Modeling and Prediction El Niño

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with thanks to
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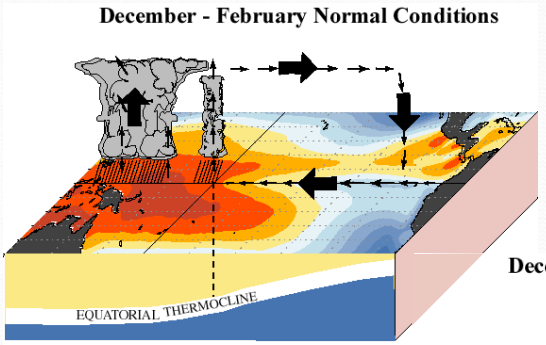
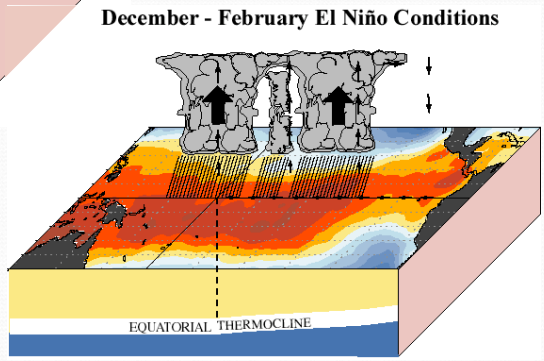
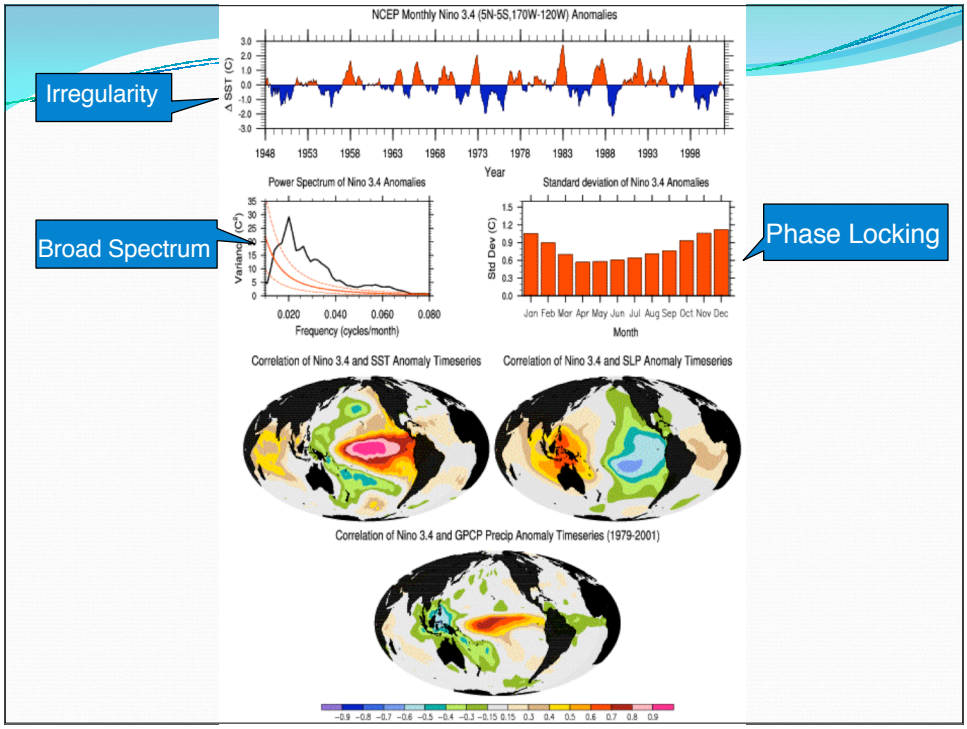
El Nino/Southern Oscillation

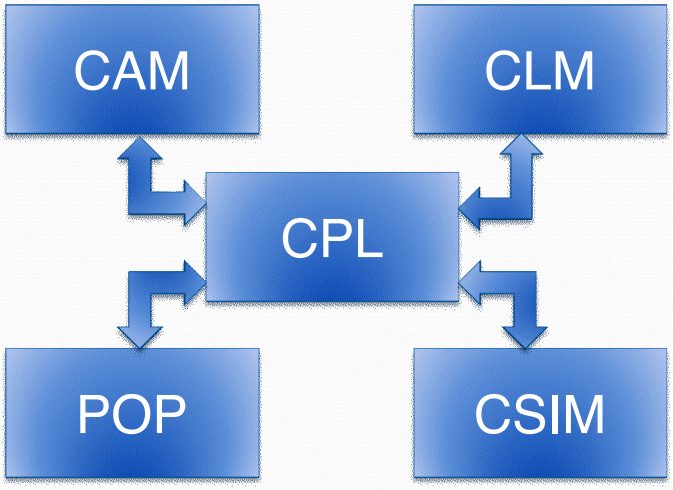


El Niño and the Southern Oscillation: the major mode of interannual variation in the tropical climate

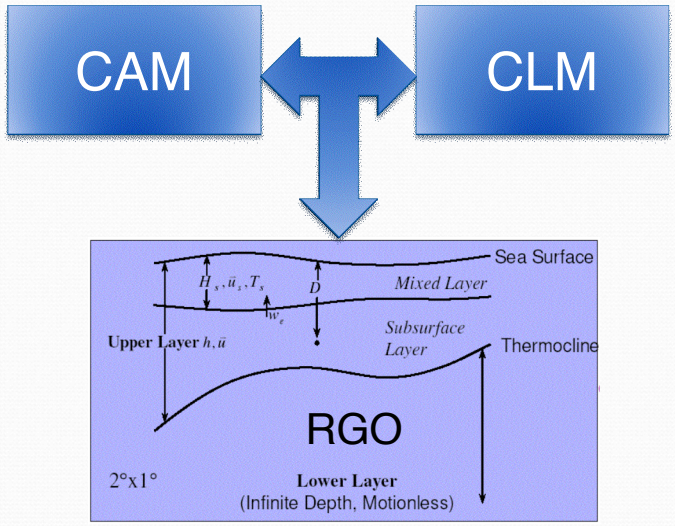



Irregularity
Broad Spectrum
Phase Locking
NCEP Monthly Nino 3.4 (5N-5S,170W-120W) Anomalies
Δ SST (C)
Year
Power Spectrum of Nino 3.4 Anomalies
Variance (C²)
Frequency (cycles/month)
Standard deviation of Nino 3.4 Anomalies
Std Dev (C)
Month
Correlation of Nino 3.4 and SST Anomaly Timeseries
Correlation of Nino 3.4 and SLP Anomaly Timeseries
Correlation of Nino 3.4 and GPCP Precip Anomaly Timeseries (1979-2001)

CCSM3


CAM
CLM
CPL
POP
CSIM

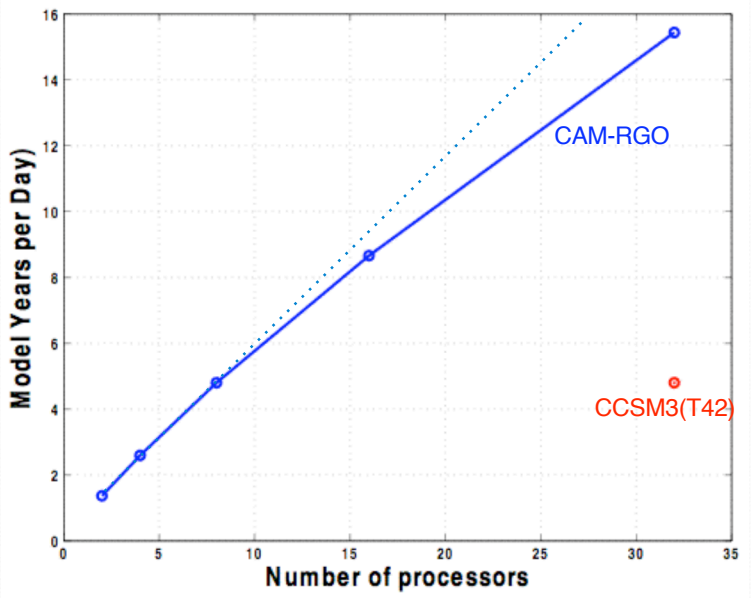
CAM-RGO

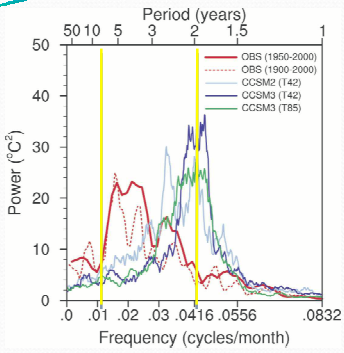


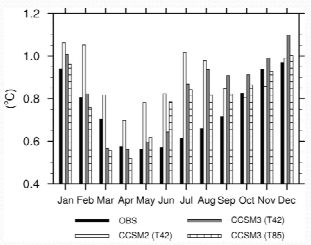
CAM3

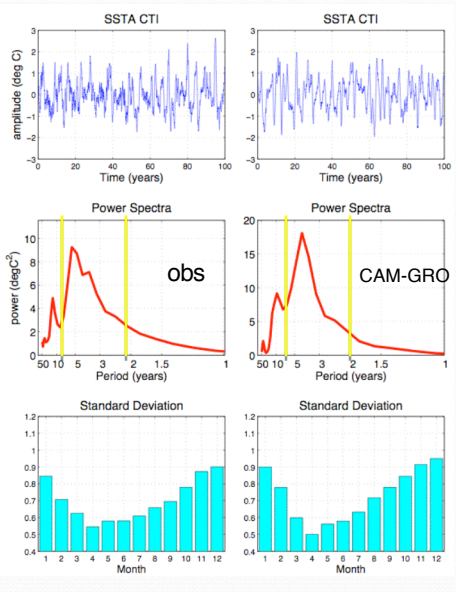
- Community Atmospheric Model version 3
  - Developed at NCAR with substantial DOE input, both scientific and software.
- The atmosphere model for CCSM, the coupled climate system model.
  - Also the most timing consuming part of CCSM.
  - Widely used by both American and foreign scientists for climate research.
    - For example, Carbon, bio-geochemistry models are built upon (integrated with) CAM3.
    - IPCC predictions use CAM3 (in part)
  - About 230,000 lines codes in Fortran 90.
- 1D Decomposition, runs up to 128 processors at T85 resolution (150Km)
- 2D Decomposition, runs up to 1680 processors at 0.5 deg (60Km) resolution.

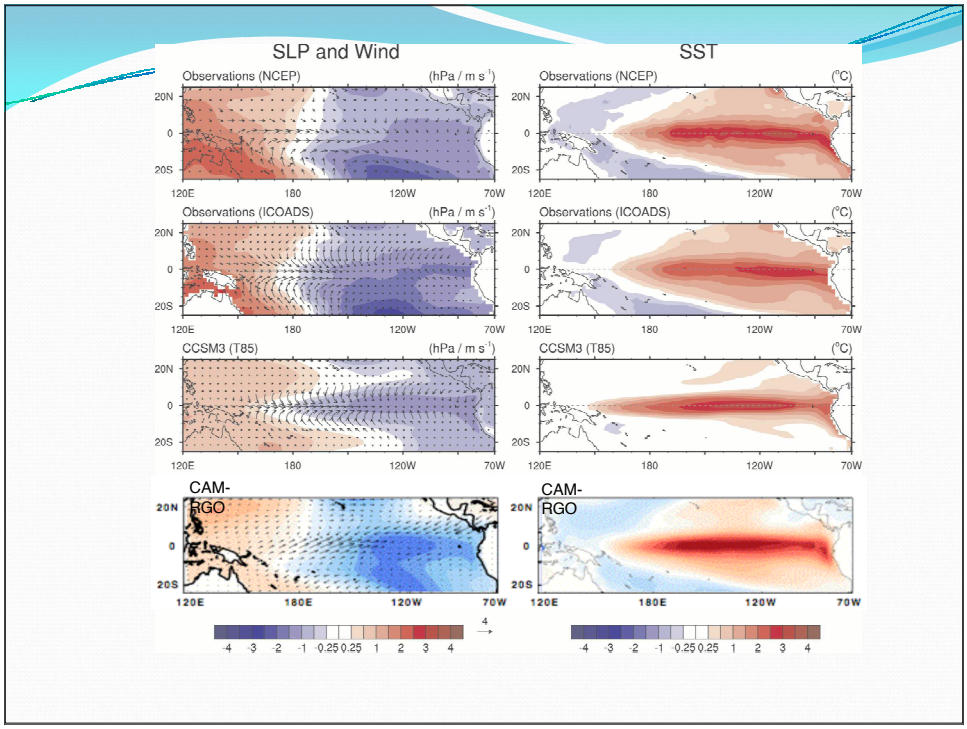
CAM-RGO Performance on Hydra



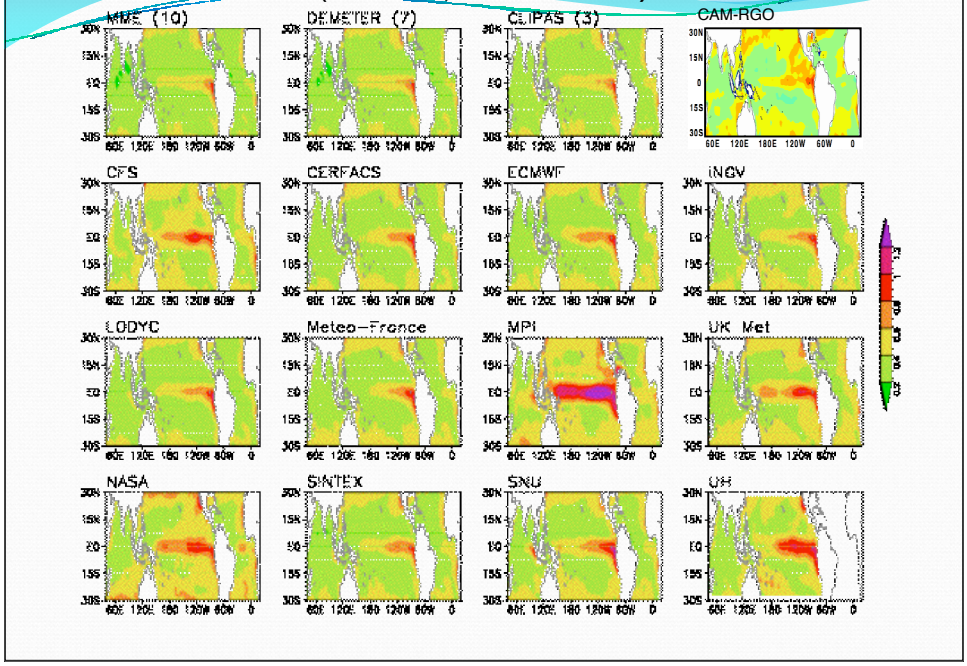




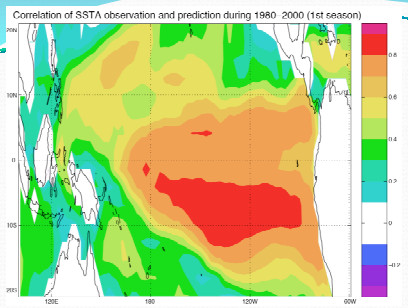




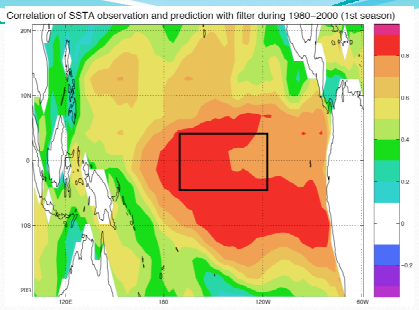
RMS Error of SST Anomalies during 1980-2001
(1st season, 2-4 months lead)



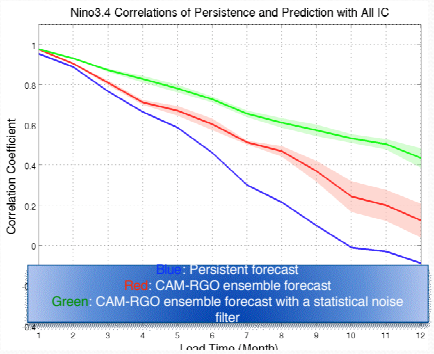
Standard Ensemble Forecast



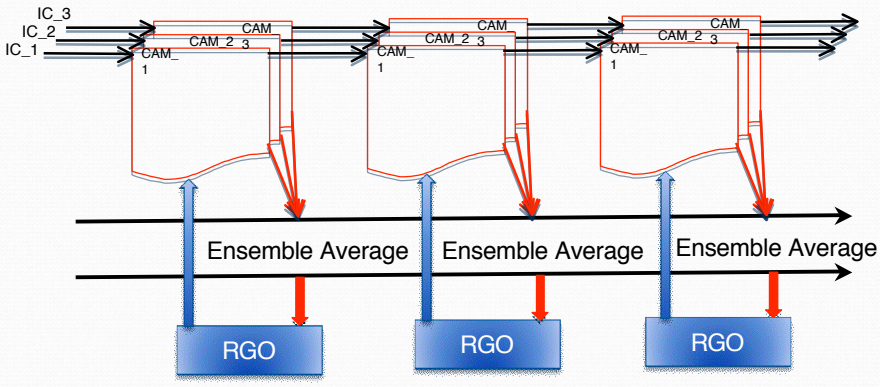
Noise Filtered Ensemble Forecast

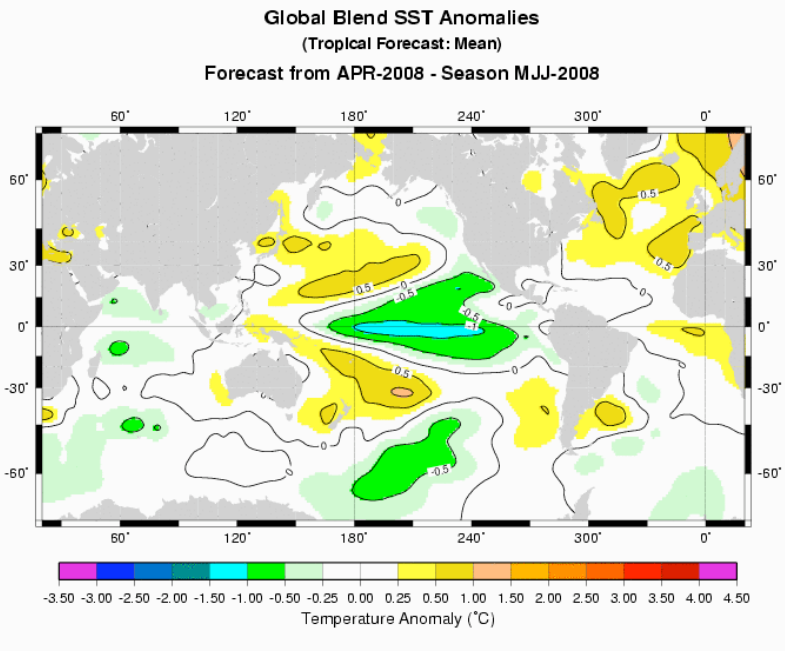


Using a statistical filter to reduce "weather noise" influence on ENSO, the model shows an improved skill in predicting tropical Pacific sea-surface temperature anomalies. To further test the result, we are experimenting with a more general noise removing procedure which is less restrictive but computationally more intensive.



Interactive Coupled Ensemble (Kirtman and Shukla, 2002)



Concluding Remarks

- A new climate modeling tool that can be very useful for ENSO study and ENSO prediction
- A new strategy for enhancing signal-to-noise ratio that may lead to improvement for seasonal climate forecast