For any questions on this RFP, please review the Q&A board before submitting your question via this form.

Reflective

Impacts and Tradeoffs of Simulated High-Latitude/Low-Altitude SAI Deployment

Request for Proposals (RFP) ID: RE-1001

Key Dates	
RFP Issue Date	Mon Apr 28, 2025
Submission Deadline for Expression of Interest (optional)	Wed May 21, 2025
Live Q&A Session	Wed May 28, 2025
Submission Deadline for Proposals	Mon June 9, 2025
Expected Date of Proposal Outcome Notifications	Week of Aug 4, 2025
Expected Grant Start Date	Mon Sep 1, 2025

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Funding Opportunity Details

Background

Climate change is accelerating—intensifying extreme weather, driving biodiversity loss, and threatening global food systems. Even with stronger efforts to decarbonize and remove carbon dioxide from the atmosphere, most climate models project that temperatures will exceed safe levels for decades. In response, **stratospheric aerosol injection (SAI)**—the introduction of aerosols into the stratosphere to reflect sunlight and cool the planet—has emerged as a theoretical option to slow near-term warming and help avoid catastrophic climate tipping points. While early modeling suggests SAI could quickly lower global temperatures, significant uncertainties remain.

One major area of uncertainty involves the feasibility and impacts of deploying SAI at lower altitudes closer to the poles (Duffey et al., 2025; Lee et al., 2021; Lee et al., 2023; Robock et al., 2008; Wheeler et al., 2025), compared to the more commonly studied high-altitude deployments in equatorial and subtropical zones. Most current models assume deployment at altitudes above 20 km—for instance, the ARISE-SAI scenario involves injections at 21.6 km across four latitudes (15°S, 15°N, 30°S, 30°N) (Richter et al., 2022). However, a fleet of aircraft capable of reaching these altitudes does not currently exist. Although there is strong confidence in the engineering feasibility of developing such aircraft, existing planes are only capable of deploying aerosols in high-latitude regions, where the tropopause—and therefore the required injection altitude—is lower (around 9-13 km) (Smith et al., 2022). This makes high-latitude/low-altitude deployment the most realistic initial pathway for SAI, should deployment be pursued in the coming decades.

Reflective's mission is to equip the world with the data and tools needed to make timely, informed decisions about SAI. In support of that mission, **this RFP seeks proposals to evaluate the impacts of a theoretical high-latitude/low-altitude SAI deployment, and to assess the tradeoffs between this approach and potential other strategies.**

Although early studies suggest high-latitude/low-altitude deployment could reduce global temperatures, many critical questions remain. These include potential effects on surface climate, human health, ecosystems, and more. To determine whether SAI using existing aircraft is a viable option, we must develop a deeper understanding of these impacts—just as we have for high-altitude scenarios. This understanding will help quantify the tradeoffs between the technical feasibility of high-latitude/low-altitude

deployment and its potential risks and consequences, informing what we stand to gain or lose from pursuing this pathway.

Research Goals

Reflective aims to advance our understanding of high-latitude/low-altitude SAI deployment scenarios and their tradeoffs with other scenarios and baseline SSP scenarios.

Proposed studies should address one or more of the following research questions:

1. **Benefits of 15km vs. 13 km:** Are there significant benefits (health, environmental, technical, economic) to aircraft that can reach altitudes of 15 km instead of 13 km in the context of high-latitude/low-altitude deployment?
2. **Showstoppers:** Are there technical or scientific "showstoppers" or dealbreakers for high-latitude/low-altitude SAI that have not yet been considered?
3. **Scaling:** How do the potential negative impacts of high-latitude/low-altitude deployment scale? Is there a threshold—during a gradual ramp-up (not exceeding current warming rates)—at which negative impacts necessitate higher-altitude, lower-latitude deployment via specialized aircraft? When might this occur?
4. **Surface Impacts:** Are there specific surface impacts (e.g., air quality, atmospheric chemistry, water availability/quality, permafrost thaw, temperature extremes, ecosystem changes, food security, etc.) that would need to be monitored, or researched more in depth, as they represent a significant source of uncertainties for high-latitude/low-altitude deployments?

We welcome a variety of methodological approaches, including (but not limited to):

- Analysis of existing or forthcoming Earth System Model (ESM) simulations focused on high-latitude SAI.
- Modeling approaches such as plume or Lagrangian models, large eddy simulations, climate models of varying complexity, or model hierarchies
- Use of observational data to benchmark and constrain potential high-latitude/low-altitude deployments.

To support this work—especially considering data access limitations—we will provide grantees with simulation datasets from several ESMs, developed as part of ongoing GeoMIP efforts. Specifically, we will provide new high-latitude, low-altitude simulations in CESM, UKESM, and E3ESM (see Visioni et al., 2023 §4.1 and Visioni et al., 2024 1-iv).

While final "operational" versions of these are still in development, initial sets are already available.

These simulations will be openly accessible in a cloud-optimized (zarr/netCDF) format, with co-located computing via a new community Jupyter Notebook platform (more information below). Proposals may also support expanding this intercomparison with additional modeling teams.

We encourage projects that explore the technical feasibility tradeoffs across SAI scenarios, incorporate geopolitical dimensions, and engage with or are led by Arctic local and Indigenous communities.

Application Process

1. If possible, please submit an Expression of Interest by 11pm Pacific Time (PT) on Wednesday, May 21st, 2025 to indicate your intent to apply. This is optional, but strongly encouraged as it helps Reflective identify reviewers for the peer review process. It will not be used for screening or evaluation purposes.
2. If you have any questions, we will be hosting a live Q&A session from 8-9am Pacific Time (PT) on Wednesday, May 28th, 2025. **Register here.**
3. Submit a proposal by 11pm Pacific Time (PT) on Monday, June 9th, 2025 using this form. A preview of application questions can be reviewed below.
4. Applications will undergo an initial eligibility screening before being sent to our external reviewers for a thorough evaluation using the criteria outlined below.
    a. Have someone in mind who would make a great peer reviewer for this proposal? Nominate them here!
5. We anticipate notifying applicants of the proposal outcome by Friday, August 8th, 2025 with an anticipated project start date of Monday, September 1st, 2025.

Awardees will be required to submit a mid-point report and a final report with any promised deliverables. Further details will be provided to award recipients.

For any questions on this RFP, please review the Q&A board before submitting your question via this form.

Estimated Funding & Period of Performance

Total Funding Available	$400K
Max Award Size Per Recipient	$100K
Minimum Award Size Per Recipient	$25K
Expected Number of Recipients	4-8
Period of Performance	6 - 12 months

Please note, while the max award size is $100K, Reflective would prefer to have more recipients at lower funding amounts to increase the breadth of research conducted under this grant. Projects with slightly higher budgets will not be immediately ruled out, but are discouraged and must be accompanied by sufficient explanation of the necessity of the additional cost.

Budget Categories

Applicants will be asked to fill out a budget workbook to outline project costs.

- *Personnel:* Includes salary & benefits for all personnel involved.
- *Travel:* Includes flights, accommodations, transportation and per diem for any travel required to complete the objectives of the grant.
- *Equipment & Supplies:* Items needed to complete the project
- *Indirect:* Costs not directly relevant to the project but important for operations. Please see Reflective's indirect cost policy for more information
- *Other/Miscellaneous:* Expenses that do not fit into the categories above.

Allowable Expenses

- Personnel
    - For academic faculty on an academic year salary in PI or co-PI roles, the grant can provide up to one month of summer salary support and related benefits. These salary funds are not substitutional (cannot be used to relieve a university of salary costs) and cannot be used to reduce teaching loads below the departmental norm.
    - For staff and research scientists in PI or co-PI roles, the grant can provide salary support and related benefits.
    - For staff and research scientists not in PI or co-PI roles, as well as postdoctoral, graduate and/or undergraduate research assistants, the grant

can provide salary support and related benefits, including graduate student tuition.

- Travel
    - Domestic or international travel for project members for scientific purposes (including conferences and meetings) per the travel policies of the awardee institution.
    - Support for visitors and collaborators, including domestic and international travel.
- Research equipment, supplies, and other expenses directly related to the research, including publication expenses and professional membership dues. Funds may not be used for computer time to run simulations as we are providing access to simulations, as described below.
- Up to 20% of funds may be allocated as indirect costs. Reflective's indirect cost policy can be viewed here.

Eligibility

- This grant is open to academic institutions, non-profits, government-affiliated organizations, for-profits, and similar groups. Individual researchers with appropriate resources may also apply.
- There are no restrictions on country of origin, and projects from the Global South are highly encouraged.
- Only one application may be submitted by the same organization/PI.
- Proposals may be submitted by individual investigators or multi-PI teams from the same or different institutions.

Open-Access Guidelines

- We require work to be published as open-access.
- The underlying outputs—code, data, presentations, etc.—must be openly published (i.e. code on GitHub and data on Zenodo or the Reflective Cloud repository).
- Consistent with our 501(c)(3) status, grant funds may not be used for the purposes of commercial technology development, marketing communications, business development activities, or any other activities directed at generating a profit.
- We will require grantees to pledge not to assert any IP developed under Reflective grants through ARIA's patent pledge (still in development).

Data and Resources Provided

To support proposed research, the following data and computational resources will be made available to successful applicants:

- Climate Model Simulation Outputs: Researchers will have access to SAI simulation data from a variety of Earth system models and scenarios, including from the ARISE-SAI high-altitude global deployment experiments in CESM2 and UKESM1, as well as a limited set of new simulations of high-latitude/low-altitude injection scenarios (±60° & ~13–15 km). To the extent possible, Reflective will facilitate communication between grantees and modeling centers to ensure that specific outputs from these high-latitude/low-altitude simulations necessary for grantees are available. We invite applicants to describe in the Expression of Interest or Application what use, if any, they would make of these simulations, and what outputs, including the desired variable and temporal resolution, they would need to support their research. If a particularly high data volume output is required, please briefly explain its necessity. Applicants can submit questions to the Reflective team via the Q&A form or find us at the Degrees Global Forum to discuss questions in-person. There will also be a more focused discussion of these simulations during the GeoMIP meeting at the Degrees Global Forum, during which prospective applicants are encouraged to suggest desired outputs. The requested outputs for the high-latitude/low-altitude simulations will be available by September at the latest.
- Cloud-Based Computational Platform: Researchers will be granted accounts on a cloud-hosted JupyterHub environment pre-configured for SAI data analysis. This platform provides browser-based Jupyter Notebook access to the above datasets and common analysis libraries, along with sufficient computing resources to handle large climate model outputs. The cloud platform eliminates the need for proposers to have local high-performance computing infrastructure; it allows teams to interactively explore data, run analysis code, and collaborate in a centralized workspace. Use of this platform is encouraged to ensure reproducibility and to lower technical barriers for all research teams.

Evaluation Criteria

Initial Eligibility Screening

The first phase of evaluation is an eligibility screening. This screening will include checks for the following:

- Eligible organization/institution type

- Within budget guidelines of the RFP
- Within project period of performance guidelines of the RFP
- High level check on alignment with RFP Goals

Peer Review Evaluation

Applications that pass the eligibility screening will be evaluated by at least two peer reviewers with relevant areas of expertise, where possible. The areas of evaluation are as follows:

- Impact & Technical Feasibility
    - Evaluation of how the project will move forward our understanding of SAI deployment at high-latitude/low-altitude
    - Level of alignment with RFP goals
    - Feasibility and appropriateness of the proposed approach/methodology
- Work Plan Efficacy
    - Evaluation of the reasonableness of the budget and timeline and whether the project team has the resources and capabilities needed to complete the work
- Overall feedback
    - Strengths of the proposal
    - Potential weaknesses of the proposal
    - Additional risks

Application Content Requirements

The following is a copy of the application form to help you prepare your application materials in advance. The software we use will save a copy of your responses locally to your computer and browser, but we recommend preparing your responses beforehand in a separate document before submission. Questions marked with an asterisk are required. *All long response questions have a 2400 character limit.*

Section 1: Applicant Details

1. Organization Type*
    a. University/Academic Institution
    b. Non-profit/NGO
    c. Government-affiliated organization
    d. Other
2. Organization/Institution Name*

3. Organization Website*
4. Primary Principal Investigator (PI) Title*
5. First Name*
6. Last Name*
7. PI Email Address*
8. How did you hear about this funding opportunity?*

Section 2: Project Overview & Team

1. Project Title*
2. Which overall research question(s) from the RFP does your proposal address?*
    a. Benefits of 15km vs 13km
    b. Showstoppers
    c. Scaling
    d. Surface Impacts
    e. Other
3. Please describe the resources, tools, software, and technology available to you/the team for this project.*
4. If applicable, please list all project team members (aside from the PI) and their role in the project
5. Please upload ONE file with the resumes/CVs of all project team members with the PI as the first resume in the file. Please submit as a PDF*
    a. Max 2 pages per resume/CV in the file.
6. What regions are represented on your project team?*
    a. Africa
    b. Asia
    c. Europe
    d. Latin America & Caribbean
    e. U.S./Canada
    f. Middle East
    g. Oceania

Section 3: Technical Description

1. Please describe your project. Explain in detail what your research goals are for this proposal and your motivation for pursuing them.*
2. Please describe your intended methodology, including scientific rationale and/or references to support it. This should include an explanation of any existing simulations or data you intend on utilizing in your research, if applicable.*

3. If you plan on utilizing one of the simulations mentioned in the RFP, please detail which variables and at which temporal resolution would be needed for your project. Where a particularly high data volume output is required, please give a brief explanation of why this is needed.
4. Please provide an estimated timeline for the project, including specifics about when you expect to complete certain milestones.*
5. Please upload any supporting figures, data, visuals, etc. (optional)
6. Please describe the final deliverable(s) for your project.*

Section 4: Budget & Timeline

1. How long will your project take (in months)?*
2. What is your total budget for this project?*
3. Upload your budget justification workbook* (make a copy of and fill in this template)
4. What areas of expertise in a peer reviewer would be most relevant for your proposal? (select all that apply)
    a. Aerosols
    b. Air Quality
    c. Arctic Climate
    d. Atmospheric Chemistry
    e. Atmospheric Dynamics
    f. Aviation/Engineering
    g. Cryosphere
    h. Ecology
    i. Extreme Weather
    j. Health Impacts
    k. Modeling
    l. Permafrost
    m. SAI
    n. SRM (non-SAI)
    o. Sea Ice
    p. Other
5. Do you have anyone in mind who would make a good peer reviewer for a proposal like yours?
    a. If yes, you'll be asked for the reviewer's title, first, last name, and email address.