COLA CMIP5 Decadal Forecasts Using CFS Version 2

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Description

• Model CFS version 2 provided by NCEP EMC
• Initial data
  – Atmosphere, land, sea ice CFSR reanalysis
  – Ocean NEMO (ECMWF) interpolated to CFS
• Computer resources
  – NASA Pleiades
THE NCEP CLIMATE FORECAST SYSTEM Version 2

Paper

CFS v2

1. An atmosphere at high horizontal resolution (spectral T574, ~27 km) and high vertical resolution (64 sigma-pressure hybrid levels) for the real time analysis
2. An atmosphere of T126L64 for the real time forecasts
3. An interactive ocean with 40 levels in the vertical, to a depth of 4737 m, and horizontal resolution of 0.25 degree at the tropics, tapering to a global resolution of 0.5 degree northwards and southwards of 10N and 10S respectively
4. An interactive 3 layer sea-ice model
5. An interactive land model with 4 soil levels
Status of Runs

• Ten year 4 member forecast ensembles from 1960, 1965, ..., 2000 completed
• 30 year 4 member forecast ensembles from 1960, 1980 (mostly completed)
• 2005 cases not yet started, pending choice of future scenario.
Results: Biases

• “mean drift” for 10 year hindcasts: average (forecast – obs) over all lead times

• Drift evolution (high latitudes)
Mean Drift

Mean Forecast T2m Drift Relative to Reanalysis, Years 1–10
Drift Evolution High Latitudes

T2m Drift 65N–75N (black), 65S–75S (green)
Results: Ensemble Mean Hindcast Anomalies

- NINO3.4 SST index
- North Atlantic AMV SST index
- Ensemble mean for each hindcast
- Annual cycle removed
NINO3.4 Hindcasts

NINO3.4 SST (Annual Cycle Removed)
North Atlantic Seasonal AMV Index
T2m Averaged 0N-60N, 300E-360E (Land Included)
Sea Ice/AMOC Biases (courtesy of Bohua Huang)
AMOC (Sv), CFS_v2, Control, 30-yr

Mean State

(b) 26.5N, 1000m
Salinity (averaged in 0°–60°W, 40°N–70°N)

Solid lines: CFS–CFSR
Dashed lines: CFS–NEMO
MLD (averaged in 40°W–60°W, 55°N–65°N)

CFS–NEMO

CFS–CFSR
Future Plans

• Tune sea ice to reduce high latitude drifts by increasing albedo, hopefully improve AMOC
• Run again
• Anomaly initialization
• Run again
• ...

**Possible Issue**

- **Initial state choice**
  - Limited number of initial years may lead to biased evaluations (e.g. suppose all initial years chosen are incipient El Nino. Then a model with a tropical warming bias will appear to make better forecasts than a model with no bias.)
  - Suggest that a better experimental design for the same cost would be to sample the initial states more thoroughly with fewer ensemble members.
NINO 3.4 SSTA Correlation
Implications for Bias Correction?

• Construct a set of almost perfect decadal forecasts of global mean surface air temperature (e.g. reanalysis).
• Initialize one set every year from 1960 to 1999
• Initialize another set every 5 years from 1960 to 1995.
• Compute “drift” of each set of forecasts
  – This “drift” to be subtracted from forecast mean and used for bias correction of predictions of future.
  – Green curve (from 5 year interval between ic’s will introduce noise into the predictions.)
Drift of Perfect Decadal Forecasts of Global Mean Surface Air Temperature