

Large Scale Climate Dynamics

(Rainfall and Drought)

All tied together:

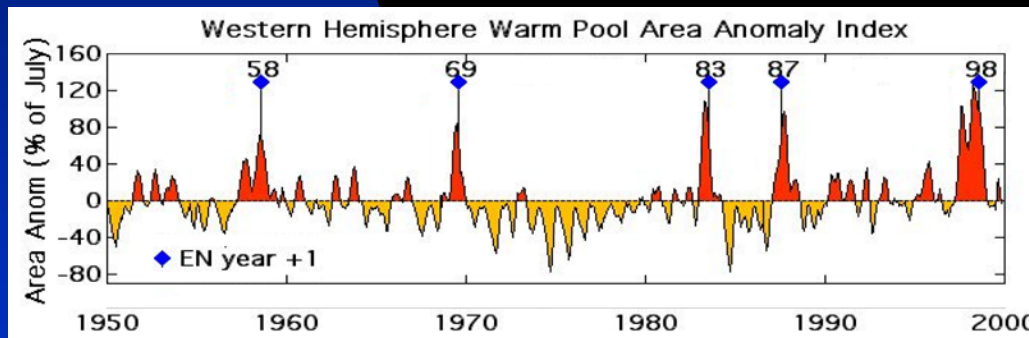
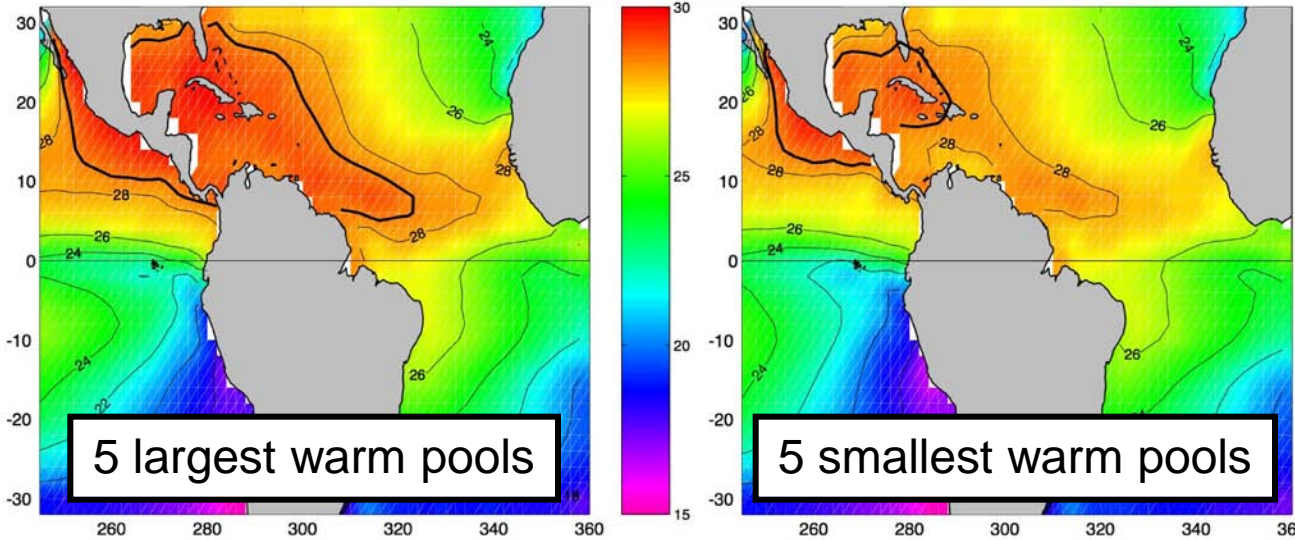
Atlantic Warm Pool
AMO
Rainfall
Hurricanes

Physical Oceanography

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Hurricane Research

Jason Dunion
Stan Goldenberg
Chris Landsea
Frank Marks



Supported by NOAA CPO/CPA, NWS

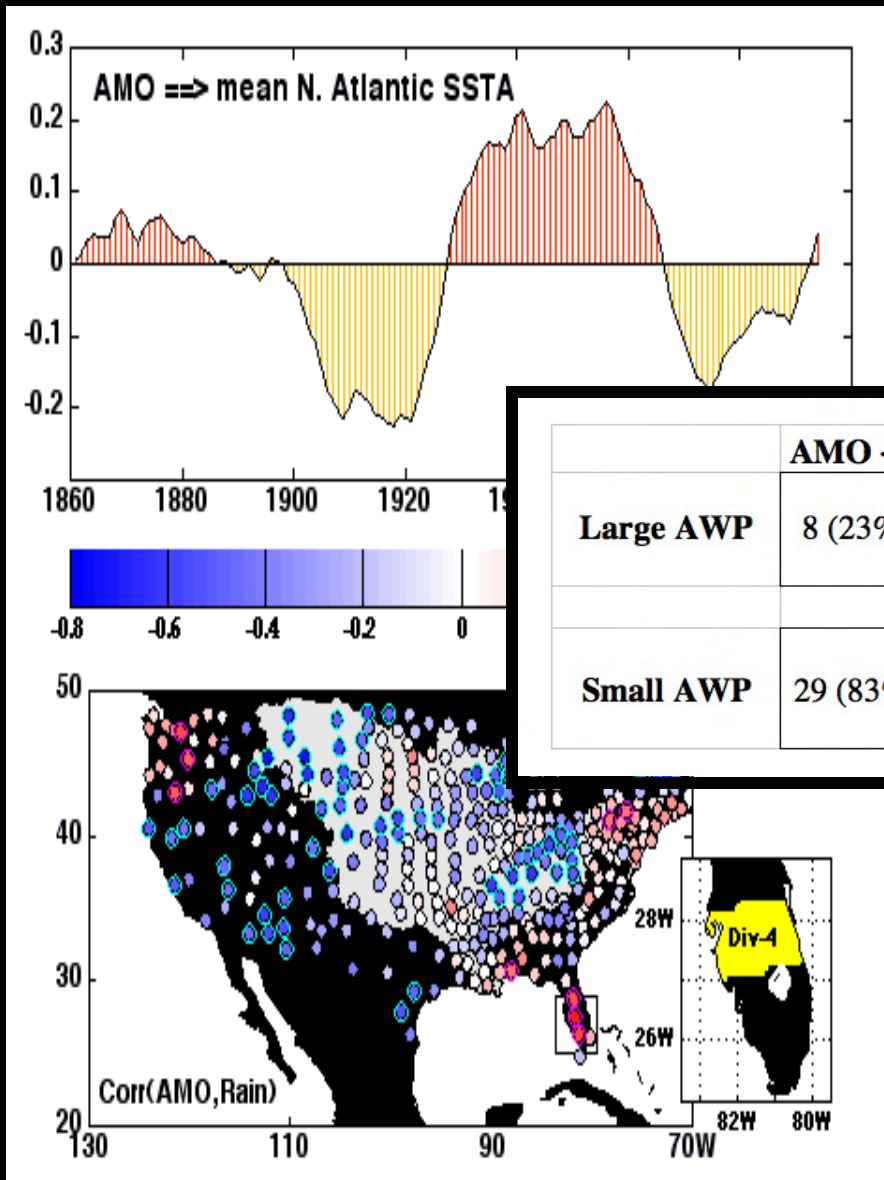
Rationale for Warm Pool Research

Why Study the Warm Pool?

- ◆ ENSO impacts climate mainly in winter; we need a value-added paradigm for summer climate prediction, especially for rainfall in the eastern US, and for Atlantic hurricanes
- ◆ The Indo-Pacific and Atlantic compete with each other and the atmosphere responds to inter-basin anomalies. We can no longer afford to make projections based only on the Pacific
- ◆ Warm pool size is an expression of SST anomalies, but weighted toward regions of maximum SST $> 28^{\circ}\text{C}$ where deep convective heating occurs -- also a good match for tropical cyclogenesis
- ◆ Applicability to summer precip and hurricanes aligns the WP research extremely well with NOAA goals & stakeholder needs

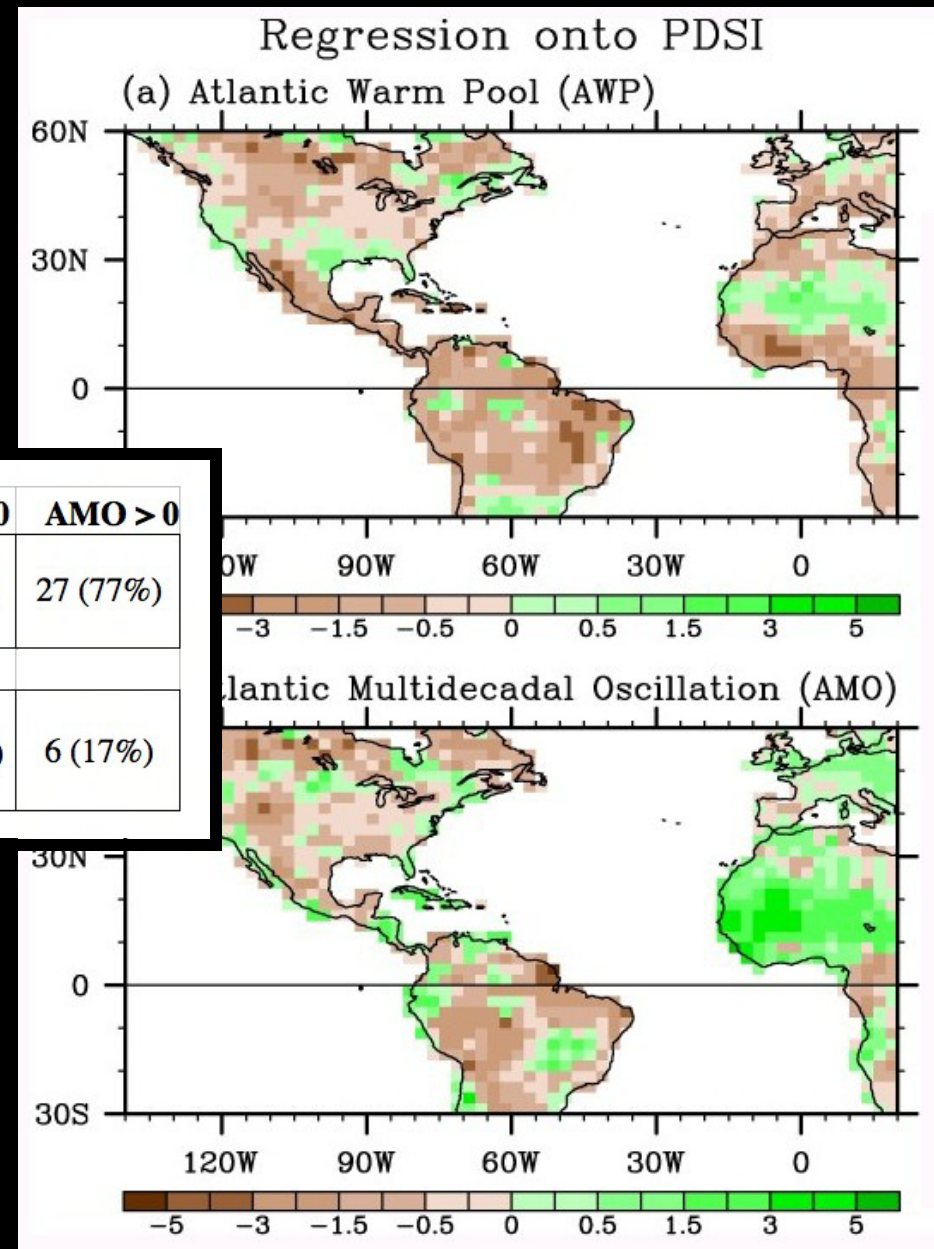
Correlation of AMO with U.S. divisional rainfall (1895-1999)

Enfield et al. (2001)



AMO & WP ==> similar impacts

Rainfall regressions very similar



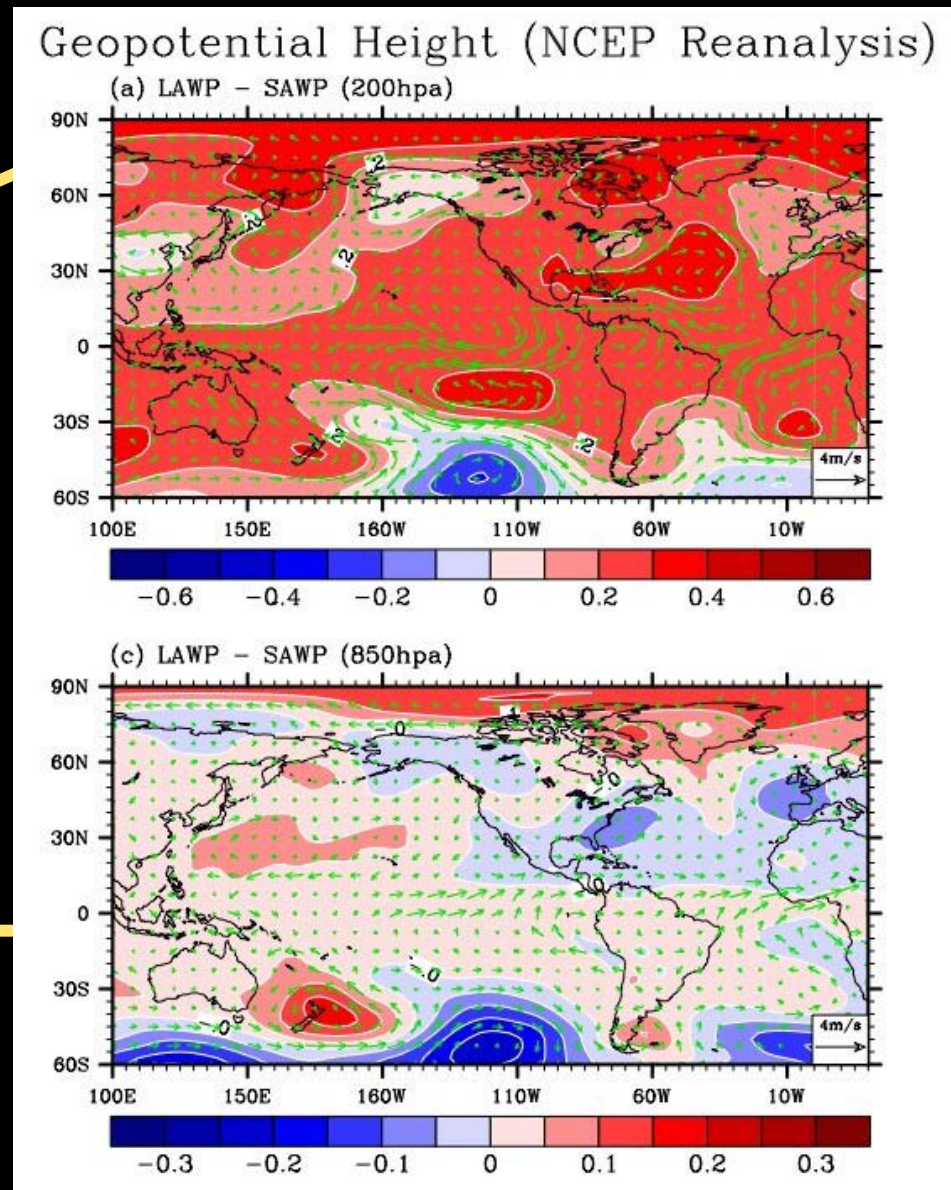
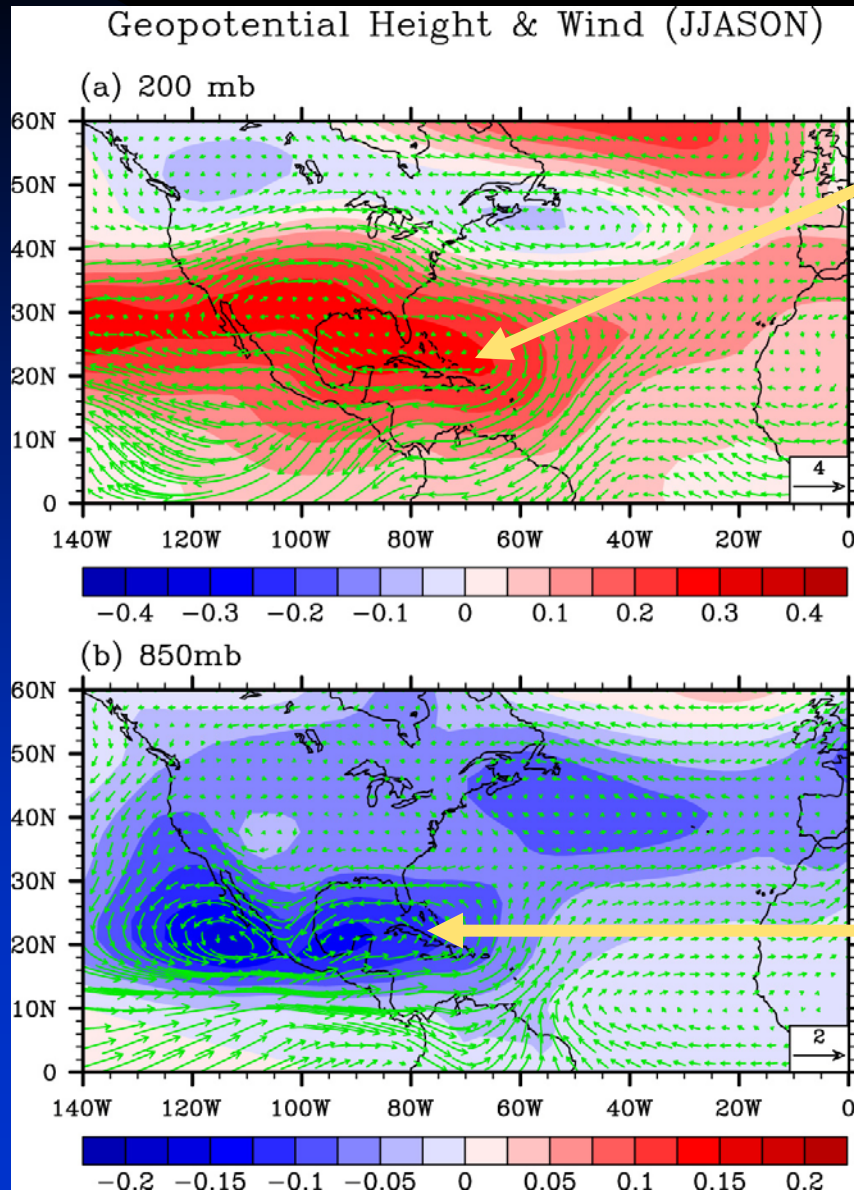
Gill atmosphere response to Warm Pool anomalies

Forced AGCM

Large minus Small AWP

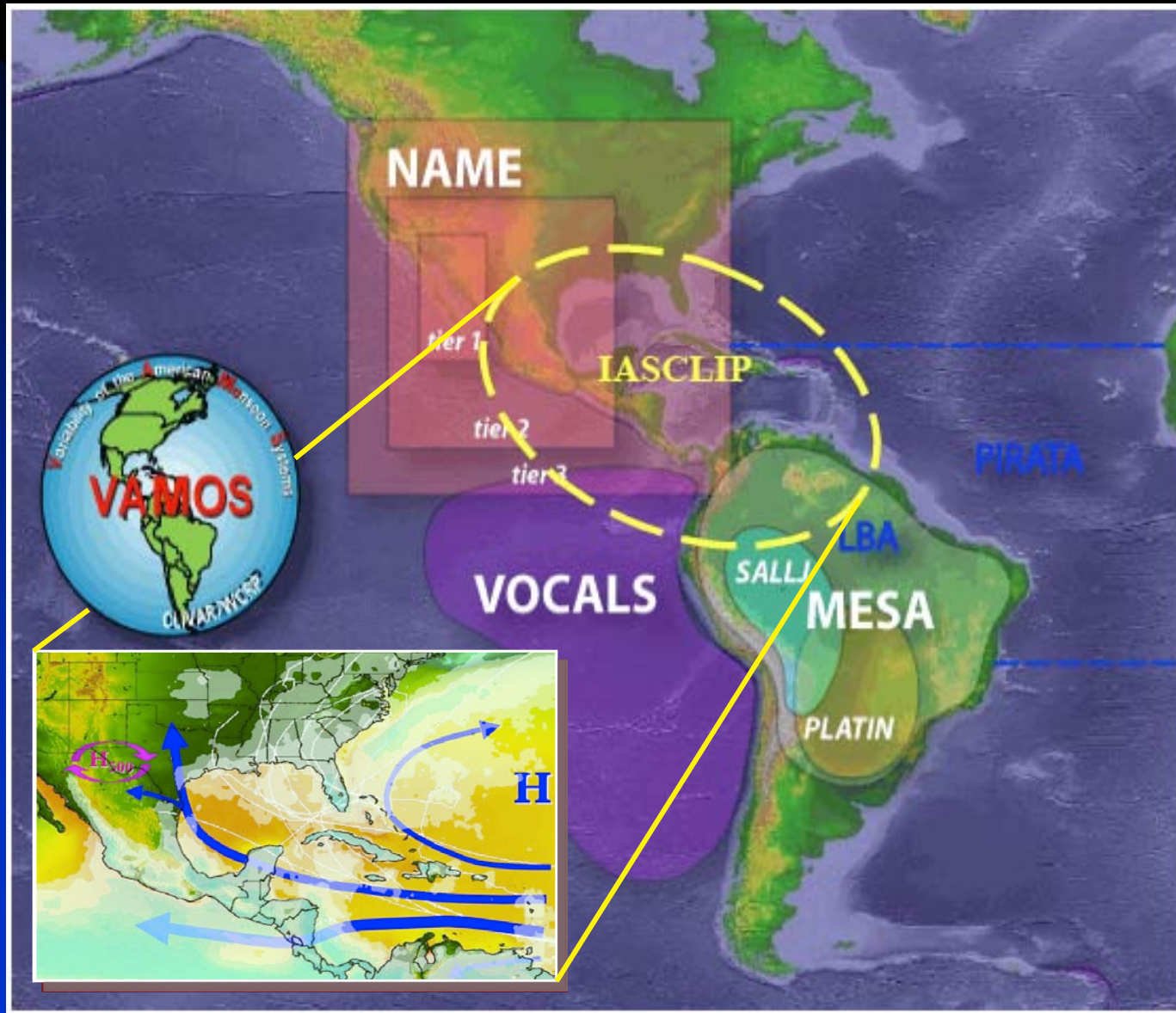
Obs (NCEP reanalysis)

Large minus Small AWP



IASCLIP = Intra Americas Study of Climate Processes

A CLIVAR-VAMOS Monsoons Program (FY09 - FY14)

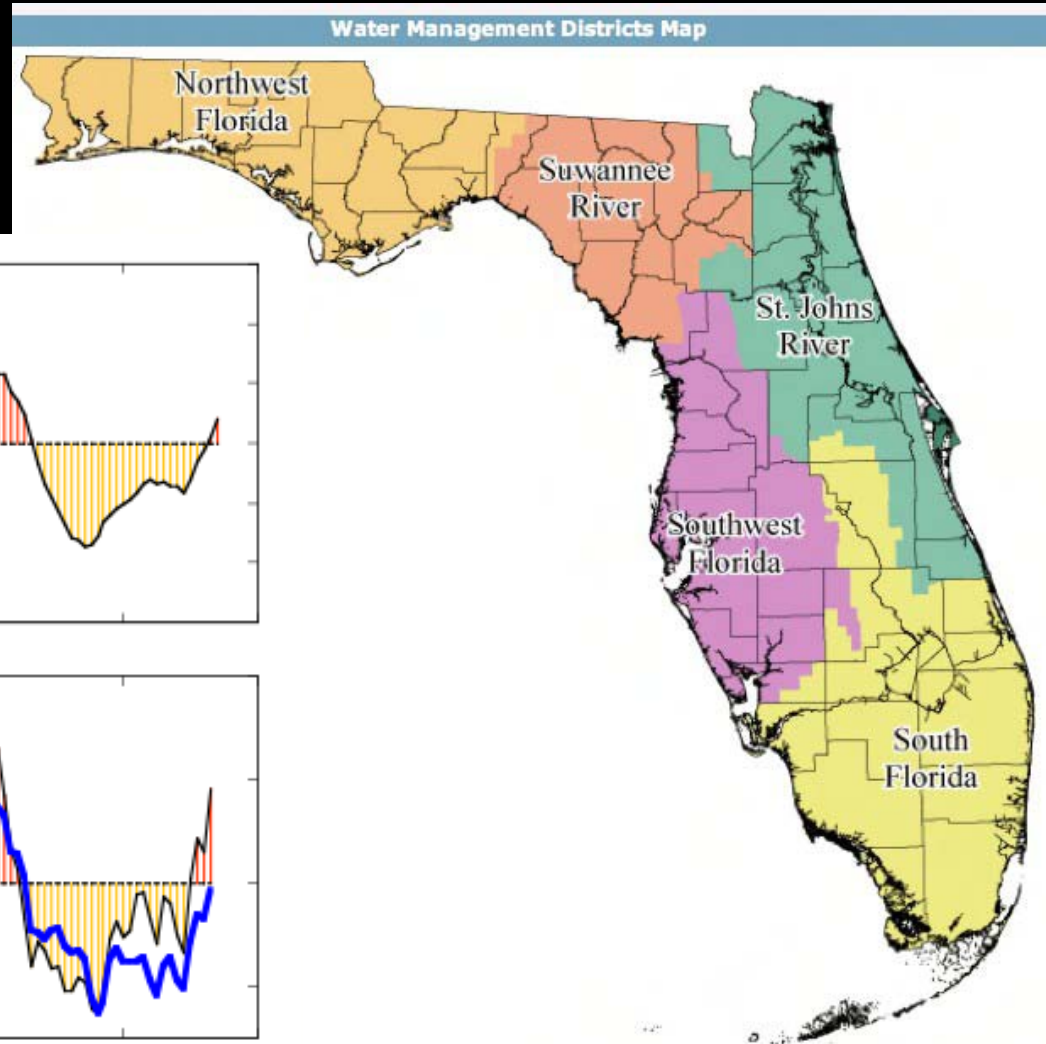
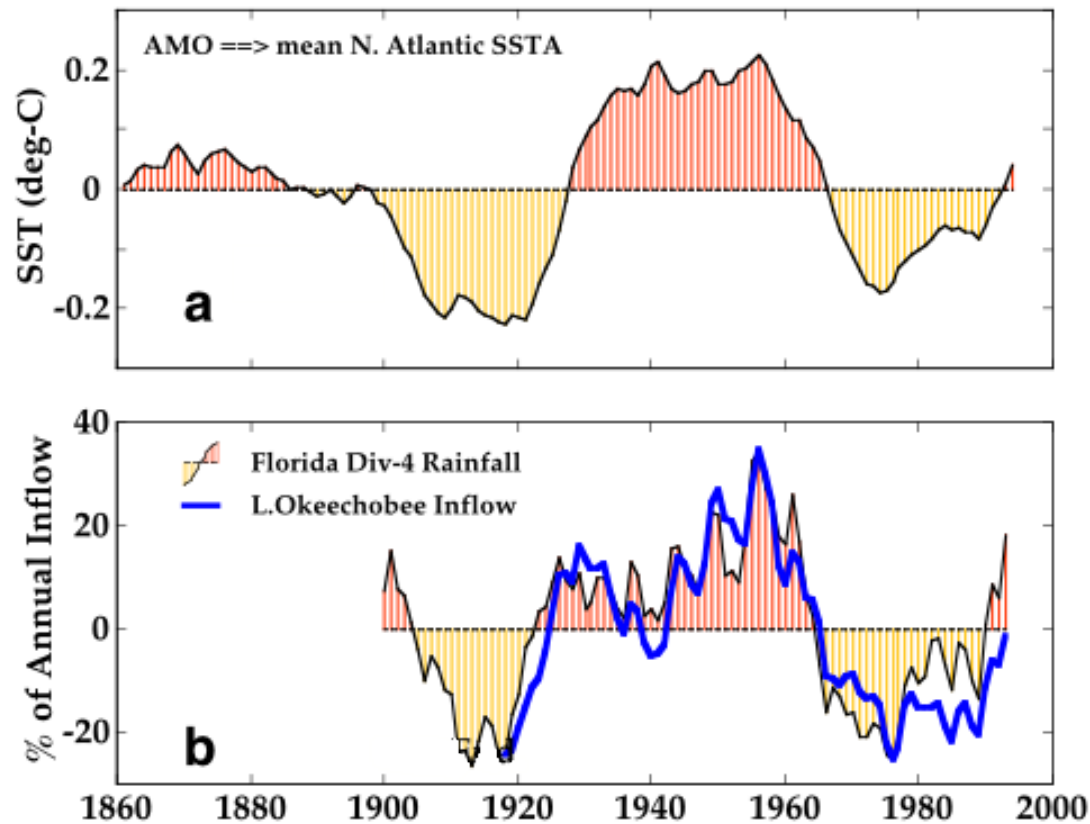


Florida Water Management Districts

AOML research is influencing water planning

Statute-mandated 20-year water plans every 5 years

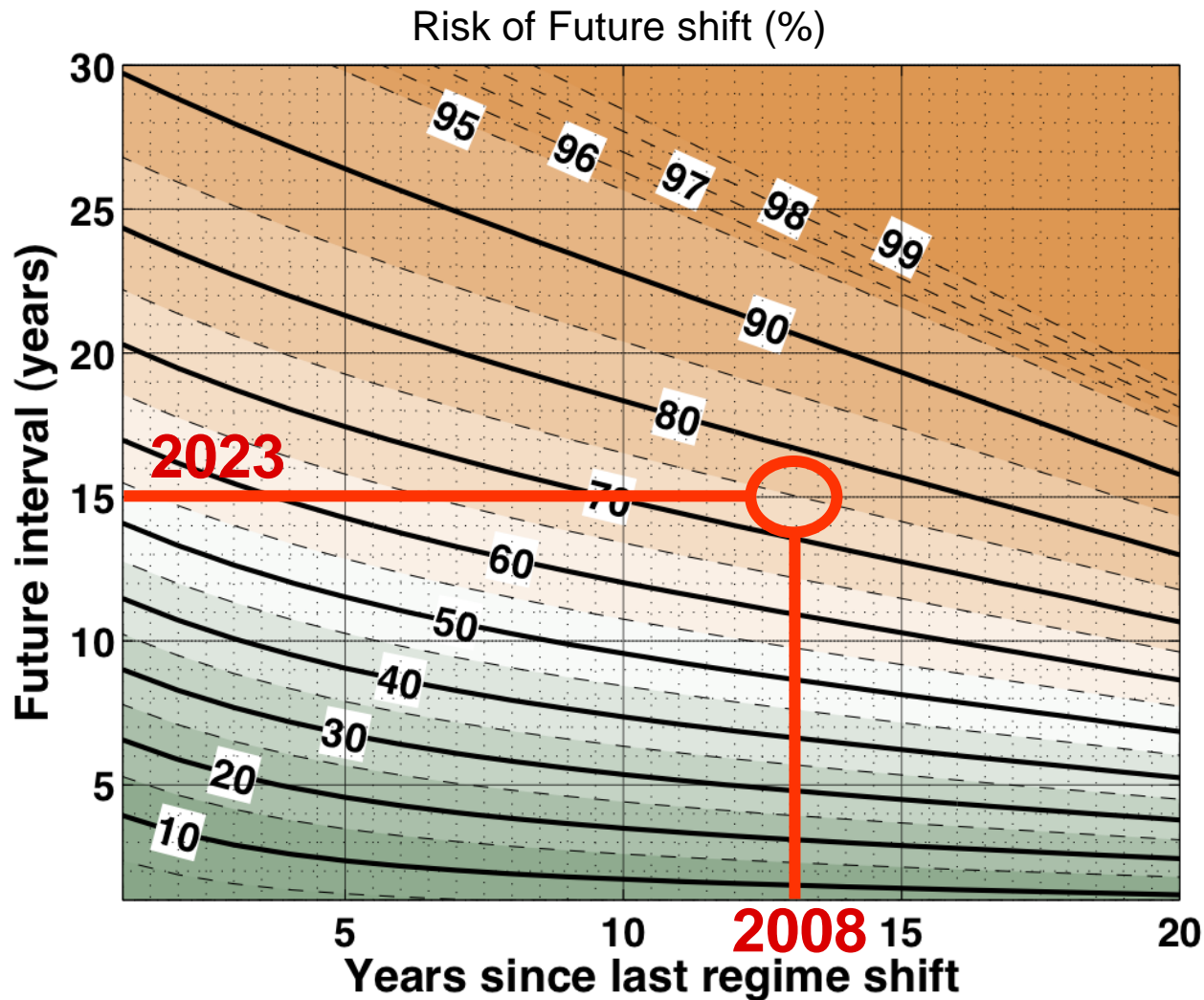
Lake Okeechobee inflow vs. AMO



A decision support tool for long-term planning

Let t_1 = years since last shift; t_2 = years until the next shift

We now compute the conditional probability for t_2 given t_1



Climate Indices on WWW (ESRL)

CLIMATE INDICES PLOTTING PAGE	Climate Indices: Monthly Atmospheric and Ocean Time Series	
PNA WP NAO EPO NAO (Jones) NP NOI PDO		
Atmosphere:		
QBO Global Angular Momentum SOI AAO AO MJO		
Precipitation:		
Indian Monsoon Sahel SW Monsoon ESPI Brazil		
ENSO:		
MEI Nino 1+2 Nino 3 Nino 3.4 Nino 4 BEST Tropical Pacific EOF		
SST:Pacific		
ONI Nino 1+2 Nino 3 Nino 3.4 Nino 4 TNI WHWP Pacific Warm Pool Tropical Pacific EOF		
SST:Atlantic		
TNA TSA Atlantic Tripole WHWP Atlantic Multi-decadal Oscillation Atlantic Meridional Mode North Tropical Atlantic Index (NTA) Caribbean Index (CAR)		
Other:		
Global Mean Lan/Ocean Temperature Solar Flux Trend Hurricane Activity		
	AMO, smoothed	<p>Note: this index is newly computed from a new dataset. Please use it and note that it supersedes the old indices. The data is calculated from the Kaplan SST. See the AMO webpage for more details.</p> <p>Enfield, D.B., A. M. Mestas-Nunez and P.J. Trimble, 2001: The Atlantic multidecadal oscillation and it's relation to rainfall and river flows in the continental U.S.. Geophysical Research Letters, Vol. 28, 2077-2080.</p>
	TNA	<p>Tropical Northern Atlantic Index* Anomaly of the average of the monthly SST from 5.5N to 23.5N and 15W to 57.5W. GISST and NOAA OI 1x1 datasets are used to create the index. Climatology is 1951-2000.</p> <p>Enfield, D.B., A.M. Mestas, D.A. Mayer, and L. Cid-Serrano, 1999: How ubiquitous is the dipole relationship in tropical Atlantic sea surface temperatures? JGR-O, 104, 7841-7848. AOML and PSD</p>
	WHWP	<p>Western Hemisphere warm pool* Monthly anomaly of the ocean surface area warmer than 28.5°C in the Atlantic and eastern North Pacific. Climatology is 1951-2000.</p> <p>Wang, C., and D.B. Enfield, 2001: The tropical Western Hemisphere warm pool, Geophys. Res. Lett., 28, 1635-1638. AOML and PSD</p>
	Atlantic multidecadal Oscillation Long Version	<p>AMO, unsmoothed</p> <p>Note: this index is newly computed from a new dataset. Please use it and note that it supersedes the old indices. The data is calculated from the Kaplan SST. See the AMO webpage for more details.</p> <p>Enfield, D.B., A. M. Mestas-Nunez and P.J. Trimble, 2001: The Atlantic multidecadal oscillation and it's relation to rainfall and river flows in the continental U.S.. Geophysical Research Letters, Vol. 28, 2077-2080.</p>

www.cdc.noaa.gov/ClimateIndices/List/

Summary and Future Vision

- ◆ With its focus on the AWP, AOML climate research is **unique**; it's relevant to society and it's well **aligned with NOAA's strategic goals**.
- ◆ Research methods are varied & robust, using both models and obs, it's **cross-disciplinary** with hurricane research, and **collaborative** with RSMAS.
- ◆ The AOML research is **helping to shape the research agenda** for the next decade ==> on track to achieve improved predictions for summer climate.
- ◆ We are **providing services** to users and we are **engaging with hydrologists** who influence public water policy.
- ◆ **Immediate future**: CLIVAR-VAMOS is expected to begin the IASCLIP program and NOAA CPO will issue AO's for IAS research in FY09; AOML will begin coupled model experiments and research on the interactions of global warming with natural variability.
- ◆ **By 2015**: Models should be improved and prediction methods will be transitioned to operations. This will follow the example set by the NAME program and predictions will be based on BOTH ocean basins.