



THE UNIVERSITY OF CHICAGO

CLIMATE SYSTEMS ENGINEERING INITIATIVE

Advancing our understanding of the potential benefits and risks of climate systems engineering.

WHAT IS CSEi?

The Climate Systems Engineering initiative (CSEi) is a key initiative of the University of Chicago's Institute for Climate and Sustainable Growth. We integrate insights from systems engineering and climate science to investigate emerging climate technologies, including:

- Sunlight Reflection Methods (SRM): reflecting sunlight to cool the planet.
- Open-Systems Carbon Removal: Accelerating natural carbon removal processes in oceans, soils, and rocks.
- Glacial Interventions: Stabilizing vulnerable ice sheets to reduce sea level rise.

CSEi works to research and debate possible tools that could help manage climate risks alongside greenhouse gas emissions reductions.

CSEi as an entity does not advocate for or against the deployment of any specific climate engineering methods. CSEi's role is to advance scientific understanding, assess potential risks and benefits, and explore policy frameworks to inform responsible decision-making.

SUNLIGHT REFLECTION METHODS (SRM)



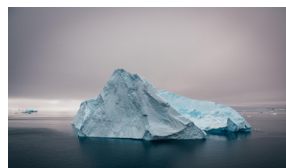
One proposed version of SRM involves dispersing tiny reflective particles of sulfur dioxide in the stratosphere, recreating the cooling effect of volcanic eruptions at a larger scale.

OPEN-SYSTEMS CARBON REMOVAL



Open-systems carbon removal methods enhance carbon sinks, or places in the world that already—naturally—absorb carbon dioxide.

GLACIAL INTERVENTIONS



Glacial intervention is an umbrella term for a range of approaches to slow the melting of glaciers and ice sheets.



STAY ENGAGED WITH CSEI

Stay connected with the Climate Systems Engineering initiative. Join our mailing list to get research updates, op-eds, funding announcements, postdoc opportunities, and more—delivered straight to your inbox. Scan the QR code to sign up and stay engaged with CSEi.



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climateengineering.uchicago.edu

CURRENT RESEARCH PROJECTS

CSEi is funding interdisciplinary research projects to advance our understanding of climate systems engineering. These projects, and their PIs, include:

- AI Emulator for Climate Engineering (Pedram Hassanzadeh)
- Assessing Biogeochemical and Ecological Tradeoffs of Alkaline Waste-Based Carbon Removal (Linta Reji)
- Biological Consequences of Ocean Alkalinity Enhancement (Dakota McCoy)
- Designing Optimal Forcings for SRM Using Differentiable AI Climate Models (Dorian Abbot)
- Dissolution and Sinking Behaviors of Alkaline Materials for Open-Ocean Alkalinization (Manon Duret and B. B. Cael)
- Ebb Carbon Field Study (B. B. Cael)
- The Effects of Ocean Alkalinity Enhancement on Larval Fish (Amy Herbert)
- The Effect of Solar Geoengineering on Surface Winds (Malte Jansen)
- Electrochemical Approach for CO₂ Management (Chong Liu and Stuart Rowan)
- Heat Wave Suppression with Tropospheric Aerosol Injection (Jim Franke)
- The Impact of Stratospheric Aerosol Injection on Cirrus Clouds: The Overlooked Role of Ammonia in Sulfuric Acid Aerosol Neutralization (X. Sally Li)
- Impacts of Stratospheric Aerosol Injection on Precipitation: A Model Hierarchy Approach (Tiffany Shaw)
- Jump-Salting the Atlantic Meridional Overturning Circulation (B. B. Cael)
- A Kinetic Modeling Framework for Sulfuric Acid-Water Nucleation under Stratospheric Aerosol Injection Conditions (Jinghao Zhai)
- Leading Indicators: Marine Microbial Community Gene Expression Responses to Ocean Alkalinity Enhancement (Jake Waldbauer)
- Low Carbon, High Albedo, and Biodegradable Spray Foam for Glacial Ice Insulation (Po-Chun Hsu)
- Mixed-Phase Clouds and Solar Geoengineering (Elisabeth Moyer)
- Ocean Deacidification Project (B. B. Cael)
- Orbital Dust Injection: An Artificial Planetary Torus (Daniel Fabrycky)
- Planetary Aerosol Geoengineering Research Illuminates Earthbound Climate Engineering (Edwin Kite)
- Planetary Interventions in the Cultural Imagination (Benjamin Morgan)
- Prudent Climate Policy in a World of Uncertainty (Lars Peter Hansen)
- Quantifying and Understanding Uncertainties in Regional Impacts of Solar Geoengineering (Tiffany Shaw)
- Researching and Designing Market Shaping Tools for Carbon Removal (Rachel Glennerster)
- The Role of Analogies in Shaping Public and Policymaker Perceptions of Stratospheric Aerosol Injection (Kim Wolske)
- Solar Radiation Management Pessimization (Dorian Abbot)
- Stratospheric Aerosol Injection Using Oxygenated Organic Aerosols (Mingyi Wang)
- Tropical Climate Change Under Solar Geoengineering (Malte Jansen)

“My only confident assertion about climate engineering is that open collaborative research today is vital to inform decisions our children must make tomorrow.”

— David Keith,
Professor and Faculty Director,
CSEi

UCHICAGO PROFESSORS WITH CSEI-SUPPORTED APPOINTMENTS



B. B. Cael



Manon Duret



Jim Franke



Pete Irvine



David Keith

CSEi has a mandate to hire 10 leading faculty members across a wide range of disciplines, including: physical sciences, social sciences, humanities, engineering, and public policy.