

## **Fiscal Year 2023 Competition Information Sheet: Science for the 21st Century Western U.S. Hydroclimate**

### **Program Name**

Modeling, Analysis, Predictions, and Projections (MAPP) Program

### **Program Mission**

The Modeling, Analysis, Predictions, and Projections (MAPP) program supports advances in the development and application of Earth system models and analyses across NOAA for the purpose of building resilience to climate impacts, predicting and projecting change from years to decades in the future, and improving our understanding of and ability to simulate the Earth system. MAPP works with partner agencies in the U.S. Global Change Research Program, and focuses on engaging the non-NOAA research community to help advance NOAA's modeling capabilities and applications.

### **Focus for FY 2023**

**Science for the 21st Century Western U.S. Hydroclimate**

### **Funding for FY2023**

Pending the availability of funds in FY 2023, the MAPP program anticipates a funding allocation of up to \$1,800,000 for this competition.

Proposals may be for up to three years, up to \$250,000/year. A total of approximately 7-10 projects may be funded.

### **Competition Information**

Drought is a common feature of the western United States, driven by the region's unique geography, location, and climate features. Despite its variability and many natural drivers, western drought increasingly intersects with other powerful forcings and impact modifiers including climate trends that drive precipitation changes and increased atmospheric water demand and increasing human demand for water in the west. This intersection has led to profound, growing, and in some cases existential challenges to the communities and economies in the west, highlighted by record low flows of the Colorado River and record low levels of its reservoirs triggering generational water crises, water restrictions along the Klamath River, reductions in and unpredictability of critical reservoir replenishment provided by snowpack, below-average reservoir storage throughout California's water supply system, and the concurrent fires and heat waves that low-moisture conditions engender. A long-foretold but now-emerging crisis of water availability in the west necessitates focused science that can advance the region's ability to effectively manage water resources across human and environmental needs against the significant risks.

The MAPP program, working together with the National Integrated Drought Information System (NIDIS) program, seeks to support science that will prepare managers, stakeholders, and communities in the west

to anticipate, react, and manage the increasing challenges posed by the dynamic hydrological systems critical to their lives and economies. For the first time in its 12-year research effort, the MAPP-NIDIS competition will focus on a specific region, necessitated by the significance of the changes occurring there.

The NIDIS program was first authorized in 2006 and reauthorized in 2018 to serve as a multi-agency partnership that coordinates drought monitoring, forecasting, and planning and information at national, state, and local levels across the country. The mission of NIDIS is to help the nation move to an increasingly proactive approach to understand and manage drought risks and impacts, and to improve long-term drought resilience. Since its inception, NIDIS has been working with various federal, state, local and tribal agencies as well as a network of researchers, academics, the private sector, resource managers, policymakers and its stakeholders. The work is the basis for the regional Drought Early Warning Systems (DEWS). Besides providing forecasts, the DEWS encourage innovation by integrating new, locally-relevant drought information into drought planning and impact mitigation processes and supporting the introduction of new technologies that detect and communicate drought risks and warnings.

Since 2011, NOAA's Drought Task Force (DTF), organized by the MAPP Program in partnership with NIDIS, has catalyzed community research aimed at improving national and regional drought capabilities. The DTF has focused on supporting NIDIS and its DEWS via advances in the understanding, monitoring and prediction of drought. DTF research has optimized NIDIS science investments by working in synergy with community activities as part of the U.S. Global Change Research Program (USGCRP), the World Climate Research Program's Climate Variability and Predictability (CLIVAR) and Global Energy and Water Cycle Exchanges (GEWEX) programs. The DTF efforts amplifies NOAA's world-class research mission and capabilities in the area of hydroclimate understanding, observing, modeling, and prediction by engaging the broad community with that mission and connecting it to stakeholder communities.

Over the past decade, DTF research has had numerous practical applications for NIDIS including new drought prediction products, improvements to drought monitoring capabilities, advanced understanding of climate variability and change drivers of drought, and synthesizing critical community understanding of ongoing droughts to inform water resource management. Drought and hydroclimate research is a central aspect of MAPP's program activities. For every \$1 NIDIS contributes to this Drought Task Force partnership, MAPP contributes an additional \$1.55 in research funding for NIDIS-relevant work through its other competitions and program activities. Advancing drought science and our national capabilities is critical for both programs and NOAA at large.

In FY 2023, the MAPP program will continue to support NIDIS goals via a new set of DTF activities that focus on the critical state of the western hydroclimate and advancing our understanding and capabilities to address the challenges posed by variability and change in that hydroclimate.

Through this solicitation, MAPP is seeking proposals for research that can advance model-based understanding, monitoring, prediction, predictability, and model representation of drought. Research projects that are relevant to the efforts taken by states, regional entities, responsible water management agencies, and stakeholders to anticipate and manage water resources in the face of climate variability and change are encouraged. There is a need for research that can help discriminate between long-term aridity vs. serial drought events vs. isolated drought events and improve understanding of how the propensity for and drivers of drought in the west are changing. There is also a need to apply models to understand and anticipate critical thresholds for water availability in the West. Connecting this research to real-world decisions, context, and operational activities is critical.

Proposals may focus on a number of research areas including:

- Predictability and prediction: Advances in the understanding of regional phenomena that drive precipitation variability and sources of water in the west (e.g., the Southwest Monsoon, synoptic systems, snowfall and snowpack), the representation of those phenomena in modeling and climate prediction systems ranging from seasonal to multi-year timescales, pathways to improve their simulation and prediction, and their interaction with local, remote, and climate change forcing.
- Monitoring and Processes: Improve understanding of the nature of precipitation and water resource variability and changes particular to the west, accounting for the full suite of Earth system processes that contribute to that variability and change. Improve accounting and monitoring of the water budget in the west, including improved representation of flows (e.g., precipitation, runoff, snowmelt) into storage systems (e.g., streams, reservoirs, snowpack) and withdrawals out of those storage systems (accounting for natural and human-managed flows, ecosystem water use, atmospheric demand). Monitoring projects may pursue the development and implementation of methods that can reduce the lag time with which monitoring products pick up drought signals in the west.
- Model application and development: Explore the utility and limitations of climate and Earth system models, and prediction systems in correctly simulating drought events and the combined Earth system conditions and feedback that contribute to these events. Projects should explore and test potential model improvements or result in diagnostics or publications that can directly contribute to future model development. A focus on NOAA modeling systems, particularly GFDL's Earth system, climate, and multi-timescale prediction (e.g., SPEAR<sup>1</sup>) systems are encouraged.

For each of these priority areas, proposals must:

- Specify the value of the proposed research for NIDIS, linking proposed research to outcomes that would advance specific NIDIS applications and its mission.
- Take advantage of state-of-art modeling systems in combination with observational data, demonstrating their availability and suitability for the proposed research goals. Research can make use of available model datasets, mechanistic model experiments (if justified), model-data fusion via data assimilation and machine learning, and model-data intercomparison. Researchers are encouraged to use NOAA modeling and observational products when possible.

Proposals should, if possible:

- Actively involve one or more NIDIS stakeholders in the project, and/or one or more NOAA Service Line Office (such as, NOAA Water Center) collaborators, as appropriate. Researchers are strongly encouraged to seek active collaboration on their projects with staff from state, regional, or federal water resource management groups or agencies.
- Complement and extend research done in NOAA Research Laboratories, including key collaborations in proposals, as appropriate.
- Consider whether a product or other tangible outcome may result from the proposed work. Such outcomes may be hosted at NOAA operational centers including NCEI, CPC, the NOAA Water Center or laboratories, or sustained by other agencies, research entities, and stakeholder

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<sup>1</sup> <https://www.gfdl.noaa.gov/spear/>

organizations. If a transition to an operational state is anticipated, proposals should describe the nature of the transition, and whether and how the transitioned product will be sustained.

For the purposes of this competition, the western region is considered to be the areas within the following five Drought Early Warning System (DEWS) regions: California-Nevada<sup>2</sup>, Intermountain West<sup>3</sup>, Missouri River Basin<sup>4</sup>, Pacific Northwest<sup>5</sup>, Southern Plains<sup>6</sup>. Collaboration with the DEWS networks is encouraged for those projects that are selected for funding.

A fifth Drought Task Force (DTF) will be formed consisting of the investigators funded through this announcement. Task Forces are a MAPP initiative designed to form communities of practice around research topics core to the program's mission, and provide opportunities for inter-project communication and collaboration, leadership opportunities for scientists, broad visibility for the program area, and value-added outcomes from the funded projects. DTFs have a history of producing high-profile assessments of drought events and drought research knowledge such as the report on the 2011-2014 California Drought<sup>7</sup>, an assessment of the role of temperature and thermal forcing in droughts<sup>8</sup>, and the ongoing situation in the Southwestern U.S.<sup>9</sup>.

Participation in the DTF is expected of all investigators funded through this solicitation, and active engagement of research staff such as graduate students and postdocs in the DTF is strongly encouraged as such engagement provides critical leadership and exposure opportunities to early-career and pre-career researchers. Proposers are asked to reserve up to \$15K/year of their proposed project budget to account for participation in and active contributions to the DTF. The proposal should describe ways in which the proposed science may be relevant to or contribute actively to potential DTF collaborative cross-project activities such as those highlighted above that may emerge over the course of the DTF's work.

MAPP Competition Manager: Daniel Barrie ([daniel.barrie@noaa.gov](mailto:daniel.barrie@noaa.gov))

NIDIS Program Director: Veva Deheza ([veva.deheza@noaa.gov](mailto:veva.deheza@noaa.gov))

#### **Additional General Guidelines for Applicants**

- Principal Investigators submitting a proposal in response to this Announcement are required to follow the Letters of Intent (LOI) and Proposal preparation and submission guidelines described in the Climate Program Office FY 2023 Federal Funding Opportunity announcement.

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<sup>2</sup> <https://www.drought.gov/dews/california-nevada>

<sup>3</sup> <https://www.drought.gov/dews/intermountain-west>

<sup>4</sup> <https://www.drought.gov/dews/missouri-river-basin>

<sup>5</sup> <https://www.drought.gov/dews/pacific-northwest>

<sup>6</sup> <https://www.drought.gov/dews/southern-plains>

<sup>7</sup>

[https://cpo.noaa.gov/sites/cpo/MAPP/Task%20Forces/DTF/californiadrought/california\\_drought\\_report.pdf](https://cpo.noaa.gov/sites/cpo/MAPP/Task%20Forces/DTF/californiadrought/california_drought_report.pdf)

<sup>8</sup> <https://cpo.noaa.gov/Divisions-Programs/Earth-System-Science-and-Modeling/Modeling-Analysis-Predictions-and-Projections-MAPP/MAPP-Task-Forces/Drought-Task-Force-III/Projects/Temperature-and-Drought-Assessment>

<sup>9</sup> <https://cpo.noaa.gov/MAPP/DTF4SWReport>

- Investigators are strongly encouraged to submit an LOI prior to developing and submitting a full proposal. LOIs should be submitted through the [FY23 Letter of Intent submission form](#)<sup>10</sup>; investigators unable to submit via the Google form should email their LOI to [daniel.barrie@noaa.gov](mailto:daniel.barrie@noaa.gov). Investigators will be notified by the Competition Manager as to whether a full proposal is encouraged based on the LOI within 30 days of the LOI due date.
- Administrative questions regarding the Federal Funding Opportunity (e.g. proposal formatting or submission guidelines) should be directed to Diane Brown ([diane.brown@noaa.gov](mailto:diane.brown@noaa.gov)).

## Diversity and Inclusion

MAPP and NIDIS recognize that they have a particular and unique opportunity and responsibility to support NOAA's and the community's commitment to diversity and inclusion by taking an intentional step that encourages program applicants to consider diversity and inclusion as part of their scientific projects. MAPP supports the goal of increasing the inclusion of underrepresented groups in NOAA-relevant modeling science. This action has the potential to make an impact on not only the diversity and inclusion in science at NOAA, but also beyond the agency. In your proposal, we encourage you to think about how your project can broaden the participation of underrepresented groups (e.g., gender, race, ethnicity, disability, geographic, etc.). Examples could include, but are not limited to, full participation of women, persons with disabilities, and other underrepresented minorities in science, technology, engineering, and mathematics (STEM). Opportunities that may engage students or early career scientists from underrepresented groups at different or earlier ages (e.g., even secondary) in the context of your proposed research are encouraged.

## Data Archiving and Computational Resources

### Computational Resources

Computational resources on NOAA's high-performance computing platforms may be requested 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<sup>11</sup> with their proposal in order to apply for computational resources.

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

### Data Management Guidance

The MAPP Program requires that all products and deliverables produced via solicitation will reside in the open access/open source domain, freely available to the public.

Public access to grant/contract-produced data will be enabled in one of the following ways (select one):

<sup>10</sup> Note, a Google account is needed to submit via this LOI submission form:

<https://forms.gle/JEHSWhos7EVmjsEZ7>

<sup>11</sup> [https://cpo.noaa.gov/Portals/0/MAPP\\_FY23\\_HPC\\_Request\\_Form.docx](https://cpo.noaa.gov/Portals/0/MAPP_FY23_HPC_Request_Form.docx)

- Funding recipients are planning to submit data to NOAA National Centers for Environmental Information (NCEI), which will provide public access and archiving<sup>12</sup>. Point of Contact for NCEI is Nancy Ritchey ([Nancy.Ritchey@noaa.gov](mailto: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>)
- An existing publicly accessible online data server at the funded institution is to be used to host these data (describe in proposal).
- An existing publicly accessible online “cloud” service is to be used to host the data (described in the proposal).

The Competition Manager (above) is the responsible NOAA Official for questions regarding this guidance and for verifying accessibility of data produced by funding recipients.

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<sup>12</sup> 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](http://www.nodc.noaa.gov/s2n)), for small volume, one-time only data collections) and Advanced Tracking and Resource tool for Archive Collections or ATRAC (<https://www.ncdc.noaa.gov/atrac/index.html>), for recurring and/or large volume data collections).