



# Climate Program Office Review

May 24-26, 2022

Pre-Recorded Presentation

Supporting Review Activity Area

1: Climate Science / Earth

System Science and Modeling

## **Earth's Radiation Budget**

Victoria Breeze, Program Manager  
Manager

NOAA/OAR/CPO

Gregory Frost, Initiative

# Overview

---



- **Briefing Purpose:** Overview of the Earth's Radiation Budget (ERB) Program
- **Context:** Subactivity for Activity Area 1; ERB is part of CPO's Earth System Science and Modeling Division and seeks to improve the understanding of aerosol impacts on Earth's energy balance

*ERB seeks to improve the understanding of aerosol impacts on Earth's energy balance 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.*

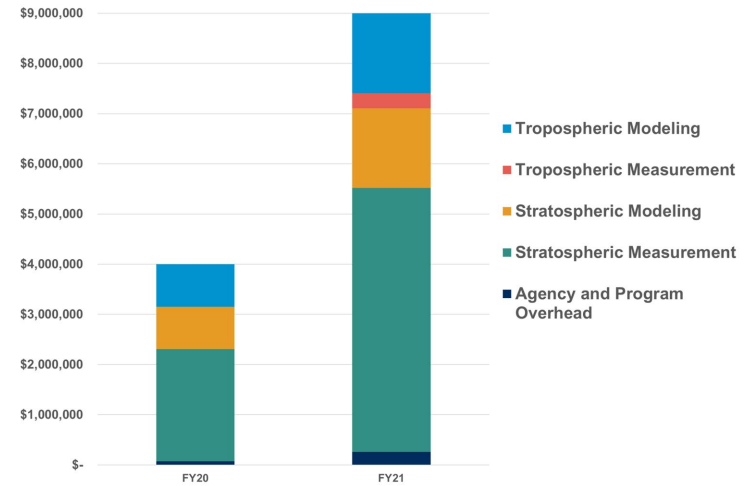
**Program Manager:** Victoria Breeze, PhD

**Initiative Manager:** Gregory Frost, PhD

- ✓ *Initiative mandated by Congress in 2020*
- ✓ *The newest ESSM program*
- ✓ *ERB Program (CPO) is the extramural portion of the larger ERB Initiative (Climate Portfolio)*

## Program components:

- \$9M FY21 Budget (Initiative)
- Directed Projects (100%)
- Competitive Research (TBD in 2022)

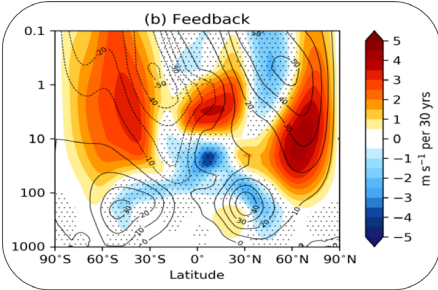


ERB Annual Budget, by topic (2020-2021)

## FY20-21 Research Portfolio



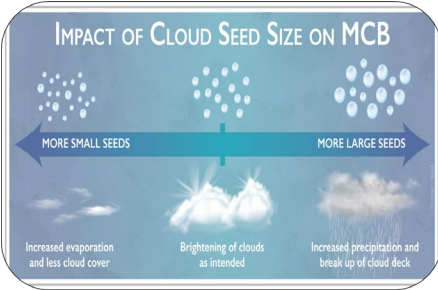
Stratospheric Measurement



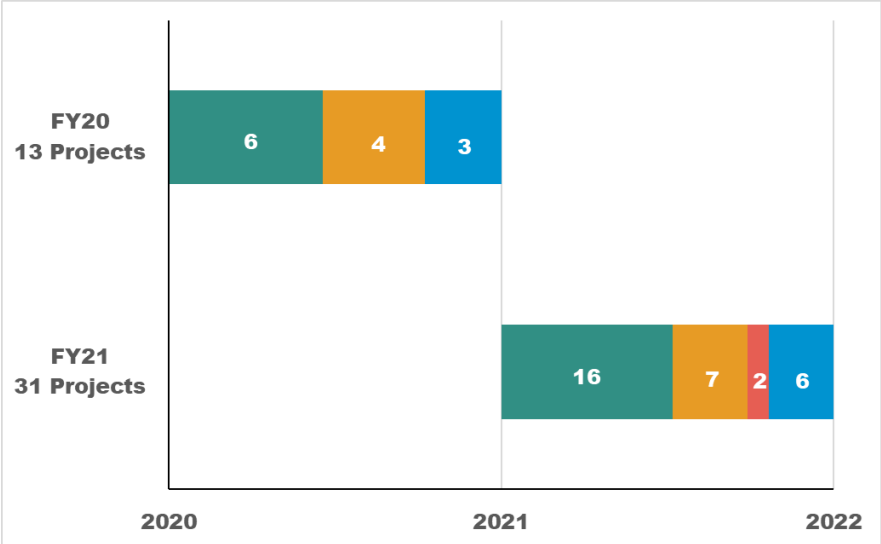
Stratospheric Modeling



Tropospheric Measurement



Tropospheric Modeling



# Key Accomplishments (FY20-21)



## Quality

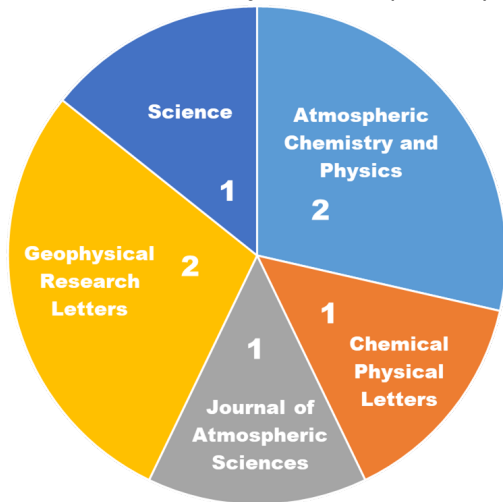
### Most Cited Publication, By Year

Glassmeier, Franziska, et al. (2021) "Aerosol-cloud-climate cooling overestimated by ship-track data." *Science*

See all @ <https://csl.noaa.gov/research/erb/pubs.html>

4

### Total Publications, by Journal (7 total)

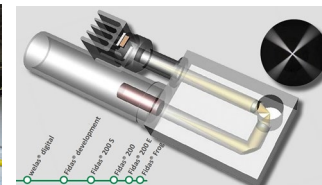


### ERB Instrument Development at NOAA for High-Altitude Aircraft

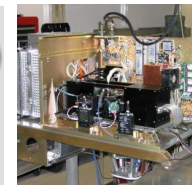
Particle Analysis by Laser Mass Spectrometry (PALMS)



White-light optical particle counter (OPC)



Single Particle Soot Photometer (SP2)



Spectrometers for Optical Aerosol Properties (SOAP)



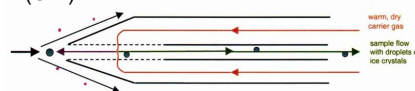
Laser Induced Fluorescence for Nitrogen Oxides



Analyzer for OCS and CO



PALMS Counterflow Virtual Impactor (CVI) inlet



Chemical Ionization Mass Spectrometer (CIMS)



# Key Accomplishments (FY20-21)



## Relevance

### Strategic Partnerships

**NOAA OAR Labs:** CSL, GML, GFDL, ARL, GSL, PMEL

#### Research Partners:

NCAR, Univ. of Washington CICOES, University of Colorado CIRES, Lamont-Doherty/Columbia Univ., Clarkson Univ.

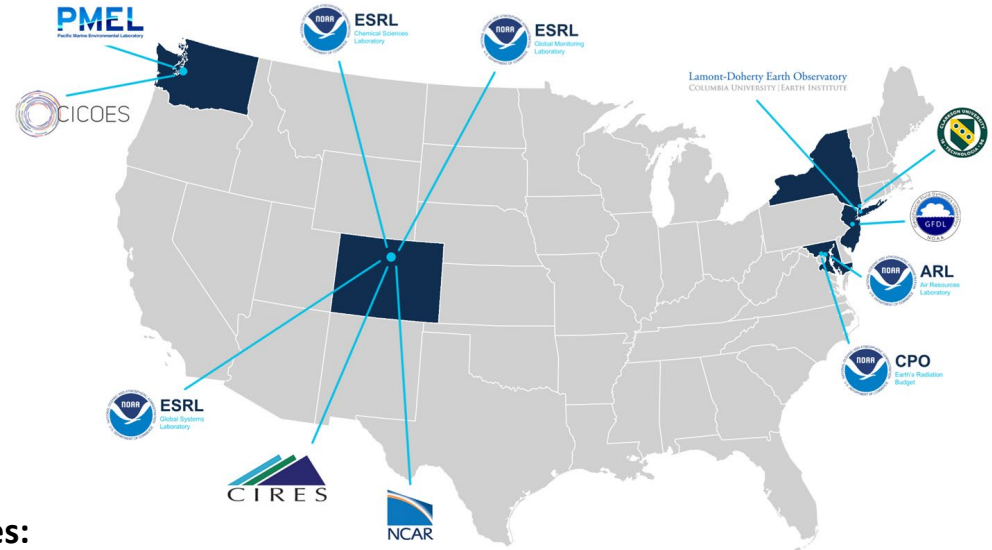
**Federal agencies:** NASA

**Actively engaged with various NOAA/CPO priorities:**

SABRE <https://csl.noaa.gov/projects/sabre/>

AEROMMA <https://csl.noaa.gov/projects/aeromma/>

### ERB-Funded Labs and Institutes (FY2020-2021)





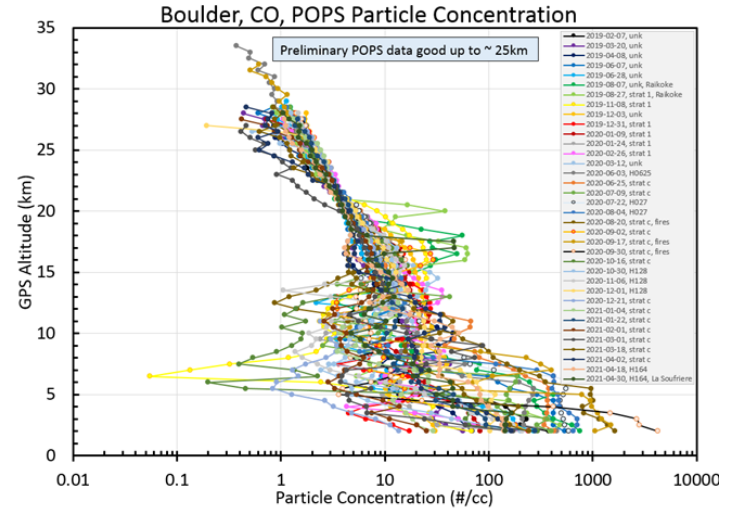
# Key Accomplishments (FY20-21)



## Performance

In the past 2 years, ERB supported investigators have:

- Carried out **small balloon observations** of stratospheric aerosols and greenhouse gases
- Built a **baseline dataset** of stratospheric aerosol distributions
- Developed an **instrument suite** to characterize baseline state of stratospheric composition
- Prepared for **annual deployments** of these instruments on a NASA high-altitude aircraft
- Improved the representation of **aerosol and cloud processes in Earth system models**
- **Modeled impacts** from proposed solar climate intervention approaches in the stratosphere and marine troposphere



# Key Accomplishments (FY20-21)

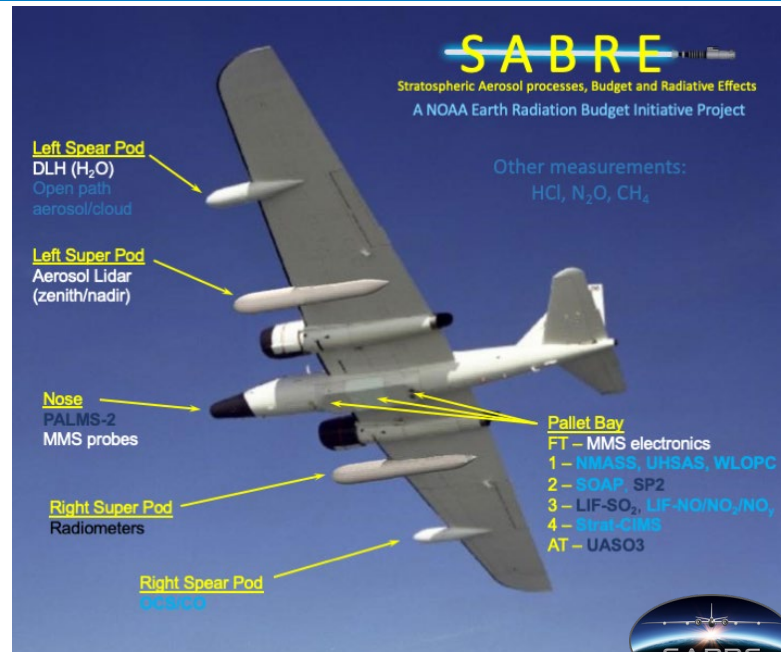
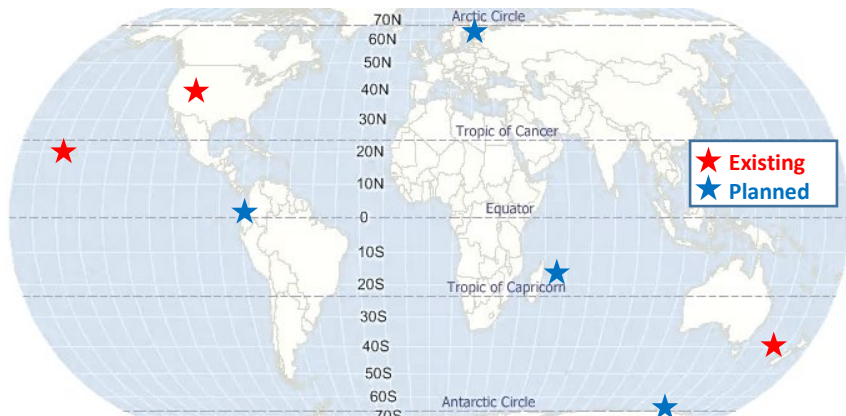


## Program Highlights



### Stratospheric aerosol measurements on small balloons

- *Current effort:* regular launches at Boulder, Lauder, and Hilo
- *Long-term goal:* regular launches from 7 sites globally



**SABRE:** extended airborne program to study the transport, chemistry, microphysics and radiative properties of aerosols in the upper troposphere and lower stratosphere to establish the baseline state and background variability of the stratosphere



# Strategic Lookahead



- **Drivers:**

- Global early warning system for aerosol injections
- Comprehensive process-level understanding of stratospheric aerosols
- Characterization of proposed materials for climate intervention
- Reliable model projections of solar climate interventions and their impacts
- Co-benefits of improved Earth system prediction through improved process understanding
- Scientific foundation to inform decision-makers responding to climate change risks

- **Some Strategic Considerations:**

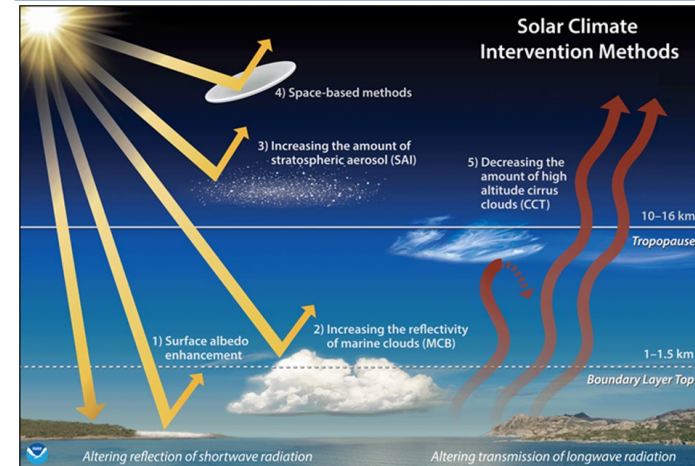
- Programmatic: What opportunities are there to leverage competitive funding?

FY22 is the first external grant year

**“Atmospheric aerosols and their potential roles in solar climate intervention methods”**

4 to 6 awards anticipated, ~\$750k each over 3 years

Illustration  
[Eastham, et al.,  
Eos, 2021]



# Additional Resources

---



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>

FY22 Notice of Funding Opportunity:

<https://cpo.noaa.gov/Portals/0/Grants/2022/ERB-FY22-Information-Sheet.pdf>

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>