

MAPP FY12 Information Sheet

Program Overview and Goal

The mission of the Modeling, Analysis, Predictions, and Projections (MAPP) Program is to enhance the Nation's capability to predict variability and changes in Earth's climate system. The MAPP Program focuses on the coupling, integration, and application of Earth system models and analyses across NOAA, among partner agencies, and with the external research community. Primary objectives include 1) improving Earth system models, 2) supporting an integrated Earth system analysis capability, 3) improving methodologies for global to regional-scale analysis, predictions, and projections, and 4) developing integrated assessment and prediction capabilities relevant to decision makers based on climate analyses, predictions, and projections.

In FY2012, the MAPP program will accept proposals targeting one of the following three priority research areas:

- 1) Advance intra-seasonal to decadal climate prediction
- 2) Develop an experimental National Multi-Model Ensemble climate prediction system
- 3) Modeling of Intra-Americas Sea climate processes associated with extremes over North America

Priority Area 1

Advance intra-seasonal to decadal climate prediction

The National Academy of Science's 2010 report "Assessment of Intraseasonal to Interannual Climate Prediction and Predictability"¹ recommended "best practices" as well as more research to improve upon the current intraseasonal to interannual climate prediction capability. In addition, decadal hindcasts from emerging experimental decadal prediction systems need to be evaluated to provide an assessment of these systems. Across time-scales from intraseasonal to decadal, research is needed to objectively assess factors contributing to climate prediction skill, limiting predictive capability, and the potential for improvements within the limits of predictability.

In FY12, MAPP solicits proposals to explore the potential to advance intraseasonal to decadal climate prediction. Research should focus on one or more of the following priority areas:

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

- i. Achieve an objective comparative evaluation of climate prediction skill from dynamical, statistical, and hybrid or consolidated systems to assess optimal prediction methodologies for specific applications.
- ii. Achieve an improved understanding of the impact of initializing select components of the Earth system (e.g. ocean, land, ice etc.) for climate prediction at a particular timescale, evaluating relevance for specific forecast times.
- iii. Assess the optimal choice of ensemble members, forecast times, and model diversity in order to characterize the impact of initial condition and model uncertainties in climate prediction.
- iv. Improve our understanding of the impact of climate model biases and their evolution in forecast time (e.g. “drift” in decadal predictions) on prediction skill, and the “best practice” for post-processing the predictions.

Proposals may elect to focus on the evaluation of climate prediction skill across a limited range of the intraseasonal to decadal spectrum. “Skill” should be evaluated using standard recommended metrics, focusing on specific aspects of the prediction for evaluation (e.g. seasonal mean precipitation). Proposed research should consider verification of skill in hindcast mode, leveraging existing experiments including those from projects such as CFS re-forecasts (CFSRR), ENSEMBLES, the Climate-system Historical Forecast Project (CHFP) experiments, the IntraSeasonal Variability Hindcast Experiment (ISVHE), and CMIP5 decadal hindcasts experiments.

Priority Area 2

Develop an experimental National Multi-Model Ensemble climate prediction system

Societal challenges, such as the occurrence of droughts and other climate extremes, require an improved predictive capability. The National Academy of Science’s 2010 report “Assessment of Intraseasonal to Interannual Climate Prediction and Predictability”² recommended experimentation with multi-model ensembles as a way to improve upon current predictive capabilities, as research has shown that multi-model systems have prediction skill that is generally superior to that of any single-model system. Indeed, a national effort toward improved intraseasonal to interannual (ISI) predictions is required to meet the regional prediction and decision support needs for climate services. A white paper discussing requirements and potentials for the development of a National Multi-Model Ensemble (NMME) system is available at http://www.cpc.ncep.noaa.gov/products/ctb/MMEWhitePaperCPO_revised.pdf

In FY12, MAPP solicits proposals to develop and evaluate an experimental NMME ISI prediction system as a partnership between NOAA and the external community in the framework of NOAA’s Climate Test Bed activities. (For details regarding the Climate

² http://www.nap.edu/catalog.php?record_id=12878

Test Bed, including current activities in support of the development of an NMME system visit <http://www.cpc.ncep.noaa.gov/products/ctb/>).

Proposals should envision an NMME system as a research prototype in preparation for an operational ISI NMME prediction system. Proposals are solicited from an NMME Team (one proposal per team) charged with leading the basic development, evaluation, and optimization of the NMME system. Proposals should include an NMME system design and work plan to meet the following requirements:

- i) Build on state-of-the-art US climate prediction models and data assimilation systems and ensure interoperability so as to easily incorporate upgrades (e.g. future model versions or additional new models).
- ii) Take into account operational forecast requirements and regional/user specific needs for drought and extreme event prediction. Proposals should include specific details regarding the forecast system such as forecast frequency, lead time, duration, number of ensemble members, etc.
- iii) Utilize the NMME system experimentally in a near-operational mode to demonstrate the feasibility and advantages of running such a system as part of NOAA's operations.
- iv) Include procedures for rapid sharing of quality-controlled reforecast data among the NMME Team members. Envision procedures for timely and open access of the data to the broader climate research and applications community. Data should include documentation regarding individual NMME system's components and forecast data, as well as details on multi-model ensembles forecasts.
- v) Include details regarding the (human and computational) resource requirements and identify key points of contact in each partner organization as part of the Team.

Research objectives of proposals should include the evaluation and optimization of the NMME system in hindcast mode, including assessing 1) the optimal number of ensemble members from each model, 2) how to best combine the multi-model forecasts, and 3) sources of complementary prediction skill. Proposals should consider the evaluation and application of the proposed NMME system in the framework of ISI drought prediction for North America in support of the development of a NIDIS Drought Early Warning System.

This solicitation is intended to support competitive projects led by Principal Investigators outside NOAA operational center(s). Prospective investigators can contact Jin Huang (Jin.Huang@noaa.gov), Wayne Higgins (Wayne.Higgins@noaa.gov), or Bill Lapenta (Bill.Lapenta@noaa.gov) for potential NOAA/NCEP collaborators. Proposals should not include budget requests for NOAA/NCEP collaborators in the projects. Support letters from NOAA/NCEP collaborators are strongly encouraged.

Project duration should be 2 years or less, depending on the activities that are being proposed. Project costs may be up to \$1M/year. Computational resources on NOAA's high-performance computing platforms are available for research in this priority area. Proposers who choose to request computational allocations on NOAA's platforms should include in their proposal a request describing the computational resources and data storage required, as well as a description of how they will port their model to the NOAA platforms (the request form for computational resources can be found at http://www.cpo.noaa.gov/cpo_pa/mapp/pdf/MAPP_FY12_HPC_Allocation_Request.pdf) Questions regarding the use of NOAA's high-performance computing platforms should be directed to the lead MAPP program manager, Don Anderson (see below).

Priority Area 3

Modeling of Intra-Americas Sea climate processes associated with extremes over North America

It is recognized that climate processes in the Intra-Americas Sea (IAS) region, including parts of the Atlantic Warm Pool, are associated with atmospheric anomalies both in the IAS region and in remote locations that can affect climate extremes over North America, including tropical cyclone activity and the frequency of droughts and floods (<http://www.eol.ucar.edu/projects/iasclip>). Atlantic Warm Pool variability during boreal summer and autumn and its interplay with major regional climate processes (low-level jets, the Inter-Tropical Convergence Zone, tropical cyclones, the North Atlantic Sub-Tropical High, and regional land-air-sea interactions) of relevance to these extremes suggest a potential for predictability on intra-seasonal to decadal time scales. Yet, state-of-the-art global climate models have large mean biases and erroneous variability over the IAS and neighboring regions of North America that limit the capability to use models to fully understand these predictive linkages and improve climate model prediction.

In FY12, the MAPP Program solicits proposals to improve the modeling of Intra-Americas Sea climate processes associated with extremes over North America focusing on one or more of the following priority areas:

- i) Assess the capability of state-of-the-art climate models to simulate climate processes in the IAS region, teleconnections of large-scale climate variability (e.g. MJO, ENSO, NAO and AMO) with the IAS region, and the linkages of IAS climate processes with North America's climate extremes.
- ii) Understand the processes underlying the formation of climate model biases in the IAS/Atlantic Warm pool region. Proposals should focus on building mechanistic understanding of how these biases are formed in global climate models, dissecting the roles of potential contributing factors (e.g. biases in large-scale atmospheric

- circulation, air-sea coupling, land-air-sea processes, cloud feedbacks, and oceanic processes).
- iii) Investigate how increased model resolution (in both the atmosphere and the ocean) or improved physical parameterizations (e.g. convection schemes) affect model biases in the IAS/Atlantic Warm Pool region and the simulation of North America's climate extremes associated with variability in the IAS/Atlantic Warm Pool region.
 - iv) Evaluate how predictions of climate processes in the IAS/Atlantic Warm Pool region impact predictions in the activity of extremes over North America. Proposals should focus on understanding the various factors that impact intra-seasonal to seasonal prediction skill, including model fidelity, model initialization, and large-scale climate phenomena. Proposals should link research with operational needs for the prediction of extremes on intra-seasonal to seasonal timescales.

Proposals should consider CMIP5-class models and, in particular, the models used by NOAA for climate prediction and projections. Proposals should leverage existing model simulations and hindcasts to the extent possible. New simulations/predictions may be proposed if necessary. Computational resources on NOAA's high-performance computing platforms are available for research in this priority area. Proposers who choose to request computational allocations on NOAA's platforms should include in their proposal a request describing the computational resources and data storage required, as well as a description of how they will port their model to the NOAA platforms (the request form for computational resources can be found at http://www.cpo.noaa.gov/cpo_pa/mapp/pdf/MAPP_FY12_HPC_Allocation_Request.pdf) Questions regarding the use of NOAA's high-performance computing platforms should be directed to the lead MAPP program manager, Don Anderson (see below).

General Guidelines for proposal submission

Principal Investigators submitting a proposal in response to this MAPP Announcement should clearly identify in their summary which of the above listed MAPP competitions (one only per proposal) they are targeting.

PIs are strongly encouraged to submit Letters of Intent following the guidance in the FFO. Letters of Intent should be emailed to the MAPP Program Managers.

Contact Information:

MAPP Program Managers: Don Anderson (lead, don.anderson@noaa.gov), Annarita Mariotti (annarita.mariotti@noaa.gov), and Dan Barrie (daniel.barrie@noaa.gov).