

# Earth's Radiation Budget Science Meeting Summary

Nov. 6 to Nov. 8, 2023

Boulder, CO and Virtual

The purpose of this public, hybrid meeting was to introduce the climate science community to current and ongoing work supported by NOAA's Earth's Radiation Budget (ERB) Initiative; inform the community of recent avenues of research and sources of data; and, encourage collaborations and bring new researchers to the ERB community. The meeting took place over three days, with Day 1 focused on overview presentations, Day 2 on topical lightning talks, and Day 3 on potential collaborations and breakout discussion groups. Topics included but were not limited to: (a) NOAA's newest stratospheric observation efforts including the Stratospheric Aerosol processes, Budget, and Radiative Effects (SABRE) campaign and the Balloon Baseline Stratospheric Aerosol Profiles (B<sup>2</sup>SAP) project; (b) model improvements and new simulations focused on stratospheric aerosol injection (SAI) and marine cloud brightening (MCB); and, (c) new process research in the stratosphere and marine boundary layer. Over 130 people participated either in person or online.



*Science Meeting Participants Attend a Lively Poster Session*

## Day 1 ([Watch on YouTube](#))

- Introduction to ERB
- Remarks from NOAA Leadership
- Keynote Talk with Dr. Chris Field
- Overview Sessions
  - SABRE
  - B<sup>2</sup>SAP and Other Observations
  - Processes & Analogs
  - MCB and Modeling
  - SAI and Modeling
- Poster Session

## Day 2 ([Watch on YouTube](#))

- Lightning Talks
  - Tropospheric Observations, Modeling, & MCB
  - Stratospheric Observations, Modeling, and SAI

## Day 3 ([Watch on YouTube](#))

- Collaborations and Future ERB Spaces
  - Cirrus Cloud Thinning (CCT)
  - GeoMIP
  - The DEGREES Initiative
  - Relevant US Dept. of Energy Activities
- Breakout Group Discussions & Report Out
- Remarks from NOAA's Chief Scientist



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## Highlights from the Breakout Group Sessions

### Session 1 - What are the most pressing high-level research questions?

- The larger climate context, including impact of specific SRM strategies on tipping points
- How do we intelligently sample the space of SRM scenarios and strategies? Can we put boundaries on risk? Are we prepared to detect and attribute impacts?
- Non-linearities of combined SAI and MCB interventions
- Understanding of the present aerosol distribution in the stratosphere
- How do we best utilize and rapidly respond to natural experiments (i.e. volcanoes, ship tracks)?
- Estimates of radiation perturbations in global models and implications on global circulation, human populations, and ecosystems + associated uncertainty and model disagreement
- Reliable representation of transport, dispersion, development, sedimentation of injected matter in the stratosphere
- Improved representation of microphysical, dynamical and radiative response of clouds in models and the statistically-representative observation of those responses at small scales in the marine boundary layer

### Session 2 - What tools are missing or underutilized?

- Lack of continuity in relevant satellite record
- Cloud interactions missing in models
- Focus on improved physics vs. higher resolution in model development
- Potential of perturbative experiments, particularly for MCB
- Routine observations via ships of opportunity and UAVs
- Sampling design that recognizes non-linearity of system
- Time and funding to analyze data from field campaigns
- Identifying useful combination of instruments and self-consistent datasets for models to use
- Plume-scale modeling in the stratosphere
- Longevity and geographic diversity of monitoring platforms
- What lessons re: model biases can we learn from model inter-comparison projects?
- Emergence of emulators, AI, and machine learning as modeling tools



Word Cloud Generated from the Breakout Discussions

### Session 3 - How can we increase collaborations?

- Bring research community together more frequently
- Encourage inter-agency coordination for SRM research
- Build Climate Process Team-like frameworks to better coordinate observational/modeling communities
- Incentive structures for modelers to have larger role in field campaigns and vice versa
- Reduce barriers for proposal development and inter-disciplinary involvement
- Incorporate more satellite and remote-sensing expertise
- Develop partnerships that allow for international funding and collaboration
- Integrate flow of information between different disciplines and stakeholders



Highlights captured here are those of meeting participants and do not necessarily reflect the views of NOAA.

<https://csl.noaa.gov/research/erb/>