CLIMATE PROGRAM OFFICE

Modeling, Analysis, Predictions, and Projections

How can we improve Earth system models to better simulate the climate system?

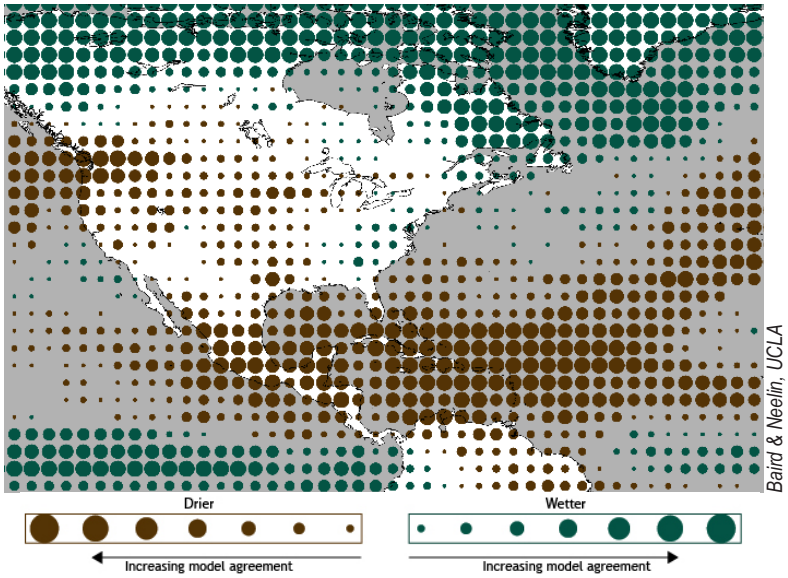
Can we improve intraseasonal to seasonal climate and drought prediction? How well can climate models project future long-term changes in climate?

The Modeling, Analysis, Predictions, and Projections (MAPP) Program's mission is to enhance the Nation's ability to understand and predict variability and changes in Earth's climate system.

To achieve its mission, MAPP supports the development of advanced Earth system models that can predict climate variations and change weeks or decades into the future, as well as project long-term climate conditions over the next century and beyond. Scientists collaborate on MAPP-funded projects from across NOAA, partner agencies, and the external research community.

MAPP Objectives

- Improve Earth system models
- Achieve an integrated Earth system analysis capability
- Improve methodologies for global to regional-scale analysis, predictions, and projections
- Develop prediction capabilities relevant to decision makers based on climate analyses, predictions, and projections



Fourteen global climate models projected precipitation change for 2070-2099 compared to modeled precipitation from 1961-1990 during June-August. The map shows where and how these models agreed on projected precipitation conditions (green: wetter conditions; brown: drier). The degree of model agreement at a given location is represented by dot size; larger dots indicate higher agreement. Small or nonexistent dots indicate where models were ambivalent about potential change. Climate modelers continue to study these areas to understand whether the model agreement is realistic, and why models disagree in certain regions.

MAPP's Approach

MAPP supports the development of next-generation Earth system models. Earth system models simulate the interactions between various components of the Earth system, including the atmosphere, oceans, cryosphere, and the biosphere. They are critical for assessing the causes and effects of past, present, and future changes in the climate system.

Researchers funded by MAPP refine models' computerized representations of Earth's processes and evaluate their performance. They continue to challenge the limits of modeling and computer technologies by generating information at increasingly higher resolutions that are necessary for studying processes at regional and finer spatial scales. These model advancements produce helpful information for decision makers in water management, agriculture, energy, and transportation.

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MAPP's Approach (cont.)

MAPP supports reanalysis projects that are critical to improving model simulations and projections. Reanalysis combines models with historical observations to create a complete and consistent historical record. The model fills in gaps between measurement stations and satellite data points. The resulting reanalysis record can be used to evaluate model performance and provide researchers and decision makers with valuable information about climate.

The interoperability of model components and integration of model developments is a critical outcome of research funded by MAPP. The Global Interoperability program enables this effort. Moreover, the ultimate goal of modeling efforts is to improve information for stakeholder decisions. The National Climate Predictions and Projections platform works at the interface between model output and stakeholder decisions linking the value of model development to societal information needs.

Predicting and Projecting Future Climate Conditions

MAPP-funded researchers are exploring the connections between natural patterns of climate variability—such as the El Niño Southern Oscillation—and extreme climate events. Improving the ability of models to simulate and predict climate phenomena can help scientists describe and predict how these patterns set the stage for floods and droughts. They also help scientists to better predict changes in the frequency of extreme events on time scales of weeks to decades.

Drought, for example, causes tremendous socioeconomic impacts, some of which can be mitigated through better monitoring and prediction. MAPP-funded researchers contribute knowledge that improves the effectiveness of the National Integrated Drought Information System and official drought products—such as the US Drought Monitor and the US Seasonal Drought Outlook—that help give advanced warning of drought events.

Many MAPP research projects are expected to contribute scientific understanding that will form the basis of next generation long-term climate outlooks for North America. Contributing research includes the evaluation of uncertainties in the long-term prediction and projection of 21st century climate over North America.

Fostering a Community

MAPP is developing new ways to connect its community of funded scientists. The Program currently organizes two task forces: one focuses on results produced by the fifth phase of the Coupled Model Intercomparison Program, and the other focuses on drought prediction and monitoring. The MAPP program also initiated a new monthly webinar series in 2011. Each webinar focuses on a different element of MAPP's research portfolio. Sessions are recorded and made available on the CPO Website.

Texas Parks & Wildlife Dept.

USDA

An unprecedented drought in the southern US dried up the Brazos River (top) in Texas in 2011. Meanwhile, historic flooding of the Missouri River (bottom) swept away crops, soil, homes, and more. Ongoing work funded by MAPP seeks to understand these extremes and improve our ability to predict and prepare for similar conditions in the future.

MAPP Highlights

- Climate models developed at various institutions across the US are each skilled at representing, simulating, and predicting various, sometimes different, elements of the climate. Combining individual models to form a multi-model ensemble, or group, can improve predictions. NOAA is spearheading a multi-agency research effort to develop a multi-model ensemble system that may ultimately improve climate forecasts.
- Earth system models help reveal the links between large-scale atmospheric processes and extreme events. Models facilitate study of the connection between moisture over the Gulf of Mexico and floods in the Ohio Valley, or the impact of El Niño on the formation of tropical cyclones and hurricanes. MAPP-funded researchers are examining these links and finding ways to improve models for better prediction, enabling planners to anticipate and mitigate the impacts of storms and flooding in their communities.