NATIONAL ESPC

EARTH SYSTEM PREDICTION CAPABILITY

The nation's security and economic well-being relies upon accurate global analysis and prediction of the physical environment over time scales of a few days to a few decades. This need for better-informed decisions is amplified by recent trends in the climate mean and variability, which reduce the reliability of predictions using average conditions and the recent extreme events affecting commerce, defense, infrastructure and water, energy and other resources. As provided in the 2017 Weather Research and Forecast Improvement Act (P.L. 115-25), the National ESPC will enable improved environmental predictions and help decision makers address critical policy and planning issues by extending the national predictive capability from days to seasonal, annual, and decadal time periods through improved, coupled global environmental prediction.

Five federal agencies partner to create a National Earth System Prediction Capability (ESPC): the National Oceanic and Atmospheric Administration (NOAA), U.S. Navy, U.S. Air Force, Department of Energy (DOE), National Aeronautics and Space Administration (NASA), and National Science Foundation (NSF).

Vision

The National ESPC enables the collaborative development and implementation of the next generation integrated physical Earth system prediction capability at weather and longer time scales to support days-to-decadal global predictions by:

- ◆ Considering the atmosphere, ocean, land, cryosphere and space.
- ◆ Supporting model interoperability and common model architecture to accelerate research to operations.
- ◆ Using multi-model, multi-agency ensembles to identify and quantify uncertainty and risk.
- ◆ Advancing computational and environmental numerical prediction science and technology.
- ◆ Partnering in research to enhance our understanding of complex interactions of the earth environment.

National ESPC

The National ESPC builds on progress made by the previous National Unified Operational Prediction Capability (NUOPC) partnership. NUOPC focused on implementing an operational, global, atmospheric ensemble system based on existing operational modeling technology at weather time scales. NUOPC developed an initial Tri-Agency collaboration and management, including a common research agenda and common model architecture. The National ESPC engages multiple federal, private, and academic organizations in a combined research, development, and operational transition effort, to meet agency requirements for an earth system analysis and prediction framework at appropriate horizontal and vertical resolution.

What is the National ESPC?

- A collaboration between NOAA, Navy, Air Force, DOE, NASA and NSF to develop an improved coupled weather, climate, and ocean prediction capability and engage other federal agencies and academic partners involved in earth system modeling, research, and development.
- A focus on extending prediction skill globally to address the nation's societal and security issues that are impacted by the environment.
- An effort to make integrated coupled ocean-ice-land-atmosphere and space predictions with a single system of systems.

Why a National ESPC?

GOAL: Improve the common science to support different agency missions through a national initiative for the best decision support information. Complex environmental models to deliver these forecasts require:

- World-class expertise from multiple agencies: no one agency has expertise to address the entire Earth System challenge.
- Interagency resource focus for improved efficiency and reduced duplication.
- Increased commonality in model components for improved collaboration.
- Distributed computing: leverage separate agency resources.
- Coordinated set of agency requirements.
- A system approach to extreme weather prediction, climate change impact, and future energy efficiencies.

Scientific Challenges

- Extending our predictive capability from days to decades through a better understanding of the earth system: Lead times of 10 to 100 days present the greatest prediction challenges.
- Improving the representation of physical processes in earth system models: the complex interactions between oceans/lakes, atmosphere, land, ice, ecosystems.
- Using increased/novel environmental observations to enhance data assimilation, including coupled data assimilation.
- Identifying and quantifying uncertainty associated with multi-timescale environmental prediction: assessing that uncertainty using model diversity of multi-model ensembles.
- Advancing our computational efficiencies and capability, leveraging cloud computing and storage technology.

Recent Progress

- Workshops to establish interagency needs, objectives, and challenges on the topics of Metrics, Postprocessing, and Products for Subseaonal-to-Seasonal Timescales, and Building Decision Support Capabilities on Seasonal to Interannual Timescales.
- Overview paper in the Bulletin of the American Meteorological Society "Coordinating the Giant" (https://journals.ametsoc.org/doi/full/10.1175/BAMS-D-16-0002.1).
- White paper on "High Performance Computing Needs in Earth System Prediction" (https://repository.library.noaa.gov/view/noaa/14319).

History

2005   Agreement by NOAA, Navy and Air Force Weather to explore collaborative prediction effort

2008-11   NUOPC operational ensemble created

2012   ESPC Interagency Memorandum of Agreement established

2014   ESPC/NUOPC unification as National ESPC

2016   Formal connection to Federal Committee for Meteorological Services and Supporting Research (FCMSSR)

2017   Weather Research and Forecast Improvement Act (P.L. 115-25)

2019   NIDIS reauthorization strengthens the Weather Act (P.L. 115-423)