

ATMOSPHERICS

09.08.23

GEOENGINEERING



Bottom Line Up Front:

- Geoengineering refers to the large-scale manipulation of the earth's natural environmental cycles, especially the climate, in an effort to counteract the effects of things like climate change.
- As an emerging field, geoengineering presents both benefits (like rapid climate mitigation) and risks (like attempting to change one environmental variable without fully understanding how other variables might change in response) which will need to be weighed with ongoing research.
- One promising aspect of geoengineering is Carbon Dioxide Removal (CDR) techniques, like direct air capture, which have the potential to not just slow down but actually reverse the accumulation of CO₂ in the atmosphere by actively removing it.
- However, because the Earth's environmental systems are intricately intertwined, a thoughtful approach to building technologies, implementing policies, and monitoring effects is critically important. Even in the early stages of this emerging field, unintended consequences are becoming apparent, underscoring the challenges of trying to apply relatively simple solutions to complex problems.

INFORMATION



A view of the information space related to the topic of the week, based on headline frequency.

Geoengineering defined: Geoengineering refers to the deliberate manipulation of the Earth's natural systems to counteract climate change. It can be categorized into Carbon Dioxide Removal (CDR), which removes CO₂ from the atmosphere, and Solar Radiation Management (SRM), which reflects sunlight back into space. While these interventions offer potential solutions to climate change, they are controversial due to potential risks, unintended consequences, and geopolitical concerns.

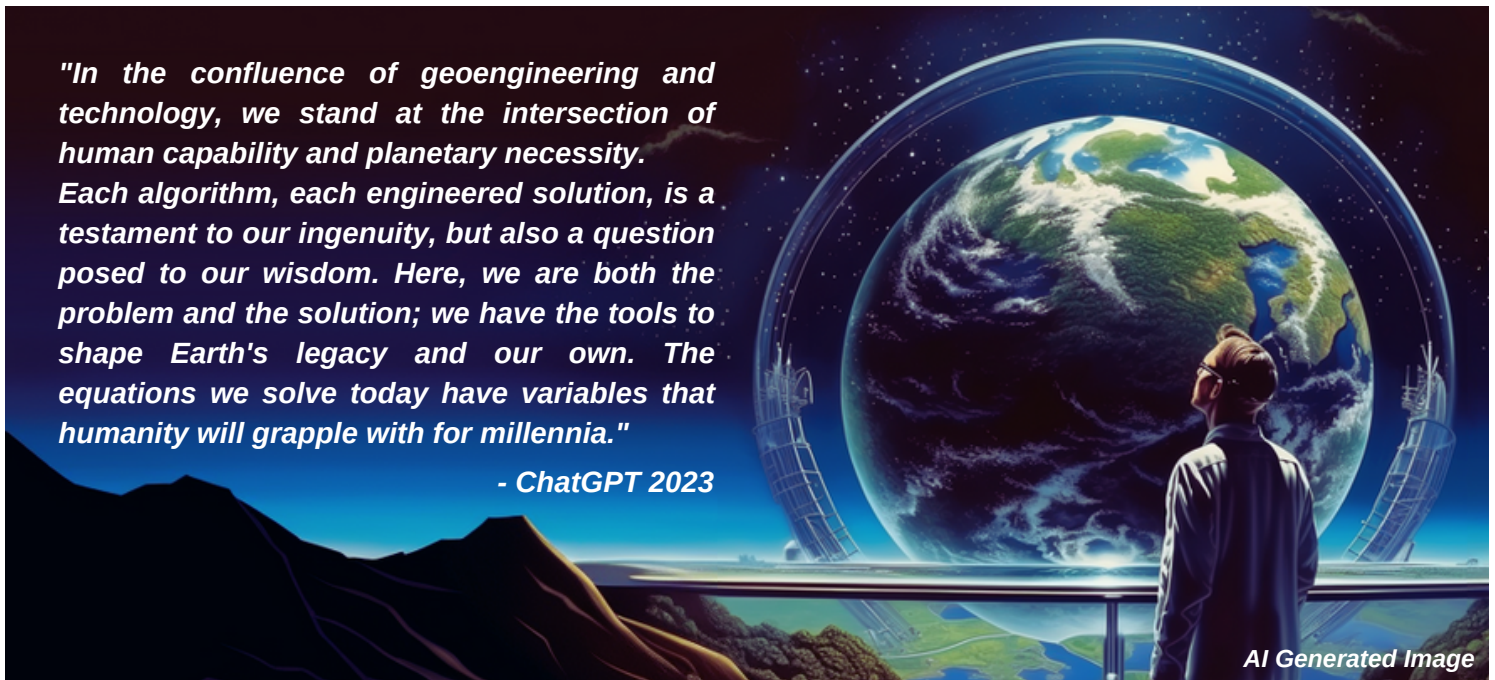
Why this topic is important right now: Geoengineering, aimed at counteracting climate change, is becoming increasingly contentious for several reasons. Proponents see it as a vital tool against escalating climate threats, while critics warn of unpredictable environmental side effects. There's also a "moral hazard" concern that its promise might reduce efforts to cut emissions. Additionally, the lack of global governance can lead to geopolitical tensions, and ethical dilemmas arise from humans attempting to control Earth's climate. The debate revolves around its potential benefits versus the multifaceted risks and challenges.

A few things to consider: Complexity over simplicity – while solutions may seem straightforward, the climate systems is complex; ethics beyond technology – the 'who' in the geoengineering equation has significant implications (decisions, responsibility, consequences, learning); though CDR and SRM are the two most prominent areas of focus, there are (and will continue to be) some emerging areas like ocean fertilization (essentially encouraging phytoplankton to absorb CO₂) which presents its own pros/cons as well

TECHNOLOGY

"In the confluence of geoengineering and technology, we stand at the intersection of human capability and planetary necessity. Each algorithm, each engineered solution, is a testament to our ingenuity, but also a question posed to our wisdom. Here, we are both the problem and the solution; we have the tools to shape Earth's legacy and our own. The equations we solve today have variables that humanity will grapple with for millennia."

- ChatGPT 2023



Geoengineering, the deliberate alteration of Earth's environment, is increasingly viewed as a potential last resort to mitigate the catastrophic effects of climate change. Within this emerging field, technologies such as Direct Air Capture, Solar Radiation Management, and Artificial Intelligence (AI) for monitoring and modeling are drawing the most attention for their strategic impact and value.

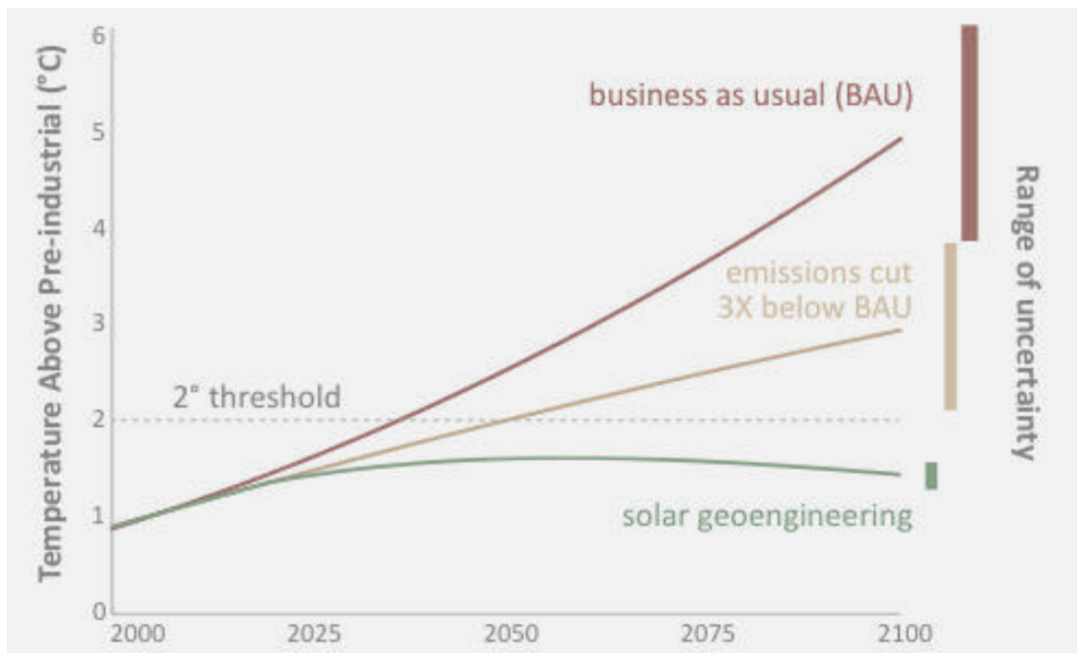
Direct Air Capture (DAC), which uses chemicals to absorb CO₂ from the air, holds promise for effectively removing greenhouse gases, but is often criticized for its energy intensity. In contrast, Solar Radiation Management (SRM) technologies like Stratospheric Aerosol Injection aim to reflect sunlight away from Earth. While SRM offers immediate cooling effects, the consequences for weather patterns and the ozone layer are not yet fully understood.

The role of AI in geoengineering is multidimensional. Machine learning algorithms are increasingly used to analyze vast datasets for real-time adjustments in both DAC and SRM applications. AI offers the adaptability needed to fine-tune these technologies, but its efficacy is contingent on the quality of the data input. More ambitiously, AI is also being explored for ethical modeling to predict the societal and ecological impacts of different geoengineering strategies.

As we move forward, the integration of these technologies could be key. Combining the immediate effectiveness of SRM with the longer-term carbon removal of DAC, all fine-tuned and monitored by AI, could provide a more comprehensive approach to climate intervention. However, the ethical implications, from governance to unintended ecological consequences, remain a subject of fervent debate.

For decision-makers, the allure of geoengineering technologies is clear: they offer potential solutions to some of our most pressing environmental challenges. However, the deployment of these technologies must be executed with great caution and transparency. The technologies we develop and deploy today will not only shape the environment but will also set the precedent for governance, ethics, and environmental stewardship for generations to come.

SENTIMENT



Harvard's Solar
Geoengineering
Research Program

Geoengineering's sentiment varies widely depending on its audience, geographic location and individual perspectives. Here are common sentiment associated with geoengineering:

Wary Appraisals: Many scientists, policymakers and environmentalists view geoengineering with some degree of suspicion. Their concerns include potential unintended consequences, ethical considerations and prioritizing emissions reduction and sustainable practices as potential drawbacks to using geoengineering technology.

Technological Optimism: Segments of society exhibit optimism about geoengineering technologies as an avenue to combat climate change. They view geoengineering as a valuable asset to supplement emissions reduction efforts.

Ethics and Governance Concerns: Geoengineering has generated numerous ethical and governance concerns among its critics, such as who will decide when and how to deploy these technologies, their geopolitical effects, equity considerations, or issues related to justice and equity.

Risk Analysis: The US public wants rigorous scientific research and risk analyses before embarking on large-scale deployment of geoengineering techniques, in order to understand both potential benefits and drawbacks more fully.

Focus on Mitigation and Adaptation: Segment of the US public have advocated that the focus should remain on mitigation (reducing greenhouse gas emissions) and adaptation (adjusting to impacts of climate change) rather than geoengineering as a solution.

Global Cooperation and Governance: US citizens that understand the impact have called for international cooperation and governance frameworks to oversee any large-scale geoengineering efforts.

INFORMATION:

1. Williams, Aime, and Alice Hancock. 2023. "Title of the Article (if provided)." Financial Times US, September 1. <https://ft.pressreader.com/v99e/20230901/281831468302353>.
2. Simon, Matt. 2022. "The Nightmare Politics and Sticky Science of Hacking the Climate." Wired, June 22. <https://www.wired.com/story/the-nightmare-politics-and-sticky-science-of-hacking-the-climate/>.
3. Voosen, Paul. 2023. "'We're changing the clouds.' An unintended test of geoengineering is fueling record ocean warmth." Science.org, August 2, 3:00 PM ET. <https://www.science.org/content/article/changing-clouds-unforeseen-test-geoengineering-fueling-record-ocean-warmth>.
4. The Independent. 2023. "Some scientists want to hack the planet to cool it down – and the consequences could be extreme." The Independent, August 5. <https://www.independent.co.uk/tech/geoengineering-climate-change-solar-b2386525.html>.
5. The White House. 2023. CONGRESSIONALLY MANDATED RESEARCH PLAN AND AN INITIAL RESEARCH GOVERNANCE FRAMEWORK RELATED TO SOLAR RADIATION MODIFICATION, June. <https://www.whitehouse.gov/wp-content/uploads/2023/06/Congressionally-Mandated-Report-on-Solar-Radiation-Modification.pdf>.
6. Intergovernmental Panel on Climate Change, Working Group I. 2021. Climate Change 2021: The Physical Science Basis. Contribution to the Sixth Assessment Report. https://report.ipcc.ch/ar6/wg1/IPCC_AR6_WGI_FullReport.pdf.
7. Versen, Joseph, Zaruhi Mnatsakanyan, and Johannes Urpelainen. 2021. "Preparing the United States for security and governance in a geoengineering future." Brookings, December 14. <https://www.brookings.edu/articles/preparing-the-united-states-for-security-and-governance-in-a-geoengineering-future/>.
8. Neptune. (2023). Atmospherics. Retrieved from Neptune Portal.

TECHNOLOGY:

1. Midjourney. [Artwork and Images] (2023). <https://www.midjourney.com/>
2. OpenAI. (2023). [ChatGPT response to prompts about Geoengineering]. <https://chat.openai.com/?model=gpt-4>
3. Google Bard. (2023). [Bard response to prompts about Geoengineering]. <https://bard.google.com/>
4. Claude AI. (2023). [Claude response to prompts about Geoengineering]. <https://claude.ai/chats>

