

Climate Intervention with Stratospheric Aerosols:

What PI control backgrounds can tell us about the climate response

Walker Raymond Lee¹, Simone Tilmes¹, Ewa M. Bednarz² ¹NSF NCAR, ²NOAA

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Background: climate intervention



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"Geoengineering"

"Solar radiation

Background: climate intervention



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"Geoengineering"

"Solar geoengineering"

"Solar radiation management" (SRM)



SAI simulated with CESM2(WACCM6)



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SAI simulated with CESM2(WACCM6)



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Motivation: SAI simulations are often short, with an evolving background

Challenges:

- Difficult to pick out SAIdriven, background-driven, and model-driven changes
- Many aspects of the climate are hard to diagnose after 35-50 years

<u>Goal:</u>

 Identify long-term response to SAI with minimal drift in background



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Old GeoMIP Experiment: G2

- Plcontrol background
- 1%CO₂ forcing
- Solar dimming to offset radiative forcing
- 50 years of cooling



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New Experiment: G2-SAI

- Plcontrol background
- 1%CO₂ forcing
- Solar dimming to offset
 radiative forcing
 - SAI to offset warming
- 50 years of cooling
 - > 150 years of cooling



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G2-SAI with CESM2(WACCM6): mirror G6 and ARISE protocols



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Initial observations (years 0-30 of injection)



"ARISE-like" overcorrects in SH early on

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Sensitivity tests (single point injections) – how wrong were our estimates?





Reminder: ARISE protocol puts most injection in SH

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SAI in 1%CO₂ background could be ~50-100% more potent than SSP2-4.5, especially at 30°S



Third G2 simulation: modified controller



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What have we learned?

- Sensitivity can vary substantially w/ scenario, even in the same model
- Small sensitivity differences can matter in the long term
- Temperature targets can be met with different injections
- Different injection strategies can meet the same targets and have very different impacts
- Implications for how we present results, talk to policy makers

Contact: walker@ucar.edu



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