

FY 2016 MAPP Program Information Sheet

The mission of the Modeling, Analysis, Predictions, and Projections (MAPP) Program is to enhance the Nation's capability to predict variability and change 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.

FY 2016 Competitions

In FY 2016, the MAPP Program is soliciting proposals for the following two competitions:

- NOAA Climate Test Bed - Accelerating Transition of Research into Operations
- Research to Advance Prediction of Subseasonal to Seasonal Phenomena

Individual proposals may target only one competition, which must be clearly identified in the proposal summary.

Details regarding the two MAPP Program FY 2016 competitions are given below.

Competition 1: NOAA Climate Test Bed - Accelerating Transition of Research into Operations

NOAA's operational climate monitoring products and predictions are a core part of NOAA's mission to support economic vitality and protect American lives and resources. These products and predictions are produced by the National Weather Service/National Centers for Environmental Prediction (NCEP) and are aimed toward providing the public with critical information about environmental conditions for better preparedness and improved resiliency. Products include outlooks from a few weeks to several seasons ahead for quantities such as precipitation, temperature, tropical hazards, drought, and other societally-relevant climate system impacts.

As part of NOAA's Office of Oceanic and Atmospheric Research, the Modeling, Analysis, Predictions, and Projections (MAPP) Program includes support for transition of research into improved NOAA operational capabilities. In particular, the MAPP Program partners with NCEP to support the NOAA Climate Test Bed¹ (CTB) to demonstrate the potential for scientific advances from the community external to NCEP to accelerate the improvement of operational climate models, monitoring, and predictions. The MAPP Program provides support for testing and demonstration research activities while NCEP provides support for the operational implementation activities.

¹ <http://www.cpc.ncep.noaa.gov/products/ctb/>

In FY 2016 the MAPP Program is soliciting research proposals to advance NOAA's operational capabilities for climate monitoring and predictions a few weeks to several seasons ahead as part of NOAA CTB by focusing on one or more of the following areas:

1. Test the performance of modeling components, schemes or methodologies developed in the broader community when included experimentally in operational monitoring and dynamical prediction systems. Focal areas include: a) data assimilation for Earth system components, including atmosphere, ocean, land, ice, waves and aerosols to improve monitoring and prediction capabilities, and b) improvements in the representation and prediction of sea ice conditions.
2. Test experimental prediction methodologies (e.g., hybrid statistical/dynamical methodologies, post-processing techniques, and verification techniques) and products developed in the broader community for operational purposes.
3. Test a multi-model system for subseasonal climate prediction with the following objectives: select prediction systems suitable for inclusion in an operational multi-model ensemble system, optimize the design of the system, and evaluate prediction products from the system. Two types of proposals are solicited:
 - a. Proposals to test the skill and demonstrate suitability of individual prediction systems for real-time prediction on subseasonal timescales. Proposed prediction systems must have a pre-existing, documented capability to simulate some of the phenomena and drivers relevant on subseasonal timescales (e.g., Madden Julian Oscillation, Sudden Stratospheric Warmings, land surface memory feedbacks, blocking, etc.) and/or produce extended-lead skill from initialization. Proposed prediction systems must also demonstrate feasibility to perform real-time predictions as part of the multi-model system experiment and a pathway to sustained real-time production as part of NOAA's operational prediction activities. A plan to share real-time data with NOAA Central Operations and the broader multi-model ensemble prediction system research team must be included.
 - b. A proposal project by a core team that will be responsible for: organizing and coordinating the multi-model experiment including reforecast and real-time predictions from the prediction systems tested under priority 3a, above; developing and evaluating the multi-model predictions from those systems; exploring ensembling techniques as well as post-processing; developing products utilizing the model ensemble system; refining the design of the multi-model system; and supporting timely and effective sharing of reforecast and forecast data for community efforts (proposers may consider working with NOAA data centers to host and distribute model output, as appropriate). These elements should be laid out with a clear plan included in the proposal. The core team should test how predictions from this multi-model system compare with those of other subseasonal systems currently available for operational subseasonal prediction at NCEP as a benchmark, and how those existing approaches can be augmented by the multi-model system being tested. State-of-the-art research models without a pathway to operations may also be used to benchmark the experimental multi-model system.

All proposals must conform to the protocol for subseasonal ensemble prediction experimentation² developed as part of Climate Test Bed activities. Proposed prediction systems will be evaluated using NCEP reference metrics and compared to currently available systems for operational prediction at NCEP, as benchmarks. It is expected that the initial focus of proposed work will be to produce the

² http://www.cpc.ncep.noaa.gov/products/ctb/Protocol_Subseasonal_NMME.pdf

reforecast datasets, followed by one year of real-time forecasts and overall evaluation. It will be the responsibility of the core-team to optimally coordinate the work of participating groups. It is expected that investigators from type 3a and 3b projects will work together as a cohesive subseasonal multi-model ensemble research team.

Projects for priority areas 1–3 above should demonstrate relevance to strategic programmatic and agency directions³ and, as appropriate, highlight relevance to prediction of climate extremes including heat waves, extreme precipitation, floods, and droughts in support of the development of information systems such as the National Drought Information System (NIDIS).

Projects relevant to this competition will propose activities that fall within the Technical Readiness Levels (TRLs) 5-8 range but are not required to include transition to TRL 8 (see the Appendix for definition of TRLs.). Those that include transition to TRL 8 will be considered of highest priority. Proposals focusing on basic research and development, categorized as of Technical Readiness Level 1–4 are outside the scope of this competition. Key metrics, benchmarks and deliverables to assess the transition to the next TRL as part of the project must be specified in the proposal.

As per the criteria laid out in NOAA Administrative Order (NAO) 216-105, section 2.09⁴, all proposals must include a transition plan⁵ that demonstrates a pathway to operational deployment for the methodology/system that is being tested, and how the project will progress between TRLs as the work is carried out. If it is envisioned that the project will arrive at TRL 8 at its conclusion, the transition plan must provide a clear plan and set of milestones for how the operational implementation will occur during the post-project TRL 9 phase. The transition plan must be signed by the CTB director, the director of the relevant NCEP center, and the NWS Assistant Administrator or designee as per NAO 216-105. The plan should include the statement certifying that the NWS, upon final acceptance of the research results from a project that is ready to move beyond TRL 8, will deploy the research results into operations and continue to fund the maintenance and operations of those research results.

Proposals must comply with the terms and requirements for MAPP–CTB proposals⁶, including: demonstrating high relevance to accelerating NCEP’s operational climate monitoring and prediction, having an NCEP co-PI, having explicit support from NCEP to access required data and models, and using NCEP’s metrics for evaluation⁷ as part of the project. A review of the project will occur at its conclusion. The feasibility of a transition of the research findings into operations will be assessed for those projects ending at TRL 8; for others, transition to the proposed TRL will be assessed.

Proposals may include support for a team member from an external institution to work at NCEP as a visiting scientist. The scope of the visit should be an integral part of the proposed research project and a plan for the visit including its timeline as part of the project, expected role of the visiting scientist, specification of an NCEP sponsoring staff member, request for adequate travel resources, and a description of resources needed by the visitor along with a guarantee of provision by NCEP.

³ <http://cpo.noaa.gov/AboutCPO/CPOStrategicPlan.aspx> ; <http://research.noaa.gov/AboutUs/OurStrategicPlan.aspx> ; http://www.ncep.noaa.gov/director/strategic_plan/strategic_plan.pdf ; <http://www.ppi.noaa.gov/ngsp/>

⁴ http://www.corporateservices.noaa.gov/ames/administrative_orders/chapter_216/216-105.pdf

⁵ <http://cpo.noaa.gov/sites/cpo/MAPP/doc/TransitionTemplate.docx>

⁶ http://cpo.noaa.gov/sites/cpo/Documents/pdf/MAPP_CT_B_Proposals_Requirements.pdf

⁷ http://www.cpc.ncep.noaa.gov/products/ctb/Metrics_climate_models&fcst_15May2015_v2.docx.pdf

DoD's Office of Naval Research (ONR); NASA's Modeling, Analysis, and Prediction (MAP) program; and the NOAA NWS Next Generation Global Prediction System (NGGPS) program are partners with MAPP on this competition and may support successful proposals. If partner agencies indicate interest, applicants may be asked to resubmit proposals to respective programs.

Proposals may be for a period of two years with a funding level of up to \$170 K/year for type 1, 2, and 3a proposals and up to \$600 K/year for type 3b proposals (only one such project will be funded).

External investigators may contact the Climate Test Bed Director to help identify NCEP co-investigators. NCEP co-investigators should discuss their Letters of Intent with NCEP management before submitting. Letters of Intent should indicate what product, technique, technology, method, etc. would be tested and could eventually be deployed in operations (all other general proposal guidelines below also apply).

Competition Contact Information:

MAPP Program Manager Competition Manager: Daniel Barrie (Daniel.Barrie@noaa.gov)

CTB Director: Jin Huang (Jin.Huang@noaa.gov)

NASA MAP Contact: David Considine (david.b.considine@nasa.gov)

ONR Contact: Dan Eleuterio (Daniel.Eleuterio@navy.mil)

NWS NGGPS Contact: Frederick Toepfer (frederick.toepfer@noaa.gov)

Competition 2: Research to Advance Prediction of Subseasonal to Seasonal Phenomena

Central to NOAA's mission is the goal to enhance community resilience in the face of weather and climate extremes³. Toward this goal, NOAA seeks to extend the lead times at which extreme events such as heat waves, drought, and flooding are skillfully predicted, thereby allowing emergency managers, water resource managers, and other stakeholders more time to prepare.

Historically, in accordance with the state of the science, prediction efforts have primarily targeted either daily ("weather") or seasonal lead times⁸. The urgent need to develop the capability to bridge weather and seasonal predictions, or the so-called subseasonal to seasonal (S2S) prediction gap, has been highlighted at the national level⁹. Addressing the S2S prediction gap is also a high priority of the international research community, with the World Climate Research Programme (WCRP) and World Weather Research Programme (WWRP) recently jointly initiating the S2S Prediction Project¹⁰ to advance research in this area. Such a focus underlines the unprecedented scientific opportunity to make significant strides in S2S prediction by leveraging sources of predictability more fully than was previously feasible¹¹. Process-level understanding of

⁸ Hoskins, B., 2012: The potential for skill across the range of the seamless weather-climate prediction problem: a stimulus for our science. *Quart. Jour. Royal Meteor. Soc.*, **139**, 573-584.

⁹ <https://www.whitehouse.gov/the-press-office/2014/09/23/fact-sheet-president-obama-announces-new-actions-strengthen-global-resil>

¹⁰ http://www.wmo.int/pages/prog/arep/wwrp/new/S2S_project_main_page.html

¹¹ National Research Council, 2010: Assessment of Intraseasonal to Interannual Climate Prediction and Predictability. Washington, D.C. National Academy Press. <http://www.nap.edu/catalog/12878/assessment-of-intraseasonal-to-interannual-climate-prediction-and-predictability>

various phenomena occurring on S2S time scales, such as the Madden-Julian Oscillation (MJO), has blossomed in recent years. This advancement in phenomenological understanding, as well as concurrent advancement in numerical modeling and data assimilation techniques, has benefited from and fed into the development of new understanding, technologies, diagnostics, and datasets that are well suited to spur advances in S2S prediction.

In FY 2016, the MAPP Program solicits research proposals to improve the understanding of predictability and the potential to advance the prediction of phenomena occurring on S2S time scales. Such phenomena include, but are not limited to, the MJO and associated midlatitude teleconnections, the North Atlantic Oscillation (NAO), stratospheric flow regimes, and atmospheric blocking episodes. Projects will use global numerical model experiments for sensitivity studies and/or reforecast datasets such as the S2S Prediction Project database¹², the North American Multi-Model Ensemble hindcast dataset¹³, the WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble database¹⁴, and the Intraseasonal Variability Hindcast Experiment (ISVHE)¹⁵ dataset, and observational datasets for diagnostic studies to explore how prediction of S2S phenomena is influenced by various aspects of the prediction system set-up, including: (i) model resolution of various prediction system components; (ii) initialization of, and coupling between, Earth system components; (iii) model physics; (iv) generation, number, and resolution of ensemble members; (v) reforecast length and calibration methods; or (vi) multi-model combination. New model system experiments (if any) are encouraged to follow elements of the protocol for experimentation on subseasonal prediction² as appropriate. Researchers are encouraged to develop and apply novel verification metrics tailored for subseasonal prediction (e.g., the probability of a large-scale flow regime transition) in addition to applying verification traditionally used for seasonal prediction.

Proposals should address the predictability and prediction of S2S phenomena in the context of key underlying physical processes (e.g., convective heating; cloud microphysics; and land-, ice-, and ocean-atmosphere interactions) and/or dynamical processes (e.g., Rossby wave forcing, wave-mean flow interactions, and troposphere-stratosphere interactions). Proposals that consider prediction of S2S phenomena in the context of extremes are of particular interest.

All proposals funded through this competition will constitute a coordinated research effort on this S2S topic as part of a new MAPP Task Force¹⁶. As such, each proposal should explicitly include which specific research activities and deliverables it intends to contribute and/or lead as part of the Task Force collaborative activities (e.g. a collaborative report). It is expected that all funded researchers will coordinate with relevant WCRP/WWRP efforts such as the S2S Prediction project and the WMO Working Group on Numerical Experimentation (WGNE) MJO Task Force¹⁷ via their membership in the MAPP task force.

Proposals in response to this solicitation may be of two types:

(1) A team proposal that will comprehensively address primary research objectives and cross-cutting issues of the competition, as described above. This team will also be responsible for organizing and providing scientific direction for the new MAPP Task Force, evaluating synergies and opportunities for collaboration with individual Type 2 projects funded under this competition, and facilitating coordination among projects and with S2S

¹² <http://apps.ecmwf.int/datasets/data/s2s/>

¹³ <https://www.earthsystemgrid.org/search.html?Project=NMME>

¹⁴ <https://www.wmolc.org>

¹⁵ <http://iprc.soest.hawaii.edu/users/jylee/clipas/>

¹⁶ <http://cpo.noaa.gov/ClimatePrograms/ModelingAnalysisPredictionsandProjections/MAPPTaskForces.aspx>

¹⁷ http://www.wmo.int/pages/prog/arep/wwrp/new/MJO_Task_Force_index.html

prediction research efforts in the broader community. The proposal should include a plan for sharing data, methodologies and research results to enable coordination and collaboration, as well for yearly research tasks and deliverables.

(2) Proposals that will address select research objectives of the competition. These proposals should articulate the specific research contributions they would make to the broader coordinated S2S research effort envisioned as part of the MAPP Task Force activities as described above.

All proposals are for up to three years. Type 1 proposals may be up to \$500 K/year (it is envisioned only one such project will be funded); Type 2 proposals may be up to \$170 K/year (multiple projects may be funded).

DoD's Office of Naval Research (ONR) and the NOAA NWS Next Generation Global Prediction System (NGGPS) program are partners with MAPP on this competition and may support successful proposals. If partner agencies indicate interest, applicants may be asked to resubmit proposals to respective programs.

Competition Contact Information:

MAPP Program Manager Competition Manager: Heather Archambault (heather.archambault@noaa.gov)

NWS NGGPS Contact: Frederick Toepfer (frederick.toepfer@noaa.gov)

ONR Contact: Dan Eleuterio (Daniel.Eleuterio@navy.mil)

General Guidelines for FY 2016 MAPP proposal submission for all competitions

- Principal Investigators submitting a proposal in response to this MAPP Announcement are required to follow the Letters of Intent and Proposal preparation and submission guidelines described in the Climate Program Office FY 2016 Federal Funding Opportunity announcement.
- Investigators are strongly encouraged to submit Letters of Intent prior to developing and submitting a full proposal. MAPP program Letters of Intent should be emailed to oar.cpo.mapp@noaa.gov.
- Proposals must clearly identify in their summary which one of the above-listed MAPP competitions is being targeted (only one competition may be targeted by a given proposal) and which sub-element of the competition is being targeted, if applicable.
- Administrative questions regarding the Federal Funding Opportunity (e.g. proposal formatting or submission guidelines) should be directed to Diane Brown (diane.brown@noaa.gov).

Computational resources on NOAA's high-performance computing platforms may be available for research sponsored as a result of this solicitation. Proposals should indicate the availability of alternative computing resources should NOAA resources not be available for carrying out the project. Proposers who choose to request computational allocations on NOAA's platforms must 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 methodology to the NOAA platforms. Proposers must submit a request form in order to apply for computational resources.¹⁸ Questions regarding the use of NOAA's high-performance computing platforms should be directed to Dan Barrie (daniel.barrie@noaa.gov).

¹⁸ http://cpo.noaa.gov/sites/cpo/Documents/word/MAPP_FY16_HPC_Request_Form.docx

Appendix - Technical Readiness Levels

Mission Function	TRL #	Technical Readiness Level Definition
Research	1	Basic principles observed and reported
	2	Technology concept and/or application formulated
Development	3	Analytical and experimental critical function and/or characteristic proof-of-concept
	4	Component/subsystem validation in laboratory environment
	5	System/subsystem/component validation in relevant environment
Demonstration	6	System/subsystem model or prototyping demonstration in a relevant end-to-end environment
	7	System prototyping demonstration in an operational environment
	8	Actual system completed and "mission qualified" through test and demonstration in an operational environment
Deployment	9	Actual system "mission proven" through successful mission operations