



Florida's Climate: From El Niño to Climate Change



University of Florida

*Water Resource Institute
Symposium*

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Center for Ocean Atmospheric
Prediction Studies

The Florida State University



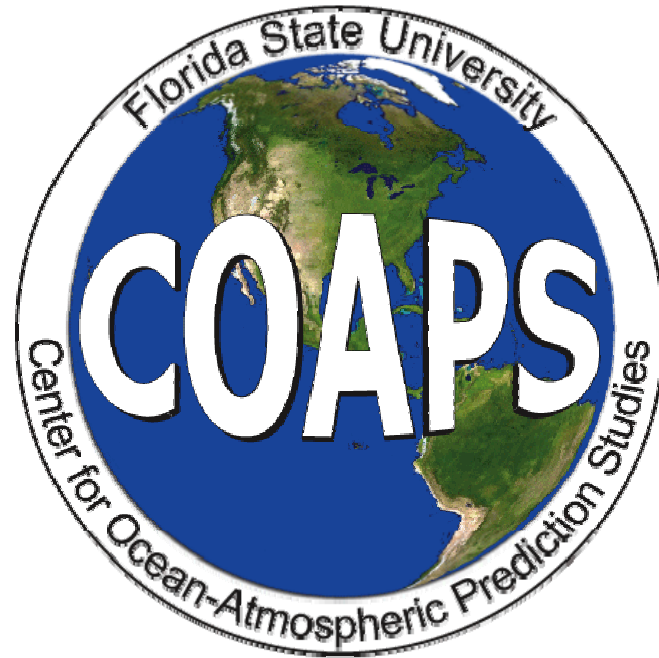


What is a State Climatologist?



- Originally a NOAA program until 1973
- States urged to appoint their own SC
- Most states made it a faculty appointment at the land grant university
- Title transferred to FSU after a number of years
- Appointed by the department Chair
- MOU with partners at NOAA NWS and NCDC
- Office certified by the American Association of State Climatologists





Climate of Florida



Characteristics of Florida's Climate

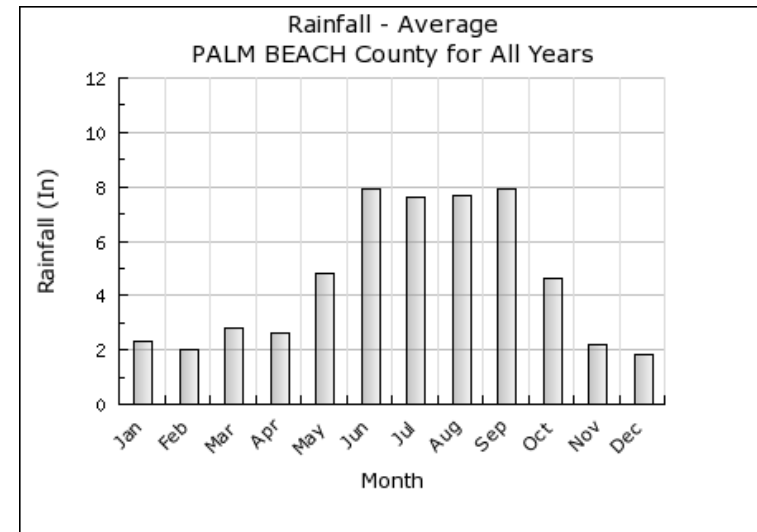
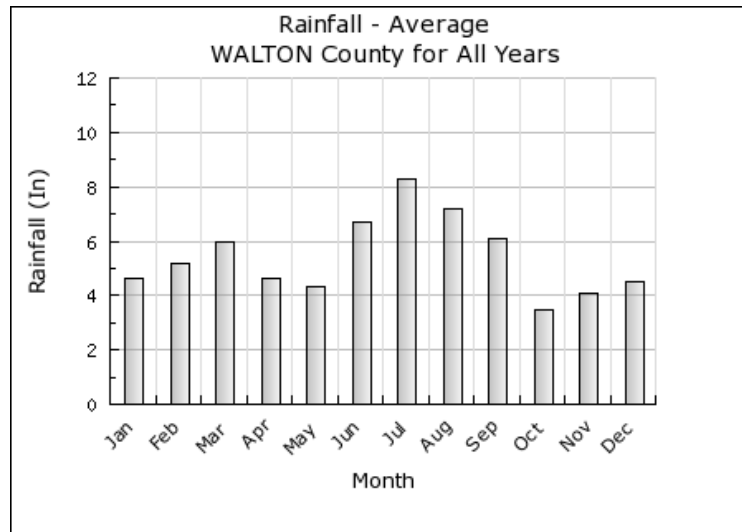
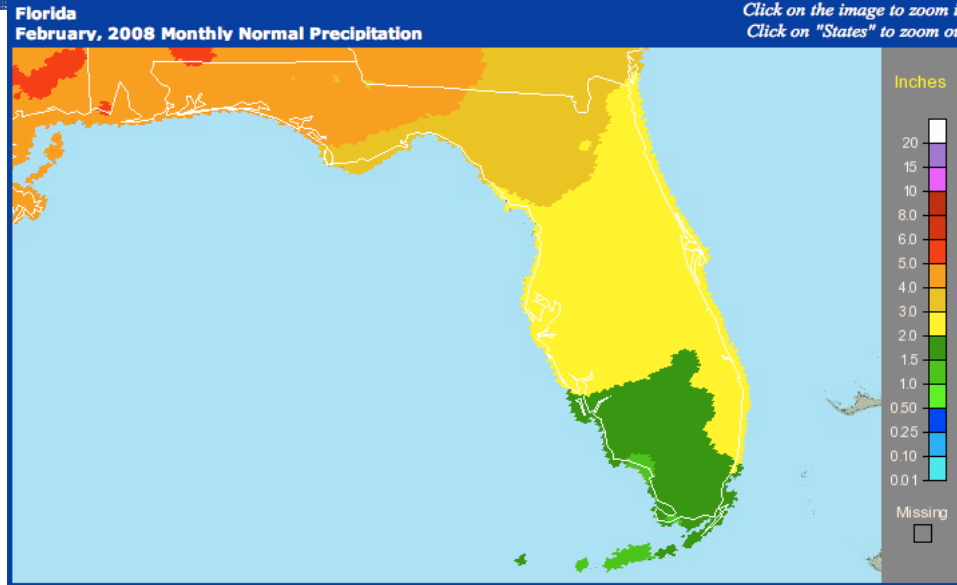


- Much of Florida is classified as humid-subtropical, except extreme South Florida and the Keys
- Two very different climate regimes, the Panhandle and North Florida vs. Peninsula
- Subject to freezing temperatures in winter
- Most hurricane-prone state
- Subject to severe weather
- Local and regional variations due to land cover, coastal influences, etc.





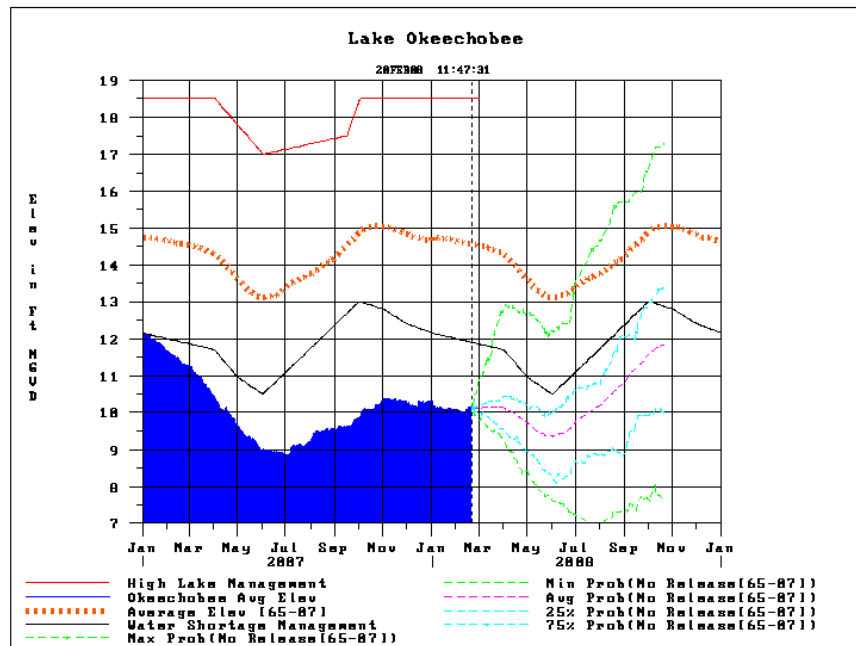
Seasonal Rainfall Patterns





Response of Hydrologic Systems

Lake Okeechobee



Apalachicola at Chattahoochee

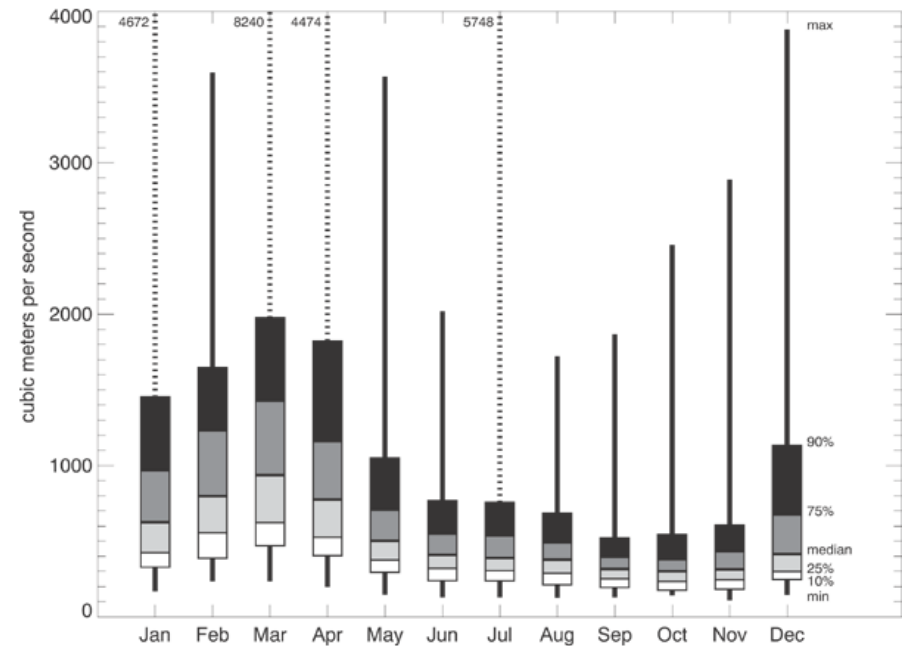
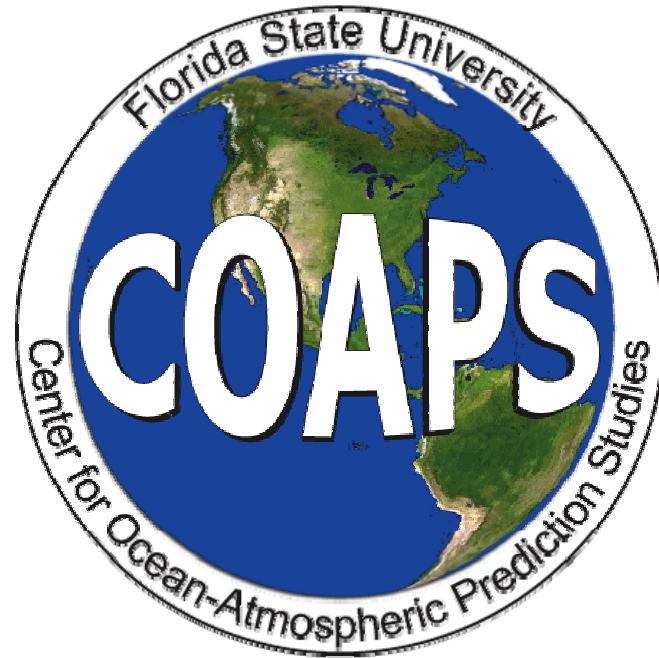


Figure 2

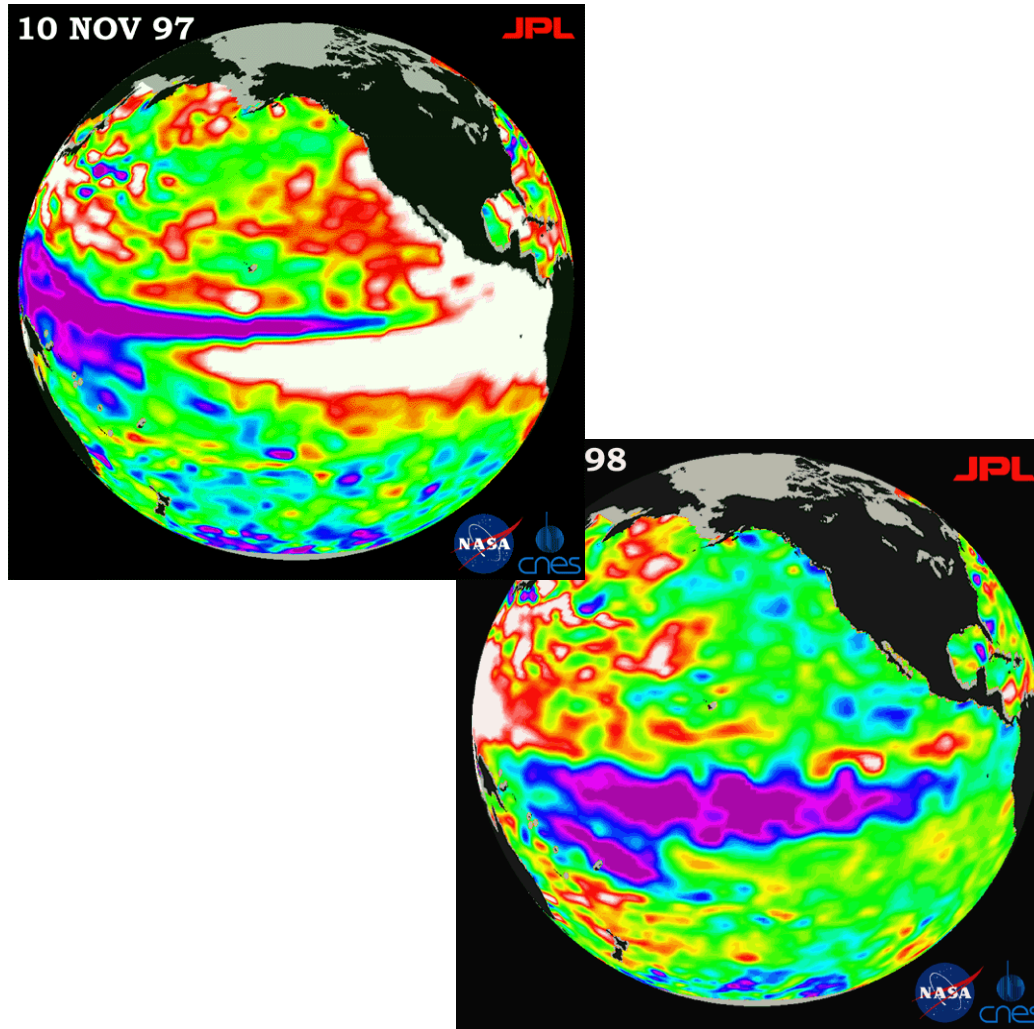




The El Niño/La Niña Cycle



Coupled air-sea interactions



The El Niño/La Niña cycle is the predominant mode of year to year climate variability.

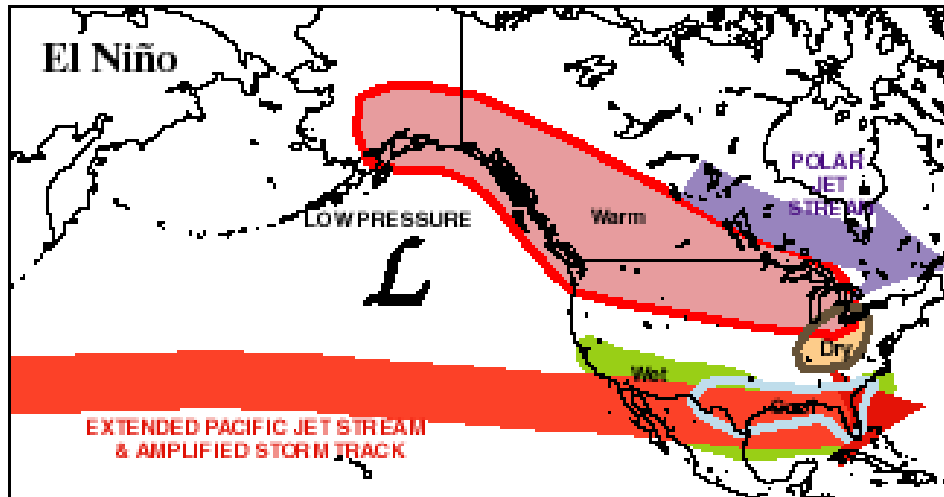
“The CPC seasonal forecasts lack useful skill in the absence of a strong El Niño/La Niña event” - Bob Livezey



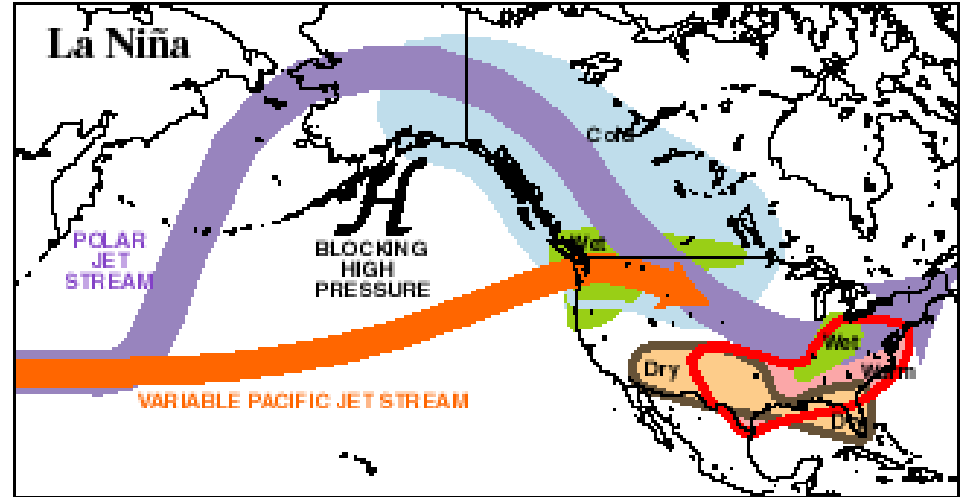


Winter Jet Stream Patterns during El Niño and La Niña

El Niño



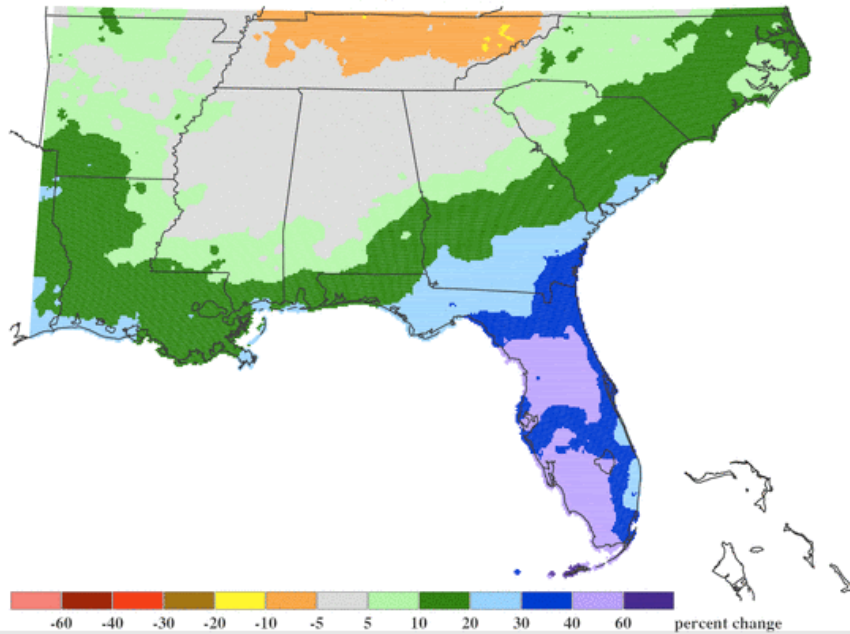
La Niña



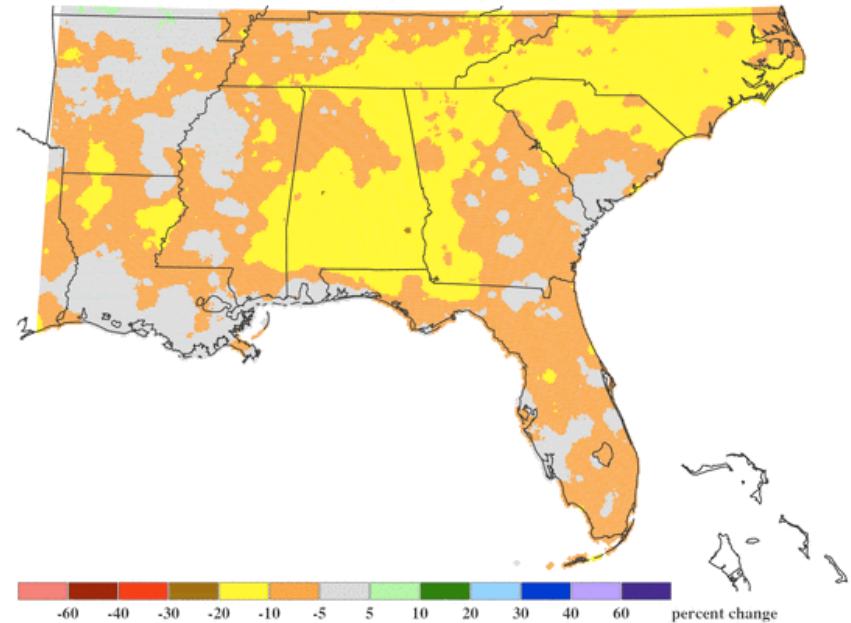


El Niño Effects on Precipitation

JANUARY
EL NIÑO vs. NEUTRAL
PRECIPITATION

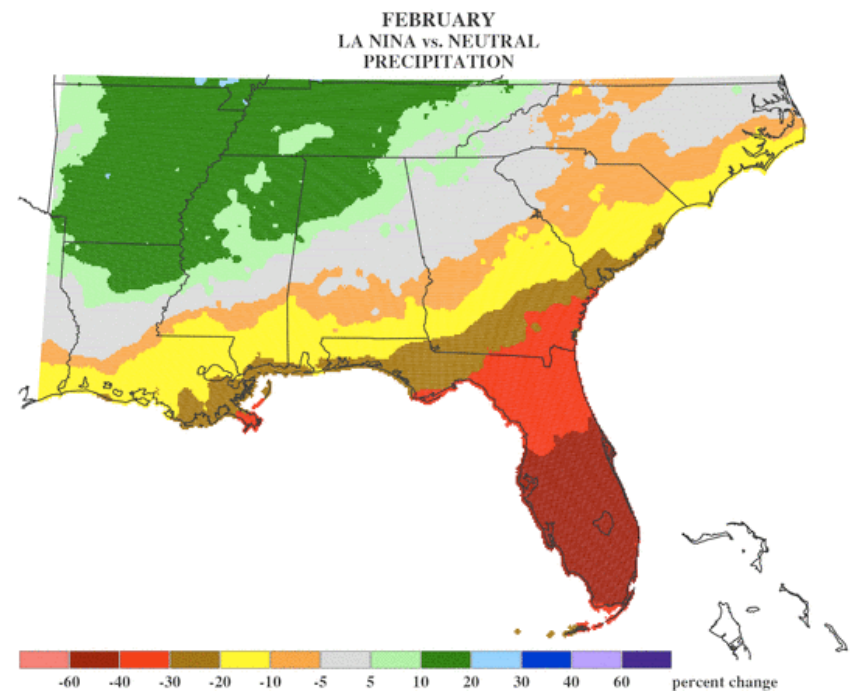
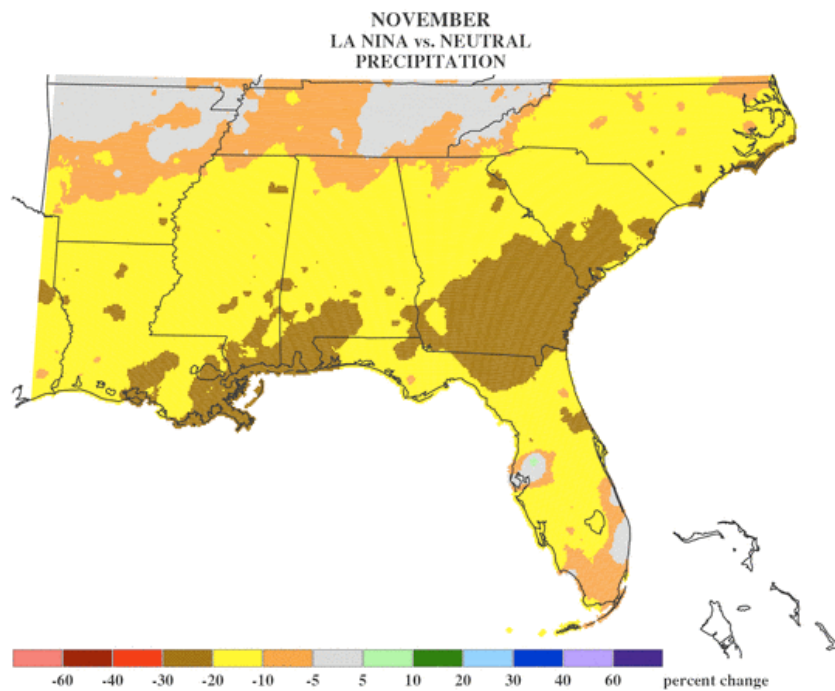


JULY
EL NIÑO vs. NEUTRAL
PRECIPITATION





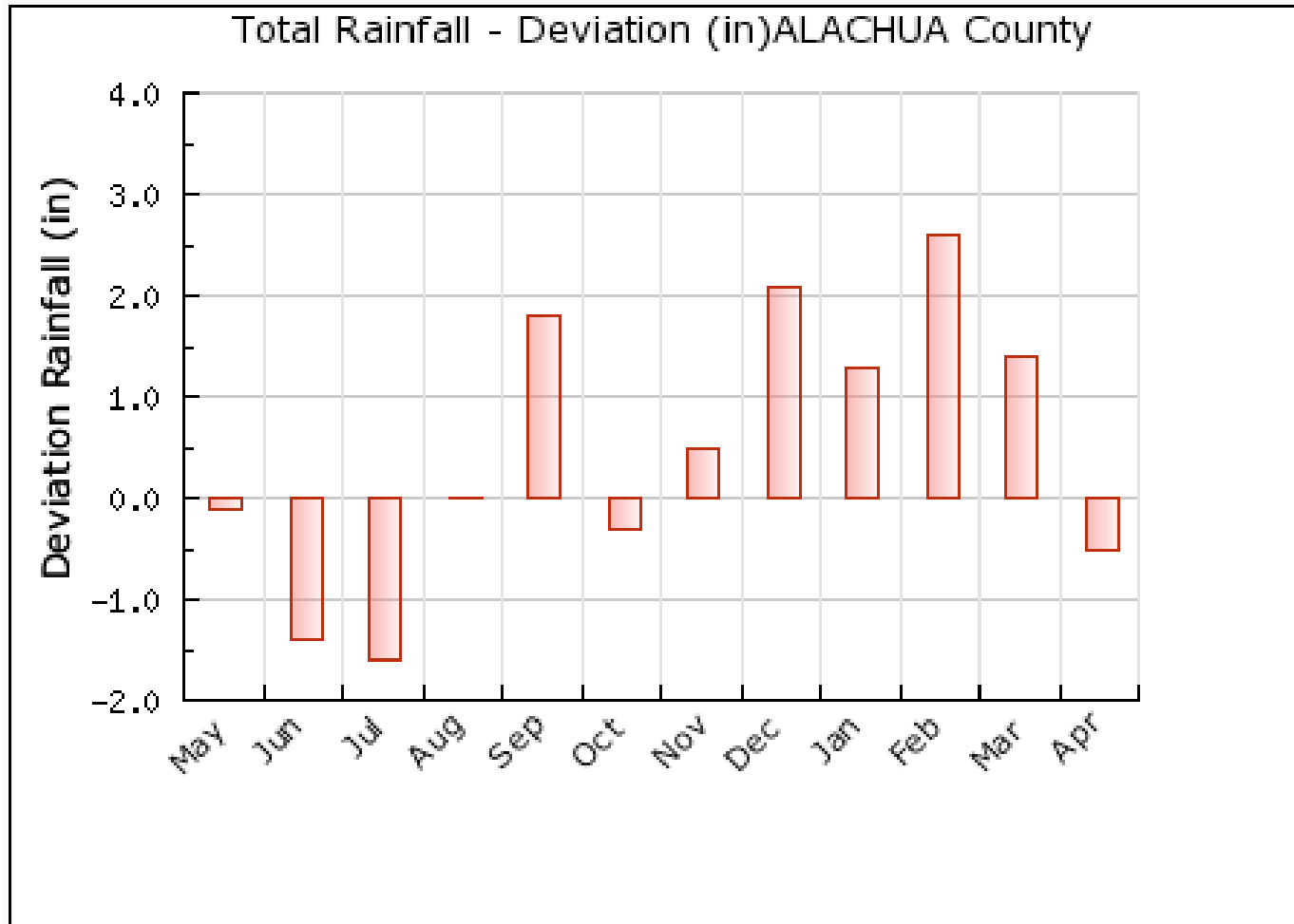
La Niña Effects on Precipitation





Local Climate Information

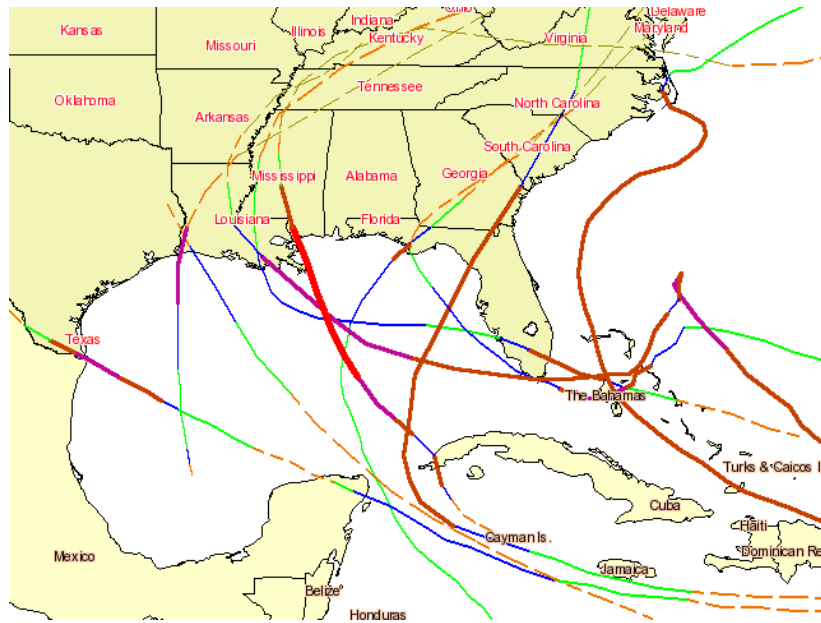
El Niño Rainfall



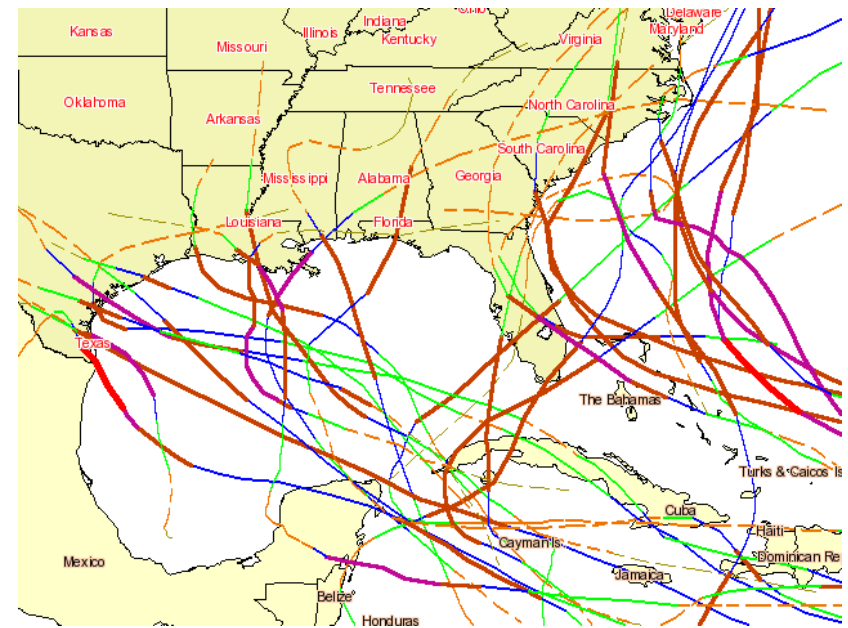


El Niño/La Niña and Major Hurricanes

El Niño

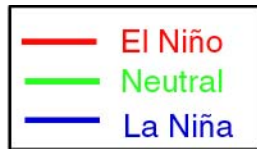


La Niña

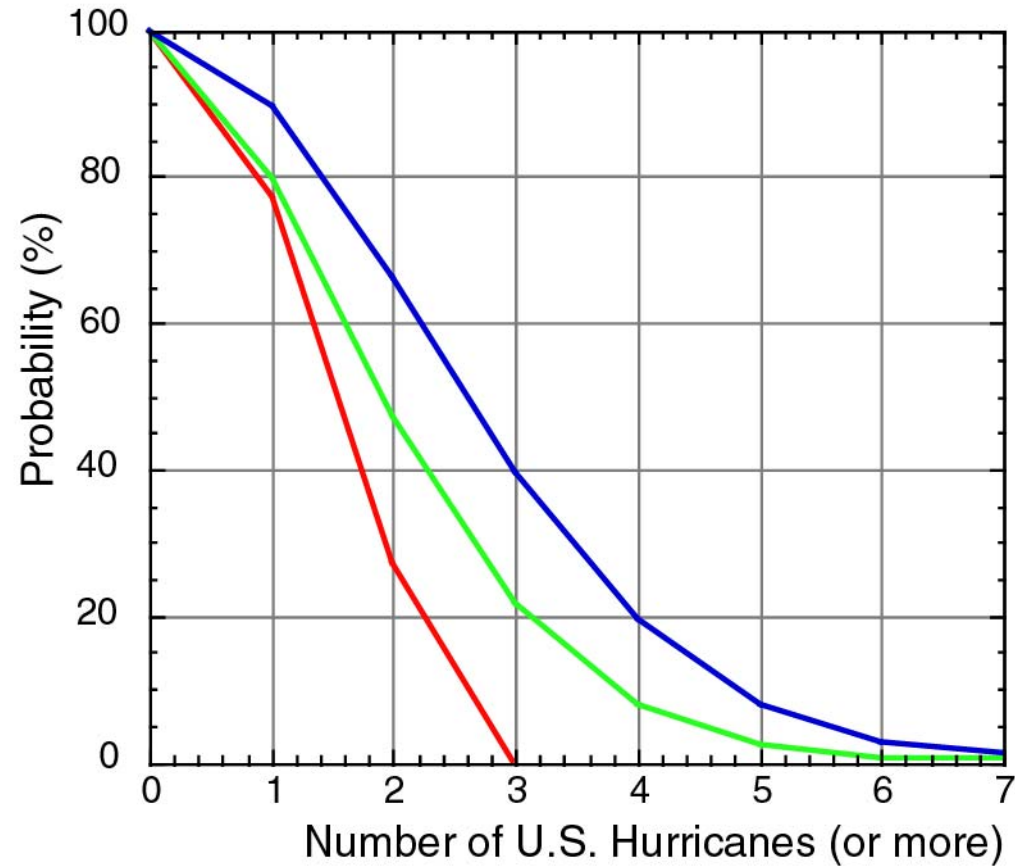




Probability of Hurricane Strikes



U.S. Landfalling Hurricane Probabilities





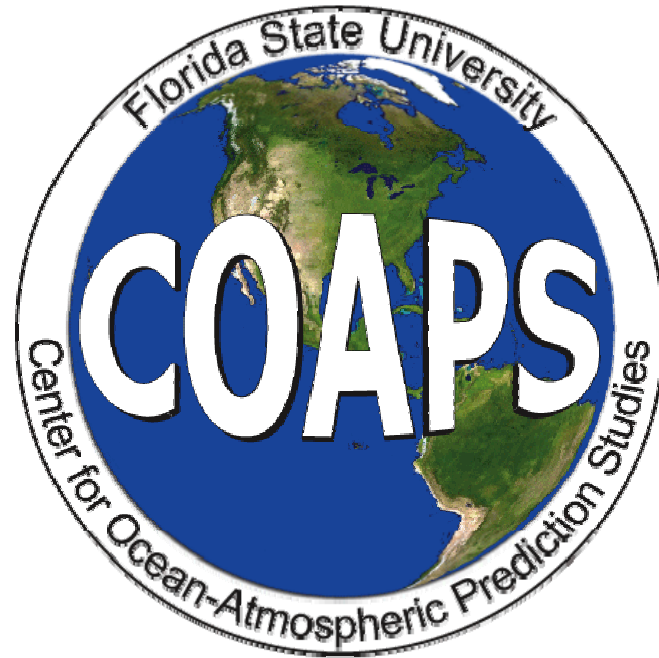
Impact Freezes of the last century

| <u>Freeze Date</u> | <u>ENSO State</u> |
|--------------------|-------------------|
| *Dec 1894 | Neutral |
| Feb 1899 | Neutral |
| Dec 1934 | Neutral |
| Jan 1940 | Neutral |
| *Dec 1962 | Neutral |
| Jan 1977 | El Nino |
| Jan 1981 | Neutral |
| *Dec 1983 | Neutral |
| Jan 1985 | Neutral |
| *Dec 1989 | Neutral |
| Jan 1997 | Neutral |



* High Impact

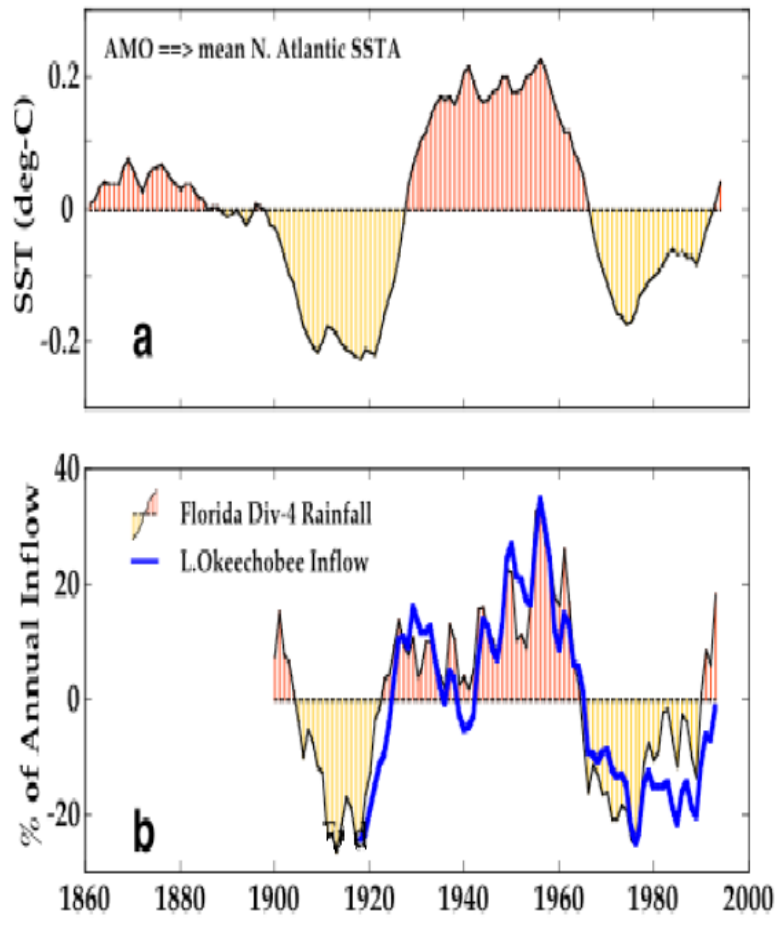




Beyond El Niño: Multidecadal Variability and Trends

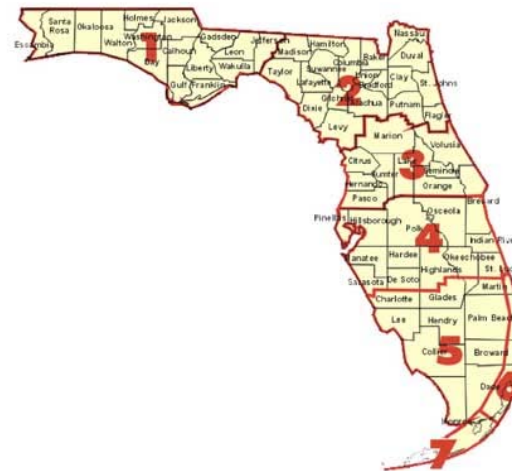


Atlantic Multidecadal Oscillation



The Atlantic multidecadal oscillation (AMO) describes variations in sea surface temperatures north of the equator.

It is tied to changes in the thermohaline circulation or conveyor belt.



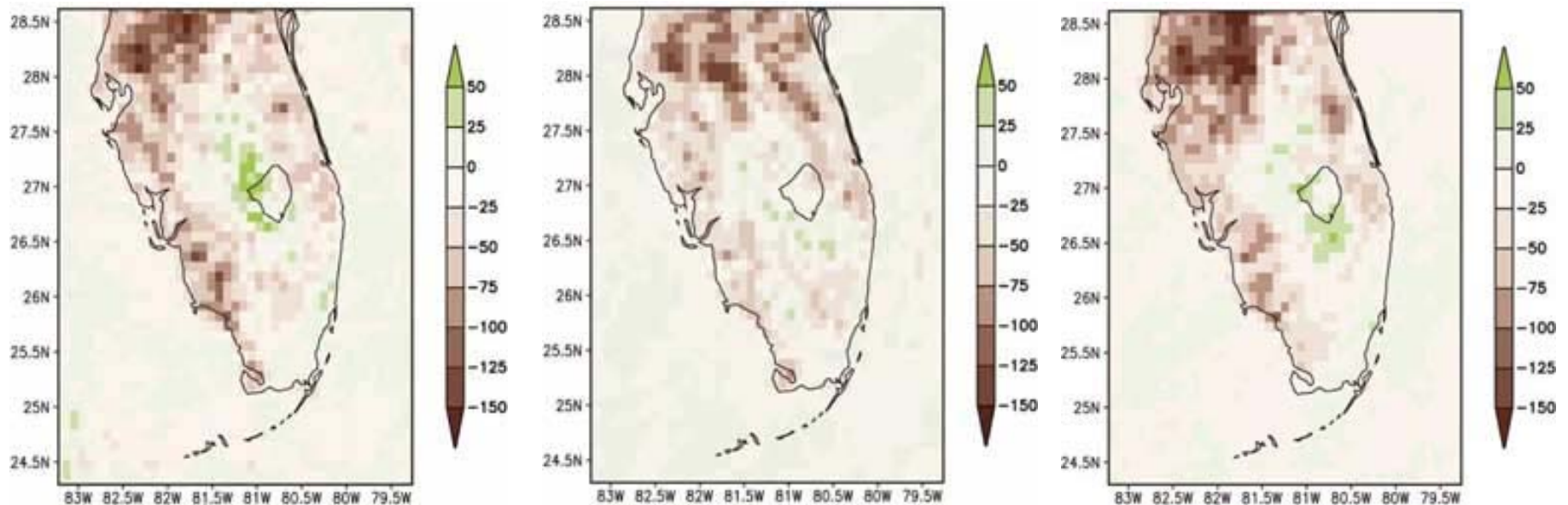
Enfield, et. al. 2001





Impacts of Land Use Changes

Modeled differences in convective summer (July – Aug.) rainfall using pre-1900 and 1993 land cover.



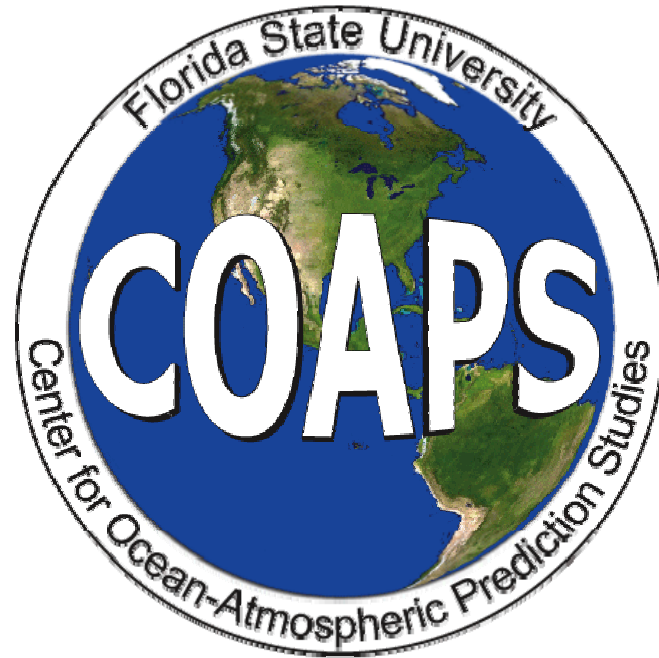
1973

1989

1994

Marshall, Pielke, et. al. 2004





Climate Change Issues



Climate change is a contentious issue...



Pro-Global Warming

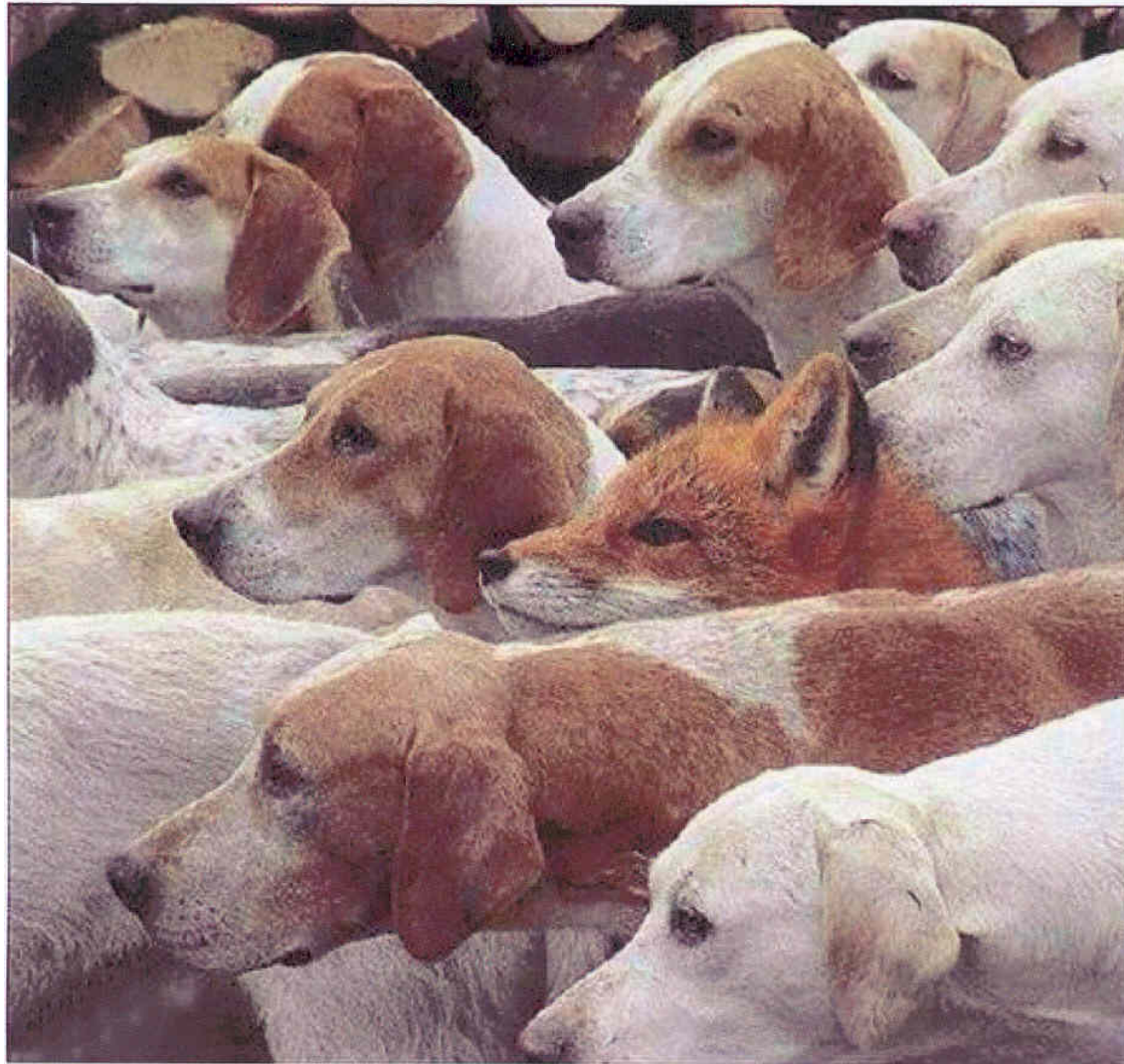


Anti-Global Warming





Where do I stand on global warming?



When you are in deep trouble,
say nothing, and try to look inconspicuous.





“Climate Change” versus “Global Warming”

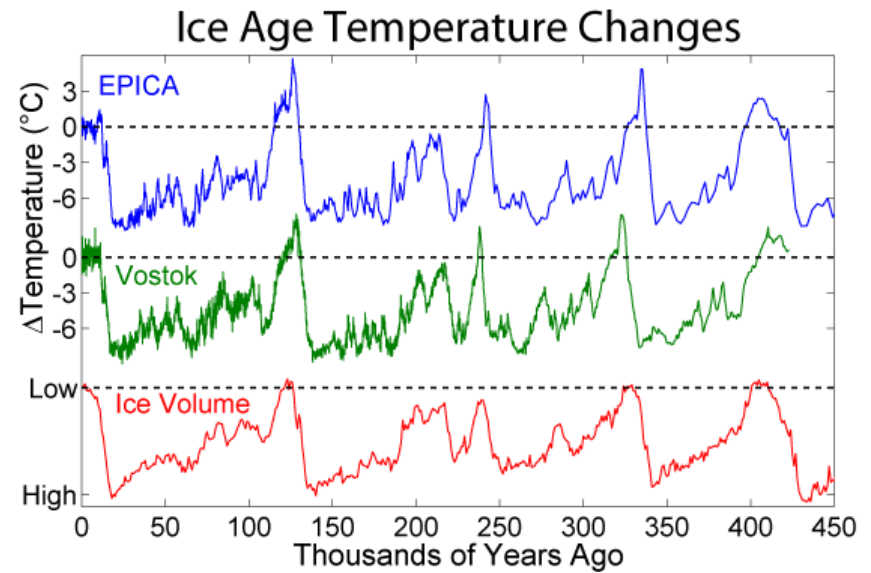
Climate change is ongoing and has many causes, both natural and man-made.

Natural causes:

- Changes in solar intensity
- Eccentricity in the earth’s orbit and “wobbles”
- Vegetation, albedo changes
- Volcanic eruptions
- Coupled ocean/atmospheric cycles

Man-made causes:

- Urbanization
- Land use changes (irrigation of semi-arid areas, draining wetlands, etc.)
- Aerosols
- Greenhouse gases



“Global warming” specifically refers to a general warming of the planet due the anthropogenic increase in greenhouses gases.

Unfortunately, “climate change” is now misconstrued as the same as “global warming.”

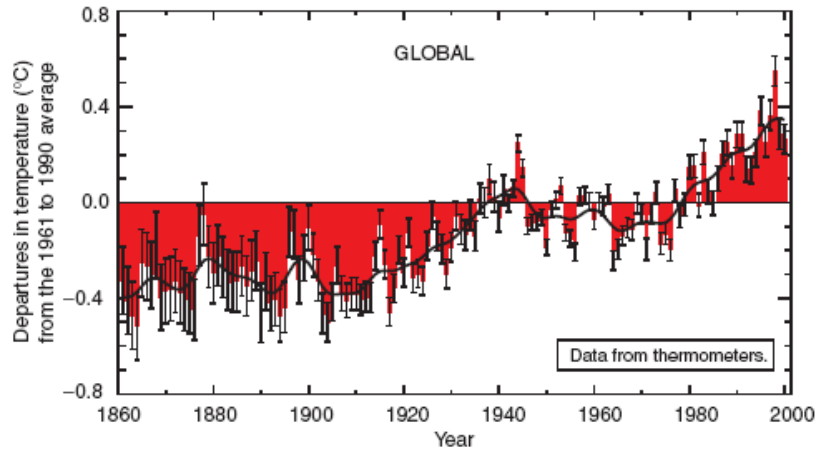




Modern Day Temperatures

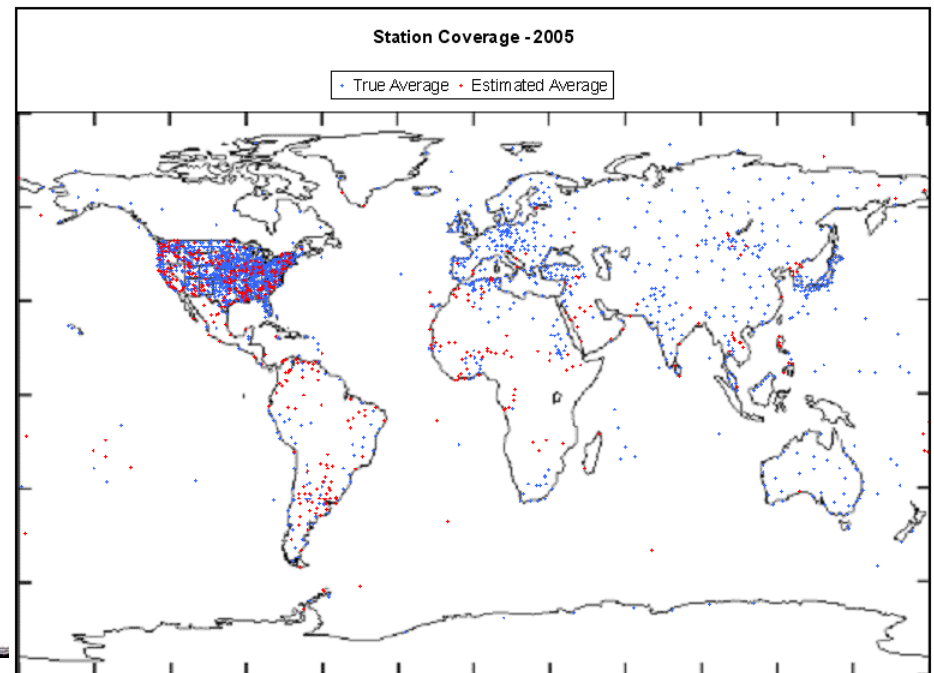
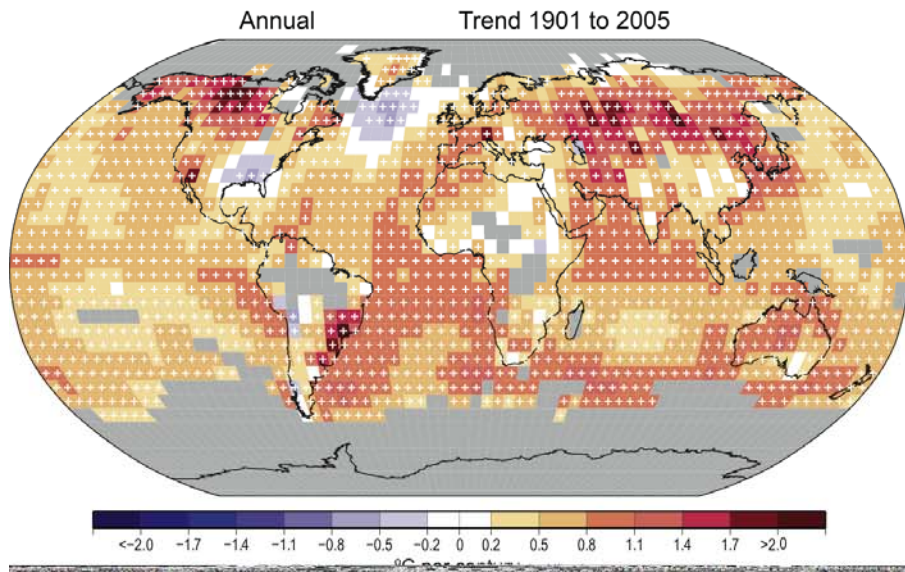
Variations of the Earth's surface temperature for:

(a) the past 140 years



“Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.”

- IPCC 4





Rural Weather Station



Town is located to the northeast of Eglin AFB, a large expanse of undeveloped forests.

Surrounding countryside consists of pastures, farmland, and pine forests.

Station located at Showel Farms, 3 miles to the east of the city.

Walton County population is very low at around 40,000.

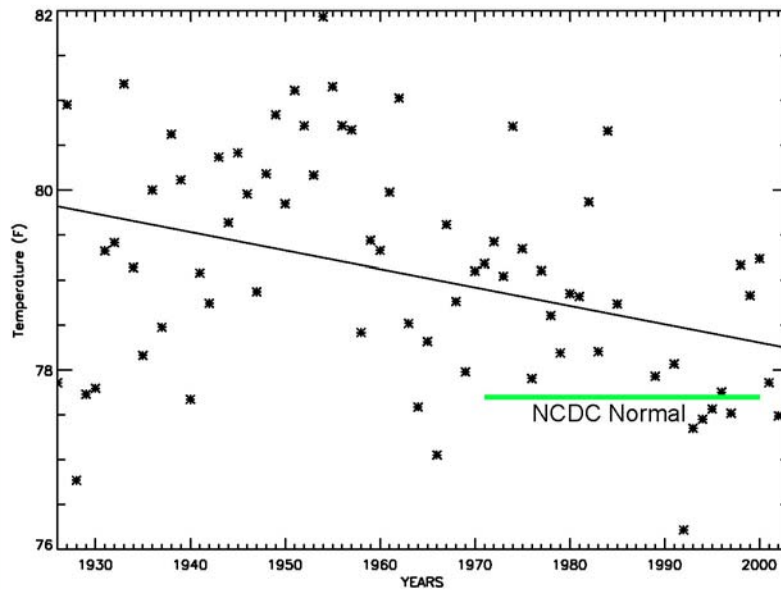
USHCN station (unadjusted data)



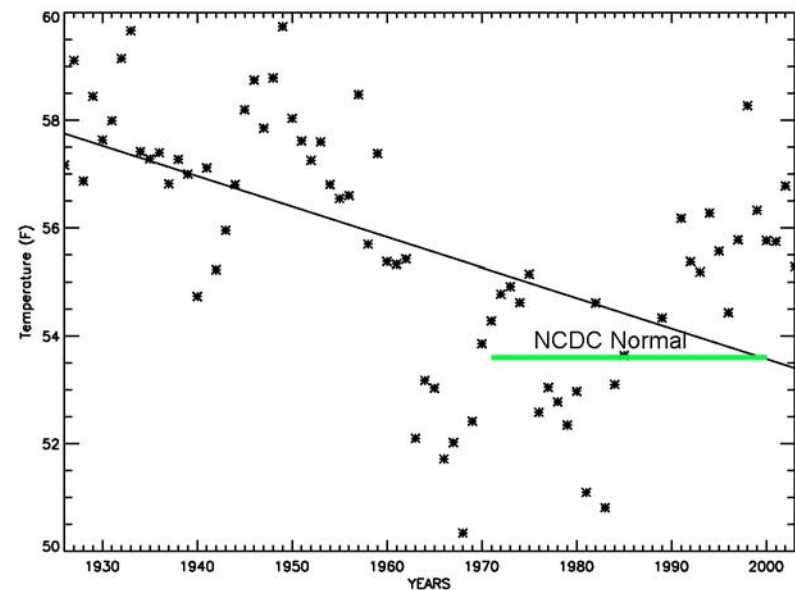


Rural Weather Station

De Funiak Springs
Annual Average Maximum Temperature

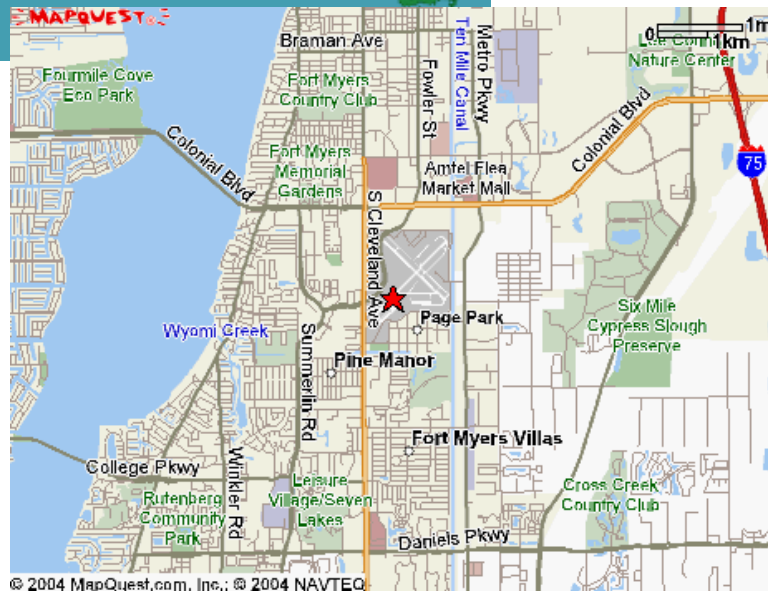


De Funiak Springs
Annual Average Minimum Temperature





Urbanization



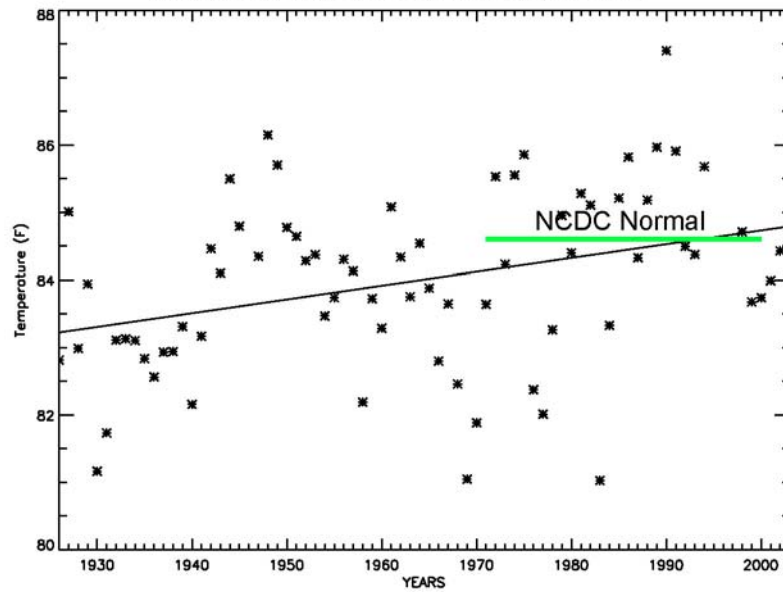
- Station located at Page Field near downtown Fort Myers.
- The city of Fort Myers has experienced tremendous urban sprawl in the last 40 years.
- Lee county population has ballooned from 60,000 to over a half million in the last 40 years.
- USHCN station (unadjusted data)



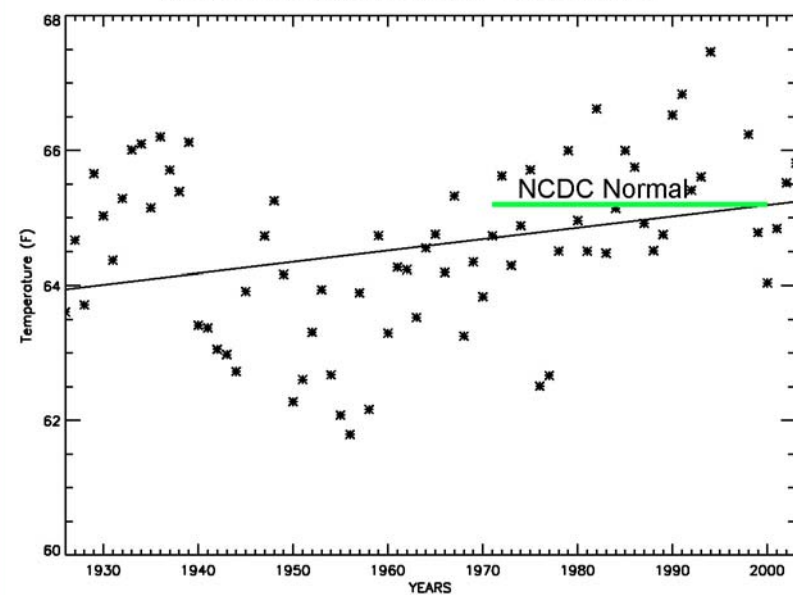


Urbanization

Fort Myers
Annual Average Maximum Temperature



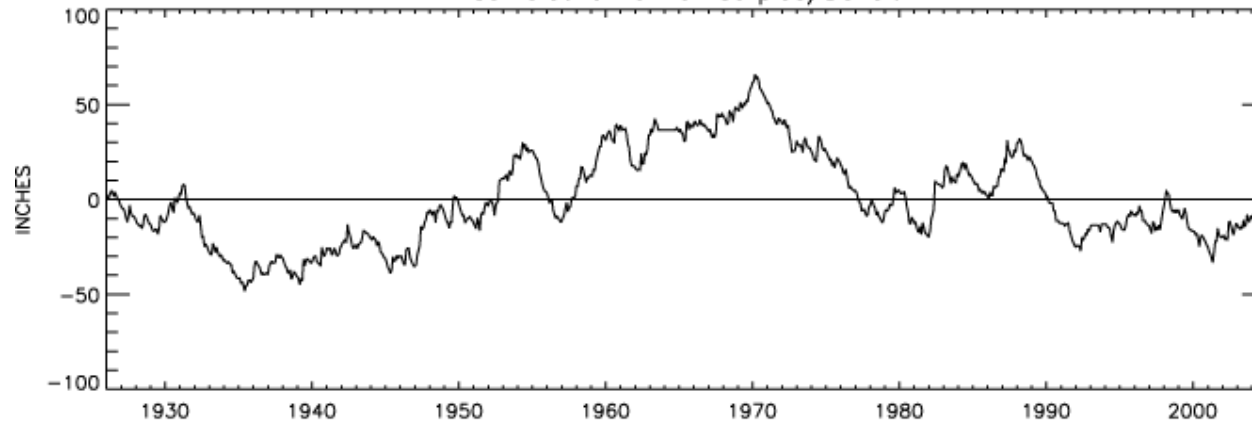
Fort Myers
Annual Average Minimum Temperature



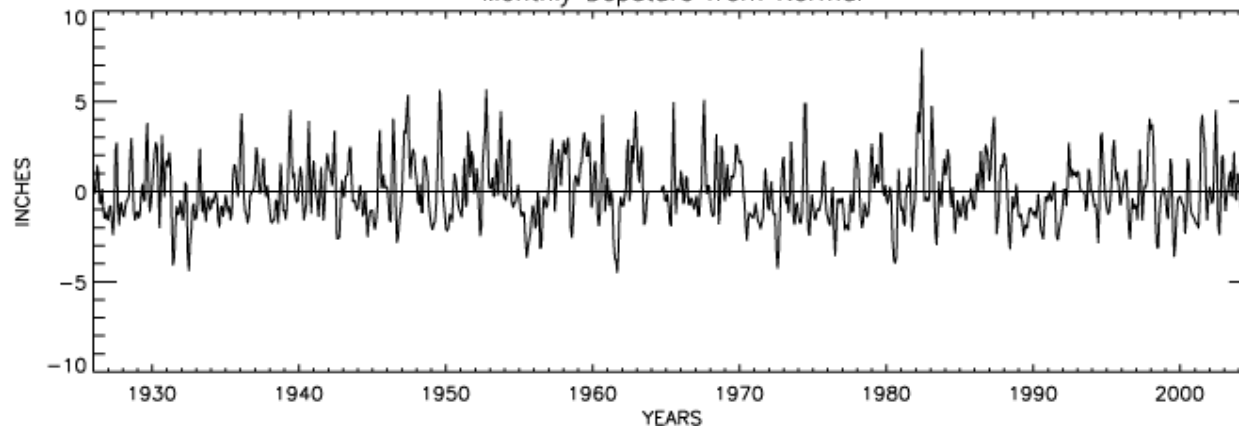


Long-term Rainfall Trends

ARCADIA: Long Term (1926–2004) Precipitation Trends
Cumulative Rainfall Surplus/Deficit



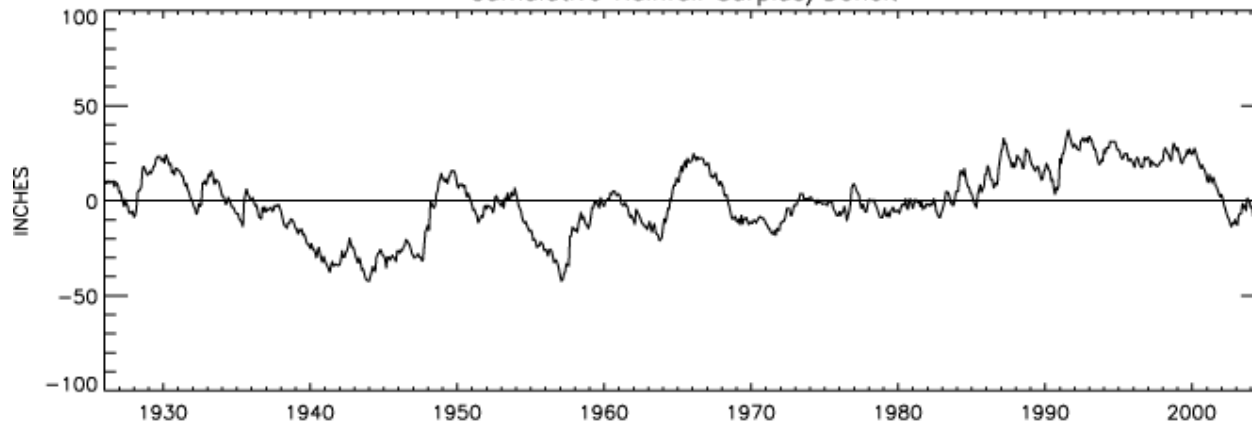
Monthly Departure from Normal



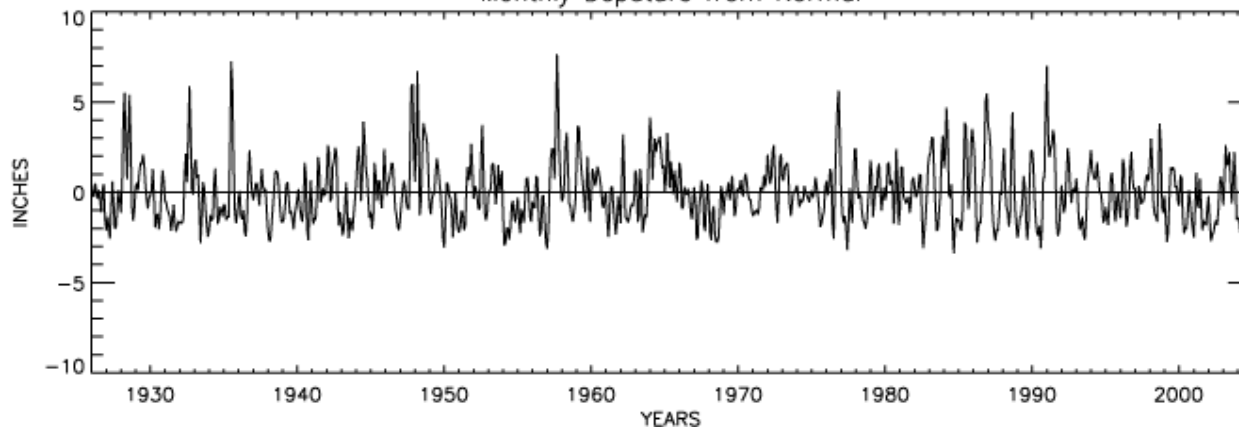


Long-term Rainfall Trends

MADISON: Long Term (1926–2004) Precipitation Trends
Cumulative Rainfall Surplus/Deficit



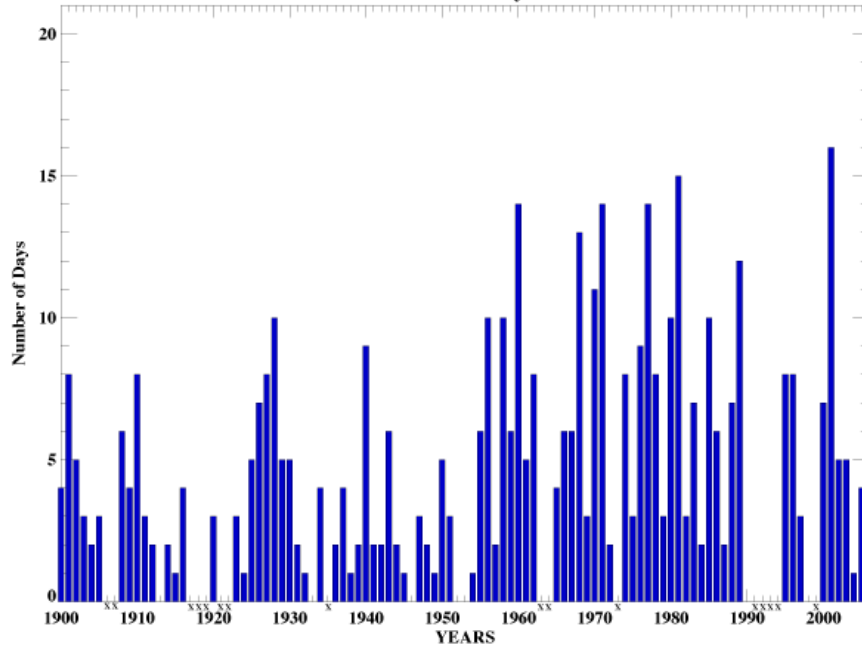
Monthly Departure from Normal



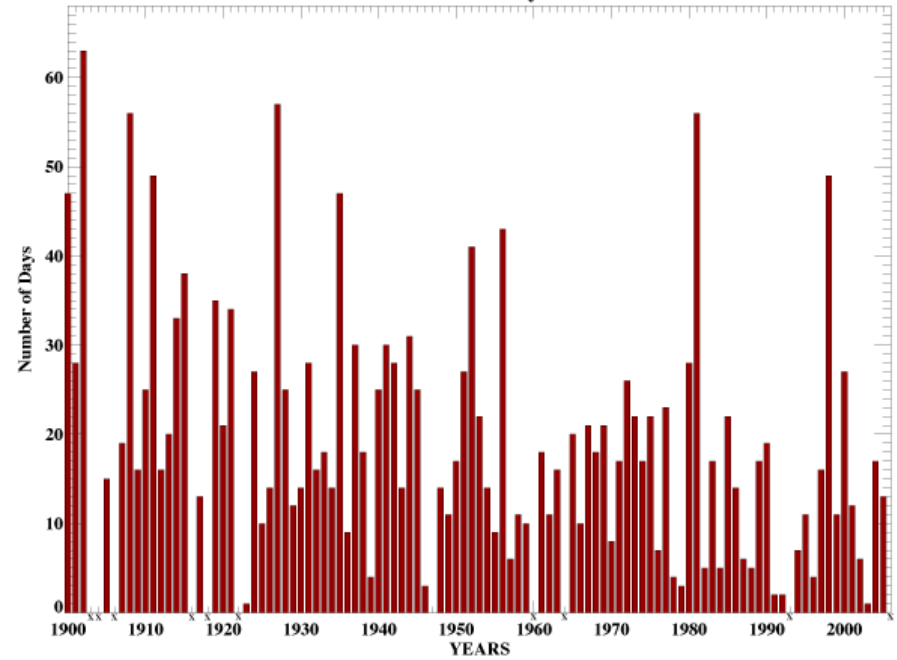


Temperature Extremes

ARCADIA: Number of Days At/Below 32F

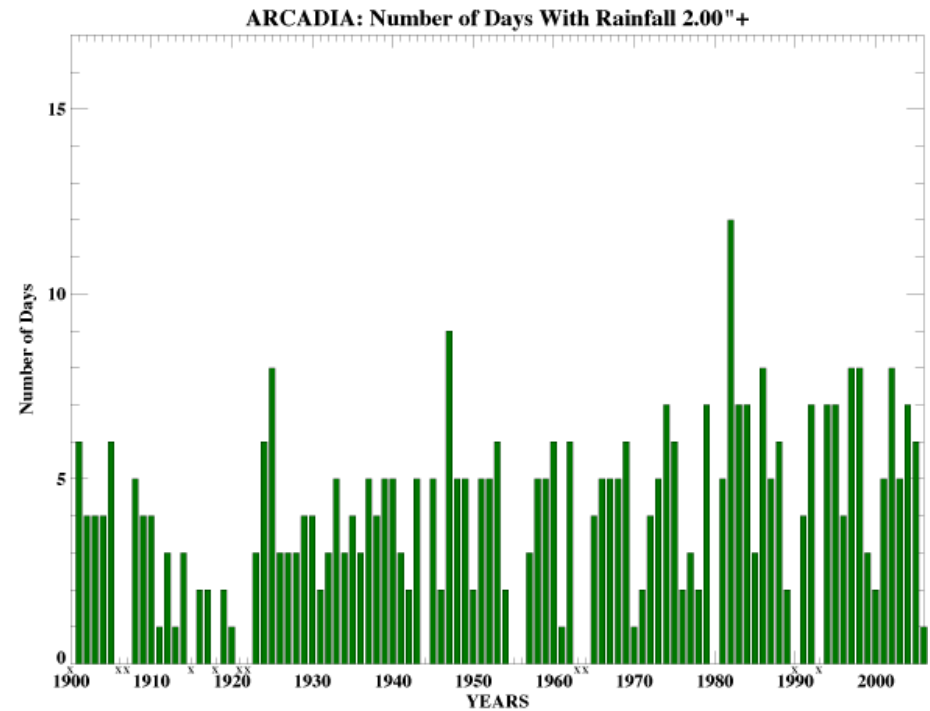
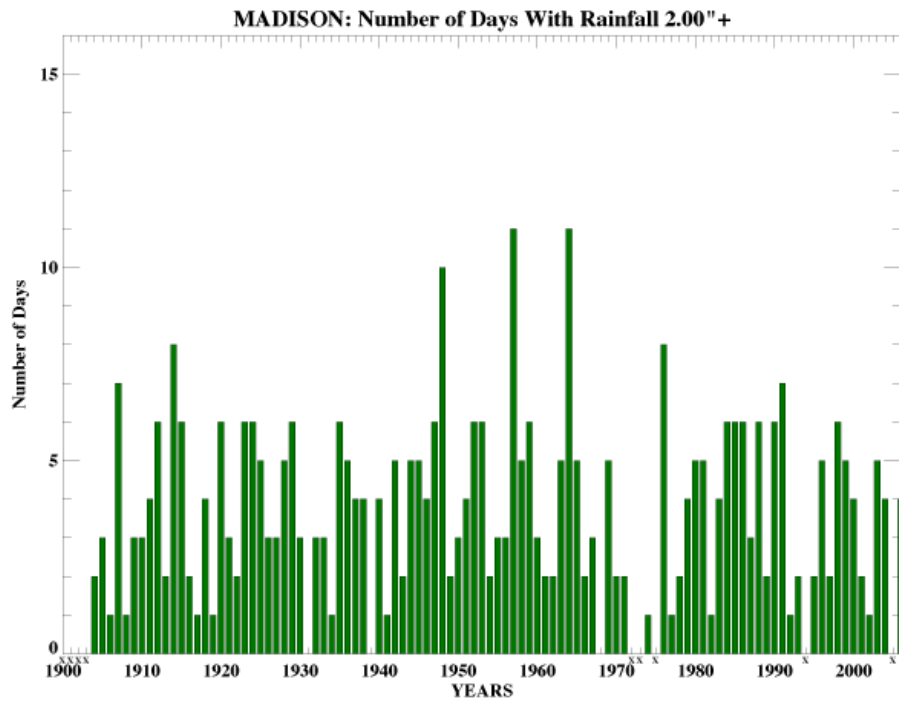


ARCADIA: Number of Days At/Above 95F





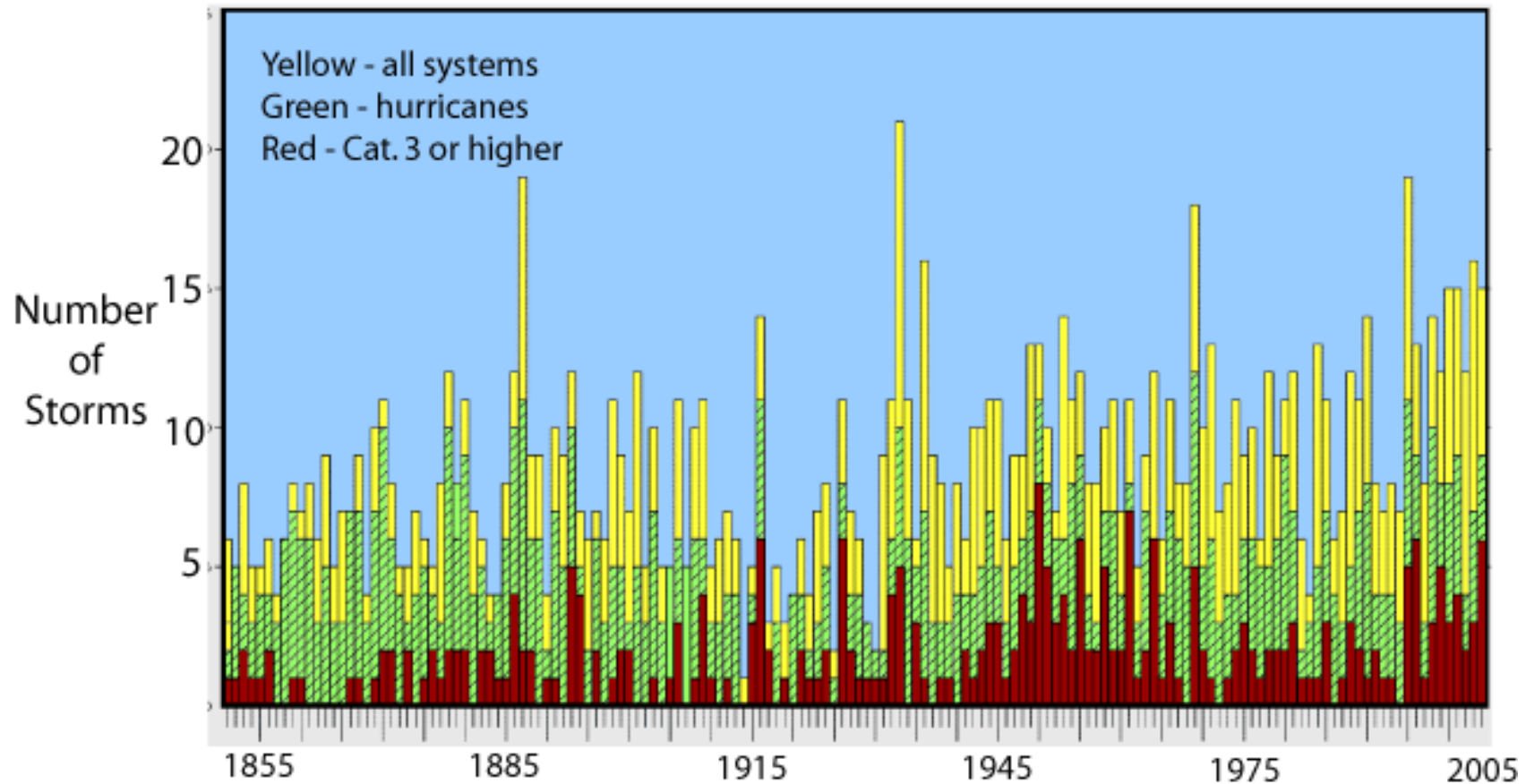
Precipitation Extremes





Atlantic Hurricanes

Historical Hurricane and Tropical Storm Counts for the Atlantic Basin





“Over the long term the effects of changes in society dwarf the effects of any projected changes in tropical cyclones...”

“...claims of linkages between global warming and hurricane impacts are premature...”

- Pielke, et. al., 2005

“Thus large, long-term ‘trends’ in tropical cyclone frequency are primarily manifestations of increased monitoring capabilities and likely not related to any real change in the climate in which they develop.”

- Landsea, 2007

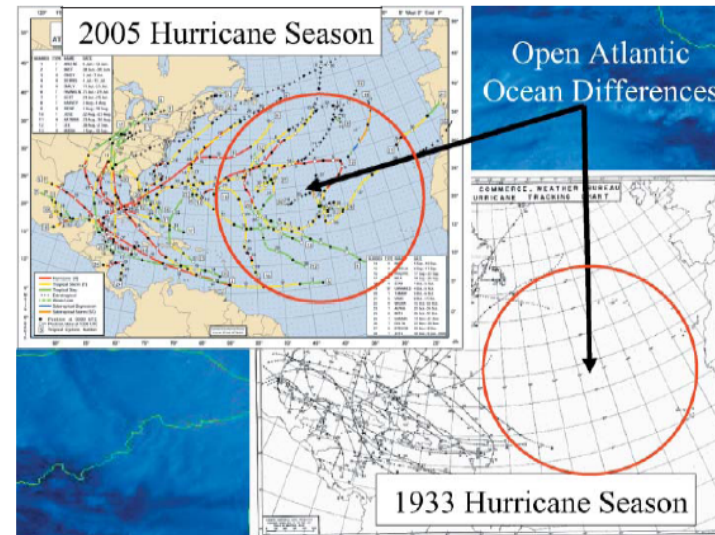
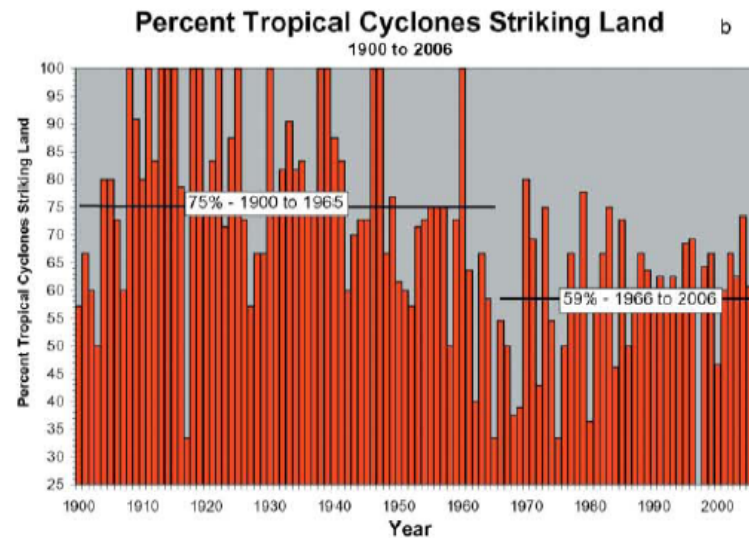
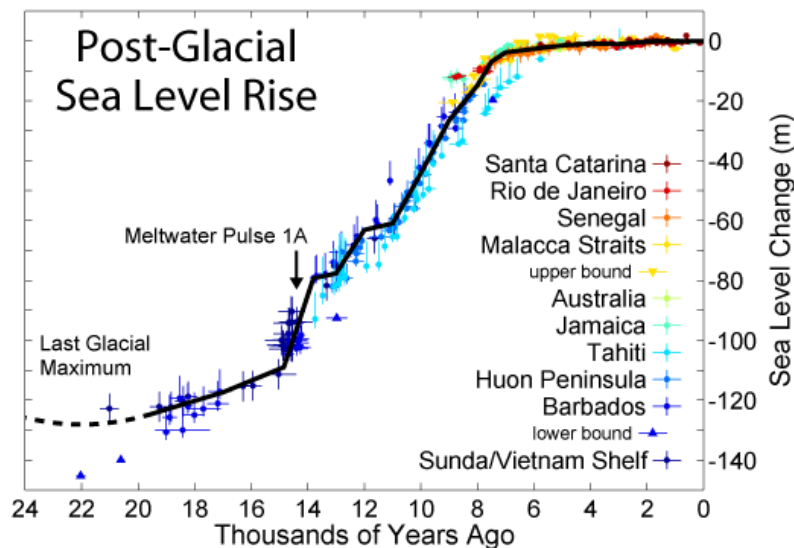
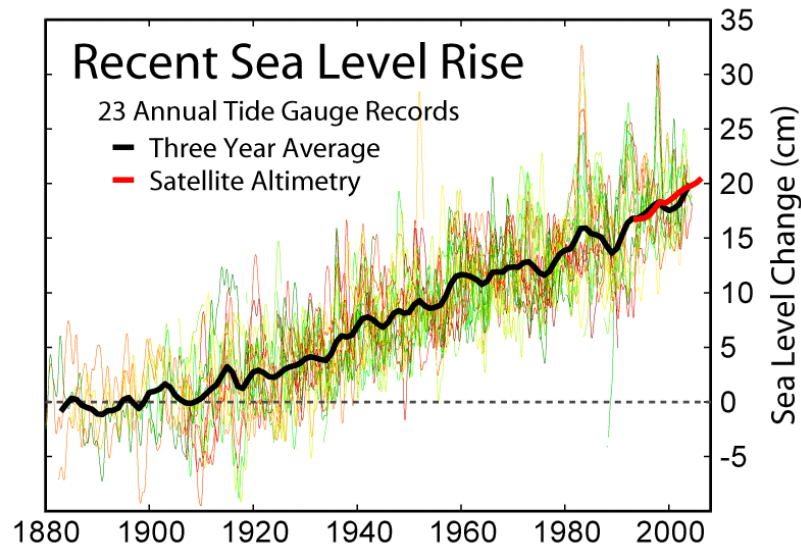


Fig. 1. Track maps of the Atlantic hurricane seasons of 2005 and 1933, the two busiest hurricane years on record for tropical cyclone frequency. The circles highlight large differences in activity that occurred over the open Atlantic Ocean.





Historic sea level rise



- Sea level measurements from 23 highest quality tidal stations around the world.
- Estimates of sea level rise from 1 mm/yr to 2 mm/yr.
- Satellite measurements (altimeters) since 1992 indicate a rise of around 3mm/yr.
- IPCC third assessment report stated "No significant acceleration in the rate of sea level rise during the 20th century has been detected."





Uncertain Future

Limitations of Climate Models

- The physics of water vapor, clouds, and precipitation are poorly represented.
- Limited spatial resolution
- Climate models have not demonstrated the ability to reproduce the modes of variability seen in the 20th century.
- Cannot accurately predict regional shifts in temperature or precipitation.
- Coupling between the atmosphere and the ocean, land surface, and ice surfaces is limited.





Global Warming “Myths”

“Throw out the record books, because global warming is raising temperatures in Florida and across the country,”

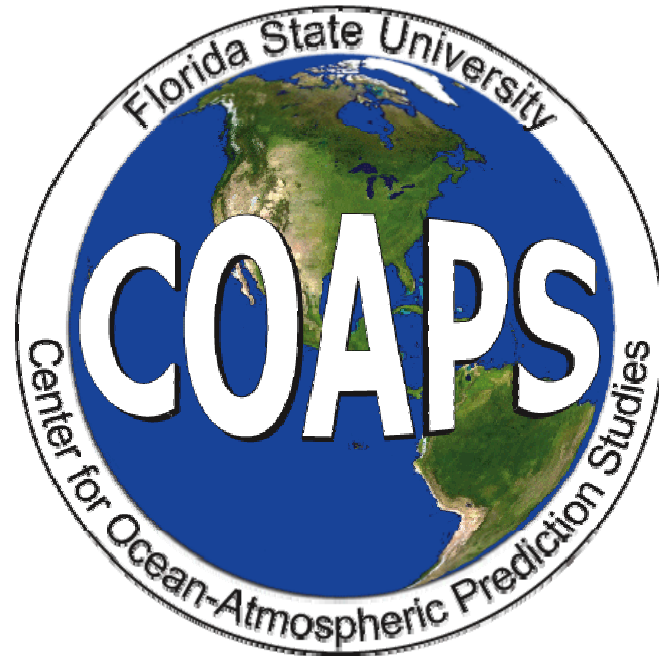
- Environment Florida

"In low-lying areas, anticipated sea-level rise could force water to flow horizontally as much as 400 feet or more inland--flooding shoreline homes and hotels and eroding Florida's famous beaches,"

- NRDC

“The Union of Concerned Scientists predicts a three- to 10-degree Fahrenheit rise in winter low and summer high temperatures for Florida as a whole. Northern Florida, the group says, will suffer the most from loss of soil moisture.”





The End

For more information, visit our websites:

COAPS: www.coaps.fsu.edu

Florida Climate Center: www.coaps.fsu.edu/climate_center

AgClimate : www.agclimate.org



Global Sea Surface Temperatures

QuickTime™ and a
Animation decompressor
are needed to see this picture.

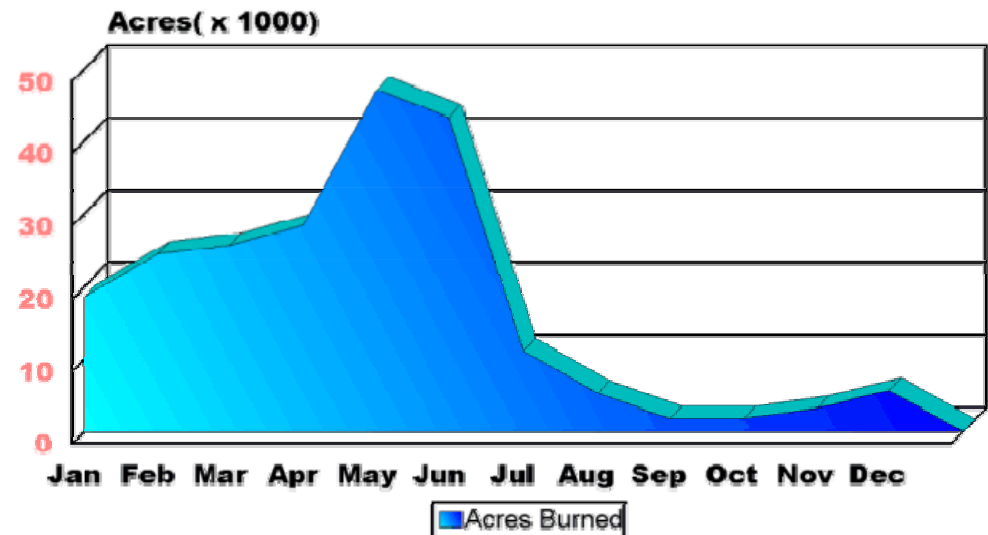




Typical Wildfire Season in Florida and the Southeast

- The peninsula experiences an extended dry season from Oct. through April.
- Unlike the Western U.S., Florida's wildfire season peaks in the spring/early summer.
- Winter wildfires are usually caused by human activities.
- Late spring and early summer fires are predominantly caused by lightning and can occur in remote/inaccessible locations.

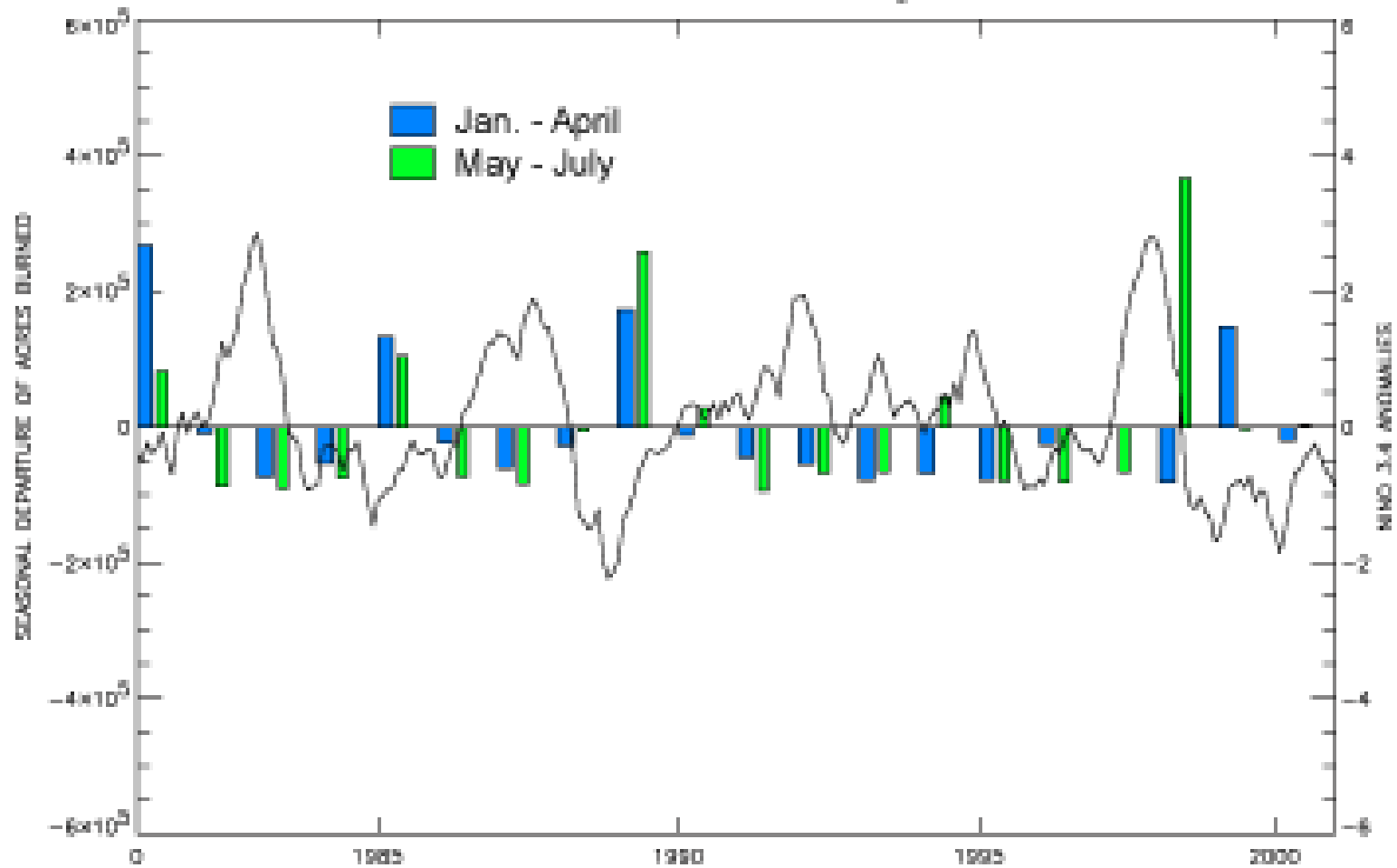
Avg. # of Acres By Month 1981 -2000





Wildfire Activity

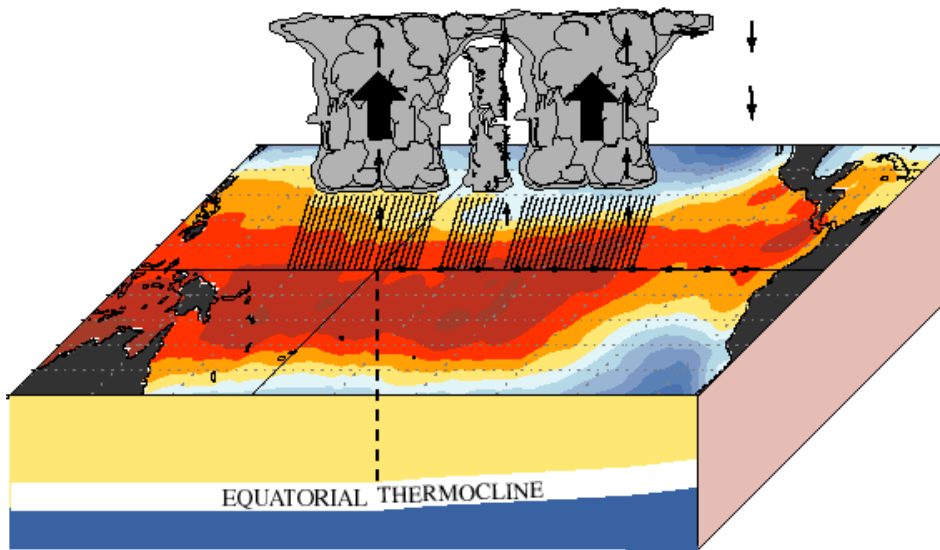
Wildfire Activity in Florida Nino 3.4 Index and Anomalous Acreage Burned



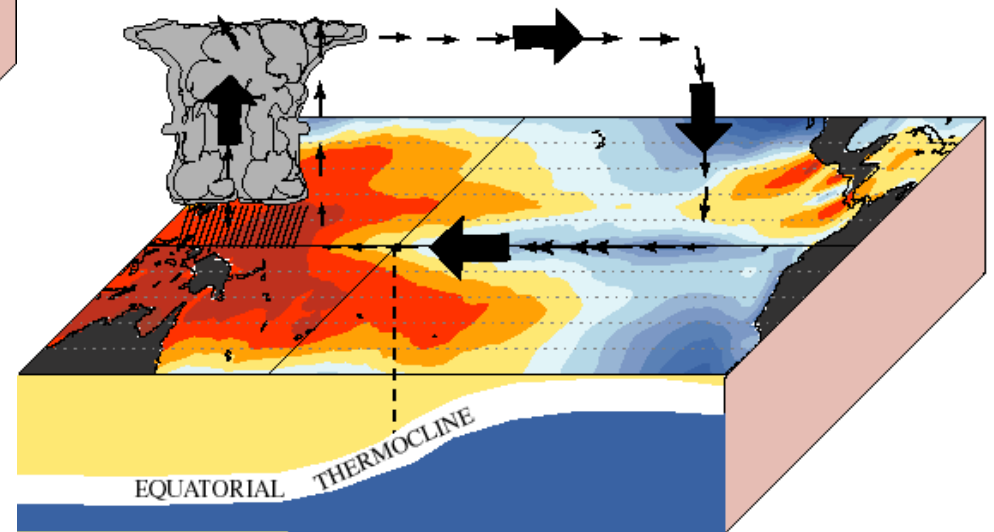


How El Niño/La Niña Effect the Atmospheric Circulation

December - February El Niño Conditions



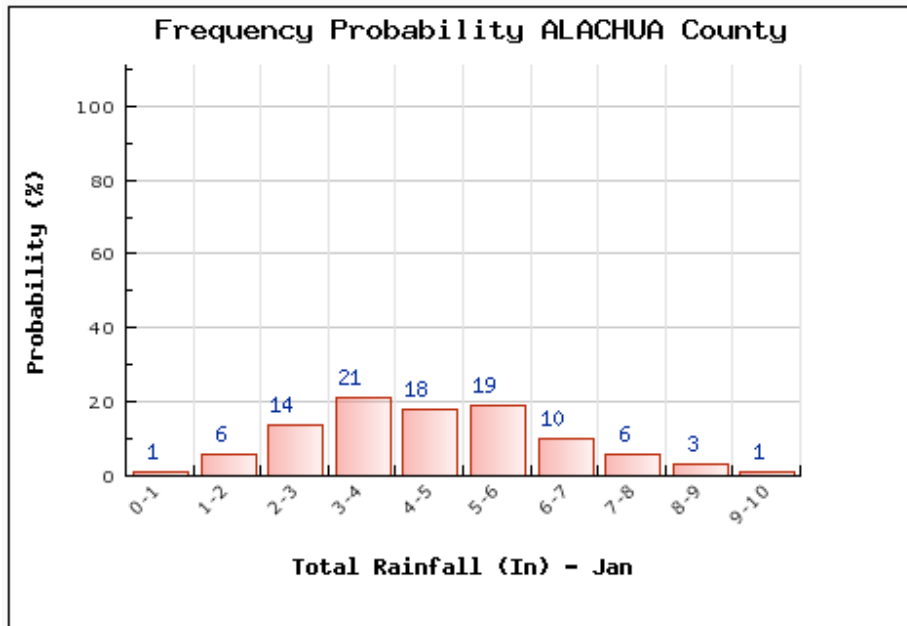
December - February La Niña Conditions



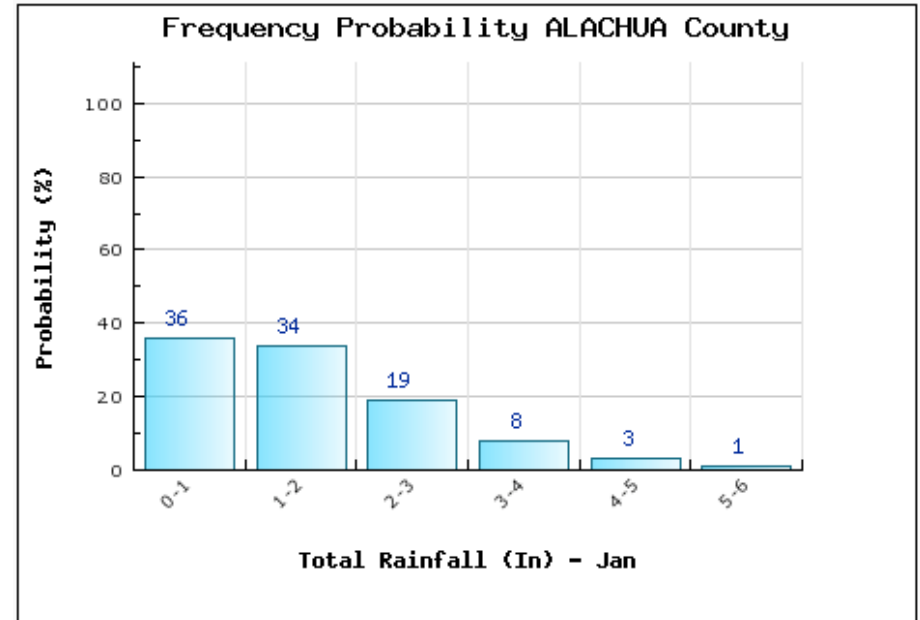


Probabilistic Nature of Forecast

El Niño



La Niña





IPCC Projections

