NOAA Climate Test Bed (CTB)

National Multi-Model Ensemble (NMME) Prediction System

Phase-1 NMME Implementation Plan

Project Duration: July 1, 2011- June 30, 2012

NMME Coordinating Lead Contacts: J. Huang (NOAA/CTB) and B. Kirtman (U. Miami)

Phase-I NMME Partners:
NOAA/EMC – S. Saha and G. White
NOAA/CPC – H. van den Dool and J. Huang
U-Miami/COLA/ESRL – B. Kirtman, J. Kinter and K. Pegion
NASA/GMAO – S. Schubert
IRI – D. DeWitt and M. Tippett
NOAA/GFDL – A. Rosati

The recent US National Academies "Assessment of Intraseasonal to Interannual Climate Prediction and Predictability" (NRC 2010[1]) was unequivocal in recommending the need for the development of a US NMME operational predictive capability. Indeed, the national effort is required to meet the specific tailored regional prediction and decision support needs of the emerging National Climate Service. The challenge is to meet this national need without diluting existing model development activities at the major centers and ensure that the forecast products continue to improve and be of societal value.

There is little doubt that US participation in EUROSIP is beneficial to both the US and European forecasting communities and users of the forecasts. However, as a US National Climate Service emerges and as the possible National Center for Predictions and Projections (NCPP) develops, the need for a NMME system becomes paramount for supporting continued research on MME based prediction that can transition to operations. For example, a NMME system facilitates modifications (e.g., extending the forecast to longer time-scales) to the forecast strategy, allows for better coordination of the forecast runs compared to EUROSIP (e.g., hindcast period, forecast scheduling etc.) and allows free exchange of data beyond what is supported by EUROSIP. Also, by testing various national models on weather and seasonal time-scales, the NMME system will accelerate the feedback and interaction between US ISI prediction research, US model development and the decision science that the forecast products support. For instance, the prediction systems can potentially be used to evaluate and design long-term climate observing systems, because US scientists will have open access to the prediction systems (i.e. data, data assimilation and forecast models). Our national interests require that we (1) run these ISI prediction systems operationally in the US, (2) retain the flexibility to modify the prediction systems and how they are used based on emerging national needs, and (3) ensure that there is a robust communication and collaboration network open among operational ISI forecasting, research and model development.

[1] http://www.nap.edu/catalog.php?record_id=12878

Based on two CTB NMME workshops (February 18, and April 8, 2011) a collaborative and coordinated implementation strategy for a NMME prediction system has been developed. Phase-1 of the recommended strategy includes experimental real-time ISI forecasting that leverages existing CTB and external community activities.

This work plan describes the Phase-1 hindcast requirements, time-line for routine real-time ISI forecast, partner hindcast/forecasts, data dissemination strategy, resource requirements and management plan. All elements of this Phase-1 work plan and implementation strategy are based on the consensus developed at the two CTB NMME workshops noted above. This Phase-1 work will be carried out as a CTB activity as part of NOAA Climate Program's MAPP (Modeling, Analysis, Predictions and Projections) Program.

a. Hindcast Requirements:
   The hindcast requirements developed for Phase-1 are specifically designed to leverage ongoing ISI prediction activities by the Phase-1 NMME partners:
   1. Real-time ISI prediction system must be identical to the hindcast prediction system. This necessarily includes the procedure for initializing the prediction system. The number of ensemble members, however can be larger for the real-time system.
   2. Hindcast start times will include all 12 calendar months, but the specific day of the month or the ensemble generation strategy is left open to the forecast provider.
   3. Lead-times up to 9 months are required, but longer leads are encouraged.
   4. Hindcast period target is 30 years (typically 1981-2010).
   5. Ensemble size is left open to the forecast provider, but larger ensembles are considered better.
   6. Data distributed will include each ensemble member (not the ensemble mean). Total fields are required (i.e., systematic error corrections to be coordinated by MME combination lead, NOAA/CPC). Forecast providers are welcome to also provide bias-corrected forecasts and to develop their own MME combinations.
   7. Model configurations – resolution, version, physical parameterizations, initialization strategies, and ensemble generation strategies are left open to forecast providers.
   8. Required output is monthly means of global SST, T2m, and precipitation rate. Addition fields will be added based on experience and demand. It is also recognized that higher frequency data is desirable and this will be implemented as feasible.
   9. Routine real-time forecast data needs to be available by the 8th of each month.

b. Time-Line For Routine ISI Forecasts:
   The Phase-1 NMME partners agreed that the target date for initiating the routine real-time ISI forecast is August 8, 2011. This requires that the hindcast data (at least for the August cases) be in advance of August 8, 2011. The CTB partners have committed to this time-line and monthly teleconferences among the partners will be held to ensure this time-line is met and that the MME combination lead (NOAA/CPC) has the necessary hindcast data.

c. Partner Hindcasts/Forecast Activities:

The Phase-1 NMME partners have agreed to provide hindcast data and routine real-time forecast data (conforming to the above requirements) using the following prediction systems listed below. The point of contact for each group is noted above.

U. Miami/COLA/ESRL: CCSM3, transitioning to CCSM4
NOAA/EMC: CFSv1, CFSv2
NOAA/GFDL: CM2.1
NASA/GMAO: GEOS5
IRI: ECHAM4.5-MOM3

In addition, NOAA/CPC has agreed to evaluate the hindcasts, combine the forecasts (NMME), perform verification, provide an NMME web site and make the real-time NMME forecast delivery.

d. Data Dissemination/Coordination Strategy:

The forecast providers will serve their own forecast data ensuring access to all Phase-1 NMME partners. NOAA/CPC will obtain and store the monthly mean data (hindcasts and real-time forecasts) for the three required variables from all the participating models and maintain a NMME web site serving this minimal data set

e. Management Plan:

The CTB director (J. Huang) and the B. Kirtman (U. Miami) will take lead responsibility for phase one of implementing the Phase-1 implementation of the NMME prediction system. They will be the points of contact for all external inquiries, ensure the coordination of the CTB NMME partners and that the hindcast and forecast data are properly disseminated. Huang and Kirtman will coordinate monthly teleconferences (starting in May) to assess progress, identify potential problems and develop solutions. The monthly teleconferences will also scope the long-term NMME strategy, which may also require face-to-face meetings. NOAA/CPC will lead the data collection (minimal fields), multi-model combination, hindcast evaluation, NMME web site, and real-time forecast dissemination. The Phase-1 NMME partners have agreed to this overall strategy for the hindcasts and forecasts including providing the required data participating in the monthly teleconferences.