FY22 Program Information Sheet

Program Name

NOAA Earth's Radiation Budget (ERB) Program

Program Mission

At the direction of Congress, the NOAA ERB Program aims to:

- Improve the understanding of aerosol impacts on the Earth's energy balance;
- Establish a capability to observe and monitor stratospheric conditions;
- Detect and accurately simulate the impacts of natural and human-caused aerosol injections on radiative forcing, weather, climate, and the Earth system; and
- Apply this improved foundational understanding to Earth system prediction.

Focus for FY22

Atmospheric aerosols and their potential roles in solar climate intervention methods

Funding for FY22

Proposals should budget for no more than $750K total over 3 years. A total of 4-6 awards is anticipated, if funding allows.

Competition Information

NOAA has identified research priorities for improving the foundational understanding of atmospheric aerosols and their representation in numerical models, in order to assess potential solar climate intervention approaches. A recent report by the National Academies of Sciences, Engineering and Medicine (NASEM) emphasized the urgency of research into the physical science basis and impacts of these approaches.

For stratospheric aerosol injection (SAI), the priority is for more accurate model treatments of aerosols in the background stratosphere. Specific goals are improving the ability of climate models to simulate (i) the magnitude and spatial distribution of the radiative forcing produced in SAI scenarios and the dependence of this forcing on the aerosol size distribution and its evolution; (ii) the feedbacks from aerosol-induced stratospheric heating; and (iii) the model representation of the impacts of aerosols on stratospheric and upper tropospheric composition and the chemistry controlling stratospheric ozone.

For modeling marine cloud brightening (MCB), the priorities are understanding how aerosols interact with marine clouds locally on shorter time scales and how clouds subsequently evolve regionally over longer time periods. The intended effect of MCB, brightening of low-level marine clouds by increasing the number of droplets, occurs at relatively small spatial scales within minutes of injected aerosols reaching the cloud layer. MCB also relies on larger-scale interactions with heat and water transport that determine the evolution of the cloud on timescales of hours to days. While local processes affect how much a cloud will brighten, larger scale processes can alter cloud lifetimes and affect the persistence of MCB. Necessary research includes (i) high-resolution modeling studies to better understand the local processes governed by aerosol microphysics and the resulting impacts on cloud droplets and their optical properties; and (ii) larger scale models to assess how low-level marine clouds change hours to days after aerosol perturbations and to quantify the impacts of brighter clouds on regional meteorology and the Earth system. An overarching need is improving the skill of climate

models to accurately represent cloud occurrence and properties, aerosol emissions and processes, and the interactions between aerosols and clouds.

With support from the ERB Program, NOAA is expanding its capabilities to measure aerosols and trace gases in the atmosphere and the laboratory, in alignment with the NASEM report's call for new observations to better constrain models. NOAA is now routinely sampling stratospheric aerosols with instruments on small balloons, with the eventual aim of establishing a global climatology of stratospheric aerosol size distributions. Laboratory studies of the chemical and optical properties of proposed materials for SAI are underway. NOAA is developing a comprehensive suite of airborne instrumentation to characterize the detailed baseline chemical and physical state of the stratosphere, with field deployments planned for the next several years. Past field work by NOAA and its partners has investigated the formation mechanisms for shallow marine clouds and their interactions with naturally and anthropogenically produced aerosols. With ERB support, NOAA is developing new observing capabilities for aerosols, trace gases, clouds and radiation in the marine troposphere and lower stratosphere.

The ERB Program's FY22 competition focuses on improving the representation of SAI and MCB in numerical models and assessing the impacts of aerosol perturbations on Earth's radiative balance, atmospheric chemical processes, dynamics, weather, and climate. Proposals to this competition should address NOAA's priorities for improving the model representation of aerosols and their roles in SAI and MCB. Proposals incorporating relevant observations by NOAA or others to provide constraints on these model studies are strongly encouraged. Successful proposals will address at least one of the following topics:

- Improving model representations of stratospheric aerosol processes and the atmospheric chemical, dynamical, and physical responses to aerosol forcing;
- Advancing model treatments of aerosol microphysics, aerosol-cloud interactions and the corresponding impacts on weather, tropospheric chemistry, and climate;
- Model assessments of the efficacy, risks, and Earth system feedbacks of SAI or MCB.

Contact:
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Data Archiving

Public access to data produced with ERB Program support should follow these guidelines:

- Funding recipients will establish their own data hosting capability.
- Proposals will describe the proposed technical approach. The use of open-standard formats and methods is encouraged.
- Proposals are permitted to include the costs of data sharing or archiving in their budgets.