

## **PACI: Performance Assessment for Climate Intervention**

**Lauren Wheeler** (lwheele@sandia.gov), Todd Zeitler, Sarah Brunell, Carianne Martinez, Kevin Potter, Benjamin Wagman, Lyndsay Shand, Erika Roesler, and Jessica Lien (Sandia National Laboratories, Albuquerque, NM)

**Background/Objectives.** There is a need for an assessment process to understand the impacts of climate intervention strategies in support of potential future regulations and to policy decisions. The assessment space of these impacts across the Earth system, however, is large. Our approach is to identify assessment targets based on current Earth System Model outputs and leverage existing metrics for climate change risk assessments and analyses of Stratospheric Aerosol Injection (SAI) simulations. The objectives of this project are to develop and test a framework for assessing climate intervention scenarios with a focus on SAI. The goal is to develop an assessment of regional responses, across multiple climate variables, to a particular set of SAI strategies which includes a theoretical ranking (global and regional) of those outcomes.

**Approach/Activities.** This research leverages existing model archives of simulated SAI (GLENS; Tilmes et al., 2018) and is adapting an existing assessment framework: Performance Assessment methodology, a risk assessment framework pioneered by the Nuclear Waste Disposal community (Meacham et al., 2011). The research here focuses on Risk-Risk Assessments (e.g., Harrison et al., 2021), where the impacts are assessed as the risk of implementing SAI against the risk of climate change. The metrics for assessment are identified using the key climate risk parameters from the IPCC Matrix of Climate Risks and Sectors of Impacts (IPCC, 2022). There is currently no regulatory requirement for this type of probabilistic methodology for climate intervention. This assessment considers an output measure (e.g., mean surface temperature change) relative to a pre-defined performance metric, in this case theoretical regulatory boundaries which could be globally, locally, or regionally defined. As part of this research, we have also developed a fully Connected Neural Network surrogate model trained on GLENS simulations to predict climate response.

**Results/Lessons Learned.** Preliminary results have identified graphical metrics by which to assess the target parameters. The results presented at this conference will build on these preliminary results by incorporating more climate model output variables, beyond temperature and precipitation, and will include population-based weights. Additionally, we will present preliminary results which build on the uncertainty in the risk assessment by increasing the number of input ensemble members from both GLENS and other simulation archives (e.g., GeoMIP and ARISE-SAI). Finally, we will present results from the fully Connected Neural Network which show that the model can predict the climate response to forcing with increasing accuracy as the number of training datasets increases. This supports the development of a library of climate simulation output to train models for optimizing SAI strategies that meet potential future regulations at lower cost than running computationally expensive climate models for every possible scenario and can be used as a scenario screening process in the Performance Assessment.