



Earth's Radiation Budget (ERB) Initiative and Program

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NOAA/OAR Climate Program Office



INTRODUCTION

At the direction of Congress, NOAA is leading a new research initiative to investigate **natural and human activities that might alter the chemistry and reflectivity of the stratosphere or the reflectivity of the marine boundary layer through the addition of aerosols, and to understand the potential impacts on the Earth system.** These activities include proposed climate intervention approaches to influence climate warming by reflecting sunlight from the atmosphere, which require extensive scientific research and assessment. ERB seeks to answer its mandate through:

- ✓ establishing a capability to **observe and monitor** stratospheric conditions;
- ✓ **detecting and accurately simulating** the impacts of natural and human-caused aerosol injections in the stratosphere and troposphere; and,
- ✓ **deriving co-benefits for Earth system prediction** through better understanding of aerosols and clouds.

ERB Initiative

- ✓ Part of NOAA's Office of Oceanic and Atmospheric Research
- ✓ Broad activity with Congressional mandate
- ✓ Directed funding with an internal NOAA focus

ERB Program

- ✓ Sits in NOAA's Climate Program Office, Earth System Science & Modeling Division
- ✓ Competitive funding
- ✓ External research community focus

NOAA is currently the only Federal agency with Congressional appropriations for a comprehensive research program to study the scientific foundation of solar radiation management approaches and impacts.

RESEARCH HIGHLIGHTS & FOCUS AREAS

Stratospheric Aerosol processes, Budget and Radiative Effects (SABRE)



SABRE is an extended airborne science measurement program utilizing the NASA WB-57 high-altitude research aircraft to study the transport, chemistry, microphysics and radiative properties of aerosols in the upper troposphere and lower stratosphere.

- Integration / test flights: January – February 2022
- Arctic Science deployment: February – March 2023
- Tropical Science deployment: June – August 2024
- Southern Hemisphere Science deployment: June – August 2025

Each deployment has 2 components: Houston, Texas along with another location, which provides the ability to consistently map out the Northern Hemisphere mid-latitude stratosphere in different seasons, with excursions to the Arctic and northern Tropics to capture the other parts of the Brewer-Dobson circulation, as well as the Southern Hemisphere to contrast with the Northern Hemisphere.

For more information on SABRE visit: <https://csl.noaa.gov/projects/sabre/>
SABRE PIs:
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Small Balloon Observations



Troy Thornberry, Elizabeth Asher, Michael Todd, Steve Clonora, Ru-Shan Gao (NOAA OAR CSL)
Dale Hurst, Emrys Jordan, Patrick Cullis (NOAA OAR GML)

Collecting baseline stratospheric aerosol profiles using small balloons to quantify and build a climatology of stratospheric aerosol distributions.

- Rapidly deployed to Reunion Island to sample the plume from the Hunga Tonga volcano within 5 days of its eruption.

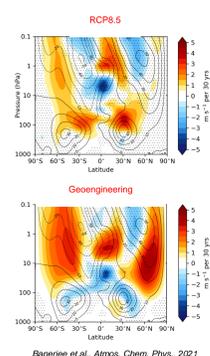
Regular sampling (~2 samples/month) in:
• Boulder, Colorado
• Lauder, New Zealand
• Hilo, Hawaii
• Reunion
The eventual goal is to have 7 sites across the world for a global stratospheric aerosol monitoring capability (mid-lat, tropics, polar for both hemispheres and equator).

...and more!

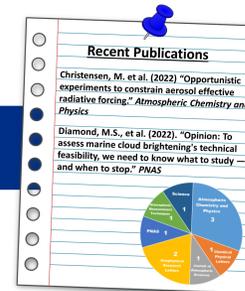
- Lab studies of stratospheric aerosol material and chemical processes.
- Developed airborne instrumentation on an uncrewed aerial system for marine boundary layer studies.
- PNAS perspective on physical science checkpoints and exit ramps for marine cloud brightening research.



Stratospheric & Tropospheric Modeling



- Improving the representation of stratospheric aerosols arising from volcanic eruptions, increased rocket traffic, and potential stratospheric climate intervention.
- Assessing the climate impacts of stratospheric aerosols.
- Advancing understanding of the interactions of tropospheric aerosols with marine boundary layer clouds.
- Understanding the feasibility of potential marine cloud brightening scenarios.



FUNDING OPPORTUNITIES

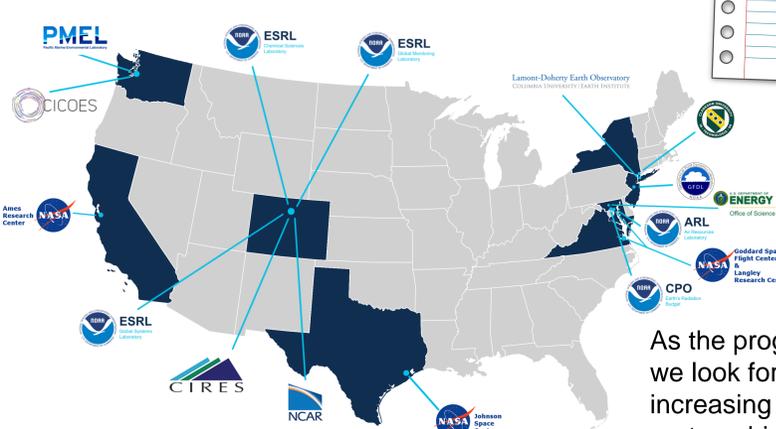
Program Announcement: Fiscal year 2022 was the first year ERB released a notice of funding opportunity for competitive grants. ERB anticipates issuing a program announcement on an annual basis; research priorities are announced in the summer, with Letters of Intent due several weeks later and full proposals due 90 days after letters.

Proposal Review: ERB conducts two-stage peer-review panels with many community members involved in the review process.

Contact: Please contact Victoria Breeze (victoria.breeze@noaa.gov) to be included on the ERB mailing list to hear about upcoming solicitations and/or to volunteer to review proposals.

PARTNERSHIPS

ERB partners include OAR labs, other federal agencies, cooperative institutes, and academic institutions.



As the program grows we look forward to increasing our partnerships!

REFERENCES

- ERB Initiative: <https://csl.noaa.gov/research/erb/>
- ERB Program: <https://cpo.noaa.gov/Meet-the-Divisions/Earth-System-Science-and-Modeling/Earths-Radiation-Budget-ERB>
- NOAA Climate Intervention Factsheet: <https://csl.noaa.gov/factsheets/climateinterventionsos.pdf>
- 2021 National Academies Solar Geoengineering Report: <https://www.nap.edu/catalog/25762/reflecting-sunlight-recommendations-for-solar-geoengineering-research-and-research-governance>
- 2015 National Academies Climate Intervention Report: <https://www.nap.edu/catalog/18988/climate-intervention-reflecting-sunlight-to-cool-earth>