VAMOS Extremes

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Proposed VAMOS Perspective on Extremes

Focus on extremes in **warm season climate**, primarily related to perturbations to monsoon circulation and warm season transients.

Multi-scale approach to understanding processes occurring at **different space and time scales** within monsoon systems, such as terrain heating, vegetation-atmosphere coupling, land-sea breezes, regional moisture flux patterns, synoptic disturbances and oceanic teleconnections.

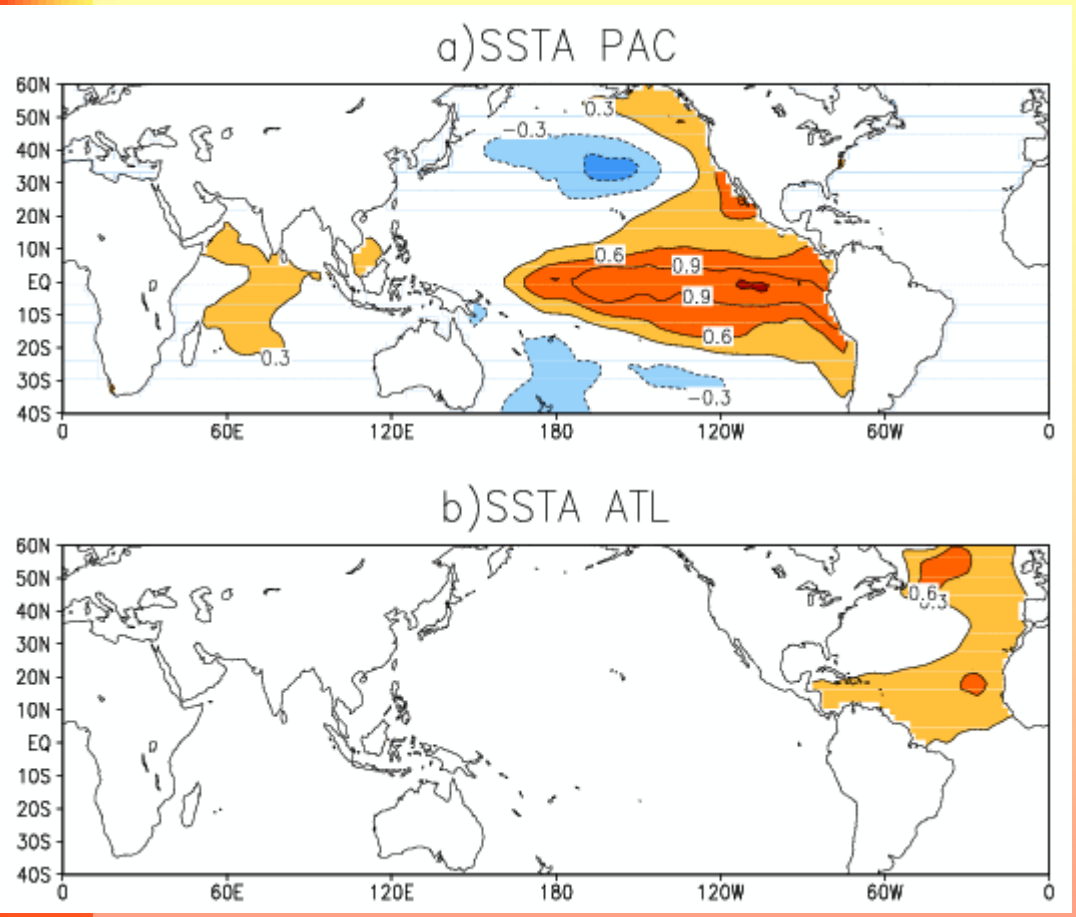
Major Extreme Events being Considered

- **Droughts**:
  - P*ersistent precipitation deficits (SPI),*
  - *Soil moisture deficit for agricultural drought, or*
  - *Streamflow deficits for hydrological droughts.*

- **Fluvial or inundation periods**:
  - *Periods of anomalous frequency of heavy precipitation events, based on daily to weekly characteristics. Wet extremes encompass a wider range of timescales.*

- **Heat waves**:
  - *Extreme heat waves are often coincident with drought, so should be considered also in terms of their covariance with precipitation extremes. Temperature-based extremes also span a range of time scales.*

CLIVAR Drought Working Group experiments



(Schubert et al, 2009)

Experiments:

a) Climatology SST

b) Pacific SSTAs:
PwAn, PcAn

c) Atlantic SSTAs:
PnAw, PnAc

d) Combined SSTAs:
PcAc, PcAw, PwAc,PwAw

Models:

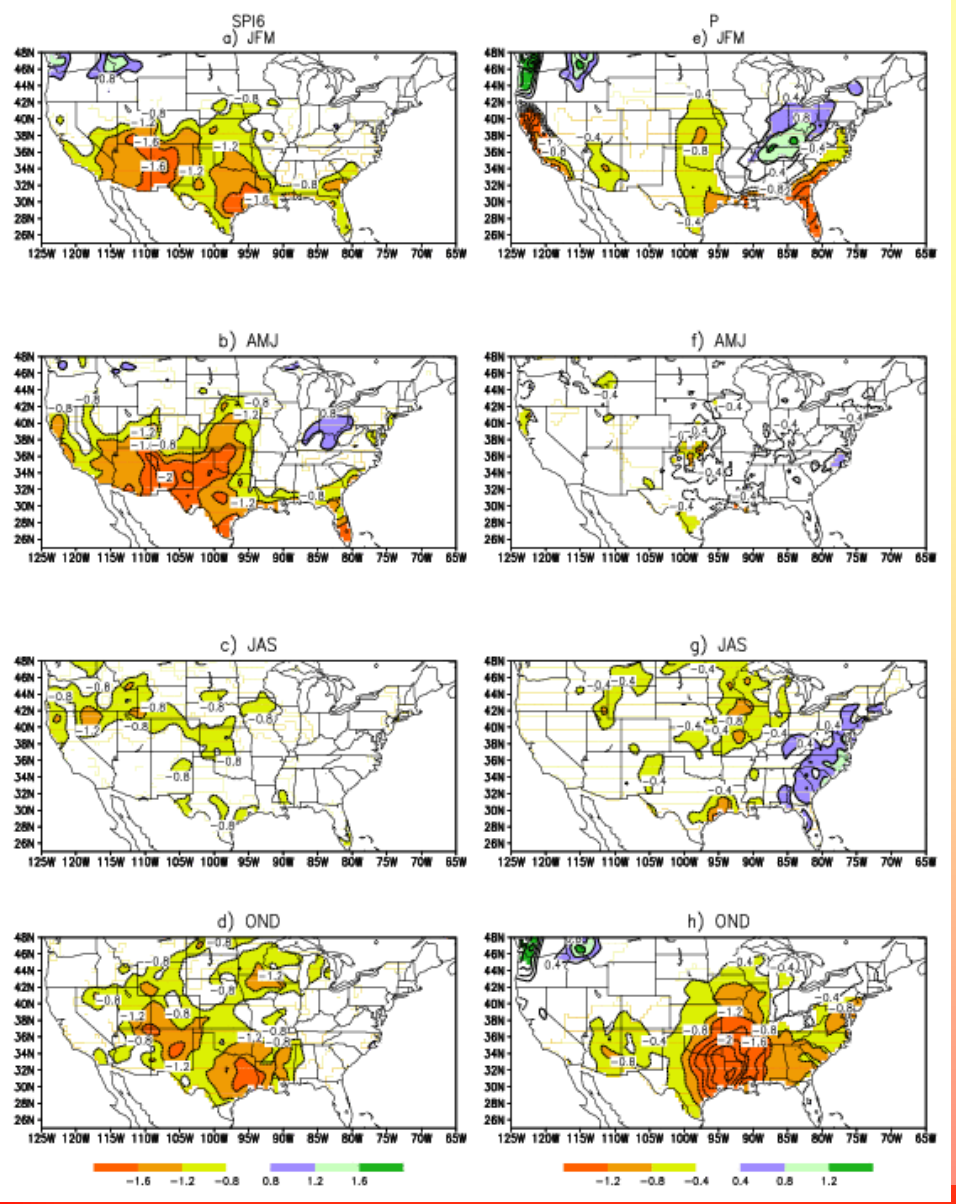
GFS/NCEP (36-yr),
GFDL and NSIPP(50-yr)
CCM3(US) CCM3.5(SA)

Data:

P Monthly means

Cold-warm ENSO composites

SPI6 **P**



ENSO impact

JFM

AMJ

JAS

OND

P anom does not imply drought because drought means persistent P anom.

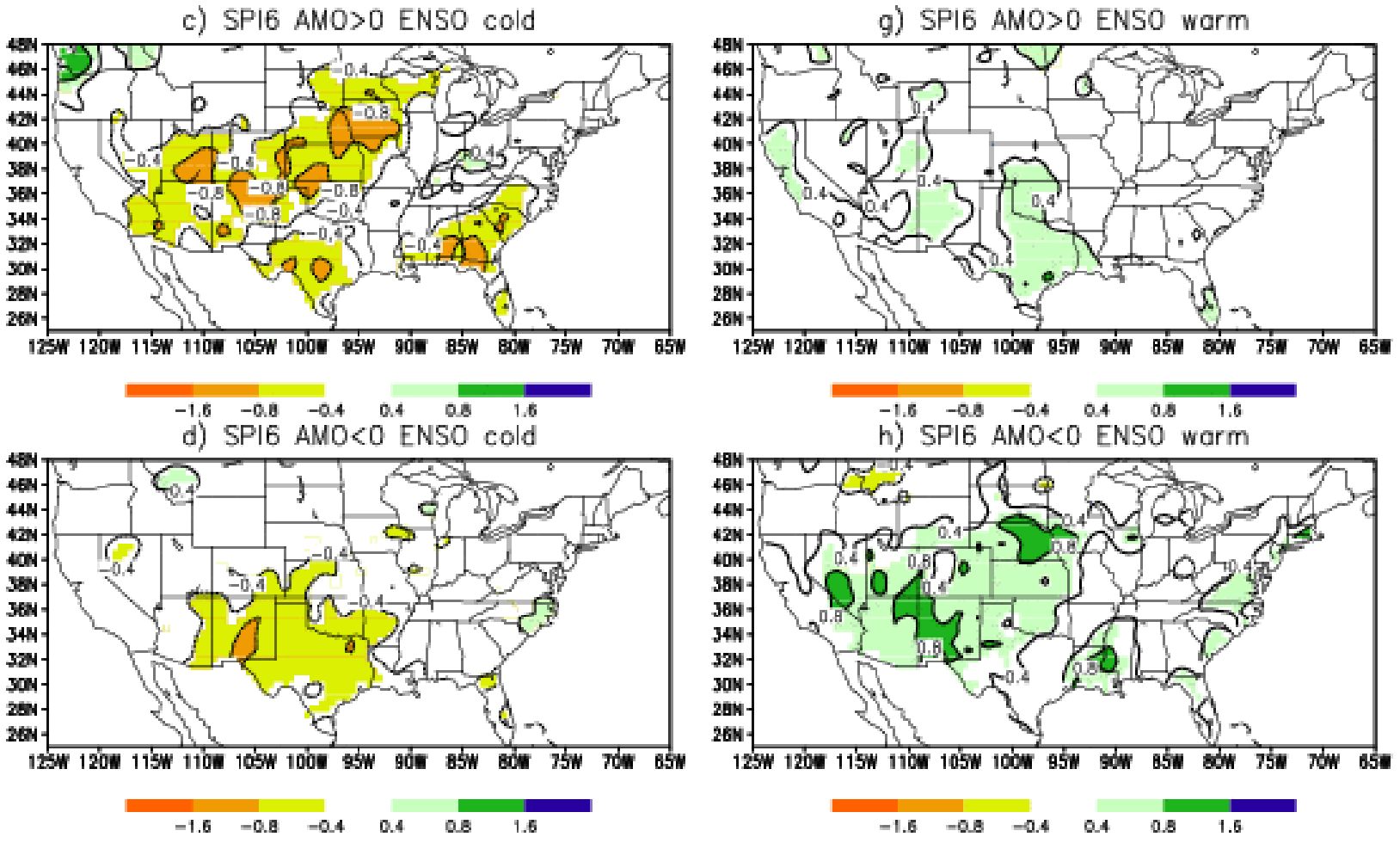
For the East coast, Southeast, cold ENSO may initialize drought but if ENSO persist from winter to summer, then drought will not last because P responses to ENSO are seasonally dependent

For the southern Plains, Colorado basin, Southwest, persist cold ENSO=> persist drought

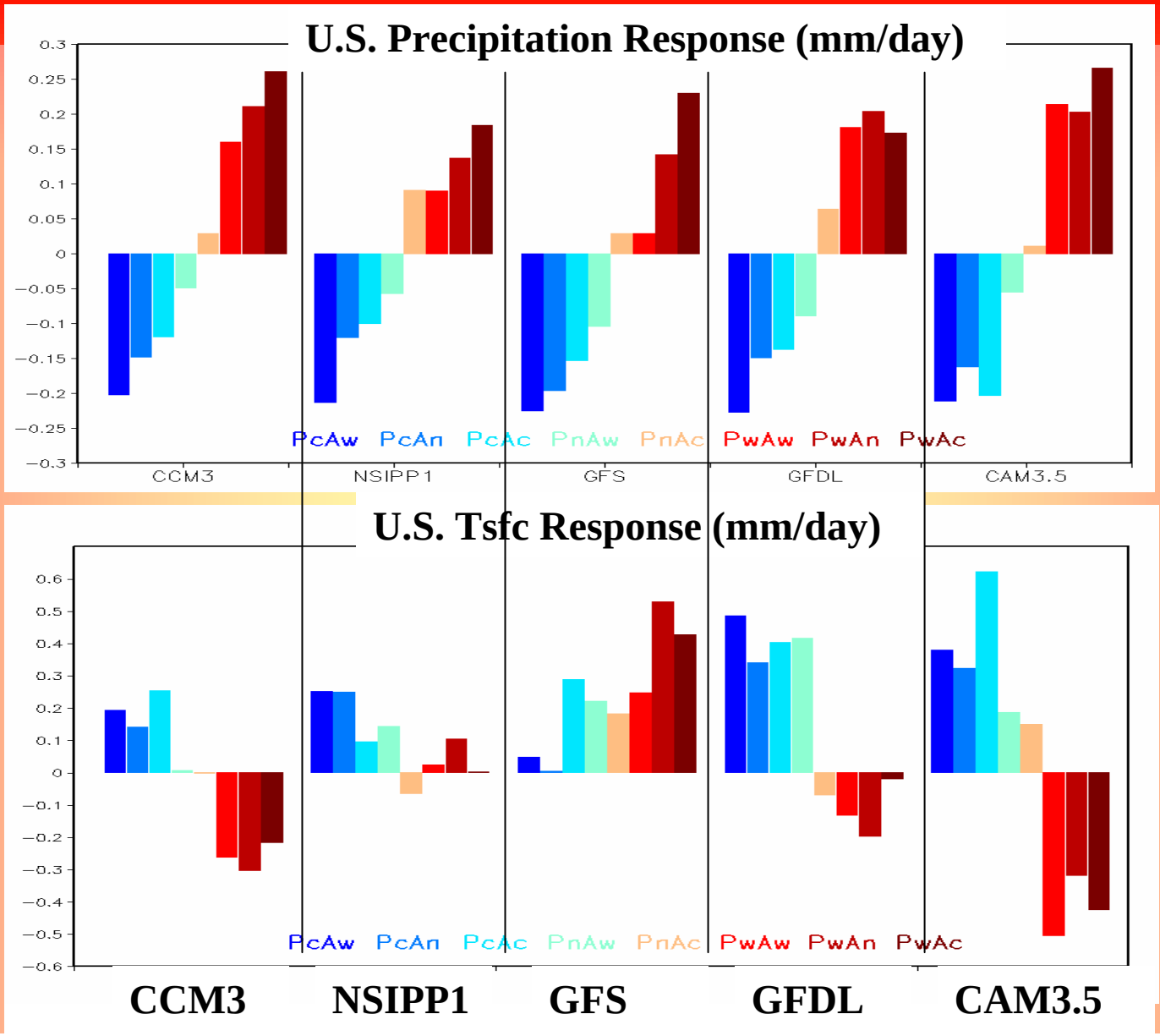
Source: K. Mo

AMO influence through ENSO

Composite of SPI6 with all seasons together
for different phase of the AMO and ENSO



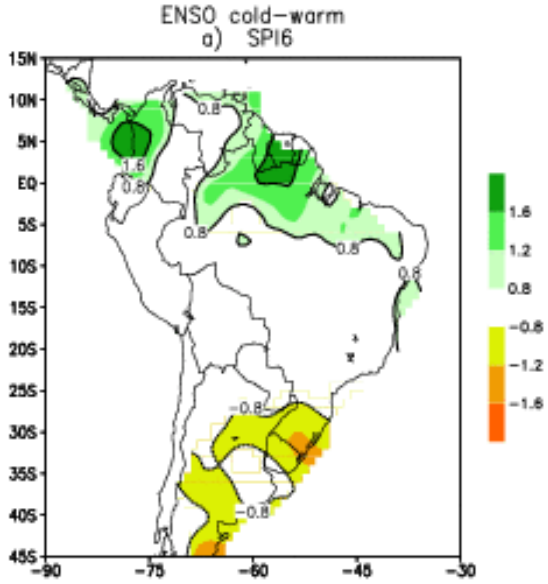
Source: K. Mo

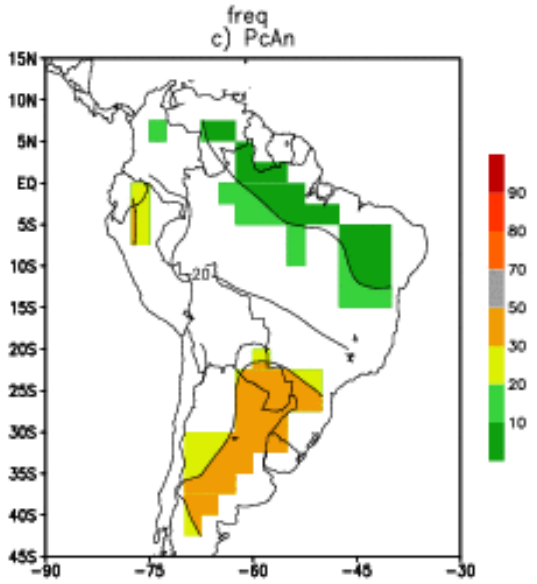


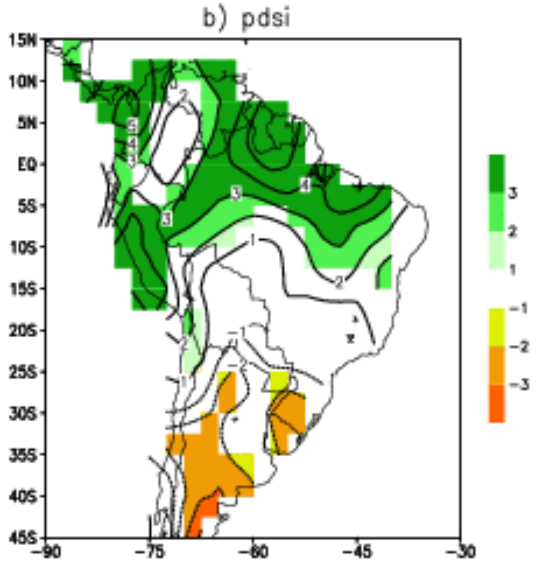
The annual and continental United States mean responses for precipitation (top panel) and surface temperature (bottom panel) for all 8 combinations of the Pacific and Atlantic patterns for the 5 AGCMs

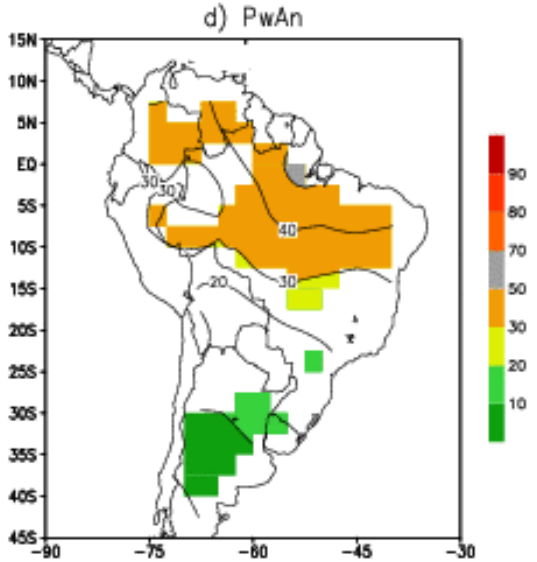
(Schubert et al, 2009)

ENSO









Cold Trop. Pac =>

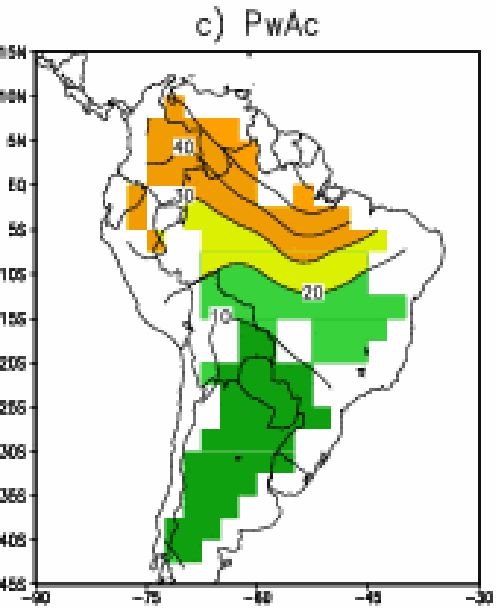
Drought: Argentina & SE South America

Wetness: Northern South America

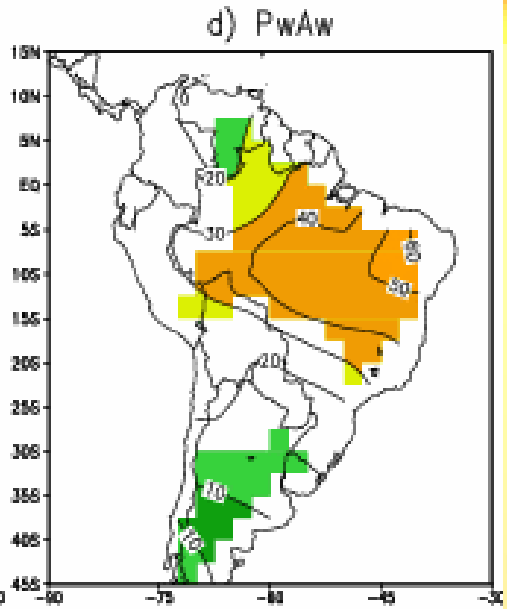
Observations

Ensemble

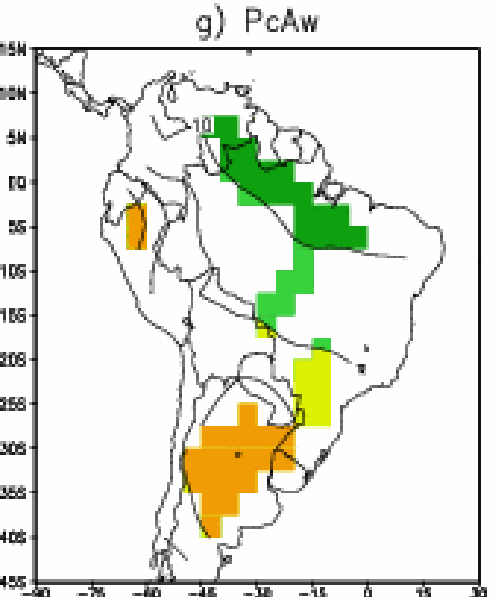
Source: K. Mo

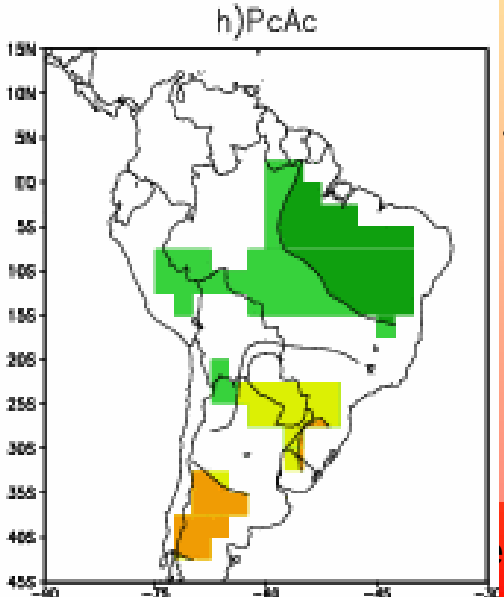


NTA & ENSO
out of phase



NTA & ENSO
in phase



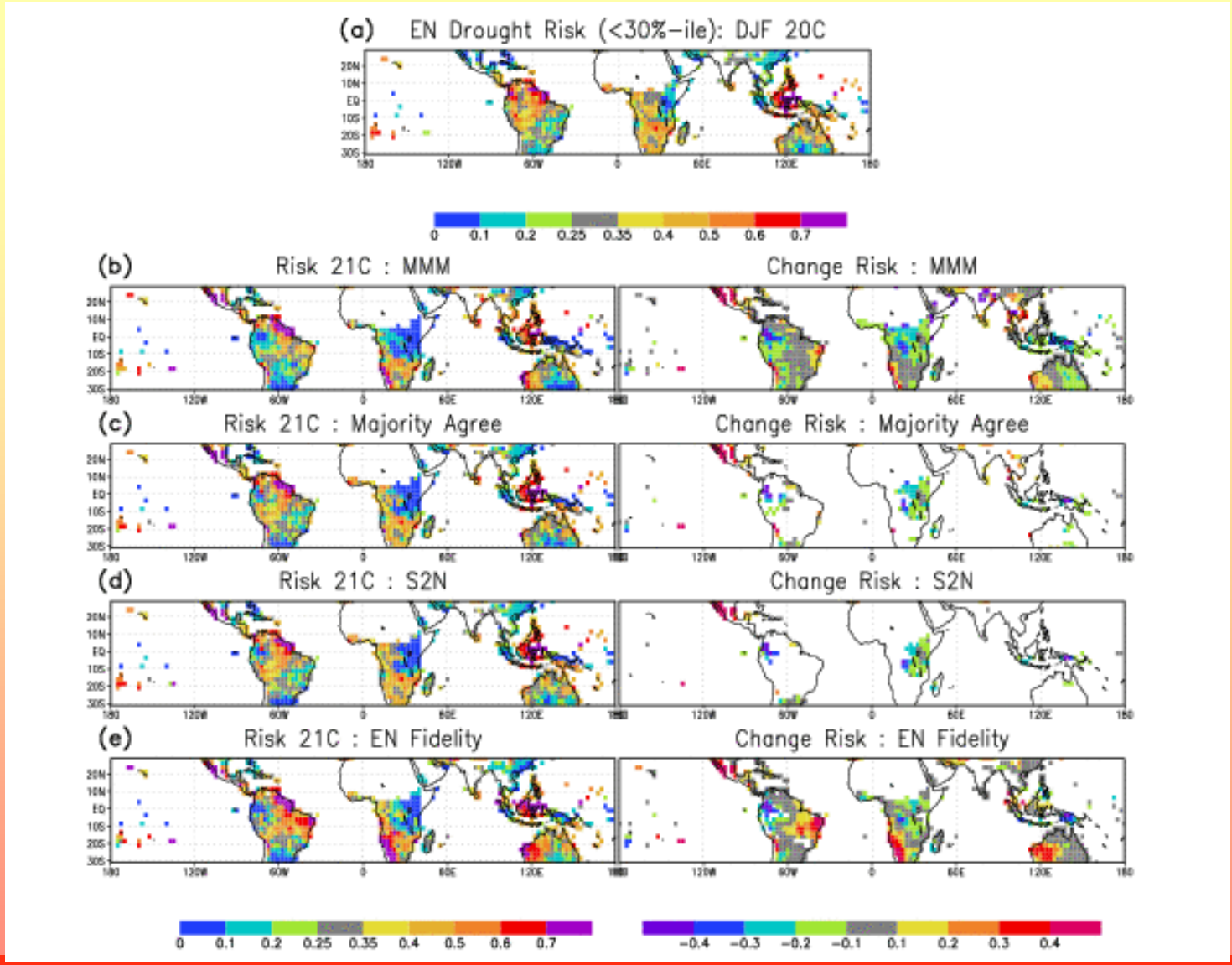


North Atlantic SSTAs modulate the impact of ENSO on drought

- **The major influence of the NTA SSTAs is to modulate the impact of ENSO on drought by shifting the areas of most frequent drought occurrence over northern South America**

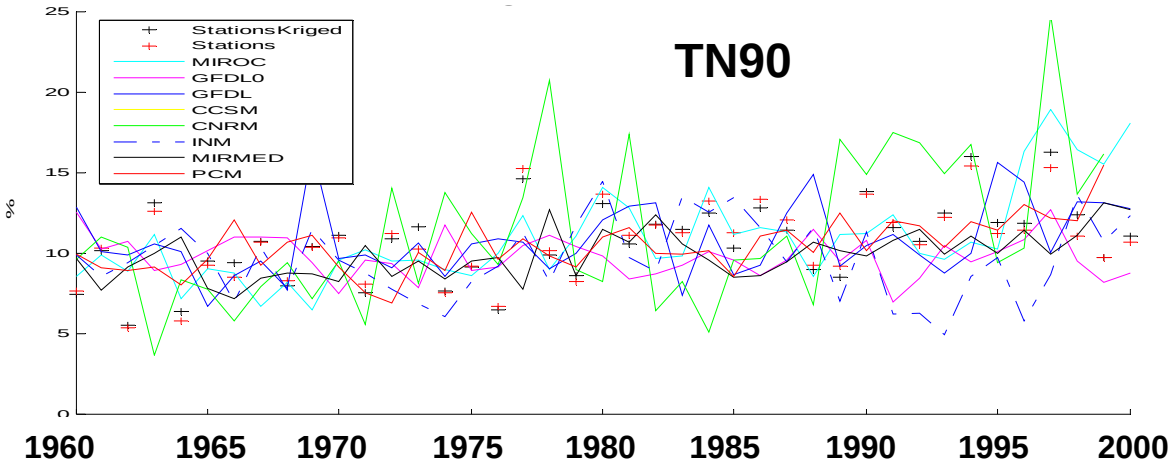
Source: K. Mo

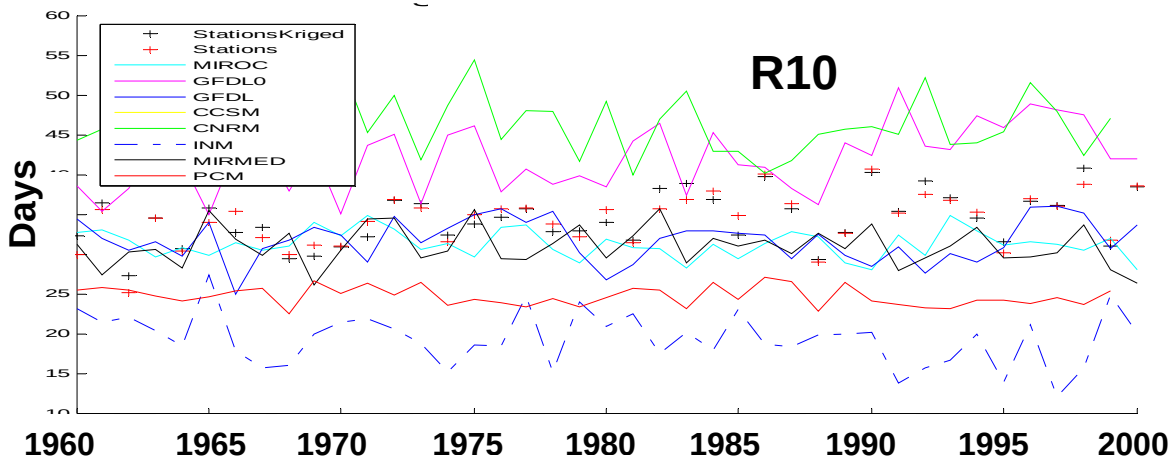
El Niño-Related Drought & CC

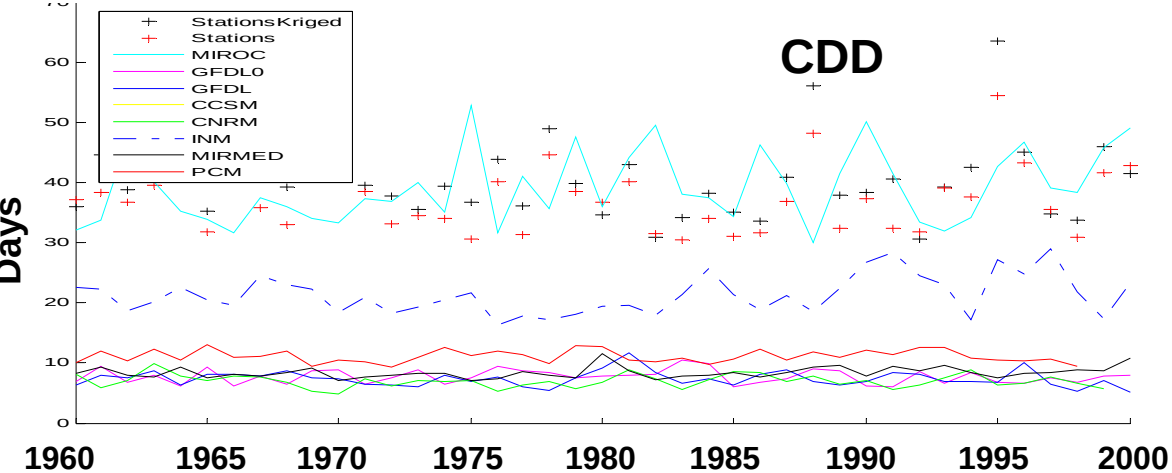


(Coelho & Goddard, 2009)

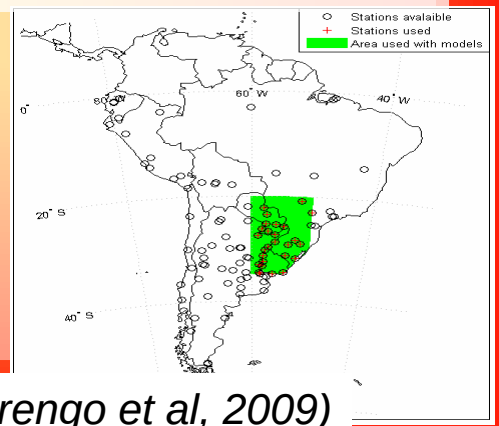
VAMOS and Extremes
Observed and simulated trends of warm nights, intense rainfall and dry spells in the LPB region: CLARIS and CLARIS-LPB





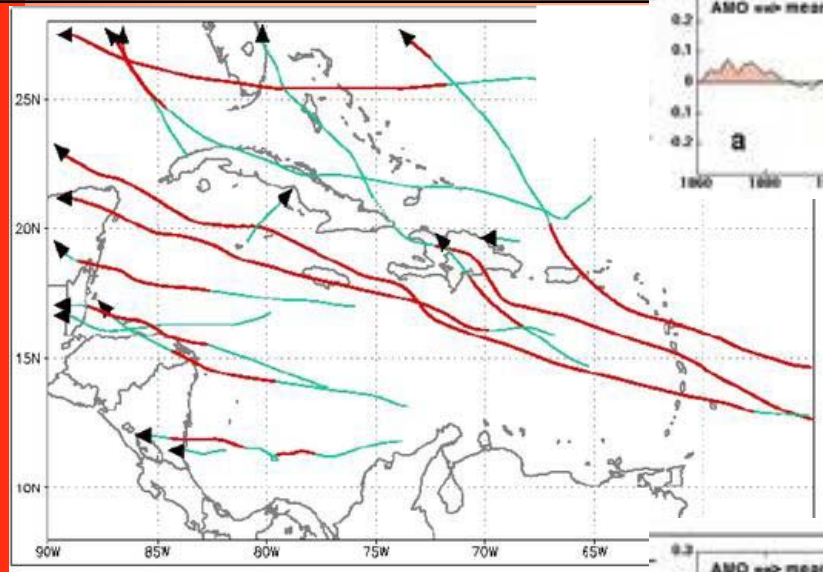


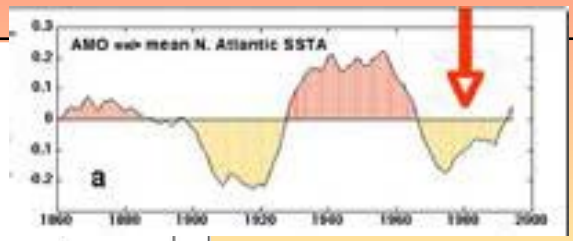
Times series of observed and simulated TN90 (warm nights), R10 (intense rainfall events) and CDD (consecutive dry days) indices during 1960-2000 in the LA Plata Bain region of southeastern South America.

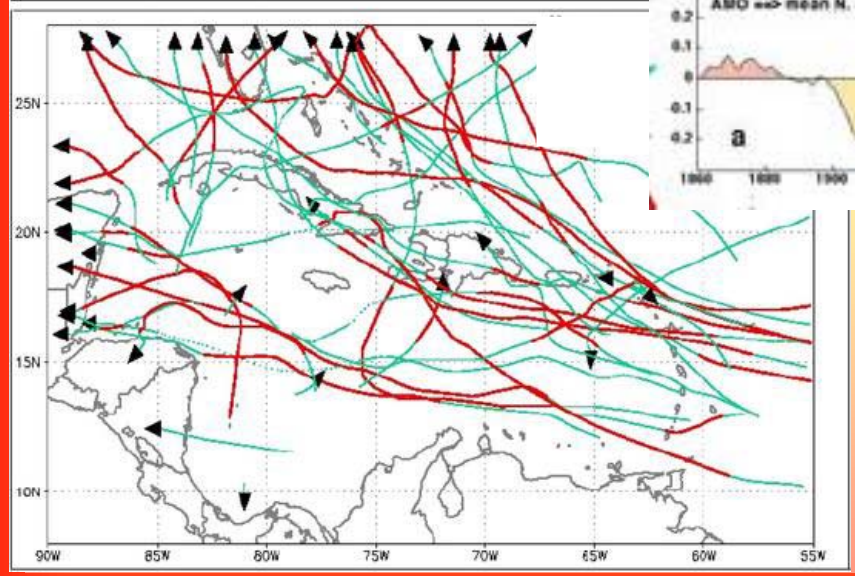


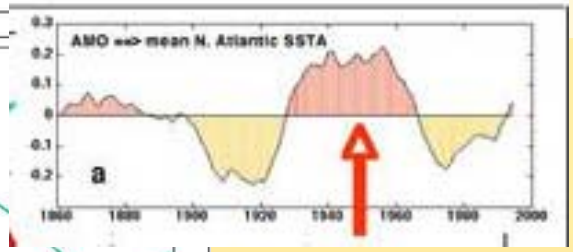
(Marengo et al, 2009)

AMO effects on Atlantic hurricanes









"During warm phases of the AMO, the numbers of tropical storms that mature into severe hurricanes is much greater than during cool [illegible], **at least twice as many**."

Source:
http://www.aoml.noaa.gov/phod/d2m_shift/amo_faq.php

Resources and Relevant Efforts

- **Observational data:**
  - Precipitation and surface temperature data

    monthly gridded and station data 1950+; multi-decade timeseries of daily data
  - Streamflow data

    (USGS: United States Geological Survey; ANA: Brazilian National Water Authority; other NMHSs)
  - Land surface data

    Satellite data; land data assimilation systems
  - Paleo-data

- **Model data:**
  - The NAME Forecast Forum (and previous NAMAP effort) http://www.cpc.noaa.gov/products/Global_Monsoons/American_Monsoons/NAME/index.shtml.
  - The CLIVAR Drought Working Group http://www.usclivar.org/drought.php and http://gmao.gsfc.nasa.gov/research/clivar_drought_wg/index.html
  - Model Archives (e.g. CMIP, IRI, DEMETER, CHFP)

    AGCM & CGCM simulations & hindcasts from seasons to centennial

Issues

- Importance of multi-scale considerations, particularly regarding timescales
- Could use more process oriented research on extremes within VAMOS
- Leadership of TF??