Geoengineering

By Mallory Barndollar

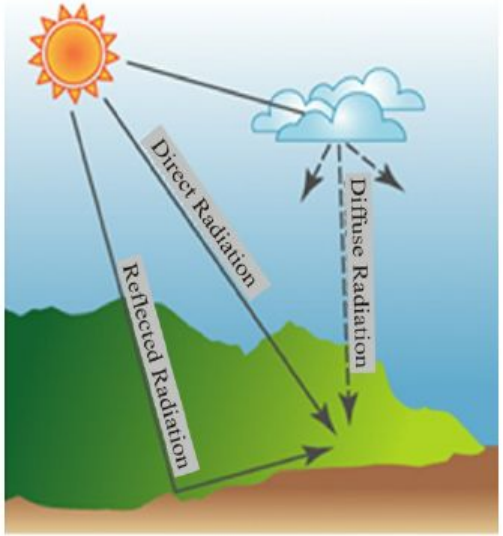
What is geoengineering?

Geoengineering: “the deliberate, large-scale intervention in the Earth’s natural systems to counteract climate change”

Two Main Methods:

Solar Radiation Management

Carbon Dioxide Removal

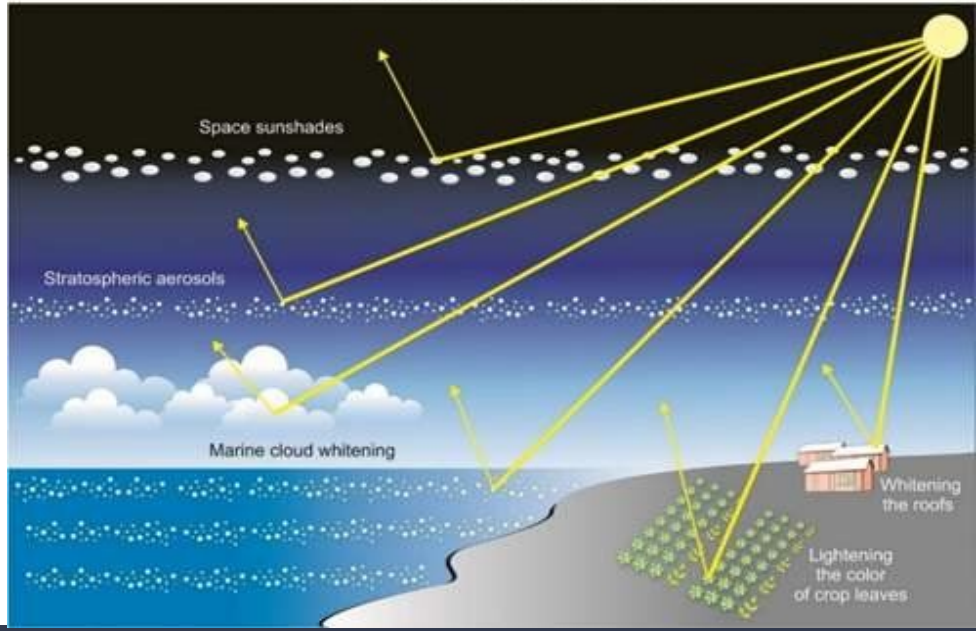


Why do we need geoengineering?

- **Climate Change Mitigation**
  - Global Temperature Cooling!
- Solar Radiation Management
  - Techniques to cool the planet by reflecting solar energy back into space
- Carbon Dioxide Removal
  - Techniques to remove CO2 from the atmosphere directly

Solar Radiation Management

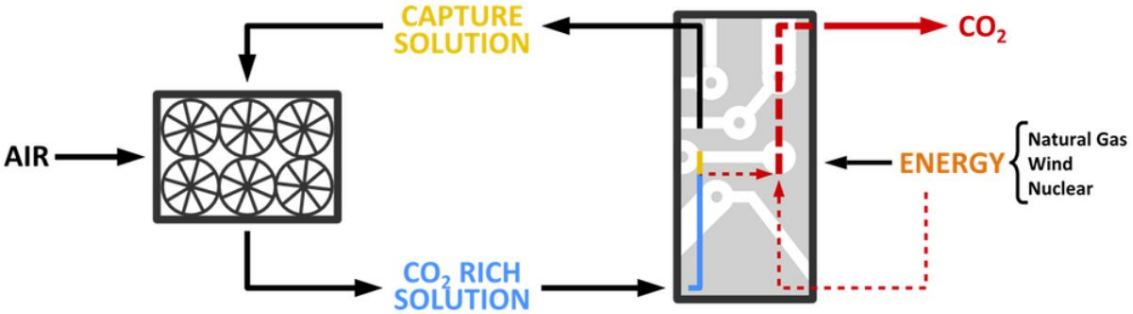
1. **Albedo Modification**
    a. Increasing the reflectivity of the Earth's surface to reflect more heat (clouds, roofs, etc.)
2. **Space Reflectors**
    a. Blocking incoming radiation before it enters the atmosphere
3. **Stratospheric Aerosols**
    a. Introducing small particles to help sunlight reflectivity in the atmosphere

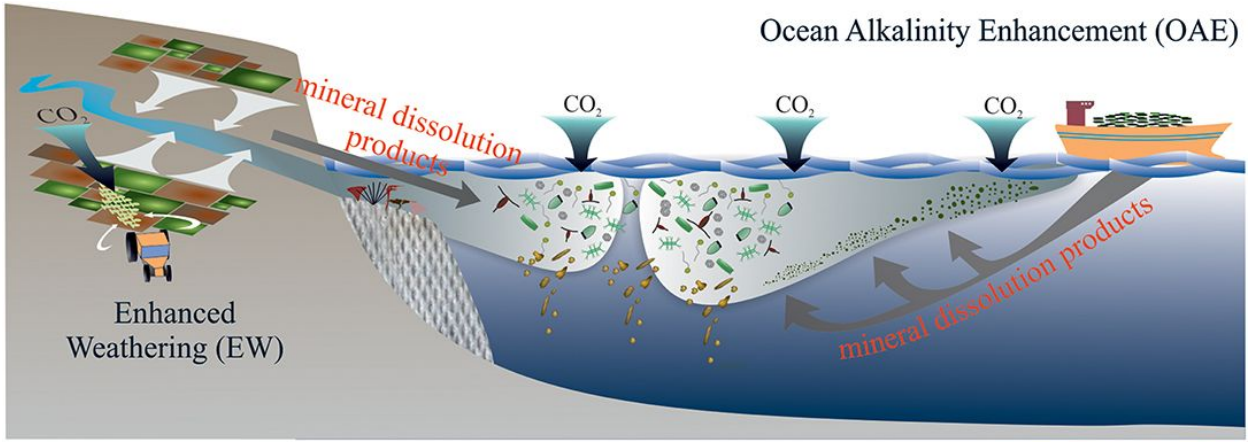


SRM Strategies

Carbon Dioxide Removal

1. **Ambient Air Capture**
    a. Constructing large machines that will remove CO2 directly from the atmosphere
2. **Ocean Enhancement**
    a. Fertilization: adding nutrients to the ocean to increase primary production
    b. Alkalinity: dissolving rocks in the ocean to increase its carbon sequestration capacity
3. **Enhanced Weathering**
    a. Exposing minerals that will react with CO2 in the atmosphere to then be stored in the ocean/soil





CDR Strategies

Discussion

Large Group

Main Questions:

1. For solar radiation management, do any strategies stand out to you? Good or bad?

2. For carbon dioxide removal, do any strategies stand out to you? Good or bad?

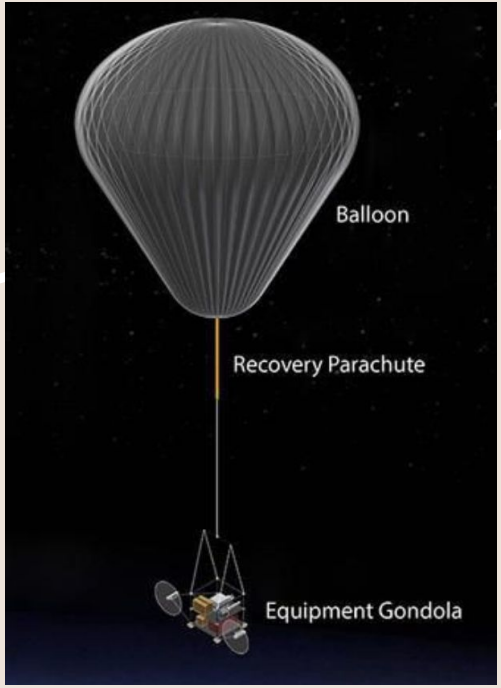
3. If you had to pick a method, would you as a policymaker prefer SRM or CDR?

Stratospheric Aerosol Injection

A Controversial Approach to Geoengineering

SAI Overview

- Why was this strategy proposed in the first place?
  - Simulation of post-volcanic eruption events
  - Mimicking natural climate cooling strategies
- What is being injected into the atmosphere?
  - Sulfur Dioxide (SO2)
- Why would this method help reduce solar radiation?
  - Inorganic particles to reflect sunlight
  - Reduces global surface temperatures



How would this work?

Methods of Dispersal

1. Lofted Balloons
2. Military Planes
3. Artillery Guns
4. Sky Hoses

Timeline

- Dispersed over time, also needs to be terminated slowly
- Termination Shock
  - Once this project starts, if it is stopped abruptly it could raise temperatures
- Programs project through 2100

What do you think?

What are some pros and cons you can identify? Type in the chat or unmute yourself!

PROS and CONS

PROS

- Reduction in solar radiation
  - Sea level rise decrease, slow ice melting
- No land use conflicts
- Hurricane reduction
- Relatively inexpensive
- Alternative aerosols
- Little infrastructure needed

CONS

- Governance
- Drought
- Ozone depletion
- Termination shock
- Public health
- Moral hazard
- Less sunlight

Discussion

Large Group

1. Why do you think geoengineering is such a divisive topic?

2. As a policymaker, would you approve of a stratospheric aerosol injection plan?

3. How does global governance and politics play a role in efficiency and efficacy?

Any final thoughts or questions?

- http://www.geoengineering.ox.ac.uk/www.geoengineering.ox.ac.uk/what-is-geoengineering/what-is-geoengineering/
- https://link.springer.com/content/pdf/10.1007/s10584-011-0027-7.pdf
- https://www.nature.com/articles/nclimate2882
- https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2009GL039209
- https://www.ucsusa.org/resources/what-climate-engineering
- https://www.geoengineeringmonitor.org/2021/02/stratospheric_aerosol_injection/
- https://www.smithsonianmag.com/science-nature/risks-rewards-possible-ramifications-geoengineering-earths-climate-180971666/
- https://iopscience.iop.org/article/10.1088/1748-9326/aba7e7/meta

Bibliography

Thank you!