# Solar geoengineering emerges as contentious climate stopgap amid rising global heat



As global temperatures continue to climb at alarming rates, the idea of manipulating the sun’s rays to combat climate change—known as solar geoengineering—has garnered increasing attention. Although long considered controversial and rife with ethical dilemmas, this approach, specifically solar radiation modification (SRM), is finding its way to the forefront of the climate change debate.

The last few years have witnessed unprecedented warmth, marking 2022 as the hottest year on record. As glaciers melt and extreme weather events become more frequent, the urgency to act on climate change has never been clearer. In the wake of geopolitical shifts, particularly following the United States' withdrawal from the Paris Agreement under the Trump administration, the ambitious goal of limiting global warming to 1.5°C appears distant. Consequently, private foundations and countries including the US, the UK, and China have poured substantial investments—amounting to tens of millions of dollars—into the exploration of SRM technologies.

The spectrum of SRM techniques primarily revolves around two strategies: increasing the Earth's reflectivity of sunlight or reducing the absorption of solar radiation. Advocates argue that these methods could provide a temporary reprieve, buying vital time while the world grapples with longer-term strategies for reducing carbon emissions. Recent estimates suggest that enhancing the Earth’s reflectivity by just 1% could potentially lower the average global temperature by about 1°C, highlighting the significant impact these techniques could have, even if merely as stopgap measures.

Aerial methods like stratospheric aerosol injection (SAI), which involves releasing tiny particles such as sulphur dioxide into the atmosphere, mimic the natural cooling effect observed after major volcanic eruptions. This technique, backed by some forms of experimental research, could create a reflective layer around the Earth, reducing surface temperatures. Meanwhile, marine cloud brightening (MCB) proposes to increase the reflectivity of clouds over oceans, thereby helping to protect marine ecosystems and coral reefs from extreme heat.

Despite the scientific advancements, concerns remain ubiquitous regarding the safety and ethical implications of deploying such technologies. Critics argue that SRM addresses merely the symptoms of climate change rather than its root causes, perpetuating the risk that governments might retreat from pursuing crucial reductions in greenhouse gas emissions. Experts caution that relying on geoengineering could create a "moral hazard," leading to complacency among policymakers and delaying essential measures to curb greenhouse gas emissions effectively.

The governance of SRM technologies presents additional complexities. Numerous ethical questions arise: who gets to decide when and how these methods are applied? What protocols would ensure accountability in the case of adverse effects on climate and ecosystems? The absence of an established international regulatory framework increases the urgency of these discussions.

Recent developments included a proposed resolution at the United Nations Environment Assembly for further research into SRM, initially supported by Switzerland and Monaco. However, this motion was withdrawn amidst rising health and environmental safety concerns, largely driven by fears that such technologies would enable significant polluters to defer their commitments to reducing emissions. Opponents highlighted the risks of altering precipitation patterns, disproportionately affecting vulnerable populations, particularly in developing nations where the impacts of climate change are already most severe.

Nevertheless, a subset of climate scientists, like Claudia Wieners from Utrecht University, argues for a measured approach to research and experimentation in this arena, stating that knowledge is crucial if humanity decides to implement SRM. This stance resonates with calls for balanced research, noting that unilateral action without international consensus could lead to geopolitical conflicts.

The continuing evolution of solar geoengineering exemplifies the intricate balance between technological innovation and moral responsibility. While it offers intriguing possibilities to mitigate the worst effects of climate change, it also demands thorough examination and debate. The scientific community remains divided, and the need for transparent, global participation in these discussions could not be clearer. Without careful navigation, the pursuit of immediate solutions may overshadow the imperative task of addressing the underlying causes of climate change, ultimately shaping humanity's environmental legacy for generations to come.

### Reference Map

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## Bibliography

1. <https://www.swissinfo.ch/eng/climate-adaptation/is-playing-with-the-sun-to-fight-climate-change-worth-the-risk/89284932> - Please view link - unable to able to access data
2. <https://time.com/6258126/solar-geoengineering-billionaries-george-soros/> - Billionaires like George Soros, Bill Gates, Jeff Bezos, and Dustin Moskovitz are increasingly interested in solar geoengineering, a controversial method to address climate change by reflecting the sun's rays away from Earth. Soros proposed brightening Arctic clouds, while Gates funded a Harvard project to spray calcium carbonate, and Bezos used Amazon's supercomputers to model sulfur dioxide injections. Solar geoengineering, which aims to act as a short-term fix to flatten global temperature peaks, faces criticism for potential side effects, feasibility, and moral hazard concerns. This interest among the ultra-rich may stem from their tech backgrounds and belief in engineering solutions to complex problems. However, the debate continues on whether such measures should complement or distract from the primary plan of cutting carbon emissions.
3. <https://www.ft.com/content/cd88bf71-97ca-4142-88c8-3a5819ce81b7> - Despite existing pledges to climate action, the world is projected to face a temperature rise of 2.4 to 2.6C by the end of the century, surpassing the Paris Agreement's goal of 1.5C. Increased efforts in emissions reductions, adaptation, and carbon dioxide removal are essential. Geoengineering, specifically solar radiation modification (SRM), is being considered as a controversial but potential method to mitigate temperature rise by reflecting sunlight. Techniques like stratospheric aerosol injection and marine cloud brightening could theoretically cool the planet quickly but pose significant risks, such as disrupting weather patterns and creating a "termination shock" scenario. However, SRM does not address the root cause of emissions and presents ethical and governance challenges. The article suggests the importance of a global governance framework, a moratorium on deployment until thorough research is done, and expanded transparent research involving global participation. Properly regulated and as a last resort, SRM might offer a chance to mitigate the severe impacts of climate change.
4. <https://www.reuters.com/business/environment/safety-fears-stall-un-bid-examine-sun-blocking-climate-change-tech-2024-02-29/> - U.N. delegates have withdrawn a motion proposing further research into solar radiation modification (SRM) technologies at the U.N. Environment Assembly due to health and environmental safety concerns. Switzerland and Monaco initially submitted the resolution, which aimed to assess SRM's potential applications and risks. Critics argue that SRM could disrupt weather patterns, affect agriculture, especially in poorer regions, and allow major polluters to delay reducing greenhouse gas emissions. Despite the withdrawal, discussions initiated a global conversation about SRM. Opponents of the resolution, including various nations and environmental organizations, fear that SRM technologies would not address the root causes of climate change but rather serve as an excuse to postpone essential mitigation actions.
5. <https://www.axios.com/2021/03/25/geoengineering-climate-change-research-program> - Solar geoengineering, once considered science fiction, is now being seriously looked at as a tool to mitigate climate change. The National Academies of Sciences (NAS) released a report recommending systematic research on solar geoengineering, including funding, studying, and establishing governance frameworks. Proposed methods include injecting aerosols into the stratosphere and brightening marine clouds to reflect sunlight and lower temperatures. While these concepts are being explored, the NAS report advises against immediate development or deployment, emphasizing the need for transparency, public input, and accountability to address concerns and misinformation. The report also advocates for involving the Southern Hemisphere in these discussions. The overarching question remains whether humans should proceed with these geoengineering efforts, with a recommendation to thoroughly research and understand the implications before deciding.
6. <https://www.lemonde.fr/en/environment/article/2024/08/31/marine-cloud-brightening-a-controversial-geoengineering-technology-with-potentially-harmful-effects_6724084_114.html> - Marine cloud brightening is a geoengineering technique that injects marine salt aerosols into clouds to increase their reflectivity and reduce ocean temperatures, aiming to mitigate global warming. Despite potential benefits in reducing heat risks in regions like the North Pacific and southern California, a study by the University of California highlights potential long-term negative effects. By 2050, the technique may lose efficacy and exacerbate heatwaves in other regions due to disruptions in ocean currents. The localized benefits could lead to broader harmful impacts such as increased heat stress and altered precipitation. Opposition to these interventions is strong, with concerns about their impact on marine ecosystems, human rights, and indigenous territories. Critics argue these technologies may detract from efforts to reduce greenhouse gas emissions. Ongoing experiments in the US and Australia have sparked debates on the need for larger-scale testing and international regulations to assess and manage the consequences effectively.
7. <https://www.carbonbrief.org/explainer-six-ideas-to-limit-global-warming-with-solar-geoengineering/> - Solar geoengineering encompasses various techniques aimed at reflecting sunlight to mitigate global warming. Six primary methods include: 1) Stratospheric Aerosol Injection (SAI), which involves releasing aerosols into the stratosphere to reflect sunlight; 2) Marine Cloud Brightening (MCB), which increases the reflectivity of marine clouds; 3) High-Albedo Crops and Buildings, which enhance surface reflectivity; 4) Surface Albedo Enhancement, such as painting roofs white; 5) Space-Based Methods, like deploying mirrors in space; and 6) Cirrus Cloud Thinning (CCT), which reduces the optical thickness of cirrus clouds. Each method has distinct technical challenges, potential impacts, and levels of research maturity, with ongoing debates about their feasibility and ethical implications.