

Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention) in Geneva.

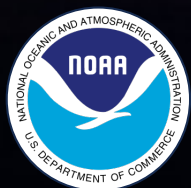
28th meeting of the Working Group of the Parties to the Aarhus Convention (Geneva, 2–4 July 2024)

A SCIENTIFIC ASSESSMENT FOR CLIMATE INTERVENTION

By

David W. Fahey, Director
NOAA Chemical Sciences Laboratory
Boulder, Colorado

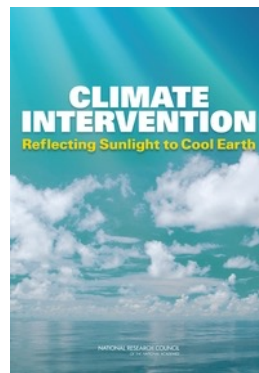
- **Disclaimer:** The scientific results and conclusions, as well as any views or opinions expressed herein, are those of the author(s) and do not necessarily reflect the views of NOAA or the US Department of Commerce.



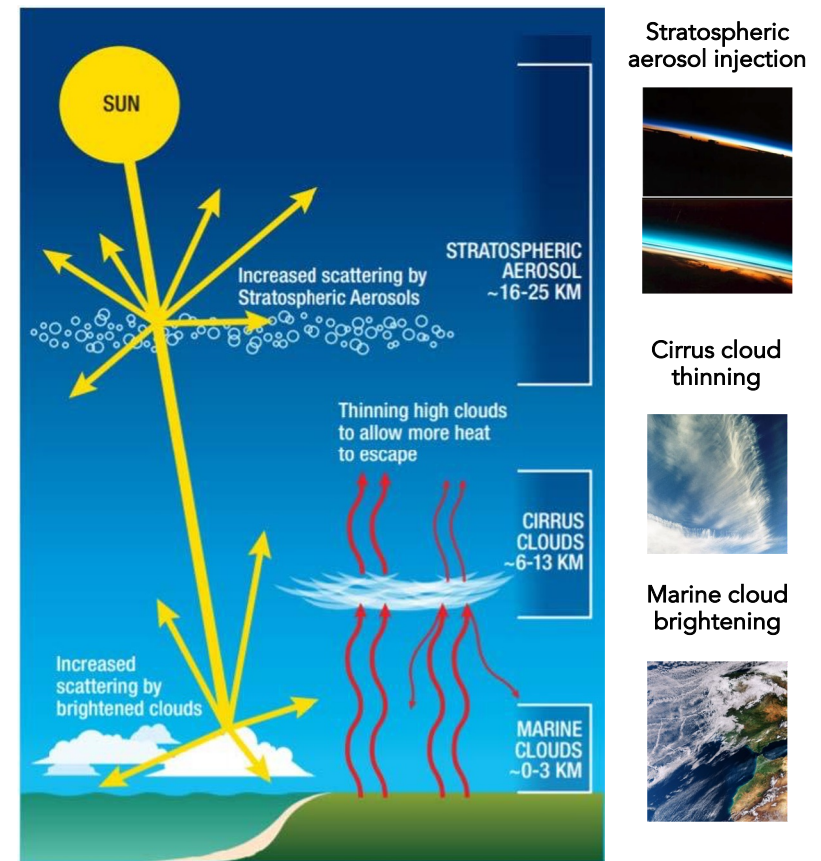
Australian wildfires from the ISS (12 February 2020)

What is climate intervention?

- *Climate intervention*, also known as *geoengineering* refers to cooling the Earth by human means to offset the warming and other impacts due to greenhouse gas accumulation.
- Principal climate intervention methods are **stratospheric aerosol injection (SAI)** and **marine cloud brightening (MCB)**
- “Should it ever become important for society to cool Earth rapidly, albedo modification approaches (in particular stratospheric aerosol injection and possibly marine cloud brightening) are **the only ways** that have been suggested by which humans could potentially cool Earth within years after deployment.”



US National Academies Press, 2015



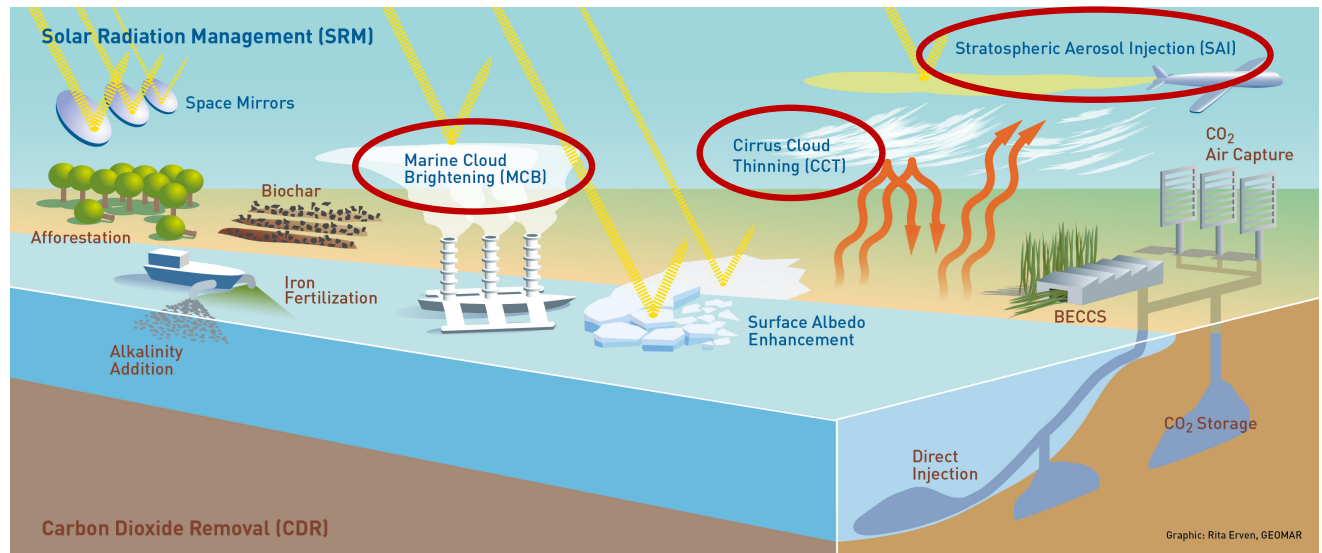
US National Academies, 2021

<https://nap.nationalacademies.org/catalog/18988/climate-intervention-reflecting-sunlight-to-cool-earth>

↳ Importance of a international scientific assessment for decision making and governance

What other ways have been proposed to cool Earth?

- There are many proposed methods to cool the Earth
- **Climate dioxide removal (CDR)** is cooling the Earth by permanently removing CO₂ from the atmosphere.
 - CDR (and emissions reductions) is **required** for cooling the Earth in the long term.
 - **No** effective and feasible CDR methods have been demonstrated at the required scale.
 - Climate intervention is **the only way** we could **'buy time'** to develop and achieve suitable CDR implementation



BECCS = Bioenergy with carbon capture and storage

Montreal Protocol on Substances that Deplete the Ozone Layer

- Cooling the Earth with stratospheric aerosol injection (SAI) is expected to have **unintended outcomes** of changing stratospheric ozone chemistry and stratospheric heating which potentially alters the global ozone distribution



- The Montreal Protocol parties asked the **Scientific Assessment Panel** for:
"An assessment of information and research related to solar radiation management and its potential effect on the stratospheric ozone layer."



UNEP/WMO 2022 Scientific Assessment of Ozone Depletion

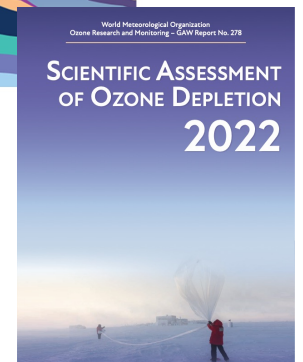
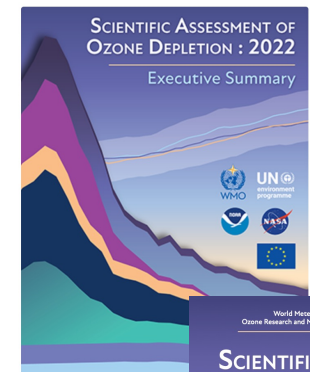
Chapter 6 – Stratospheric Aerosol Injection and Its Potential Effect on the Stratospheric Ozone Layer

Lead Authors

James Haywood (UK Met O)
Simone Tilmes (USA NCAR)

Co-Authors

Frank Keutsch (USA)
Ulrike Niemeier (Germany)
Anja Schmidt (UK)
Daniele Visioni (USA)
Pengfei Yu (China)



Note: I am a Co-Chair of the Scientific Assessment Panel of the Montreal Protocol on Substances that Destroy the Ozone Layer.

Montreal Protocol on Substances that Deplete the Ozone Layer

- Cooling the Earth with stratospheric aerosol injection (SAI) is expected to have **unintended outcomes** of changing stratospheric ozone chemistry and stratospheric heating which alters the global ozone cycle

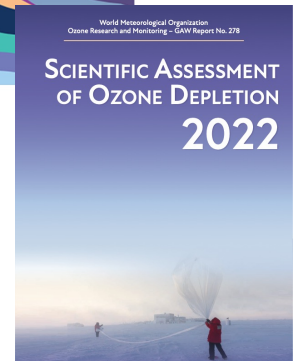
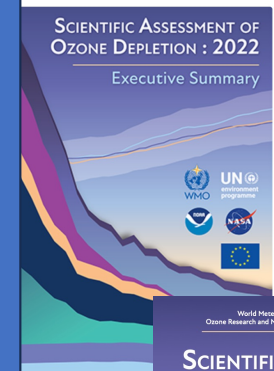


- The Montreal Protocol requires the **Scientific Assessment Panel** to conduct an assessment of the **research related to solar radiation management and its potential impacts on the stratospheric ozone layer.**

UNEP/WMO 2022 Scientific Assessment of Ozone Depletion

Climate Change and Stratospheric Aerosol Injection and Its Impacts on the Stratospheric Ozone Layer

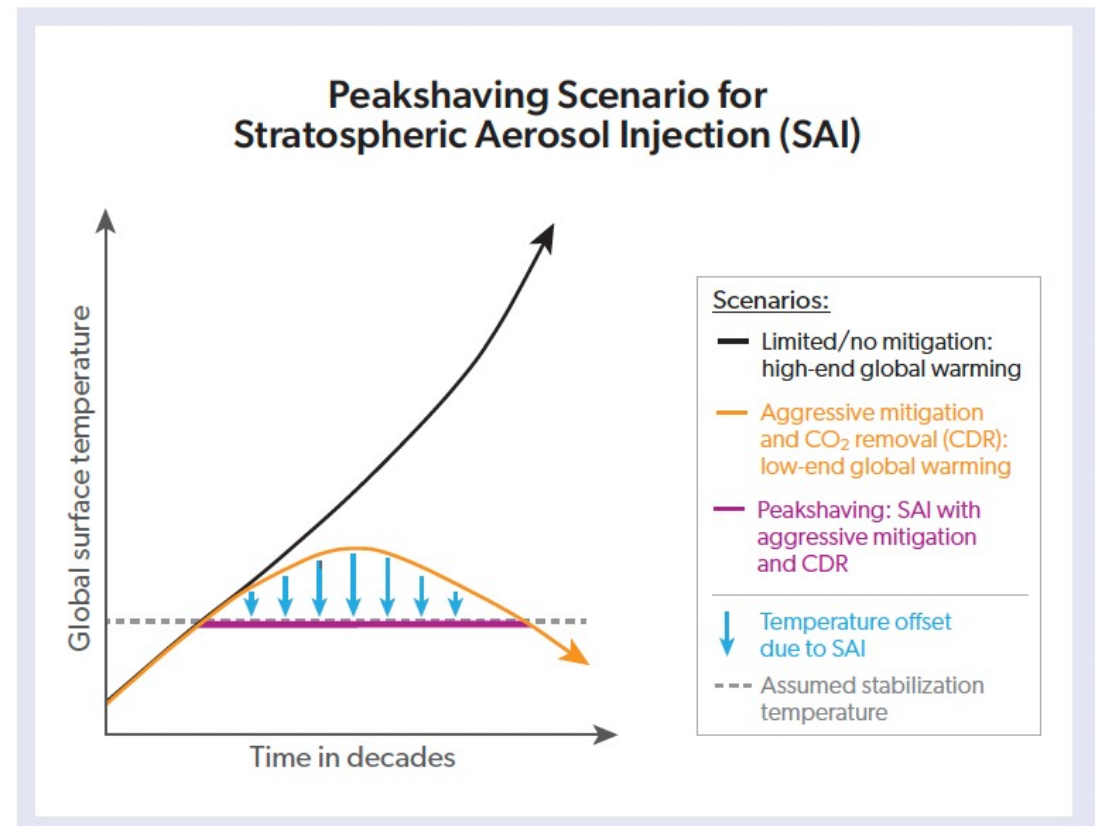
- The scientific assessment is:
- Based on *Terms of Reference* from delegates
 - Based on peer-reviewed literature
 - Open, transparent and accessible
 - Quadrennial cycle
 - Geographically inclusive
 - Equitable
 - Peer reviewed



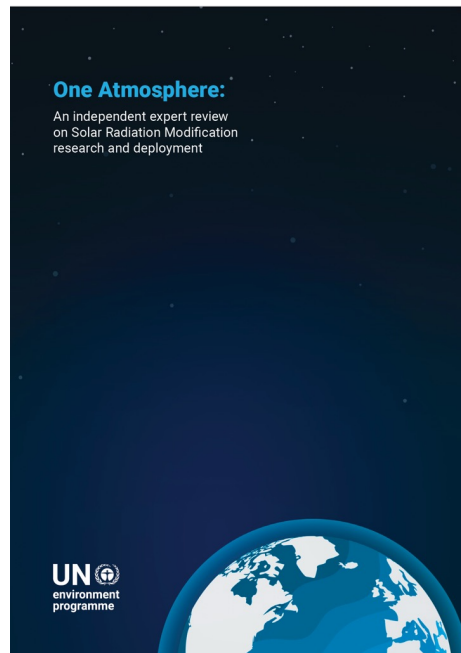
Note: I am a Co-Chair of the Scientific Assessment Panel of the Montreal Protocol on Substances that Destroy the Ozone Layer.

Why are scenarios important for climate intervention?

- Developing **scenarios** of future climate change with and without climate interventions is an essential framework to discuss the potential role of climate intervention.



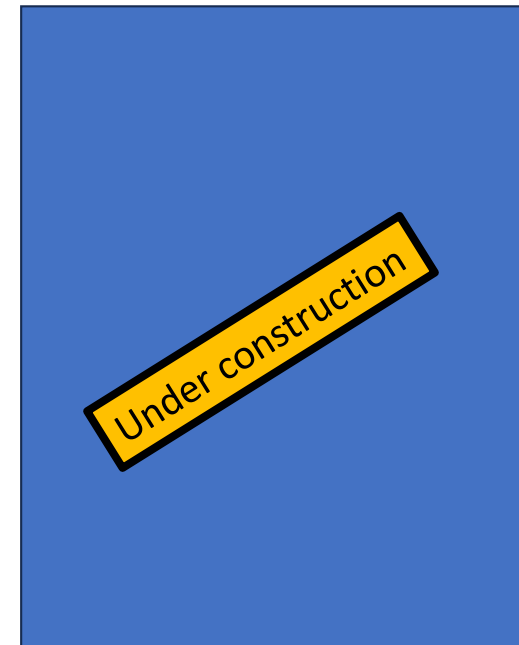
Formal Statements about Climate Intervention Research and Governance



UNEP One Atmosphere Report February 2023



US White House SRM Research Plan July 2023



2024 NOAA Research Plan

<https://www.unep.org/resources/report/Solar-Radiation-Modification-research-deployment>

<https://www.whitehouse.gov/ostp/news-updates/2023/06/30/congressionally-mandated-report-on-solar-radiation-modification/>

Formal Statements about Climate Intervention Research and Governance

p24 **An important aspect of an SRM research program would be developing a suite of SRM scenarios.** Collectively, the scenarios would span the climate intervention scenarios that the international community might choose to analyze in the future. Key aspects of an SRM research program would be assessment of both the climatic and environmental impacts, as well as feasibility of implementation strategies, of specific SRM scenarios. **The development of SRM scenarios would provide a process for the physical, biological, environmental, socioeconomic, ethical, and geopolitical aspects of SRM implementation to be considered within a holistic framework.** The exploration of a set of scenarios would serve to coordinate and integrate activities across all aspects of SRM research, while ensuring that the knowledge gained improves the assessment of the most relevant intervention scenarios.

p40 **Cooperation on SRM could usefully involve an international assessment of scenarios and strategies and their associated consequences.** For example, it might document and expand the scientific foundation for SRM scenarios and implementation strategies and provide a comprehensive analysis of their intended and unintended consequences for climate and the physical environment broadly. Such an assessment would support future research activities by identifying where knowledge and understanding seem sufficient and where significant gaps remain.

<https://www.whitehouse.gov/ostp/news-updates/2023/06/30/congressionally-mandated-report-on-solar-radiation-modification/>



ONE ATMOSPHERE SRM ASSESSMENT

p.25: The panel anticipates that periodic scientific assessments, including both the natural and social sciences, would be valuable for guiding future research and for defining the foundation for decision processes associated with an international discussion about SRM issues such as governance of small-scale outdoor experiments, technology development, financing, deployment options and governance of large-scale operational deployment. **Therefore, this panel suggests the establishment of a globally inclusive, transparent and equitable scientific review process for SRM.**



UNEP One Atmosphere Report, 2023



An assessment brings judgement and order to bear on diverse knowledge sources

SOLAR CLIMATE INTERVENTION: OPTIONS FOR INTERNATIONAL ASSESSMENT AND DECISION-MAKING



Susan Biniatz, Yale Jackson Institute for Global Affairs
Daniel Bodansky, Sandra Day O'Connor College of Law, Arizona State University

There is a growing risk that the global response to climate change will be inadequate to avoid an unsafe global climate. There is corresponding interest in exploring the potential need for, and feasibility of, rapid responses to avoid dangerous climate change – such as solar climate intervention (SCI). At the same time, there is concern that such intervention, if any, be implemented as safely as possible. This paper posits a scenario in which a group of countries seeks a cooperative, science-based¹ approach to decision-making regarding the potential use of SCI, in the context of increasingly dangerous climate conditions, taking into account “two safeties:” the safety of the global climate, and the safety of SCI, if any, in response. The paper surveys the existing institutional landscape to identify the extent to which one or more international forums would be in a position: (1) to produce a high-quality, scientific/technological assessment that would enable informed, objective decisions to be taken on the two safeties, and (2) to take such decisions (pro or con). It concludes that several forums could potentially perform one or more aspects of the scientific/technological assessment function and that the UN Security Council is uniquely placed to take authoritative decisions in a climate emergency situation, but that there is no single international forum (at least as currently configured) that could effectively serve as “one-stop shopping” for both the assessment and decision-making functions.

JULY 2020

INTERNATIONAL

SOLAR CLIMATE INTERVENTION: OPTIONS FOR INTERNATIONAL ASSESSMENT AND DECISION-MAKING



Susan Biniaz, Yale Jackson Institute for Global Affairs
Daniel Bodansky, Sandra Day O'Connor College of Law, Arizona State University

There is a growing risk that the global response to climate change will be inadequate to avoid an unsafe global climate. There is corresponding interest in exploring the potential need for, and feasibility of, rapid responses to avoid dangerous climate change – such as solar climate intervention (SCI). At the same time, there is concern that such intervention, if any, be implemented as safely as possible. This paper posits a

climate emergency situation, but that there is no single international forum (at least as currently configured) that could effectively serve as “one-stop shopping” for both the assessment and decision-making functions.

assessment function and that the UN Security Council is uniquely placed to take administrative decisions in a climate emergency situation, but that there is no single international forum (at least as currently configured) that could effectively serve as “one-stop shopping” for both the assessment and decision-making functions.

<https://www.c2es.org/wp-content/uploads/2020/07/solar-climate-intervention-options-for-international-assessment-and-decision-making.pdf>

Thank you for your attention