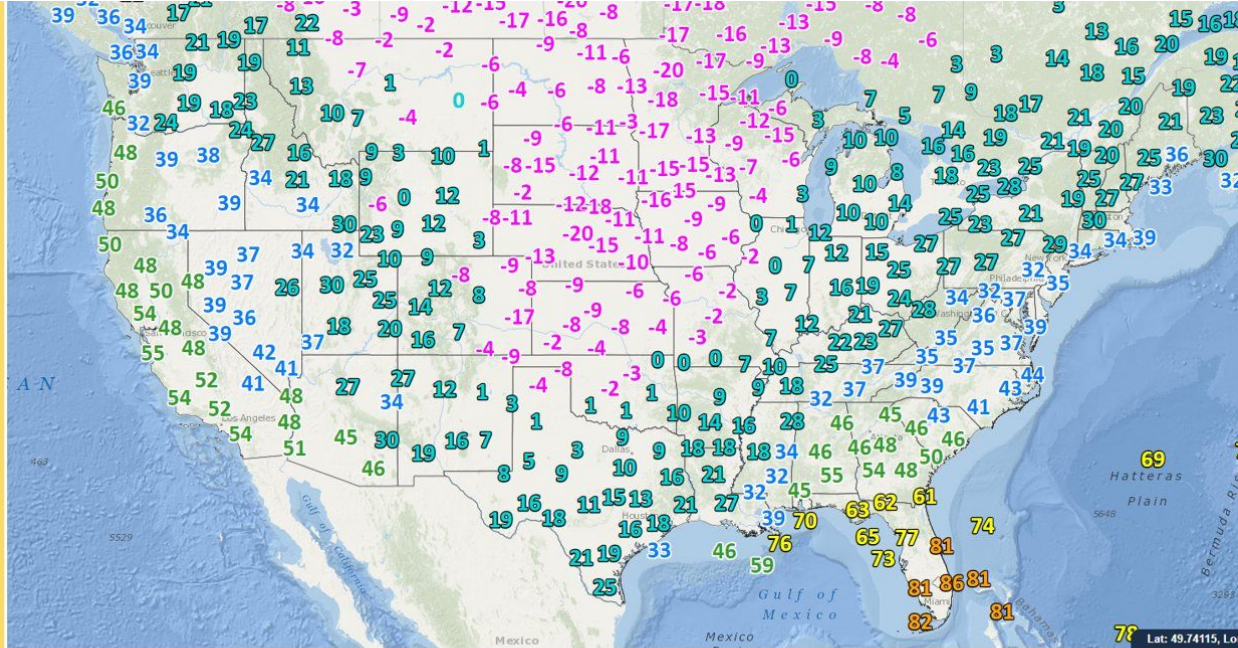


# The Polar Vortex





# The Polar Vortex Last Winter

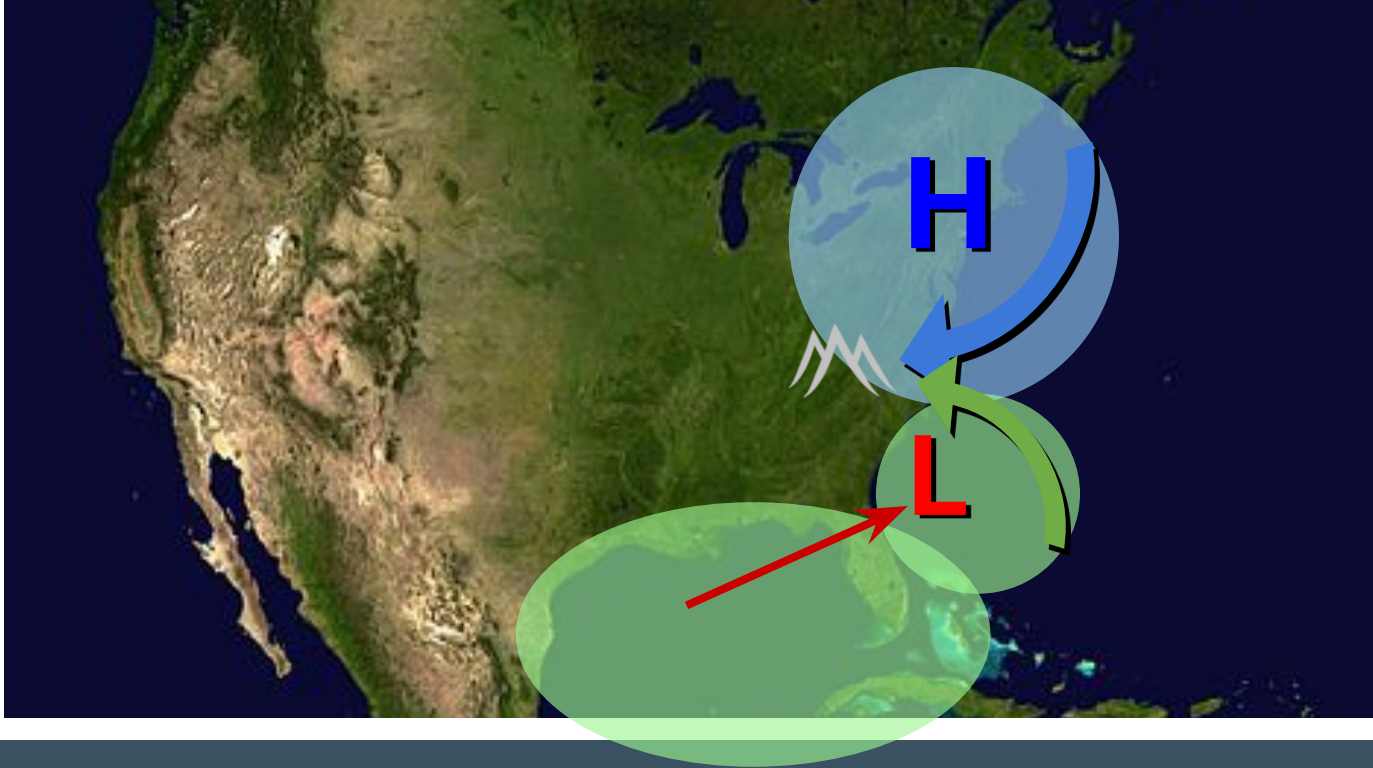


From NWS  
Sioux Falls

10 am CST Monday, February 15 - Temperatures

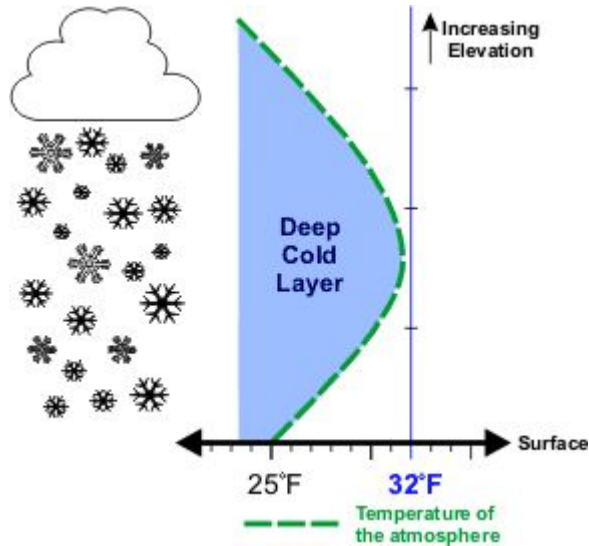


# Winter Storms

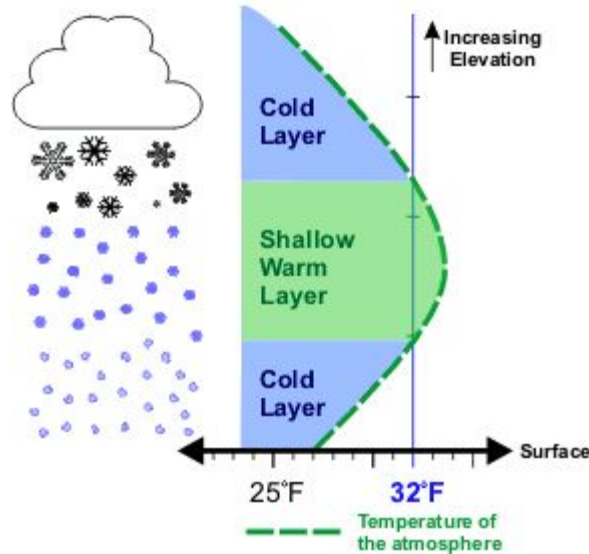


# Winter Precipitation Types

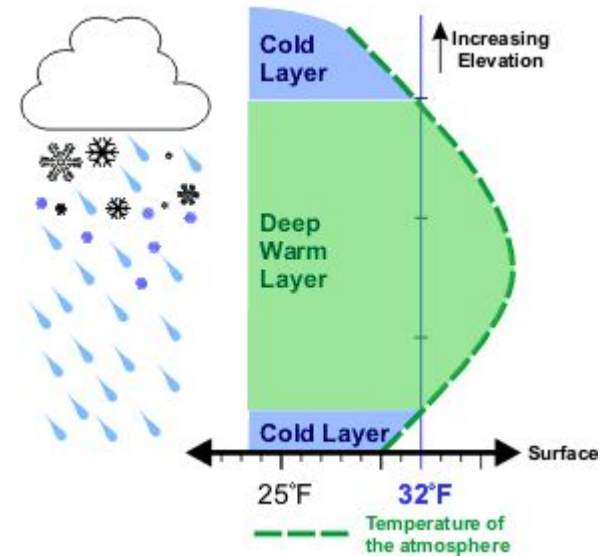
## Snow



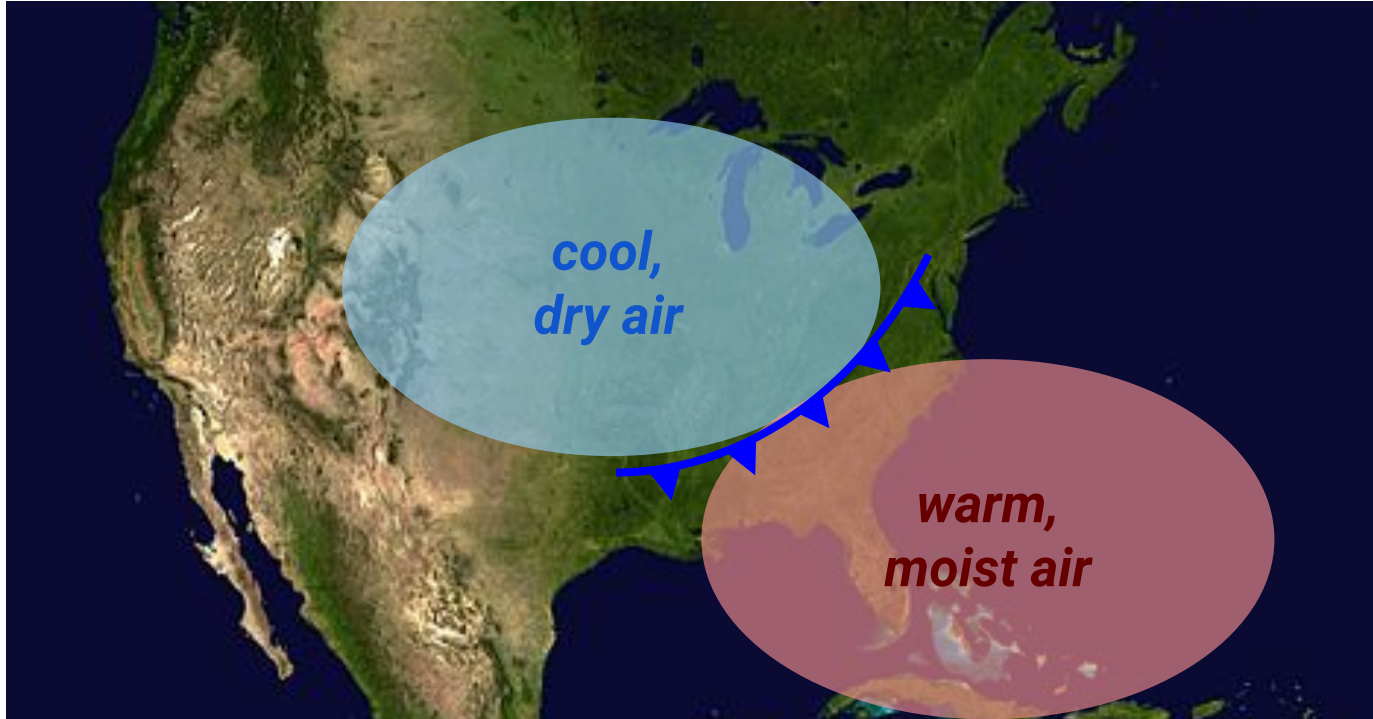
## Sleet



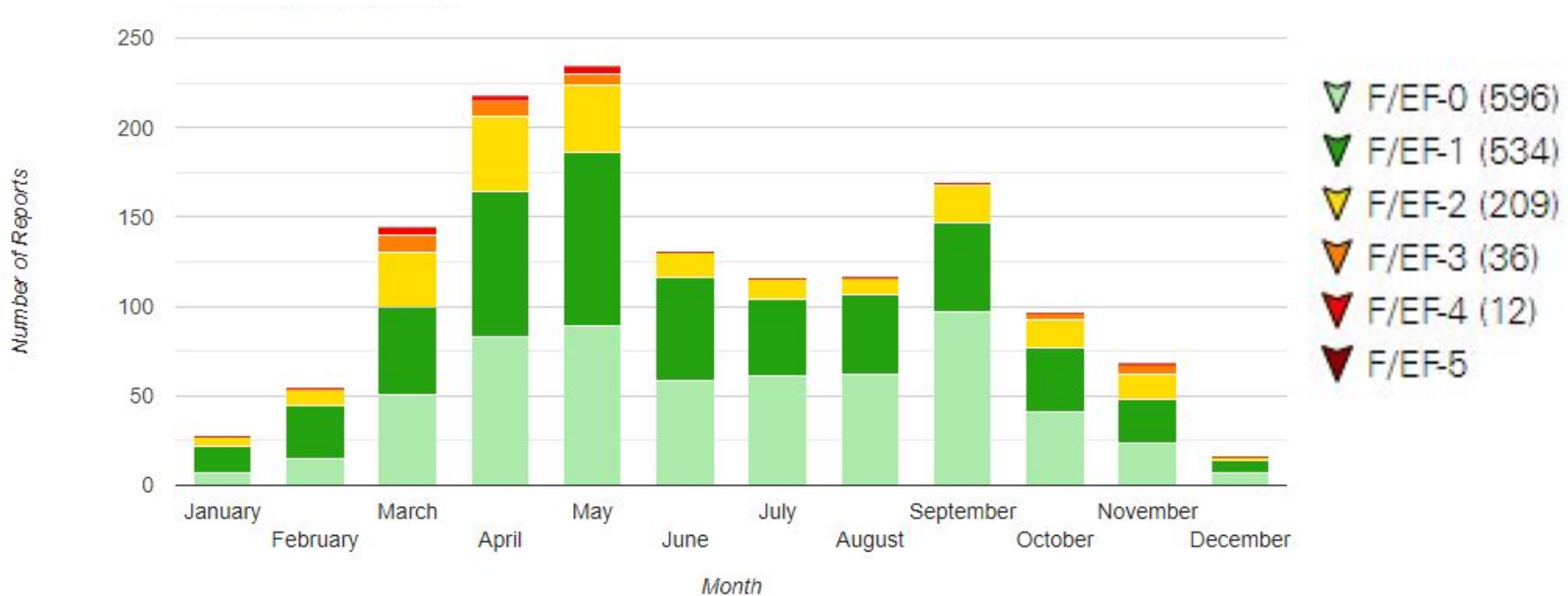
## Freezing Rain



# Severe Weather

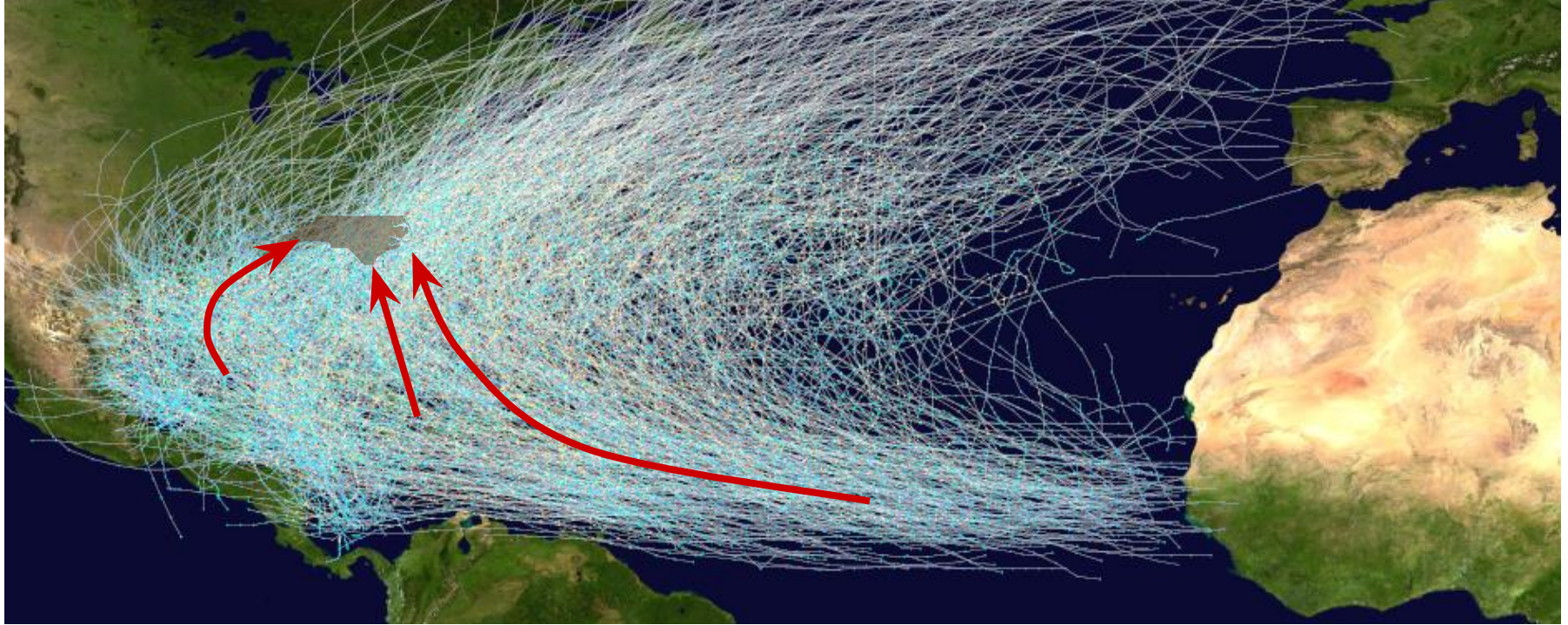


# Tornadoes by Month (1950-2019)



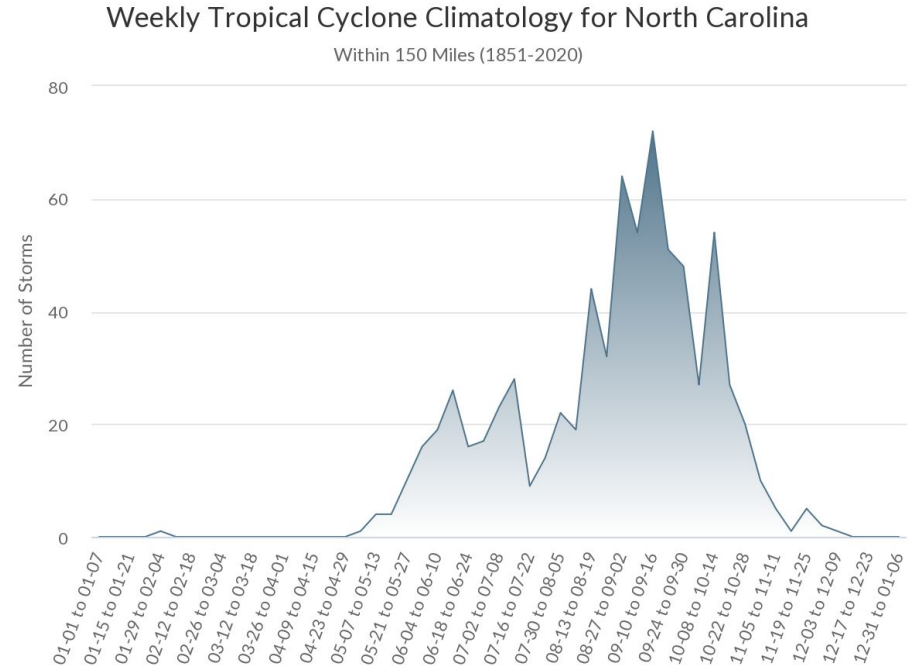


# Hurricanes



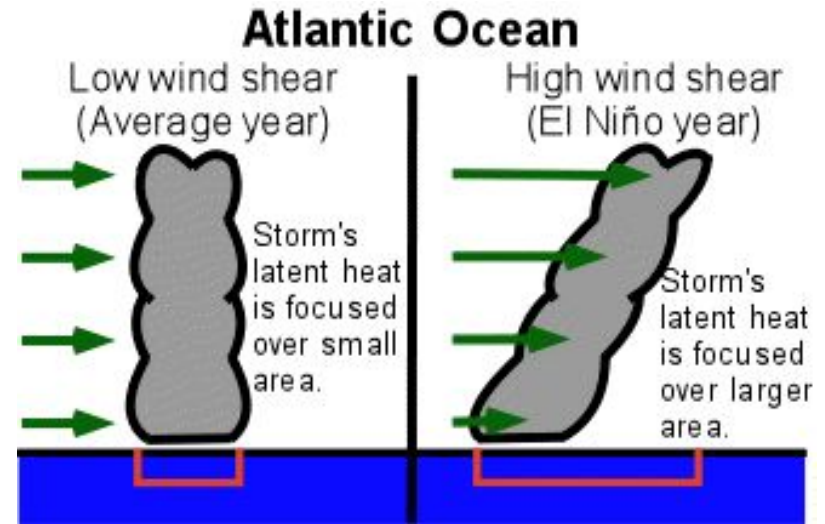
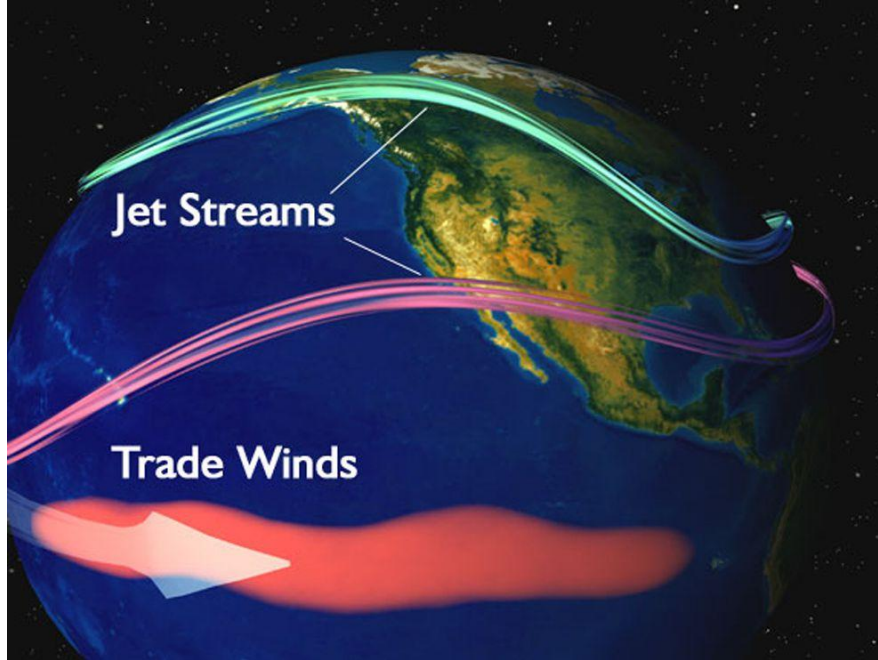
# Hurricane Stats

- Since 1850, **36 landfalling hurricanes** in NC
  - Strongest = Cat-4 **Hazel** (1954)
- Every year, **1.78 tropical storms** pass within 150 miles of NC, on average





# ENSO and the Tropics



From UIUC/WW2010

# Seasonal aspects of our climate



*Any questions?*