Influence of Global Warming on the Florida Climate

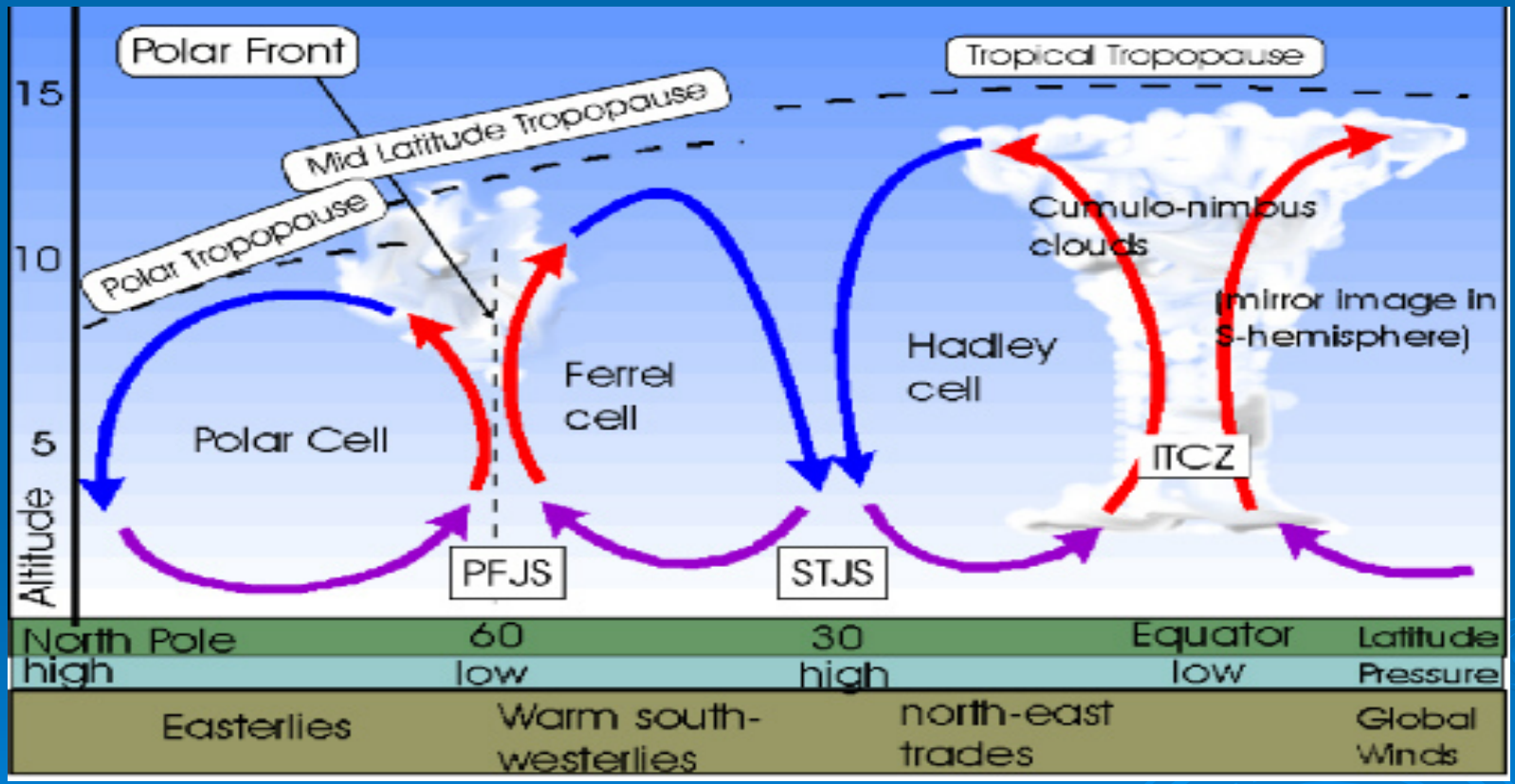
Purpose of this presentation is to:

A. give a quick review of the influence of Hadley Circulation on the south Florida climate.

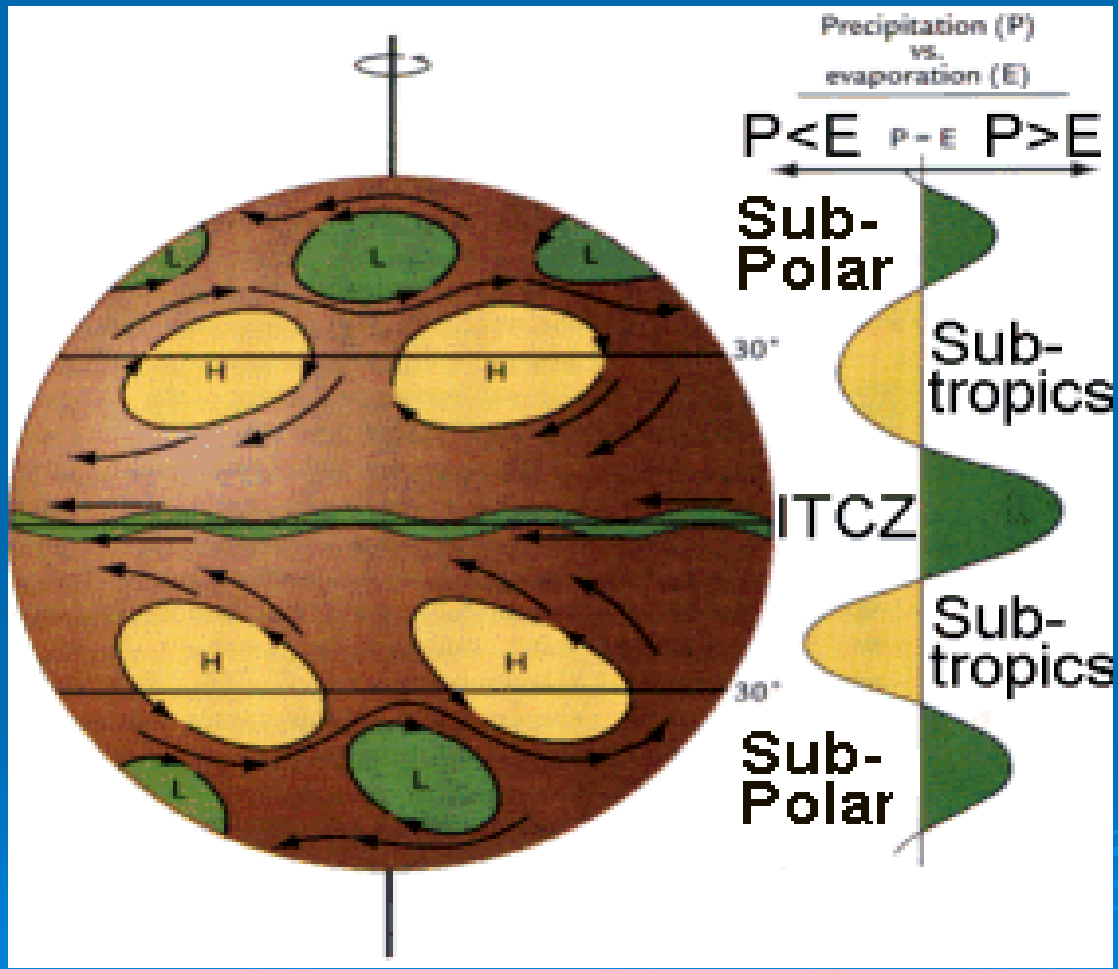
B. briefly review the Intergovernmental Panel of Climate Change (IPCC) Fourth Assessment Report (AR4) findings on rainfall in the subtropics focusing on the effect of global warming on net rainfall in Florida.

C. give summary and recommendation.

Meridional Circulation in the Northern Hemisphere

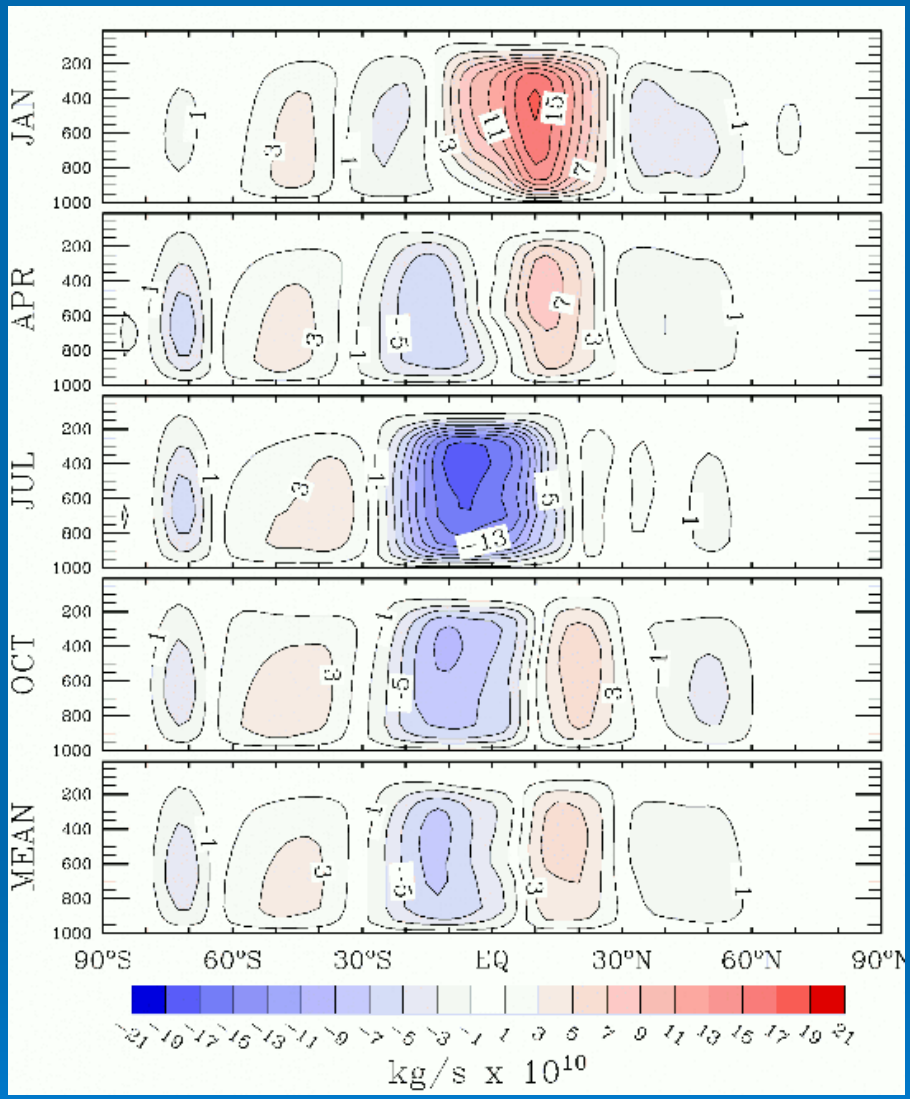


Latitudes Precipitation surpluses and Deficits



Hadley Circulation Seasonal Changes

(Meridional Stream Function)



January

April

July

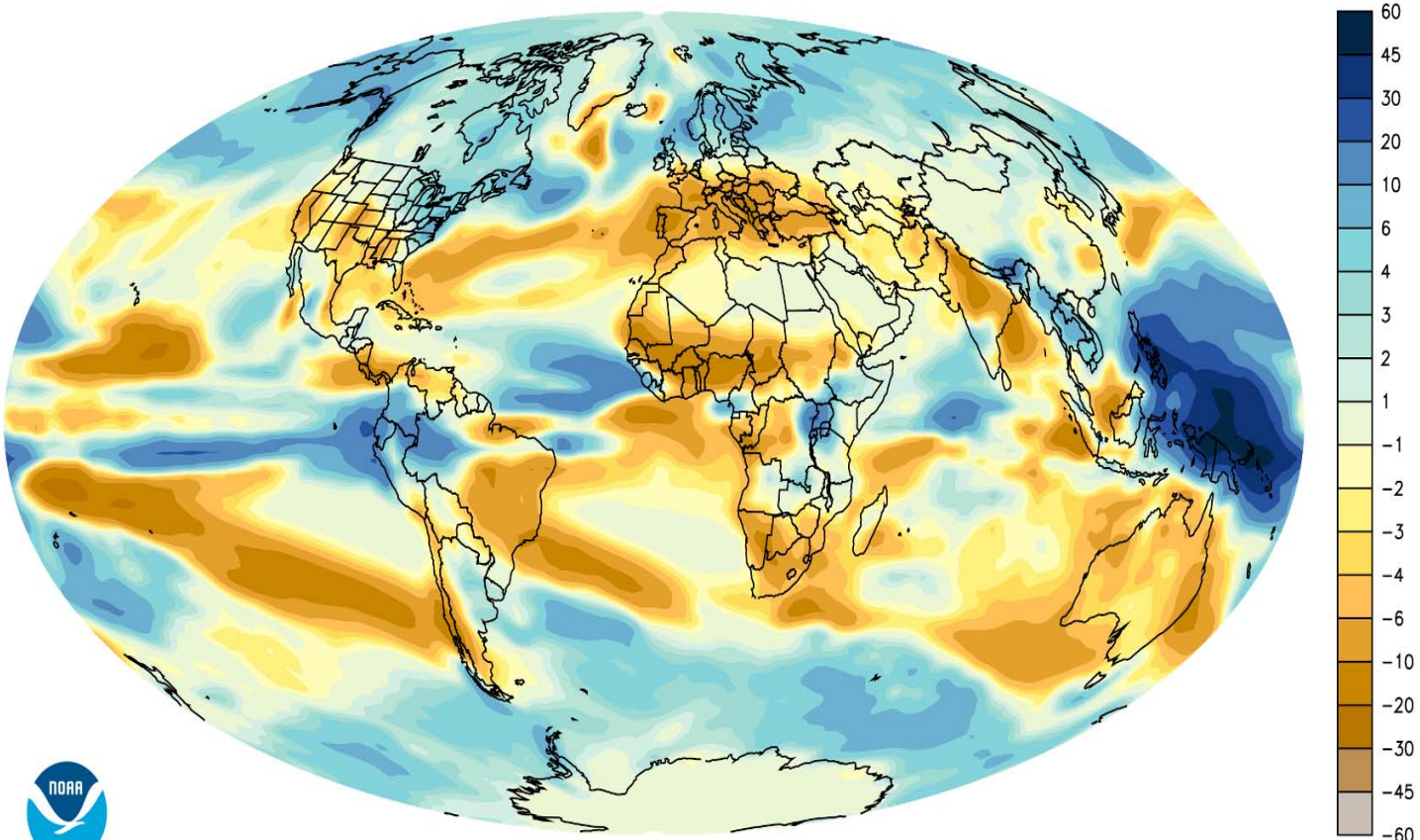
October

Mean

Monthly and annual mean stream functions illustrating the Hadley circulation from the 1968-1989 NCEP/NCAR reanalysis [Fig. 3 of Waliser et al (1998)]. Units are in 1010 kg s-1 and the contour level is 2x1010 kg s-1.

CHANGE IN PRECIPITATION BY END OF 21st CENTURY

inches of liquid water per year



as projected by NOAA/GFDL CM2.1

The National Oceanic and Atmospheric Administration (NOAA)
Geophysical Fluid Dynamics Laboratory (GFDL) - Princeton, NJ

(vol. 1, no. 5)
2007-02-08
February 2007

Drought is currently occurring for many regions projected for increased frequency of future drought by Climate Models

- Parched in Australia: Drought changes views on warming
  Drought-hit Italy declares emergency

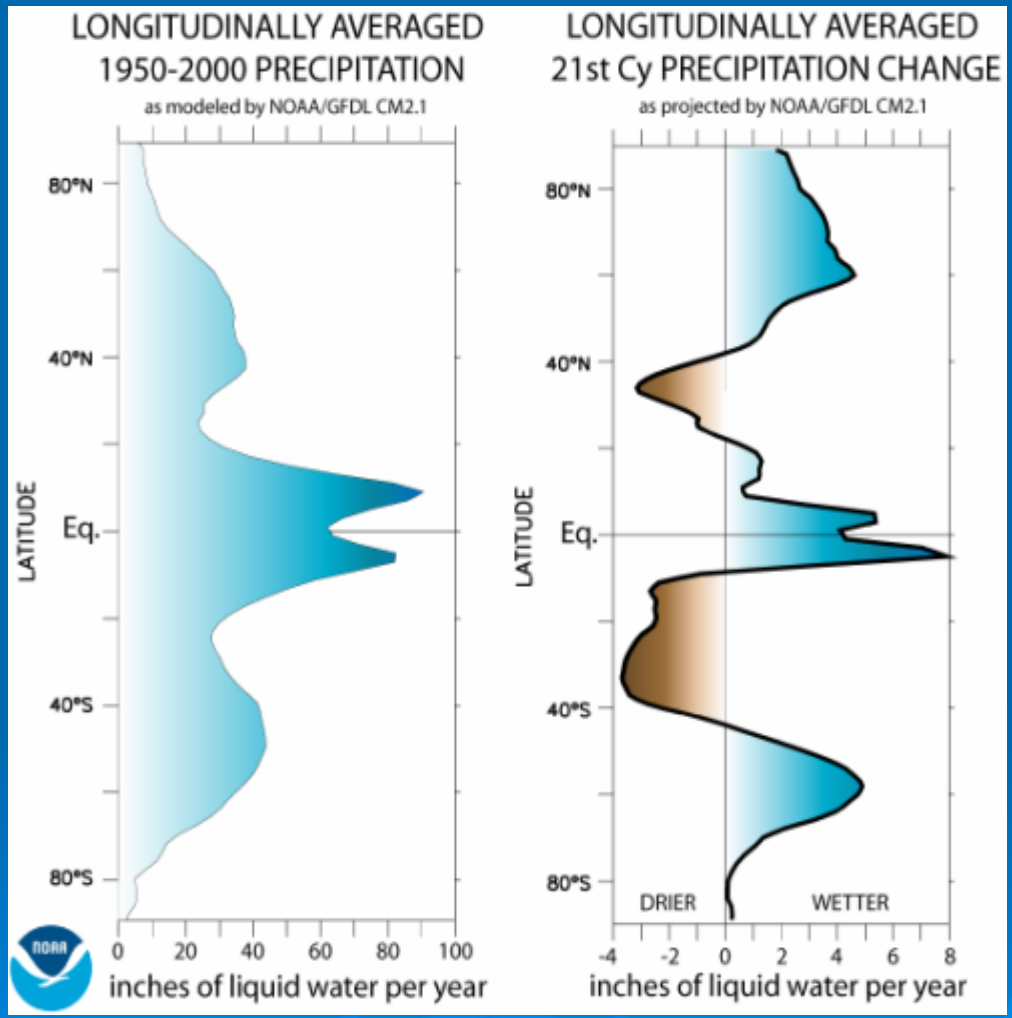
- ROME: Italy declared a state of emergency in northern and central regions on Friday due to fears of drought following unusually warm and dry weather.

- It came a day after neighboring France imposed water rationing in several of its regions, also in fear of drought

- Relying on the same computer models used in the Intergovernmental Panel on Climate Change (IPCC) report released in early 2007, a recent article published in *Science* concluded that global warming could make droughts more common, not just in the American Southwest, but also in semiarid regions of southern Europe, Mediterranean northern Africa, and the Middle East. Add to that Florida?

Latitudinal Variation of Rainfall

Dry get Drier while Wet get Wetter



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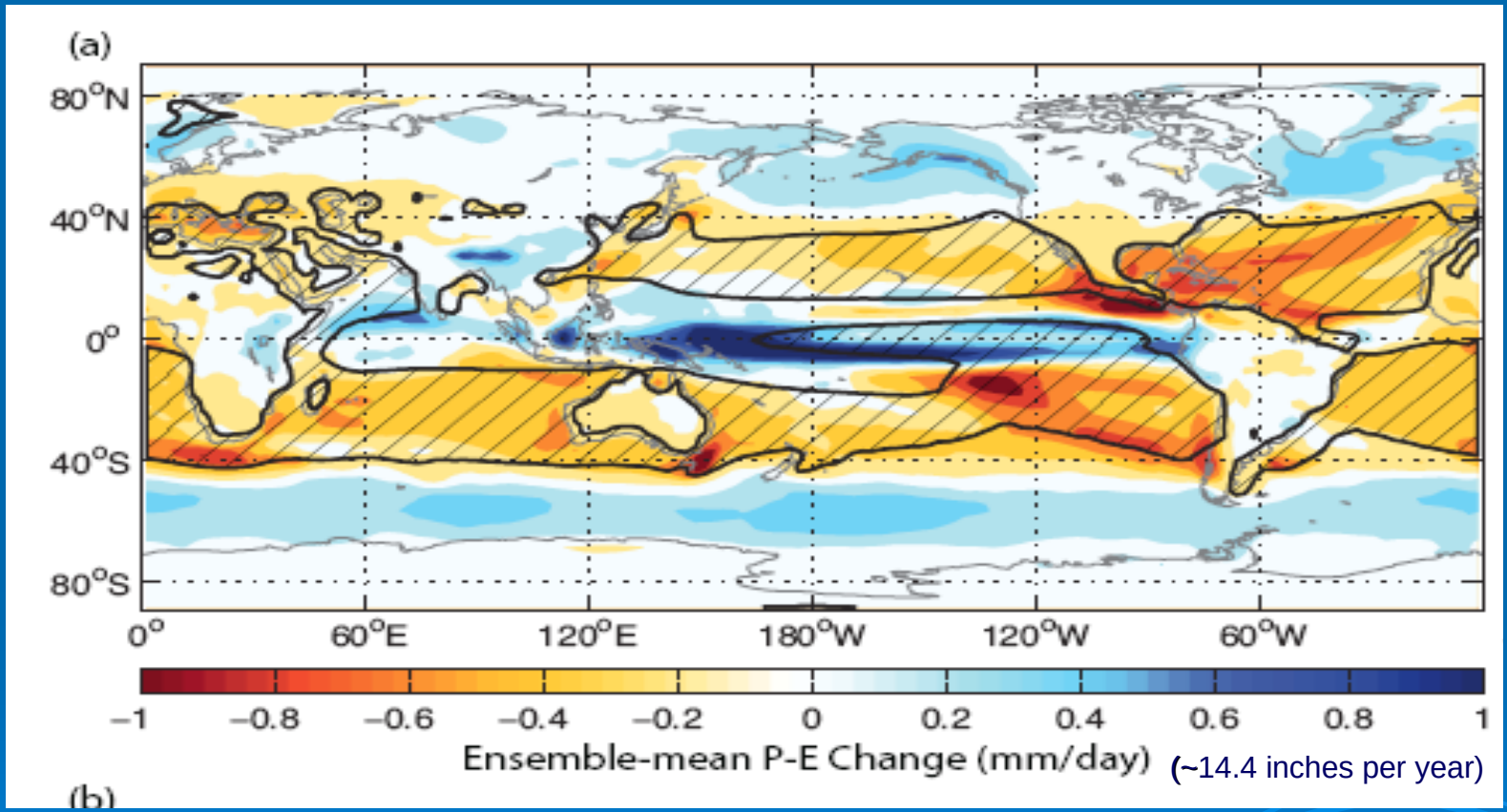
Multi-model ensemble mean P-E

of 15 state of the art global coupled atmospheric-oceanic climate models predicted these anomalies. (Lu, Vecchi, and Reichler; 2007)



Shading Indicates the difference between the first and the last 20 years of the 21st Century. Black line denotes the 0-isopleth (first 20 years).

CPC Global Reanalysis

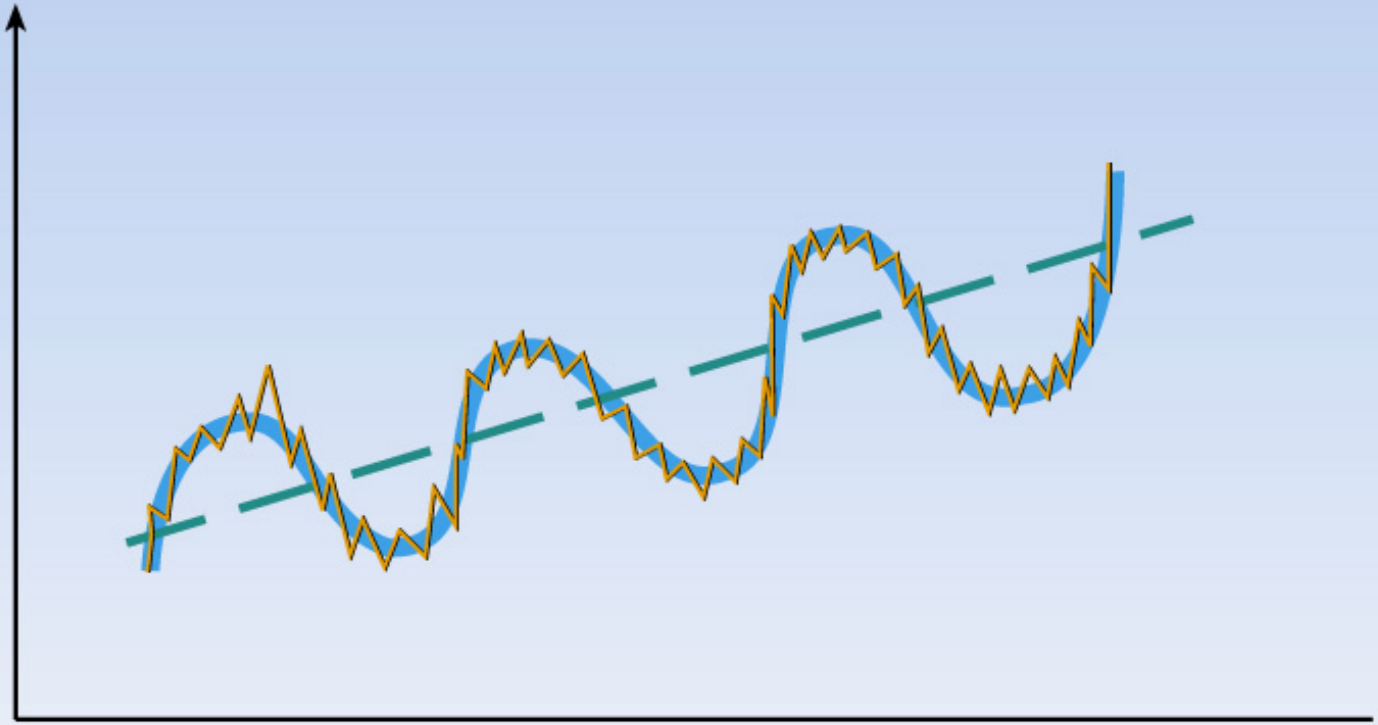
COMPONENTS OF CLIMATE VARIABILITY

A graphic from the 'Climate Changes' website:
www.dnr.qld.gov.au/longpdk/ClimateChanges/slides/dnr11.html

S.J. Crimp 2000
Department of Natural Resources

(data from Sturman and Tapper 1996)

Queensland Government
Department of Natural Resources



Trend

(e.g. It's getting hotter etc)

Cycle

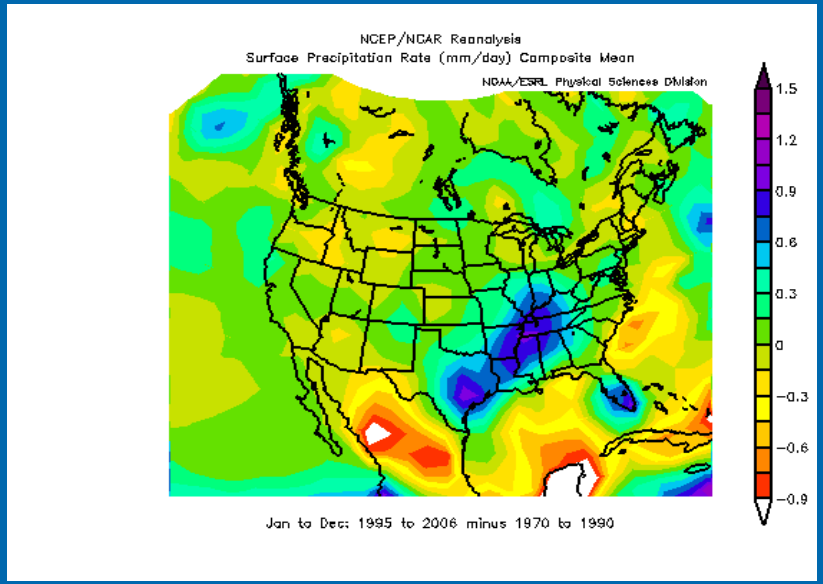
(e.g. It's hot in summer, cool in winter)

Randomness

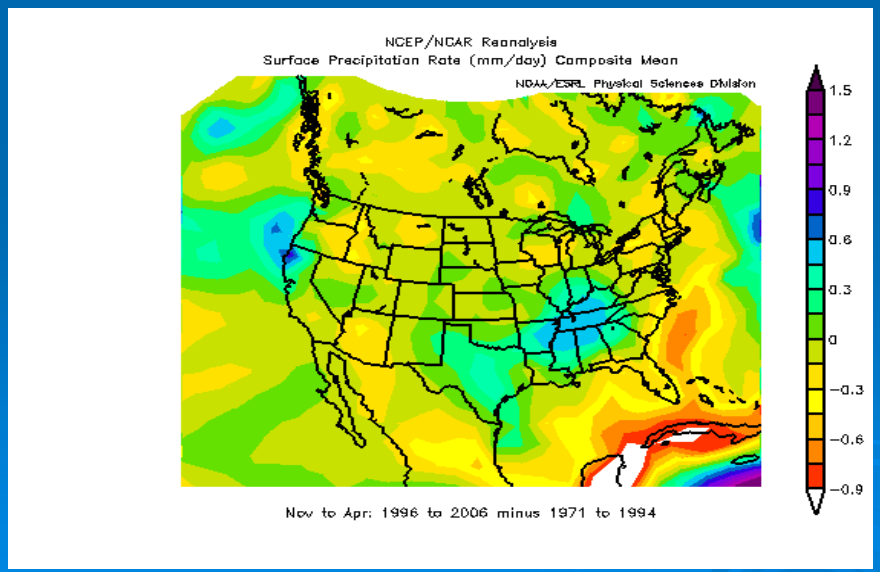
(e.g. It was hot yesterday, cool today)

Warm Phase Atlantic Multi-decadal Oscillation (1995-2006) Minus Cold Phase Atlantic Multi-Decadal Oscillation (1970-1994)

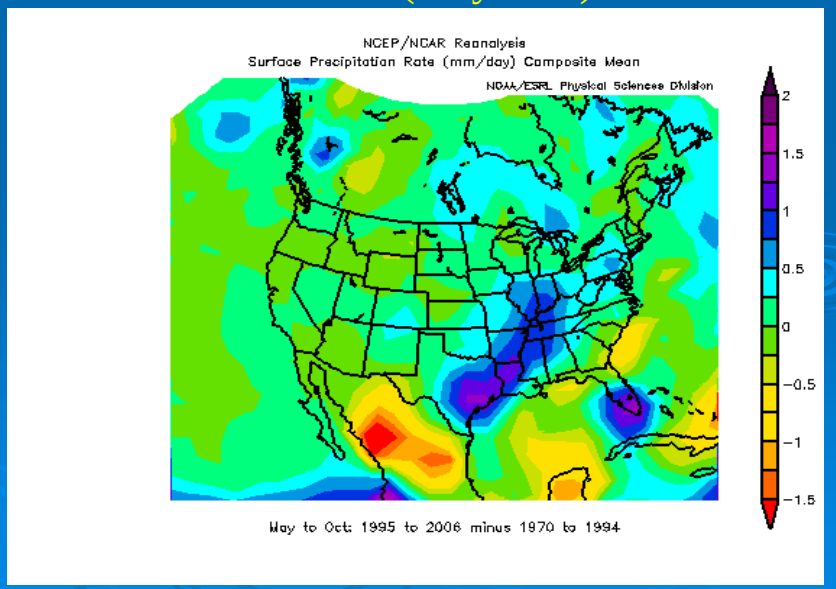
Calendar Year



Dry Season (Nov.–Apr)

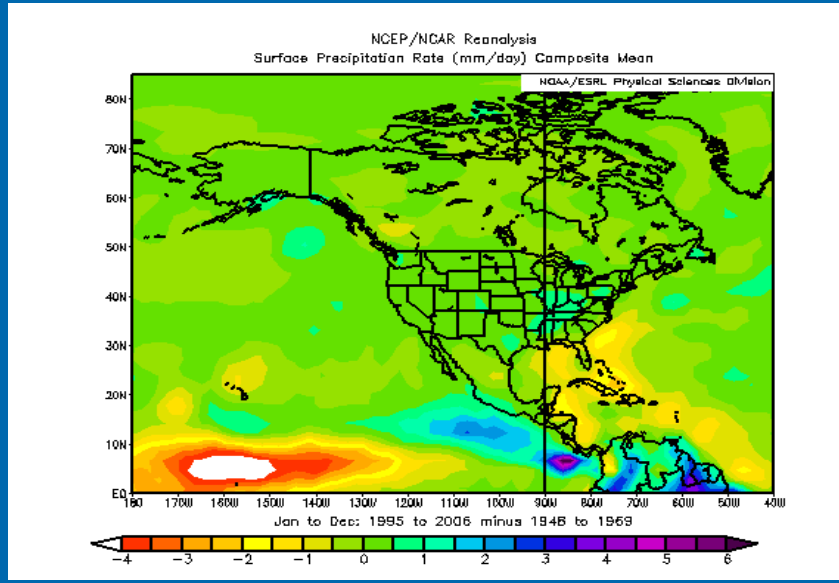


Wet Season (May-Oct.)

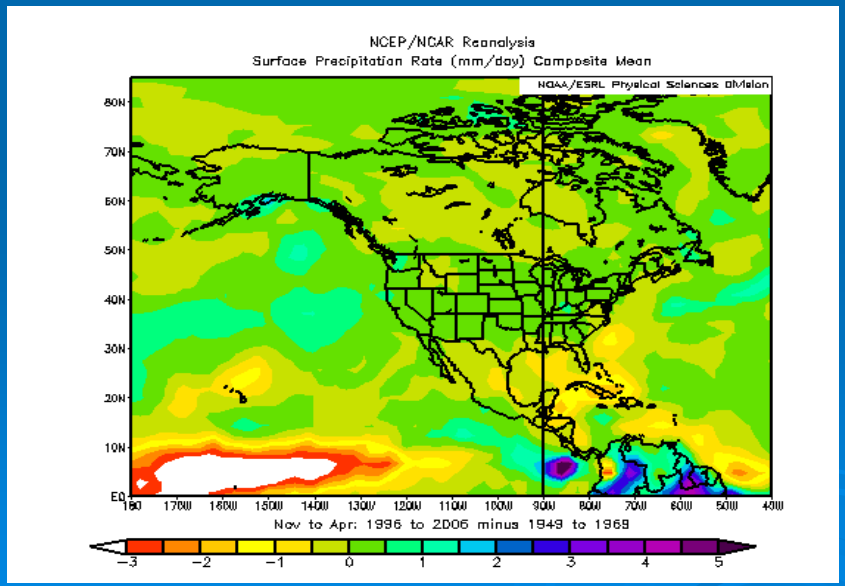


Warm Phase Atlantic Multi-Decadal Oscillation (1995-2006)
Minus
Warm Phase Atlantic Multi-Decadal Oscillation (1948-1969)

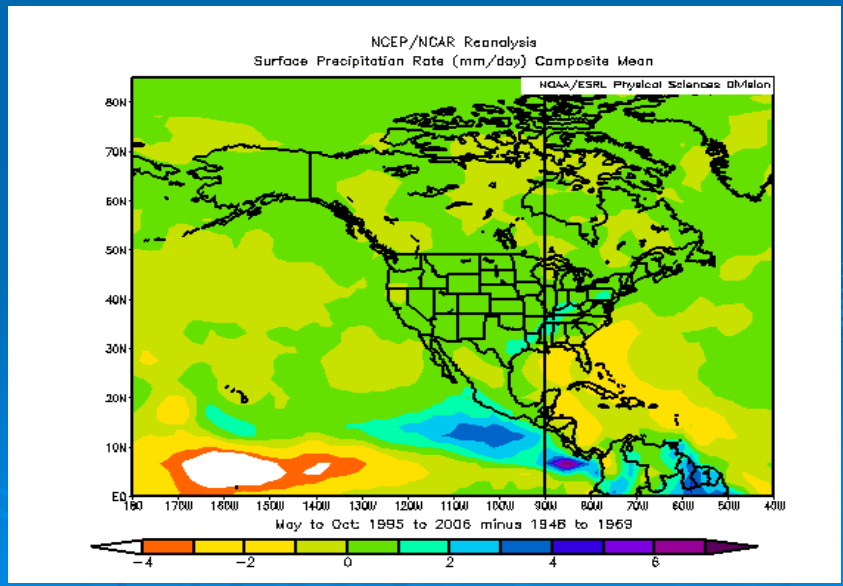
Calendar Year



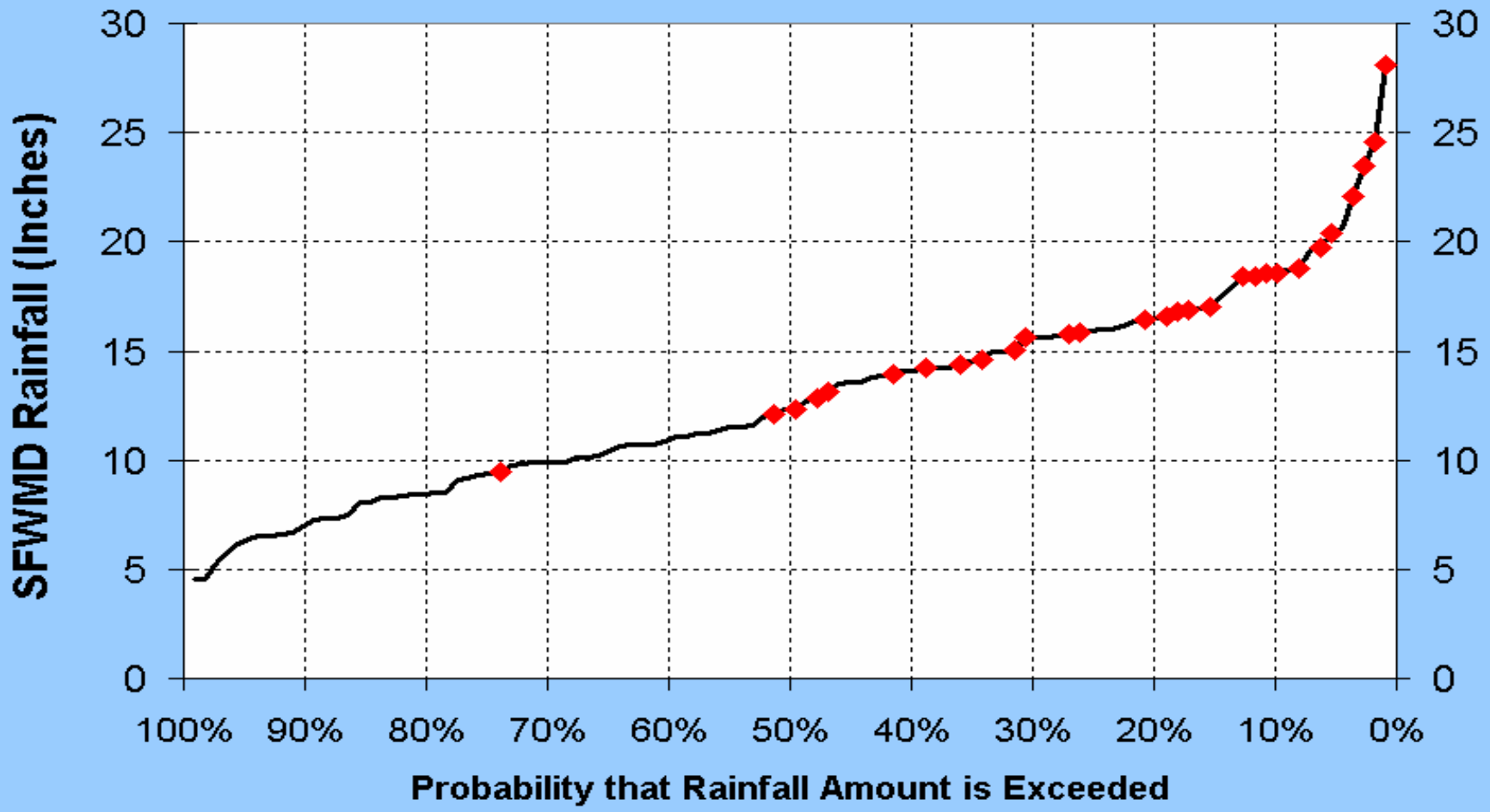
Dry Season



Wet Season



Historical SFWMD Dry Season Rainfall
(November - April, 1895-2005)



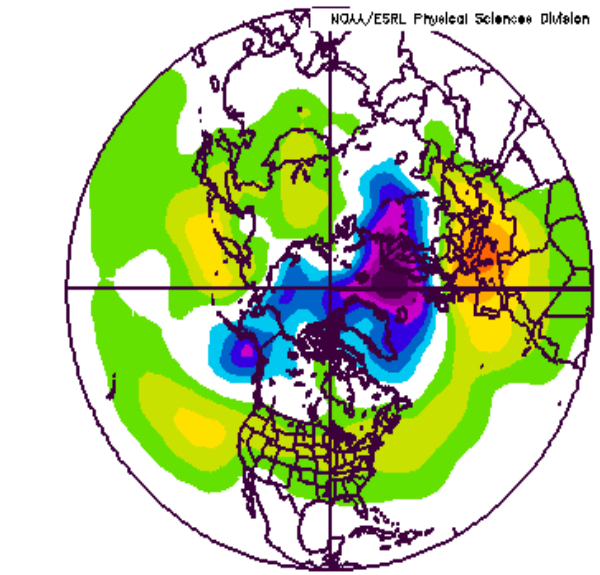
Thirty El Nino Years (1895-2005)

Driest Tercile (lowest 33%): 1977, 2007

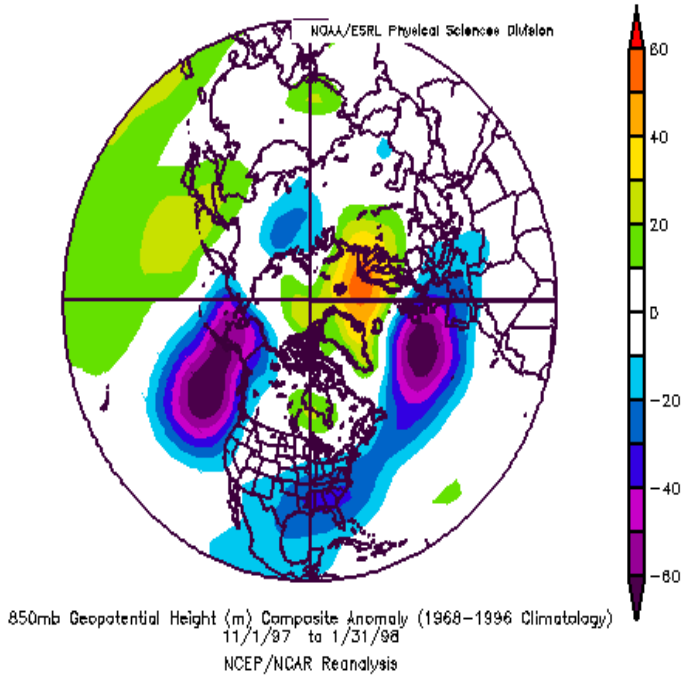
Middle Tercile (middle 33%): 1952, 1992, 2005,1924, 1969,1920, 1906, 1919

Wettest Tercile (highest 33%): 1897, 1912, 1973, 1933, 1915, 1988, 1964, 1978, 1987, 1903, 2003, 1926, 1942, 1947, 1970, 1995, 1958, 1941, 1983, 1998

2006-2007 El Nino
850 mb heights



1997-1998 El Nino
850 mb heights



First Florida Drought to Begin during El Nino?

Summary

- Analysis of satellite data indicate that the Hadley cell has been expanding poleward for at least the last 27 years (Fu et al 2006). Florida is very much in a position to be influenced by a continuing.

- Fifteen of state of the art coupled ocean-atmospheric models predict net rainfall (RF minus ET is expected) in Florida to decrease significantly with global warming.

- A review of CPC reanalysis data since 1948 indicates net rainfall has already been affected.

Summary (continue)

- While the initial view of the challenge facing water managers in the state of Florida may be the baffling sea level rise, a significant decrease in net rainfall may be upon us even more quickly with an equal degree of challenge.

Recommendations

- Regionally, nationally and globally steps need be to be taken to slow, halt and if possible reverse global warming. This should not be a debatable issue.

- Regionally plan for more severe drought and floods. This would require that a greater amount of storm runoff to be captured and stored for the occurrence of longer, higher frequency and more intense droughts that are expected to occur in our future.

- Continue investing in more refined climate models and paleoclimatology to better understand. Developing improved methodologies for up scaling and downscaling climate data.

- Invest in technology to slow global warming.