P2.17 The New ECPC GSM/MIT Coupled Seasonal Prediction Model
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http://ecpc.ucsd.edu/COUPLED/CM/coupled.html

Coupled Modeling Approach
- Goal: Coupled data assimilation model for seasonal (up to 12 months) climate prediction
- Components:
  - ECPC Atmospheric Global Spectral Model
  - MIT Oceanic General Circulation (JPL version)
- Coupled: every 24 hours
- Initialization: from atmospheric reanalysis and assimilated oceanic states.

ECPC Coupled Seasonal Prediction Model
- Job propulsion Laboratory (JPL) version of the Massachusetts Institute of Technology (MIT) OGCM 1/13°
- Spectral T62 (~200 km), 30 vertical levels
- Physical processes originated from ECPE DOE reanalysis (R-2)
- Global and Regional versions are used for experimental seasonal climate predictions at ECPC
- Spectra analysis: T62 (~200 km), 30 vertical levels
- Initial conditions: JPL ocean assimilated data

MIT Ocean General Circulation Model
- Primitive equations on the sphere
- ECO package
- GM eddy parameterization
- Full surface mixed layer model
- 360x224 (1°x1°) horizontal resolution telescoping towards the equator to 1/3° horizontal resolution with 46 vertical levels
- Adjacent MIT model exists and is routinely used in JPL together with the forward model for 3D ocean state estimation

Coupled Model Experiments
- 1. Long Run (currently 20+ years) – climatology
- 2. Retrospective forecast experiments – 12 months forecasts starting the first day of every month for 11-year (1994-2004) time period. Skill of the model depends on lead time
- 3. Experimental Forecasts for each month based on the climatology from retrospective forecasts

Skill of the long integration
- Spectra of the time series of the simulated and observed SST anomalies averaged over NINO3.4 region (7°N-5°S, 170°W-120°W) during the model and observations have peaks in between 2 and 3 years

JFM 1998 ocean forecast (05/97)
- Comparison between predicted (lower panel) and assimilated at JPL (upper panel) SST anomalies for JFM 1998. The coupled model run was started May 1-4, 1997. For “strong forcing” year, the model successfully predicts the main patterns of the SST anomalies for up to 11 months lead.

Summary
- Experiment with the long run has shown that the current version of the coupled model produces realistic intrinsic variability. The drift is negligible, thus no flux adjustment is necessary.
- The validation of the retrospective forecasts revealed that the skill of the model improves after a few months due to coupling.
- The current ECPC NINO 3.4 SST forecast lies within the scatter of the IRI forecasts

Coupled Model Development
- Evaluation of the coupled model skill: Continue the retrospective forecasts starting at different seasons (will include another fourteen years period of 1980-1993 for which the observed assimilated data is available).
- Model setup: Implementation of flux coupler that will provide parallel tools for inter-grid interpolation, time averaging and accumulation, merging data from multiple components for use by another component, etc.
- Investigation of the role of coupling in determining the atmospheric predictability: Comparison of coupled and two tiered prediction models
- Improvement of the model’s physics: Inclusion of a realistic sea-ice model, improvement of the atmospheric and ocean components

Spectral Model ECPC Global
- Spectral T62 (~200 km), 28 vertical levels model
- Physical processes originated from NCEP DOE reanalysis (R-2) (see Kanamitsu et al. 1997, NCEP-DOE AMIP-II Reanalysis (R-2) BAMS)
- Global and Regional versions of the model are used for experimental seasonal climate predictions at ECPC
- Can be pre-processed for different platforms
- Optimized for SIO PC Linux cluster (ROCKS 3.2)

Skill of mid-latitude (170°E - 150°W; 45°N-65°N) 2500 prediction
- Forecast starts: 3 months lead & 6 months lead
- January: 0.2 (AMJ) & 0.1 (JAS)
- February: 0.4 (MMJ) & 0.1 (ASO)
- March: 0.6 (JJA) & 0.1 (SON)
- April: 0.3 (JAS) & 0.4 (OND)
- May: 0.2 (ASO) & 0.1 (NDJ)
- June: 0.4 (SON) & 0.3 (DJF)
- July: 0.3 (OND) & 0.3 (JFM)
- August: 0.3 (NDJ) & 0.1 (FMA)
- September: 0.4 (DJF) & 0.1 (MAM)
- October: 0.3 (JFM) & 0.1 (AMJ)

JFM 1998 atmospheric forecast (05/97)
- Comparison between predicted 1998 Temperature (T2m) and NCEP Reanalysis II for JFM 1998. The coupled model run was started May 1-4, 1997. Model does not reproduce the main features over North America

JFM 1998 atmospheric forecast (05/97)
- Comparison between predicted precipitation and precipitation from NCEP Reanalysis II for JFM 1998. The coupled model run was started May 1-4, 1997. In addition to the equatorial dipole, the model reproduces above normal precipitation over southwest and east of the United States, below normal precipitation over Pacific Northwest and west coast of Canada.

Publications
- Stammer, D., 2002: State estimation in modern oceanic research. EGS, Transactions, American Geophysical Union.