Modeling and Prediction

El Niño

Ping Chang
with thanks to
Link Ji, Xiaohui Tang and Li Zhang

El Niño/Southern Oscillation

December - February Normal Conditions

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

December - February El Niño Conditions
• 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

![Graph showing model years per day versus number of processors.]

- CAM-RGO
- CCSM3(T42)

![Power spectra and standard deviation plots.]

- Frequency (cycles/month)
- Power (°C)
- Period (years)
- SSTA CTI
- Power Spectra
- Standard Deviation
RMS Error of SST Anomalies during 1980-2001
(1st season, 2-4 months lead)
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.
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