

Minutes for U.S. CLIVAR Decadal Predictability Working Group Meeting

Date: June 19, 2009

Location: Damon Room, NCAR Mesa Lab, Boulder, CO.

Attending: Amy Solomon, Lisa Goddard, Jim Carton, Ben Kirtman, Clara Deser, Arun Kumar, Matt Newman, Yochanan Kushnir, David Legler, Ichiro Fukumori, Doug Smith, Jerry Meehl, Dan Vimont (by telecon), Gokhan Danabasoglu (representing WGOMD), Arthur Greene (guest)

Coordination with other Working Groups

- 1) Coordination with US AMOC Science Team
 - AMOC ST would be interested in getting some feedback from the DPWG on what are the forced and natural components for AMOC, and how can this “separation” problem be approached? AMOC observational data alone is probably not enough, but the modeling subgroup would have more interest;
 - Metrics for evaluating the AMOC in model simulations would also be of interest to the AMOC WG
- 2) Input to WGCM on biases from CMIP3 and ideas to guide analyses for CMIP5
 - The DPWG is well positioned to give input on metrics to assess the decadal prediction simulations for the CMIP5. We would like to be involved in the IPCC WG1 expert meeting on metrics if at all possible.
Currently, there is no meeting planned. There will be an IPCC Expert Meeting in January 2010 discussing some kinds of metrics in the interest of weighting models, but a metrics workshop, per se, has not been scheduled. Thus, we have plenty of time to document metrics we deem important and relevant.
- 3) Coordination with NCAR Climate Change and Climate Variability WGs
 - For the 60-year 40 member ensemble with anthropogenic forcing (RUN1), and anthropogenic forcing fixed at the 2000 level (RUN2), can we propose additional perturbation runs every 10-years or so (perturbed from RUN1 simulations). Of course, burden falls on the NCAR to make the runs;

- Need to develop metrics to assess modes biases as a function of lead-time
- Some suggested analyses included the magnitude of externally-forced change versus model drift; signal-to-noise characteristics; impact of external forcing on noise statistics and regional extremes; ‘climate singular vectors’ and ‘optimal structures’

Involvement in upcoming meetings

- 1) The CLIVAR Working Group on Ocean Model Development (WGOMD) will be organizing a 3-day workshop on "Decadal Variability and Prediction: Understanding the Role of the Ocean" in Boulder in Sept 2010. They would like the DPWG to participate in the meeting. The members expressed interest in the workshop. Fall 2010 will be a good time to present the results of our metrics study and have a group meeting to finalize that paper.
- 2) We had extensive discussion on merging Vikram's October 2009 meeting and Ben's January 2010 meeting. But actually doing so may not be feasible
- 3) Ben requested support/input from the DPWG to develop separate focus for the two meetings. DPWG has also been asked to consider organizing a session at the meeting and to suggest 1 or 2 keynote speakers.

Discussions on the white paper

Title

- 1) Possible alternate titles for the White Paper: What can we expect from the initialized decadal predictions, and why? OR What additional skill we can expect from the initialized decadal predictions, and why?

Motivation

- 1) The purpose of the first WP would be to summarize and critique methodologies for separating natural from the forced part of the variability. This is something that has not been done in the existing papers (Hurrell et al. 2009; Meehl et al. 2009) and makes the current White Paper unique
- 2) Aim the DPWG White paper for BAMS...raise various scientific issues; current challenges etc.;

- Need to add why we think we can separate natural and anthropogenic variability and why this would be useful. There was a concern as why we were asking this question because it will not increase skill so why would we want to do this?
 - Potential sources of predictability, and how we are able to tap into those correctly.
 - Where can we separate natural from anthropogenic variability (water vapor – thermodynamic variable, B.Santer) and where can't we (for example, NAO, Hurrell; dynamical patterns, Meehl). As well as, the expansion of the subtropics has the imprint of an annual mode.
- 3) Context of initialized decadal predictions runs in nowcasting the climate, and for detection and attribution analysis of climate variability. The latter also connects with the question of separation of natural and externally forced variability;

Physical basis

- 1) Write in terms of physical mechanisms that can cause additional predictability in the climate systems (i.e. reemergence, persistence in mixed-layer, soil moisture, sea-ice...), but also considering statistical basis that has been the more traditional focus. Compare deterministic sources to unpredictable sources of decadal variability (For example, weather noise – Schneider work, Deser result). Avoid alphabet soup...

Existing methods to separate natural variability from forced climate change

- 1) Do we want to change this section on strategies for assessing the realism of model's decadal predictability variability? Making it more useful to the modeling community. Simple metrics to assess models, persistence metrics.
- 2) How to "ground" (or validate) the model estimates of decadal predictability?
- 3) Need to assess limited predictability from observations (i.e., Madden's study, potential predictability of climate noise).
- 4) Estimated signal/noise from observations is necessary to validate signal/noise in the models.
- 5) Lag-1 autocorrelations on daily/monthly timescales may be a useful metric to validate the model's longer term variability.
- 6) Paleo data can be used to estimate natural variability. For example, tree ring data used to estimate probability of drought for water

- resource managers. Use of paleodata... (Rajagopalan work on Colorado River; Cole GRL article using coral)
- 7) Separation methods that we might also be able to offer some code for (and including some of the cons – need to add pros):
- (a) Simple model mean – IPCC, others
 - (b) S/N changes in the noise preind/current
Most studies have looked at fingerprinting anthropogenic effect, statistically different from 0, but not really indicating magnitude.
 - (c) Least damped patterns (Newman) – mostly goes towards natural variations
 - Patterns often decay too rapidly in models
 - The extent that model variability doesn't persist long enough underestimates potential predictability (timescale)
 - Contamination of these modes by external forcing
 - (d) Detection/attribution studies (Hegerl)
 - Magnitude of attributed signal, rather than just significance?
 - Regional usefulness? Methodology doesn't exist yet, but that community could possibly be motivated to look at it.
 - S/N maximizing EOFs could be closest thing we have so far
 - Aerosols act locally, and not as monotonic trend – how do you account for that? MME could do it if all models had same forcing.
 - D/A usually done more retrospectively – how can they think about it going forward?

Challenges

- 1) There is a need to revisit the observational analyses to identify [robust] estimates of the observed trend and understanding them. Can we quantify uncertainty in the observed trend?
- 2) New results from large ensemble decadal simulations indicate that multi-decadal trends in models due to natural variability have large variability and can be as large as the trend in increased GhG simulations. Probabilistic methods may be the best way to characterize this variability and to estimate the impact of external forcing.
- 3) Also, given the new studies showing that long climate model control simulations show large dec-cen variability and long timescale regime

behavior, what is the best way to validate the models with the short observational records?

- 4) How good are the models?
 - Perfect model experiments – what if model variability is too predictable?
 - Do models resolve low-frequency processes
 - Models have PDV, AMV – may not have same spatial signature or same timescale
 - Dominant climate modes may not be the most predictable
 - Models not responding strongly enough to SSTs in higher latitudes (resolution problem – horizontal & vertical coupling)
 - Clouds and cloud feedback processes (for generating trend) over oceans (models losing cloud everywhere, except over Southern Ocean)

Future plans

- 1) The group would like to meet again at the RSMAS Workshop in Miami in Jan 2010.

Action Items

- 1) Need to populate the CLIVAR webpage
- 2) Need to set-up web page to catalogue and archive (at least document how to access these) DecPred datasets
- 3) Need to assemble databases for the metrics study (twin perfect model experiments with CCSM 40-member ensembles; Doug Smith's database; Ben Kirtman's CCSM simulations, what else?)
- 4) Revise WP outline and assign sections to members (aim for 6/29)
- 5) Submit paper to BAMS by the end of August