

FY 2017 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 2017 Competitions

In FY 2017, the MAPP Program is soliciting proposals for the following two competitions:

- Advancing drought understanding, monitoring and prediction
- Research to explore seasonal prediction of coastal high water levels and changing living marine resources

Individual proposals may target only one competition, which must be clearly identified in the proposal summary. Details regarding the two MAPP Program FY 2017 competitions are given below.

Competition 1: Advancing drought understanding, monitoring and prediction

Drought has caused serious social and economic impacts throughout the history of the United States. All Americans are susceptible to the direct and indirect threats drought poses to the Nation. Drought challenges agricultural productivity and reduces the quantity and quality of drinking water supplies upon which communities and industries depend. Drought jeopardizes the integrity of critical infrastructure, causes extensive economic and health impacts, harms ecosystems, and increases energy costs¹. Ensuring the availability of clean, sufficient, and reliable water resources is a top national and NOAA priority².

The NOAA-led National Integrated Drought Information System (NIDIS)³, including its regional Drought Early Warning Systems (DEWS), serve as part of the newly-instituted National Drought Resilience Partnership. These initiatives improve the nation's capacity to manage drought-related risks by providing the best available information and tools to assess the potential impacts of drought, and to prepare for and mitigate the effects of drought. Activities include the

¹<https://www.whitehouse.gov/the-press-office/2016/03/21/presidential-memorandum-building-national-capabilities-long-term-drought>

² <http://www.noaa.gov/world-water-day-building-sustainable-future-water>

³ <http://drought.gov>

development of partnerships to implement monitoring and forecasting at multiple governance levels; collection of information to provide useful and timely monitoring and prediction information on drought; fostering of a healthy research environment to advance capabilities; and the promotion of a framework for increasing public awareness, education, and resilience. Internationally, there have been efforts to develop similar capabilities as part of an emergent Global Drought Information System (GDIS)⁴, building on the NIDIS example. NOAA's Drought Task Force (DTF) activities⁵ have catalyzed community research aimed at improving national drought capabilities based on advancing the understanding, monitoring and prediction of drought in support of NIDIS. DTF research has resulted in significant advances in science and services⁶ that have contributed to the goals of the World Climate Research Program's Climate Variability and Predictability (CLIVAR) and Global Energy and Water Cycle Exchanges (GEWEX) programs. Building on past progress, research is needed to address remaining gaps in the understanding, monitoring, and prediction of drought toward further improvements in our capability to prepare for and address drought.

In FY 2017, the MAPP Program, in partnership with NIDIS, is soliciting research proposals for research projects as part of NOAA's DTF to include objectives focused on:

- Developing a better understanding of sources of predictability toward improving predictions of drought onset, evolution, and termination on subseasonal to interannual timescales. The focus will be on the role of atmospheric, oceanic, and land processes, and coupled interactions in providing predictability for droughts in North America. Research will also aim to improve the understanding of the role of temperature, evapotranspiration, and water management practices in affecting drought. In this context, projects will evaluate how predictability sources and processes linked to drought are represented in state-of-the-art modeling and prediction systems;
- Advancing the capability to model processes related to drought, including groundwater, snowpack, and human management of natural systems for both drought monitoring and prediction. Projects should be focused on advancing state-of-the-art modeling and prediction systems;
- Advancing operational drought monitoring systems such as the U.S. Drought Monitor and the North American Land Data Assimilation system, with a focus on improving snowpack, streamflow, groundwater and soil moisture representation; integrating new data sources including remotely-sensed products; integrating new and improved land models into NOAA's operational systems; accounting for human forcing of droughts; and improving vegetation representation;
- Advancing drought prediction systems and outlooks operated, used, and produced by NOAA (NWS and NESDIS) that contribute to the U.S. Drought Outlook and are of

⁴ <http://gmao.gsfc.nasa.gov/pubs/docs/Schubert805.pdf>

⁵ <http://cpo.noaa.gov/mapp/df>

⁶ http://cpo.noaa.gov/sites/cpo/MAPP/pdf/rtc_report.pdf

relevance to the DEWS efforts, through improved initialization, multi-model ensemble methods, post-processing techniques, hybrid statistical/dynamical techniques, and increased resolution; and

- Developing new national-scale monitoring and forecast products building off existing products and systems relevant to drought that can help integrate the results of research advances into improved information for managers and communities.

Two types of proposals may be submitted in response to this competition:

- 1) Individual proposals that address one or more of the above research topics and contribute to collaborative DTF activities. Proposals should explicitly identify their intended contribution to the DTF.
- 2) A team proposal that addresses several of the above research objectives and also provides a framework and an infrastructure platform, as needed, to integrate research from individual proposals as part of coordinated NOAA DTF activities to optimize the outcomes of this research initiative. The framework will include synthesis of new understanding of predictability sources and how they relate to drought (e.g. via topical publications, assessment reports, or other integrative products); methodologies to integrate new understanding of predictability into forecasts of opportunity and assess forecast uncertainties; a set of shared metrics and test cases to evaluate modeling, monitoring, and prediction research advances to enhance the current DTF Assessment Protocol⁷; infrastructure to share observational, model, and prediction data as necessary to facilitate intercomparison and benchmarking; and a focus on narrative reports or products connecting DTF research to relevant ongoing or historical high-impact events demonstrating how integration of research projects yields new knowledge and understanding of drought-relevant capabilities and their evolution. The core DTF team should also work to enhance international efforts that support the development of global drought monitoring and prediction such as GDIS, as appropriate.

All proposals and PIs are expected to:

- Identify and use rigorous metrics and state-of-art benchmarks to evaluate experimental methodologies and systems, as applicable. NCEP metrics⁸ and the Drought Task Force Assessment Protocol provide initial guidelines for evaluation, which may be augmented as part of DTF activities;
- Have a nationally-relevant scope but in some instances include a focus on test cases in major water basins in support of NIDIS and its DEWS efforts, and potentially also in the context of other major world droughts;
- Primarily target variability and predictions on subseasonal to interannual timescales;

⁷ http://cpo.noaa.gov/sites/cpo/Reports/MAPP/drought/DTF_Assessment_Protocol.pdf

⁸ http://www.cpc.ncep.noaa.gov/products/ctb/Metrics_climate_models&fcst_15May2015_v2.docx.pdf

- Consider multi-model and multi-system contexts for the development of probabilistic information; and
- Identify links and collaborations with NOAA operational centers, including NCEP and the NOAA National Water Center, and NIDIS and its DEWS, as appropriate.

Proposals may be for a period of up to three years with a funding level of up to \$170K/year for Type 1 proposals and up to \$600K/year for Type 2 (team) proposals (only one such project may be funded). Note that for Type 2 proposals, the funding limit includes data management costs.

Competition Contact Information:

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

Competition 2: Research to explore seasonal prediction of coastal high water levels and changing living marine resources

A crucial component of NOAA's service mission is to increase the resilience of communities to changing climate and ocean conditions, including coastal high water levels and shifts in living marine resources. For example, NOAA's National Ocean Service (NOS) highlights coastal resilience and coastal intelligence through improved products and services as two of its top priorities⁹. Additionally, increasing the production, delivery and use of climate-related information in fisheries management and protected species conservation is a top priority of NOAA's National Marine Fisheries Service (NMFS)¹⁰.

It is therefore of considerable relevance to NOAA that recent climate trends have increased the vulnerability of many U.S. communities to coastal flooding¹¹ and/or shifts in living marine resources¹². Anomalous coastal oceanic conditions (for example, elevated sea level or unusual sea surface temperatures) can arise from natural seasonal variations in climate modes or ocean dynamics such as El Niño–Southern Oscillation and the Gulf Stream, respectively, in combination with longer-term climate trends. These anomalous coastal ocean conditions pose a threat to coastal communities and economies owing to their potential over a season to increase the likelihood of coastal flooding events¹³ or impact the distribution and abundance of fish stocks or other living marine resources¹². In light of the growing recognition that seasonal changes in coastal oceanic conditions may be connected to potentially predictable sources of climate or ocean seasonal variability, an emerging opportunity exists for research to enhance our Nation's

⁹ <http://oceanservice.noaa.gov/about/About-NOS.pdf>

¹⁰ NOAA Fisheries Climate Science Strategy 2015

<http://www.st.nmfs.noaa.gov/ecosystems/climate/national-climate-strategy>

¹¹ Church, J.A. and Coauthors, 2013: Sea Level Change. In: Climate Change 2013: The Physical Science Basis.

Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter13_FINAL.pdf

¹² NOAA TM NMFS F/SPO-155: NOAA Fisheries Climate Science Strategy, Jason S. Link, Roger Griffis, and Shalin Busch (editors), 70 p. <http://spo.nmfs.noaa.gov/tm/TM155.pdf>

¹³ http://tidesandcurrents.noaa.gov/publications/NOAA_Technical_Report_NOS_COOPS_073.pdf

capability to produce seasonal predictions¹⁴ of coastal high water levels and living marine resources.

In FY 2017, the MAPP Program together with the NMFS Office of Science and Technology is soliciting team and individual exploratory research projects that use climate and Earth system models to help to advance seasonal predictions of the following topical areas: (a) **coastal high water levels**, and (b) **living marine resources**. The research focus on seasonal lead times may extend to subseasonal and/or interannual lead times if well-justified by sources of predictability and proposed methodologies.

It is envisioned that the outcomes of these research projects will provide foundational elements of emergent National information systems to increase the resiliency of coastal communities and economies. This research initiative is designed to complement international efforts such as the Coastal Inundation Forecasting Demonstration Project¹⁵ under the umbrella of the WMO-Intergovernmental Oceanographic Commission Joint Technical Commission for Oceanography and Marine Meteorology.

This research initiative focuses on the following three objectives:

(1) Explore how selected modes of climate or ocean variability relate to seasonal variations in fields such as sea level height and ocean temperature that are of primary relevance to predictability for the topical areas of the call, and evaluate the seasonal prediction skill of these modes using North American climate or Earth system prediction systems. Analysis should be based on long-term observational datasets, reanalysis and reforecast datasets such as those from the North American Multi-Model Ensemble (NMME)¹⁶ seasonal prediction system, the Subseasonal to Seasonal Prediction Project¹⁷ database, and/or model experiments. A focus on the influence on prediction skill of the representation of key ocean model processes and configurations (e.g., river discharge, ocean lid, resolution, and initialization of model components) is encouraged.

(2) Construct and evaluate a prototype ensemble seasonal prediction system for coastal high water levels or living marine resources at the National scale. The prediction system should build on state-of-art climate or Earth system prediction system(s) with an established capacity to capture key sources of predictability for application-relevant fields (as in objective 1). Any necessary model development work should be limited to coupling with state-of-the-art biogeochemical models and/or other modules required to address the targeted prediction application, which may include a regional focus. The development of component process models or ecosystem models is beyond the scope of this initiative. A comprehensive strategy should be proposed for the initialization, coupling, ensemble generation, and validation of the probabilistic prediction system prototype. The validation of the prediction system should include

¹⁴ Lead times of ~2-9 months.

¹⁵ http://www.jcomm.info/index.php?option=com_oe&task=viewDocumentRecord&docID=16549

¹⁶ <http://cpo.noaa.gov/MAPP/NMME>

¹⁷ <http://s2sprediction.net/>

a plan to leverage observational data from multiple sources and datasets (e.g., buoys, satellite, and proxies) toward rigorous verification of predictions. The choice of predictands should be justified based on established user needs.

(3) Develop and evaluate experimental probabilistic-based prediction products tailored to the needs of the NOS and/or NMFS, as appropriate. Products may be based on dynamical, statistical, or hybrid dynamical–statistical prediction methods, and may be national or regional in scale. Proposed products must include measures of uncertainty and be rigorously evaluated for statistically significant skill based on adequate long-term hindcasts and probabilistic skill metrics.

This research initiative solicits team proposals addressing either or both topical areas (a) and (b) above. Team proposals should address all objectives (1)–(3) above, thereby constituting the framework for a prototype integrated seasonal prediction system. Team proposals should include procedures for sharing of quality-controlled data among the team members, including non-team projects funded out of this solicitation, for timely and open access of the data to the broader research and applications community. Proposals should provide plans for close collaboration and coordination with NOS and/or NMFS as appropriate based on the targeted topical area. Data provided should include documentation regarding the prediction system components and forecast data, as well as details on the prediction system products.

This research initiative also solicits individual proposals for topical areas (a)–(b) above. Individual proposals will have a reduced scope compared to team proposals and should focus on only objectives (1) or (3) above for selected topical area. All research project outcomes should be clearly relevant to the service goals of the NMFS and/or NOS, as appropriate.

All PIs supported from this solicitation will be expected to collaborate and coordinate their research work as part of an Ocean Prediction Task Force to optimize outcomes toward the development of enhanced coastal flooding and living marine resource predictions as part of a shared framework.

It is anticipated that this solicitation may select a single team project in one or both topical areas (a) and (b), and 3–5 individual projects in total across the two areas. The team and individual projects will be supported for 3 years for up to \$600K/yr¹⁸ and \$170K/yr, respectively. Note that for team projects, the funding limit includes data management costs.

Competition Contact Information:

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

NMFS Office of Science and Technology Manager: Roger Griffis (roger.b.griffis@noaa.gov)

General Guidelines for FY 2017 MAPP proposal submission for all competitions

¹⁸ Team proposals that target both topical areas (a) and (b) may request support for up to \$1M/yr.

- 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 2017 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

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 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 an [HPC Request Form](#) with their proposal in order to apply for computational resources¹⁹.

Questions regarding the use of NOAA's high-performance computing platforms should be directed to Dan Barrie (daniel.barrie@noaa.gov).

Data Management Guidance

Responsible NOAA Officials for questions regarding this Data Management Guidance and for verifying accessibility of data produced by funding recipients are as follows:

Competition 1: Daniel Barrie (daniel.barrie@noaa.gov)

Competition 2: Heather Archambault (heather.archambault@noaa.gov)

Data Accessibility: The MAPP Program requires that public access to grant/contract-produced data be enabled in one of the following ways (select one):

- Funding recipients are planning to submit data to NOAA National Centers for Environmental Information (NCEI), which will provide public access and archiving²⁰. Point of Contact for NCEI is Nancy Ritchey (Nancy.Ritchey@noaa.gov)
- Data are to be submitted to an International Council for Science (ICSU) World Data System facility: <https://www.icsu-wds.org/community/membership/regular-members>

¹⁹ http://cpo.noaa.gov/sites/cpo/Documents/word/MAPP_FY17_HPC_Request_Form.docx

²⁰ NCEI supports the creation of adequate metadata and data ingest into long term repository holdings using tools such as Send2NCEI (www.nodc.noaa.gov/s2n, for small volume, one-time only data collections) and Advanced Tracking and Resource tool for Archive Collections or ATRAC (www.ncdc.noaa.gov/atrac, for recurring and/or large volume data collections).

- ❑ An existing publicly accessible online data server at the funded institution is to be used to host these data (describe in proposal).
- ❑ Data are to be submitted to a public data repository appropriate to this scientific domain (describe in proposal).
- ❑ Proposal may request permission not to make data publicly accessible (proposal to explain rationale for lack of public access, and if funded approval to be obtained from Responsible NOAA Official listed above).
- ❑ Archival of data at an established Cloud Computing facility, if cost effective and reliable

Technical recommendations:

The MAPP Program requires the following data format(s), data access method(s), or other technical guidance:

- Model data must be made available in a common machine-readable non-proprietary format with appropriate metadata and clear labels and descriptors. Use of netCDF is encouraged, and PIs can consider using CMIP5 output requirements as a guide for creating accessible datasets²¹.
- Data should be available via public and discoverable data portals, as described above.
- At a minimum, investigators should plan to archive and make available model data used in producing any figures in publications from research supported by their grants, as well as data that support conclusions reached in papers or stated publically. Only those data which are necessary for demonstrating reproducibility of published results need be archived and made public unless otherwise required as part of the solicitation.
- Model data should be made available for at least 3 years after it is initially published or made otherwise publicly available.

Resources:

Proposals are permitted to include the costs of data sharing and/or archiving in their budgets within solicitation specified proposal cost limit, and may include additional costs of up to \$30K, unless otherwise stated in the solicitation, if the total data volume is expected to exceed 10TB. Justification should be provided for why data volume is expected to exceed this limit, according to compliance with the technical recommendations given above. Proposed methods and approaches should use reasonable means to minimize data management costs.

²¹ http://cmip-pcmdi.llnl.gov/cmip5/docs/CMIP5_output_metadata_requirements.pdf