

IASCLIP Modeling and Prediction

IASCLIP Modeling and Prediction Working Group
Group Chair: V. Misra (FSU)

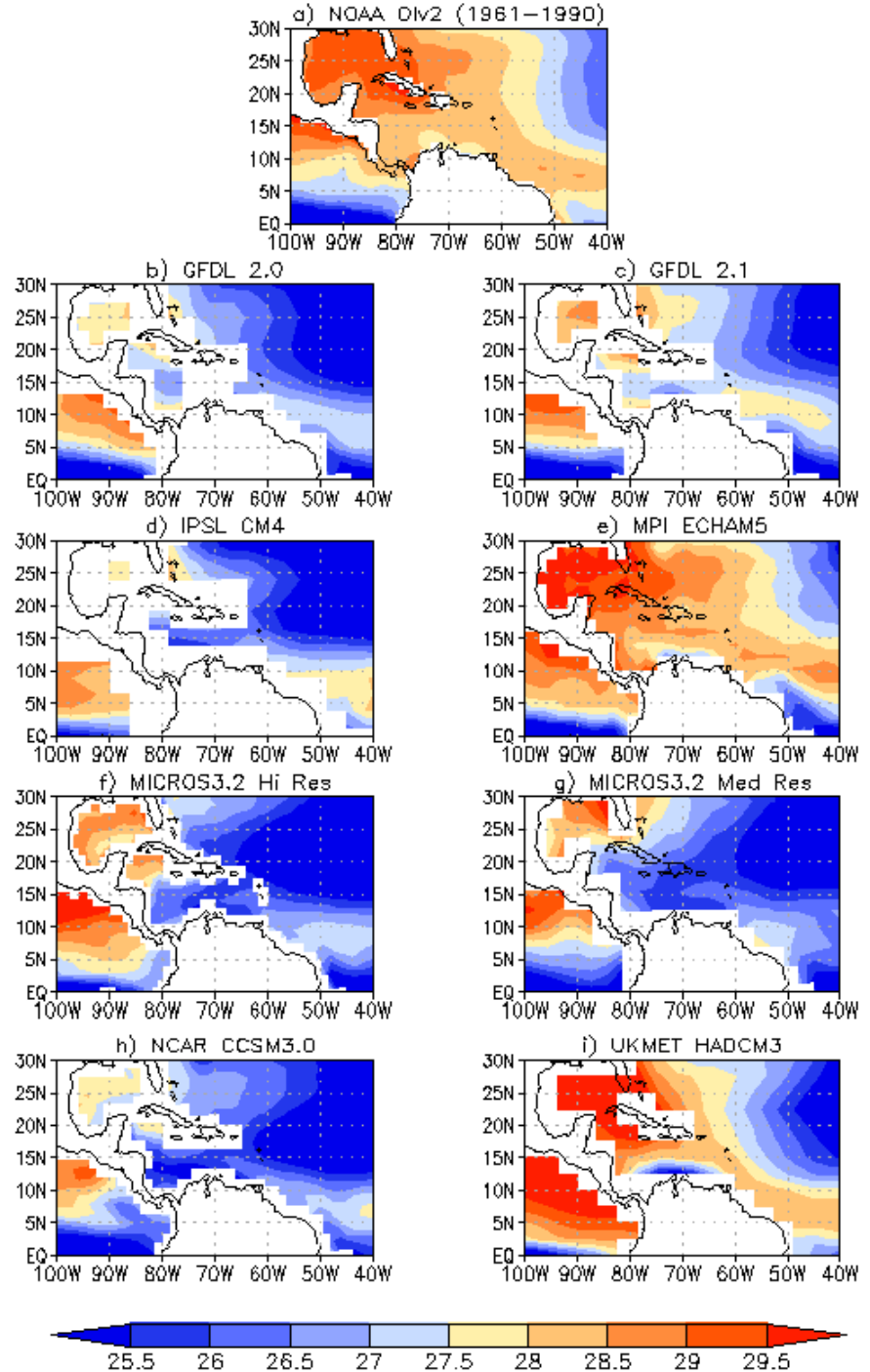
Outline

- **Significance of the Western Hemisphere Warm Pool**
- **Climate models and AWP**
 - IPCC AR4 20C3M (V. Misra, S. Chan, A. Clement)
 - NCEP CFS (V. Misra, S. Chan, R. Wu, E. Chassignet)
- **Reanalysis**
 - MERRA (B. Mapes)
 - CFSRR (K. Mo)
- **Conclusion**
- **Summary of group discussions**

Significance of WHWP

- Provides an anchor for boreal summer seasonal predictability over the US
- Has connection to climate extremes => droughts in the US and tropical Atlantic cyclone activity at seasonal and multi-decadal time scales.
- Is part of a wider general circulation that has remote connections: e.g. southeast Pacific and Amazon

IPCC-AR4: The JAS climatological mean SST

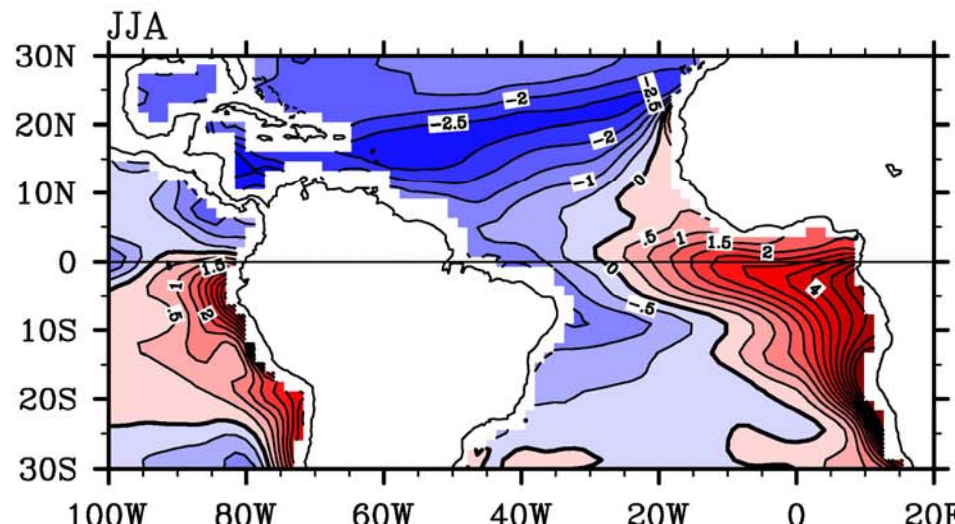
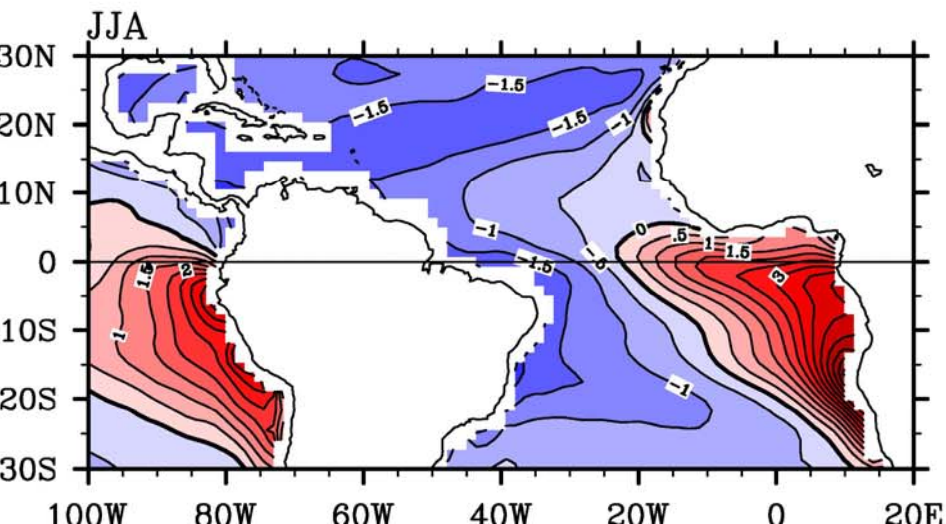
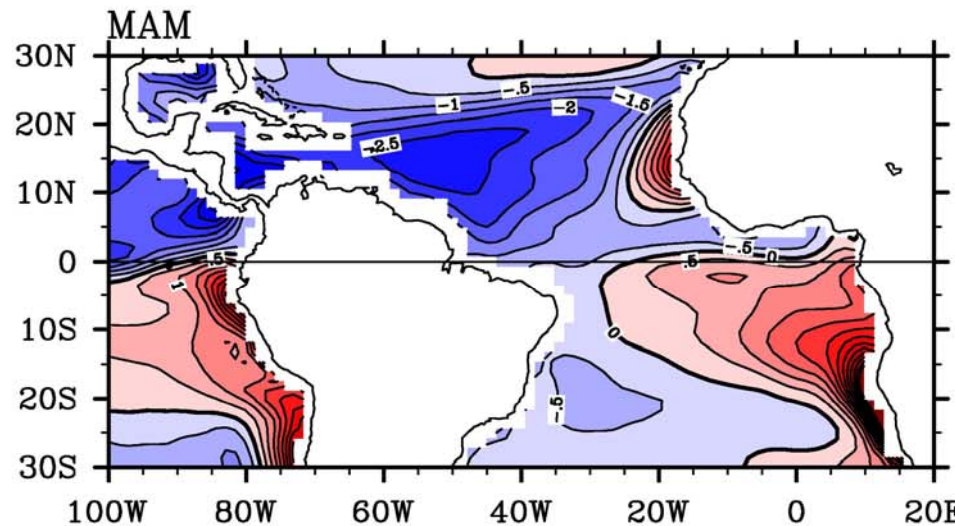
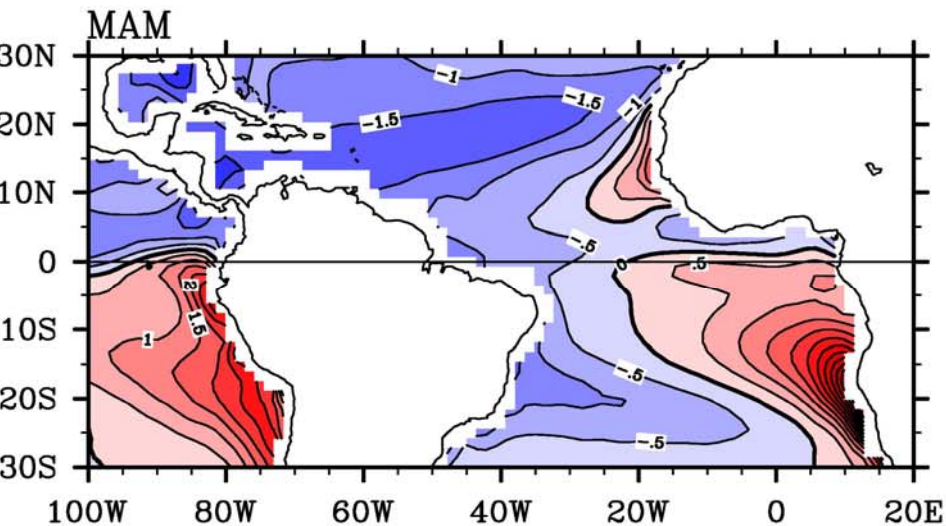


SST Bias in IPCC-AR4 Models and CCSM3

SST Bias in IPCC models

Ensemble Mean

CCSM3

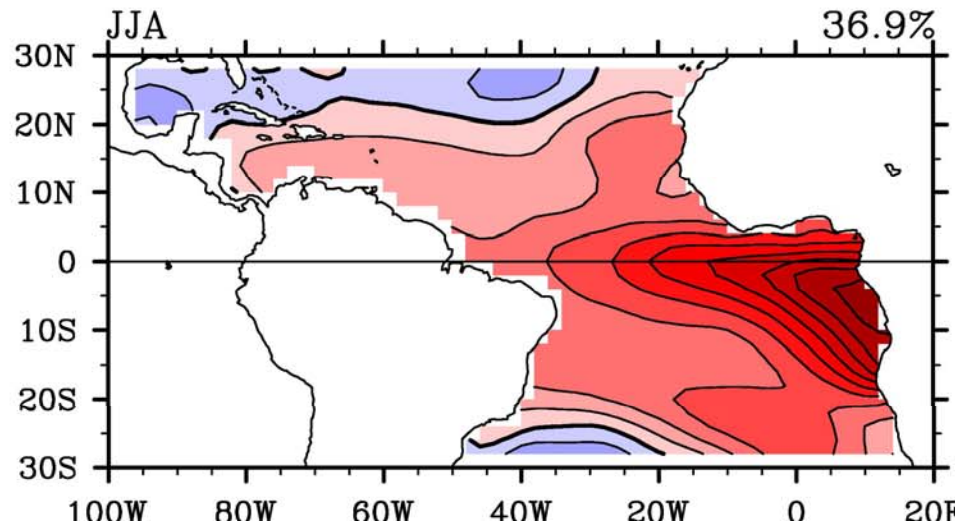
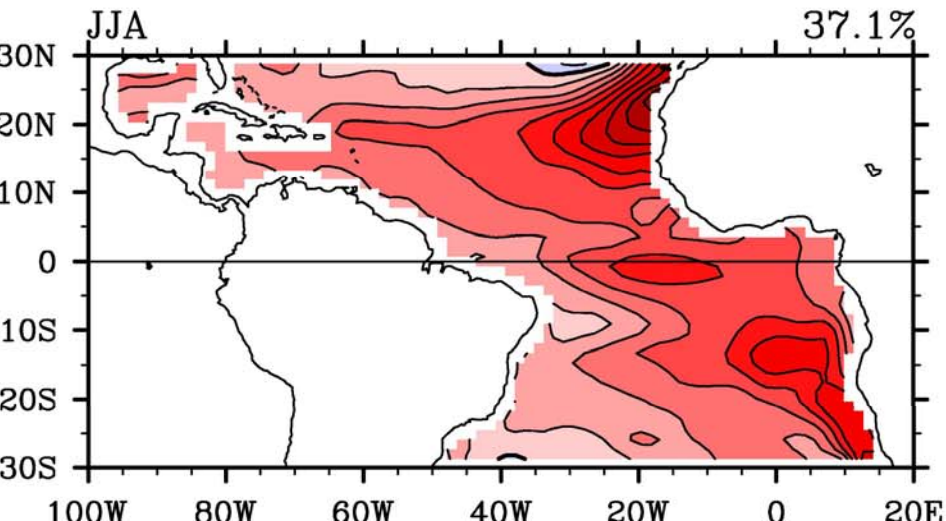
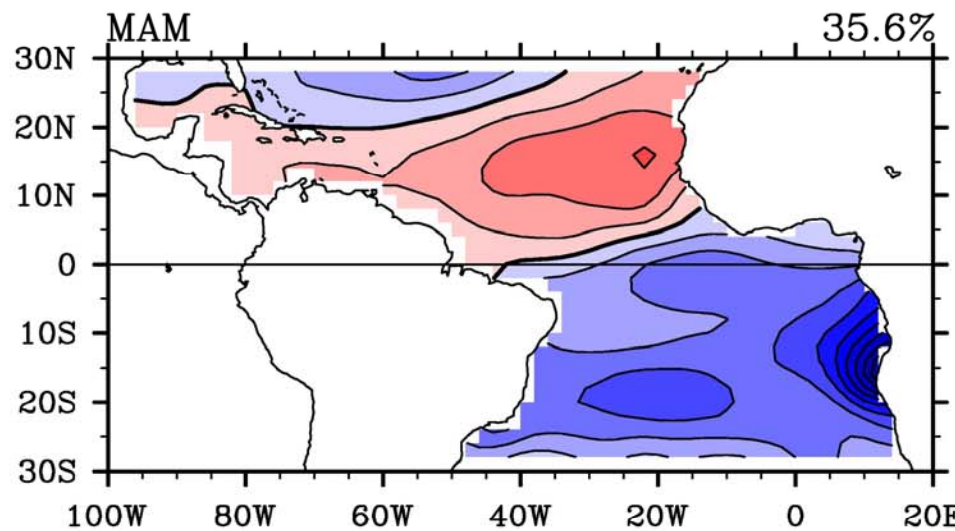
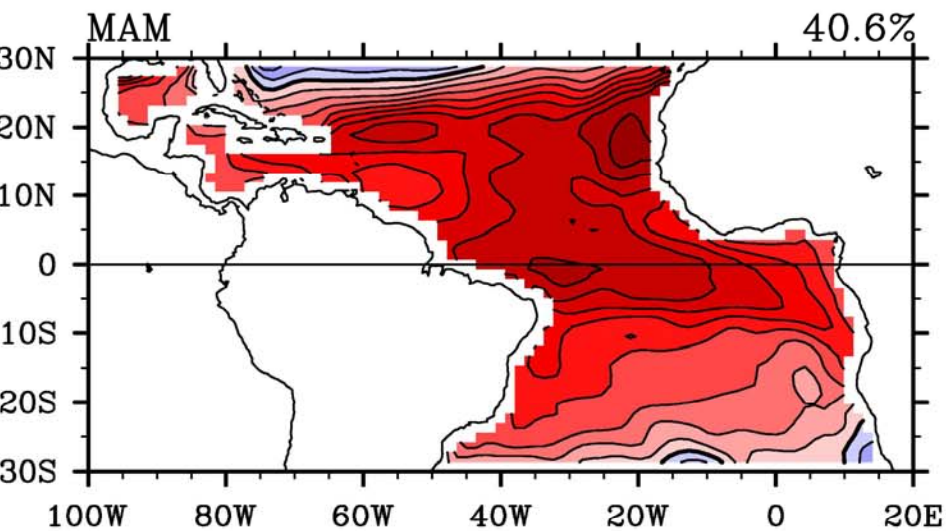


Leading EOF of SST in CCSM3 and OBS

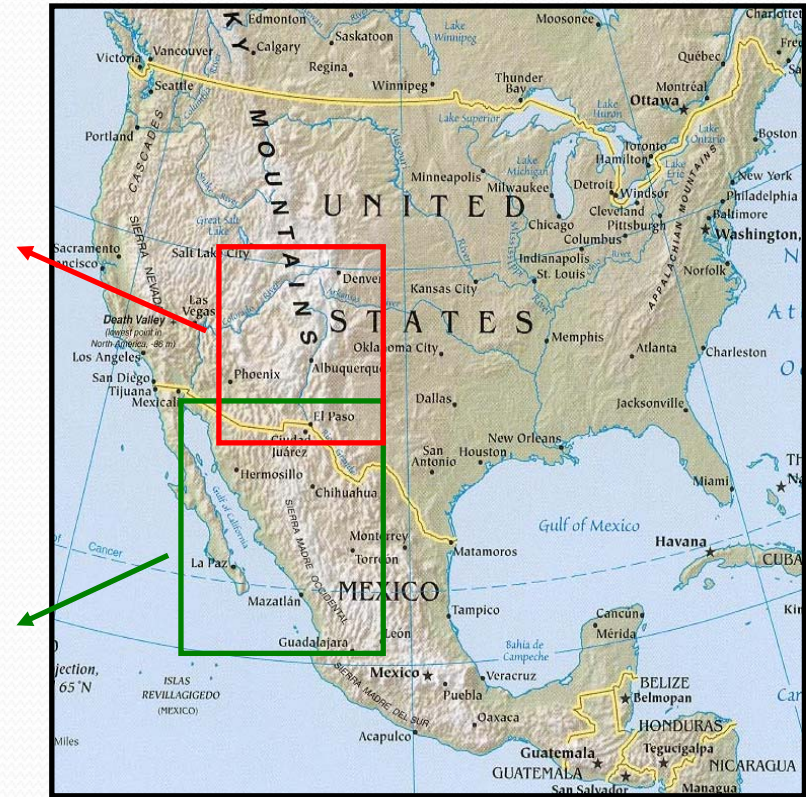
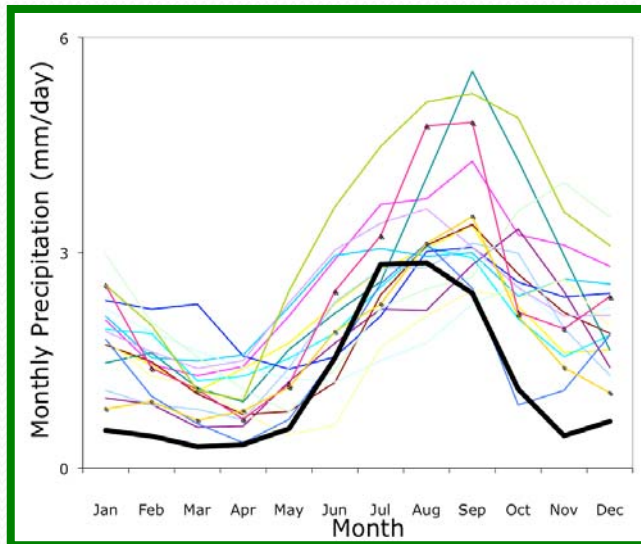
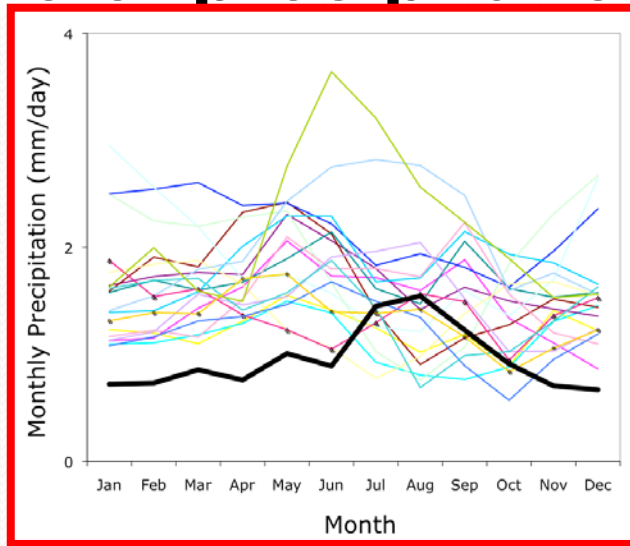
Leading EOF of SST

CCSM3

OBS



GCM's still have problems capturing the seasonal cycle of precipitation, especially in the SW USA.



IPCC average historical model precipitation (mm/day) 1970-2000 (colored lines) and **observations** (black bold line)

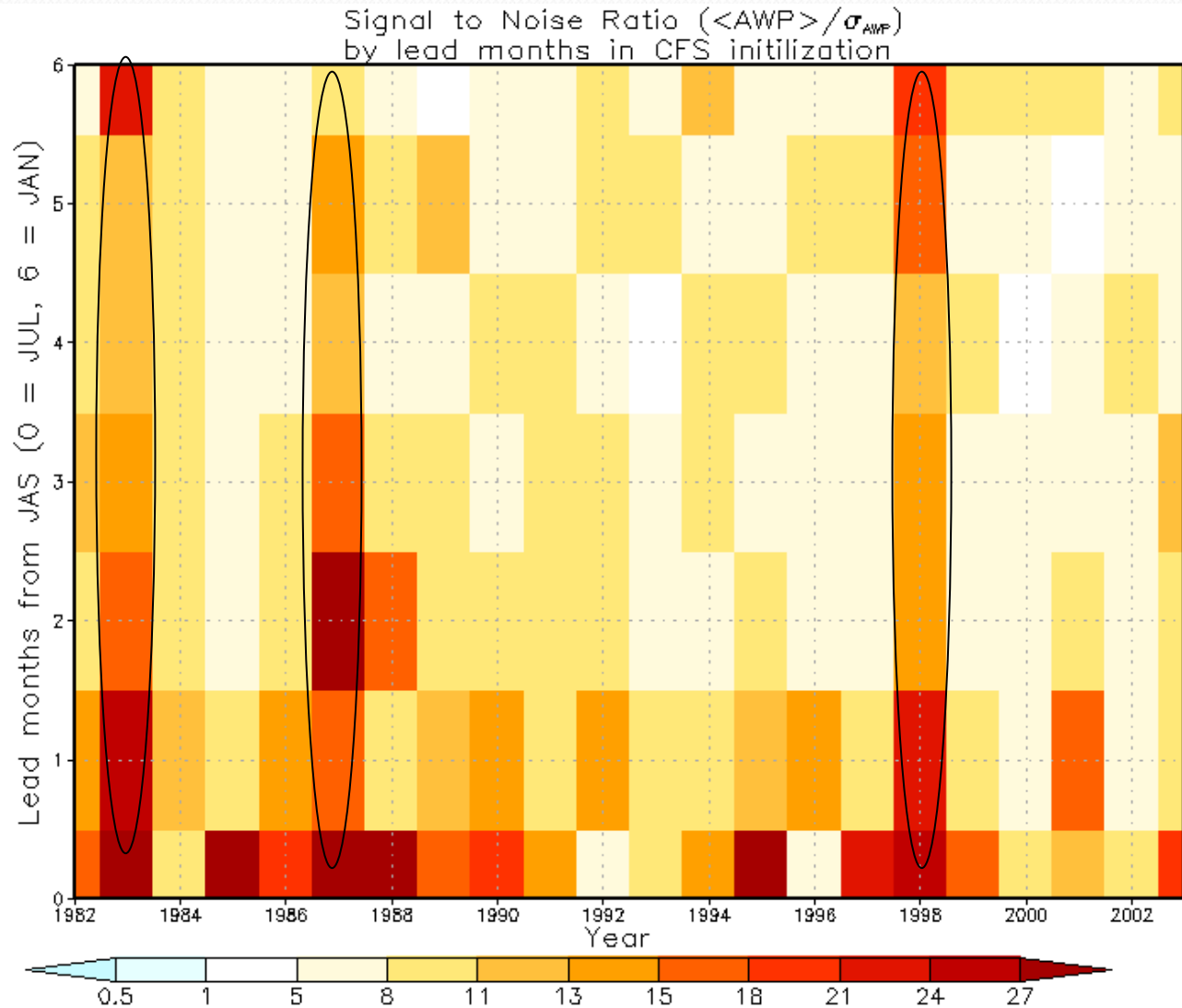
Dominguez, F. and J. Cañon and J. Valdes, 2009 IPCC AR4 climate simulations for the Southwestern US: the importance of future ENSO projections. Accepted with minor revisions in Climatic Change.

Seasonal predictability of the AWP

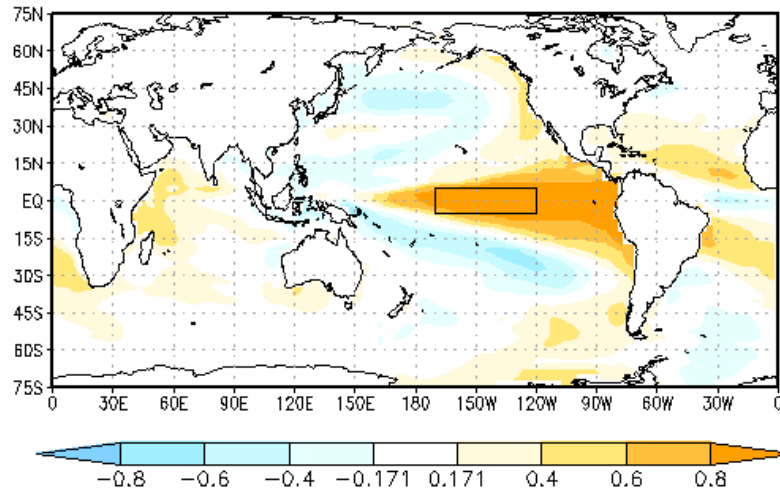
V. Misra, S. Chan (FSU, Dept. of Meteorology
& COAPS)

CFS Seasonal hindcasts:

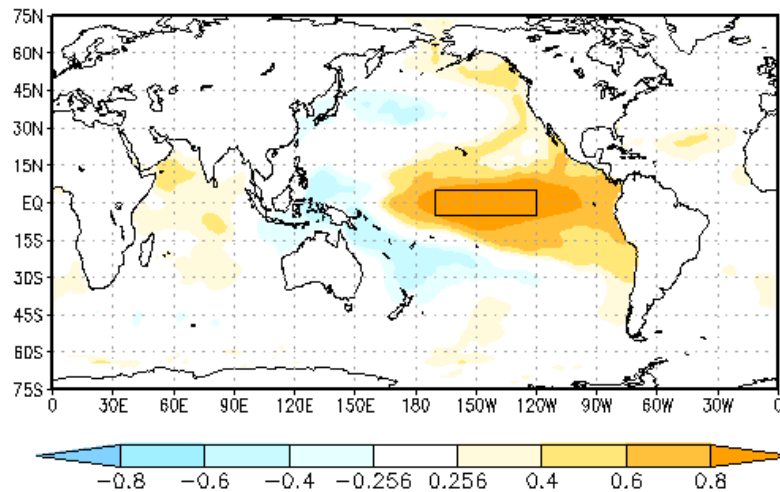
- 23 years(1981-2003)
- 15 ensemble members, starting from every month (initialized with GFDL ocean reanalysis)
- 9 month long integration



Signal to noise ratio of JAS AWP area

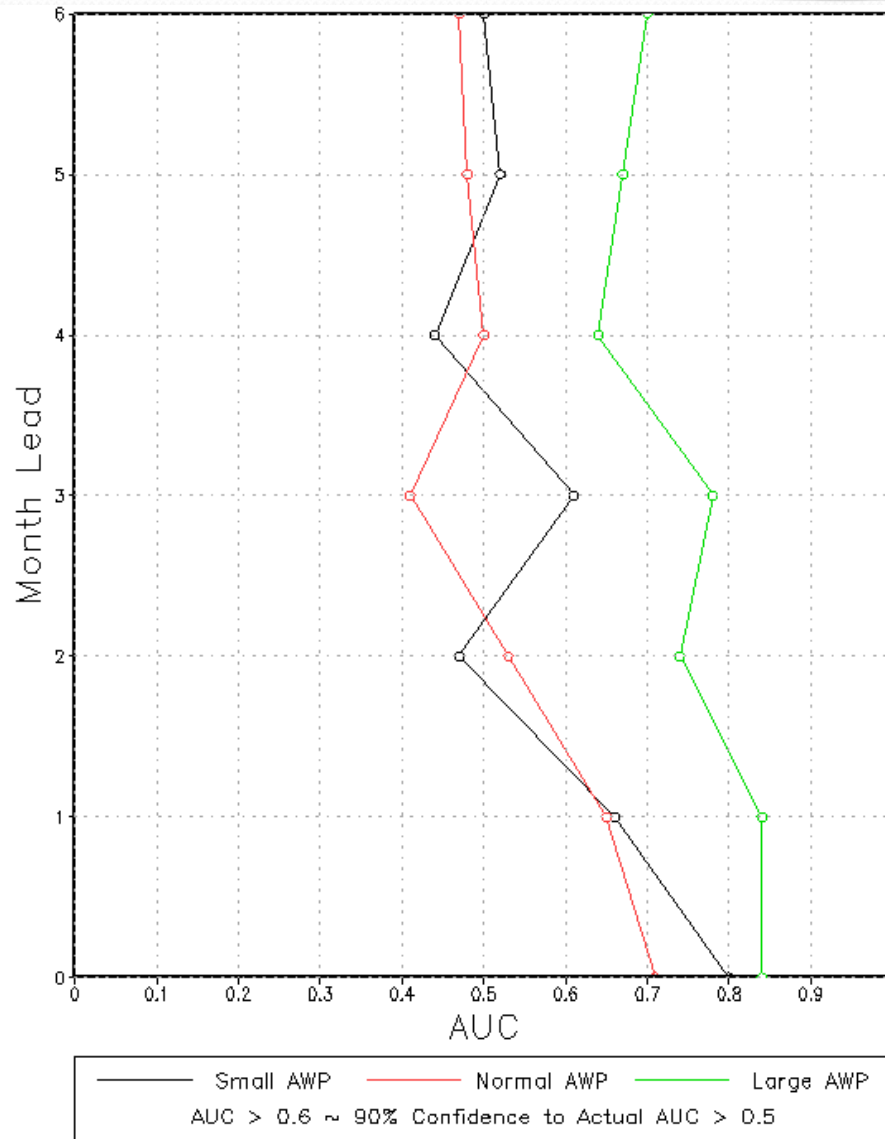


CFS LT

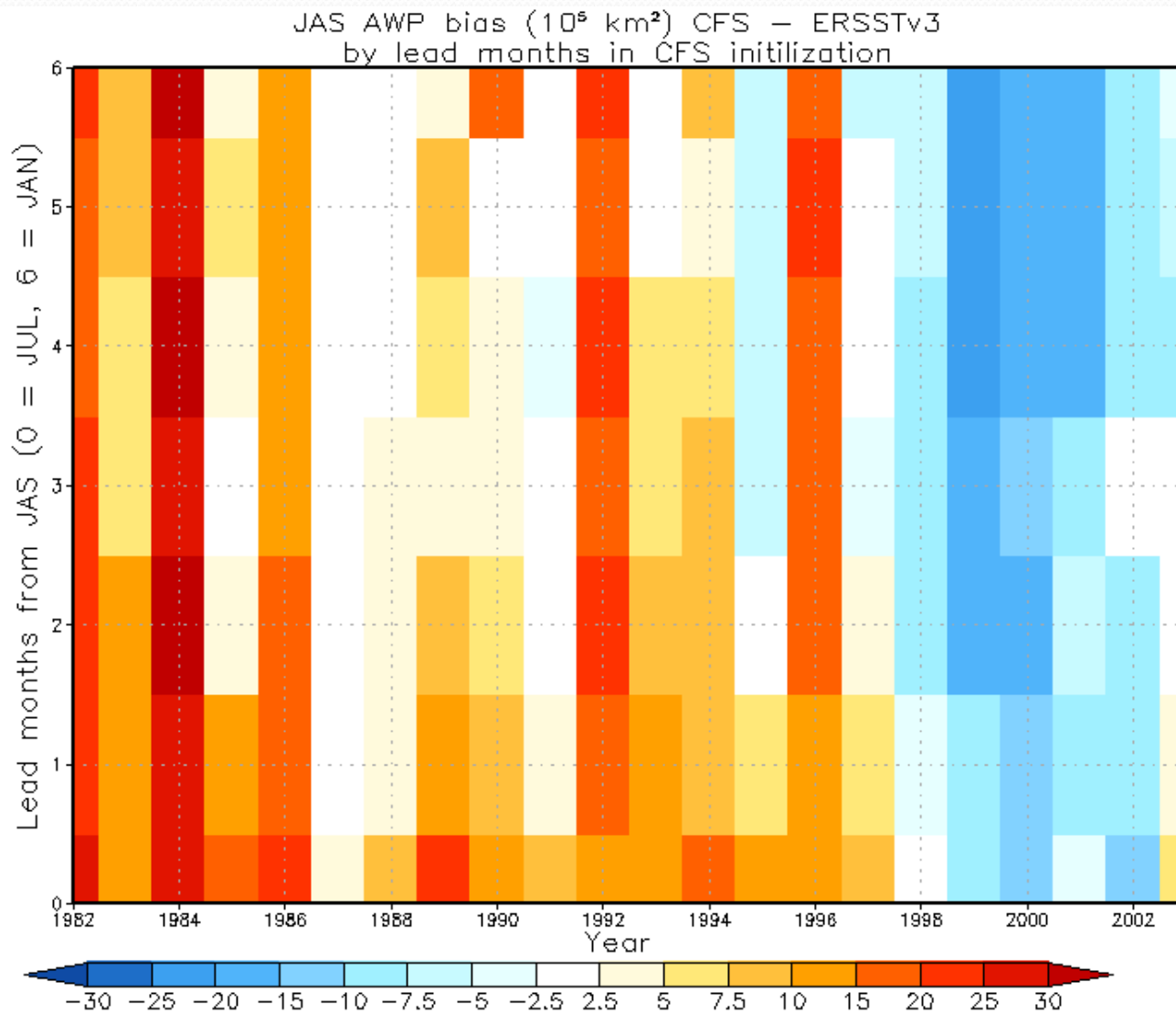


ERSSTV3

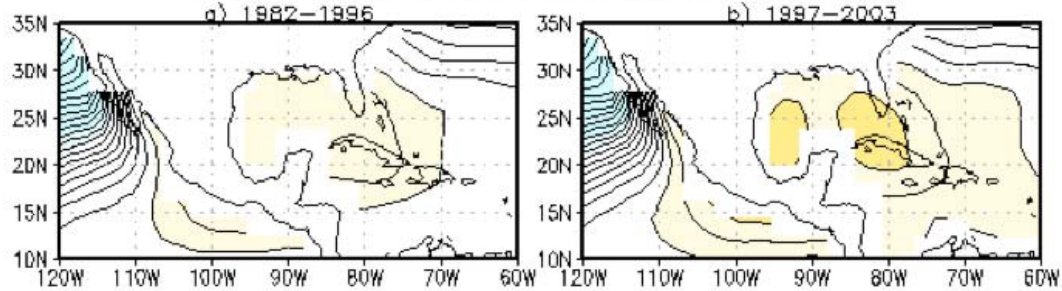
The JAS Nino3.4 SST index correlations with global SST



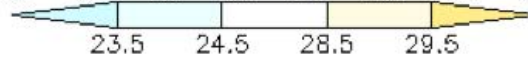
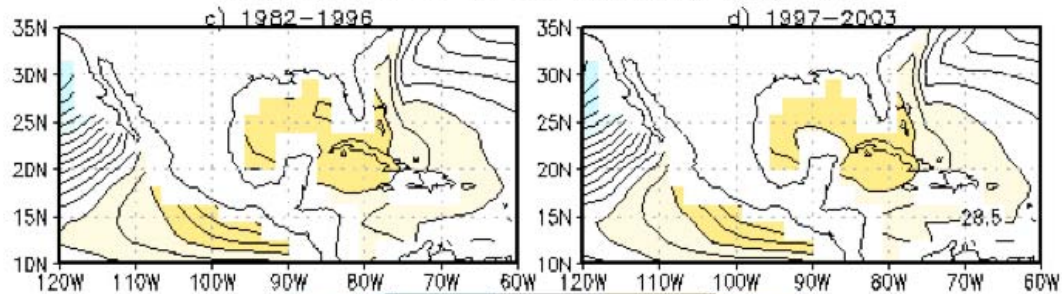
The Area Under the Relative Operating Curve



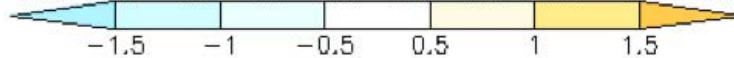
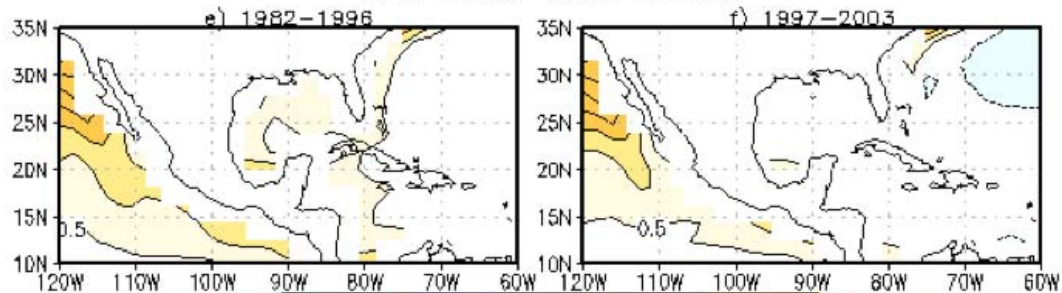
NOAA Extended Reconstructed SST version 3



CFS JAS 0-3 Mn Ld Hindcast Mean SST



CFS Minus Observations

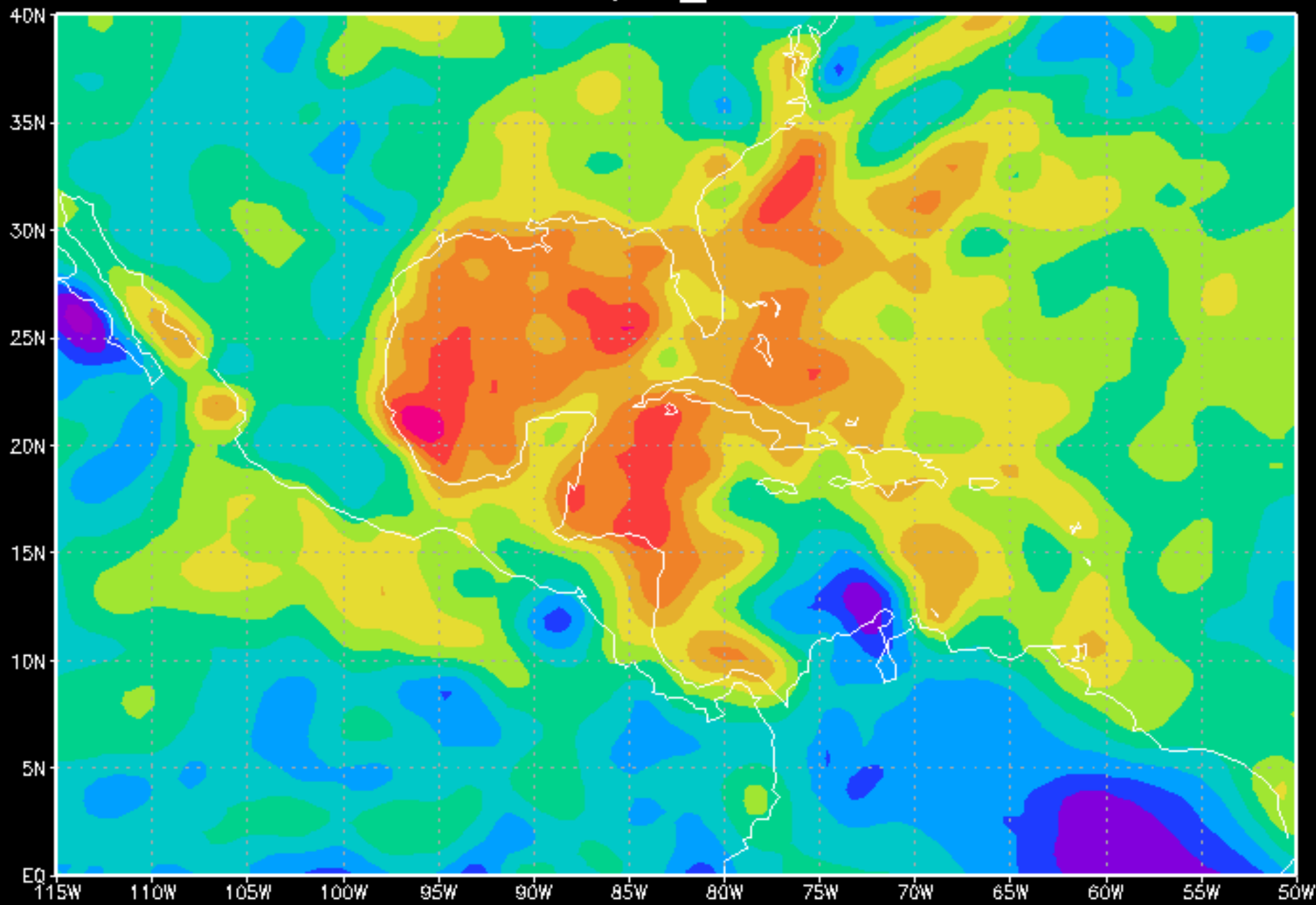


Climatological July-August-September (JAS) seasonal mean SST

NASA'S MERRA reanalysis

- “GEOS-5” GCM
- 1979-present planned (90% completed)
- $1/2 \times 2/3$ degree analysis
- **Analysis tendency** fields are part of the MERRA dataset: these measure the ways in which the model fields need to be ‘nudged’ to keep the time evolution on track.
- **Analys. Tend.** = -(Model Tend. to move away from obs)

dqvdt_ano



CFSRR

K. Mo, NCEP/CPC

CFSRR- CFS reanalysis and seasonal reforecast project

- An ocean-atmosphere-land coupled system
- Atmosphere: T382L64 GFS
- Ocean: GFDL MOM4 ocean model (0.250 in the tropics and 0.50 globally)
- Land GLDAS Noah model with 4 soil layers
- Time: Jan1979-2009 and will continue in real time
- Data will be distributed after 6 months of completion (2010)
- Monitoring in CPC will switch from CFS to CFSRR
- NCEP will have a web site monitoring the Pan American Oceanic and atmospheric conditions_VAMOS unifying theme

Conclusions

- IPCC-AR4 display some grave errors over AWP.
- CFS have useful prediction skill only if it is initialized at the peak of large AWP (July). CFS initialized in July of normal and small AWP years has a prediction skill up to only one month.
- In CFS, AWP is influenced by the onset of ENSO, which is unsupported by observations.
- Decadal variations in AWP are not captured in CFS hindcast.
- Analysis tendencies in MERRA reflect model bias: GEOS5 rains too much over IAS region
- CFSRR is coming out in 2010

What do we need to

do?

- Seasonal predictability is our initial focus: Memory of the seasonal evolution of summer climate in IASCLIP region resides in WHWP.
- OSSE studies (i.e., ocean model initializations for seasonal forecast) are required to demonstrate the needs for enhanced ocean observations in the IAS region.
- Deliverables: What ocean observations are required?--will deliver from the OSSE period (4-5 years)

What will ocean observations over

IAS do?

- Hopefully demonstrate that we can improve summer season predictability of AWP and APW-related climate variability including TC activity and seasonal droughts.
- Determine from the OSSE period what is critical and required to be sustained beyond the IASCLIP OBS period.

If we have the

resources...

- Find the sources of model bias over IASCLIP region via extensive model diagnostics.
- Study if atmospheric response to WHWP is robust across models => LAWP – SAWP experiments.
- Conduct sensitivity and process studies with coupled models that modulate WHWP.
- Study changes of AWP and its climate impacts associated with AMO and AGW.
- Understand the role of WHWP on mid-summer drought
- Perform some experiments with regional climate models (e.g., low-level jets; diurnal cycles; orographic effects on precipitation over Caribbean Islands).