Geoengineering

Geoengineering

Definition: The deliberate large-scale manipulation of an environmental process that affects the earth's climate, in an attempt to counteract the effects of global warming.

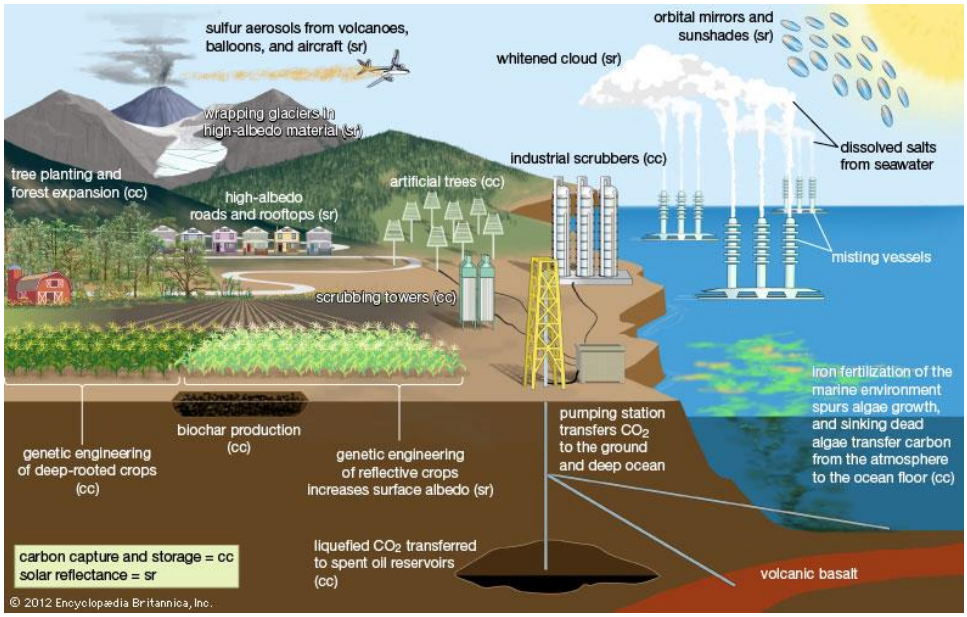
- Use technology to manipulate the environment

- Video Link: http://bit.ly/2oZJLXJ

SCIENCE & TECHNOLOGY 9 DECEMBER 2015

Geo-engineering no quick fix for climate change

New unproven technologies to halt global warming could well make our climate woes worse.


sulfur aerosols from volcanoes, balloons, and aircraft (sr)
orbital mirrors and sunshades (sr)
whitened cloud (sr)
wrapping glaciers in high-albedo material (sr)
dissolved salts from seawater
industrial scrubbers (cc)
tree planting and forest expansion (cc)
artificial trees (cc)
high-albedo roads and rooftops (sr)
misting vessels
scrubbing towers (cc)
iron fertilization of the marine environment spurs algae growth, and sinking dead algae transfer carbon from the atmosphere to the ocean floor (cc)
biochar production (cc)
pumping station transfers CO_2 to the ground and deep ocean
genetic engineering of deep-rooted crops (cc)
genetic engineering of reflective crops increases surface albedo (sr)
carbon capture and storage = cc
solar reflectance = sr
liquefied CO_2 transferred to spent oil reservoirs (cc)
volcanic basalt
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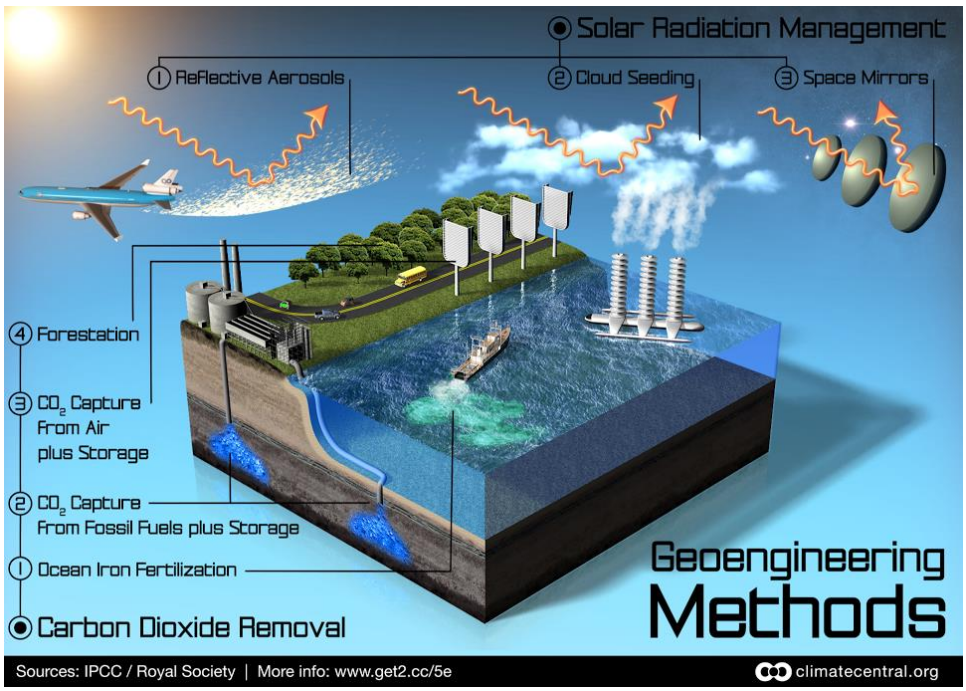

Solar Radiation Management
1 Reflective Aerosols
2 Cloud Seeding
3 Space Mirrors
4 Forestation
3 CO_2 Capture From Air plus Storage
2 CO_2 Capture From Fossil Fuels plus Storage
1 Ocean Iron Fertilization
Carbon Dioxide Removal
Geoengineering Methods
Sources: IPCC / Royal Society | More info: www.get2.cc/5e
climatecentral.org

Cloud Seeding

- A form of weather modification, a way of increasing precipitation, by dispersing substances into the air that serve as **cloud** condensation nuclei
  - Idea: More clouds → More rain
  - Usually the substance silver iodide is used
  - Regional scale
  - Uneven evidence of if/how effective cloud seeding is

L.A. officials seeded clouds during El Niño storm in hopes of more rain

Cloud Seeding, Reno, Nevada

Cloud Brightening

- Shoot salt water high into the sky over the oceans, creating clouds that reflect sunlight and thus counter global warming
- Adding particles, in this case sea salt, to the sky over the ocean would form large, long-lived clouds
- Clouds appear when water forms around particles - adding more particles creates more, but smaller, droplets
- A greater number of smaller drops has a greater surface area, so the clouds reflect a greater amount of light back into space

A conceptualized image of an unmanned, wind-powered, remotely controlled ship that could be used to implement cloud brightening

Solar Radiation Management (SRM)

- Idea – block incoming solar radiation, leading to cooler planet
- Method: Disperse sulfur aerosols into the stratosphere
  - Planetary-scale

US geoengineers to spray sun-reflecting chemicals from balloon

Experiment in New Mexico will try to establish the possibility of cooling the planet by dispersing sulphate aerosols

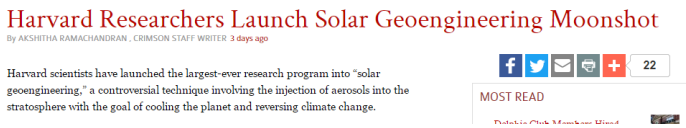
The field experiment in solar geoengineering aims to ultimately create a technology to replicate the observed effects of volcanoes that spew sulphates into the stratosphere. Photograph: Gallo Images/Getty Images

› CLIMATE

Harvard Researchers Are Preparing to Geoengineer the Atmosphere

In a first-of-its-kind study, scientists will disperse aerosols into the stratosphere in initial tests of a controversial technique for blocking incoming solar radiation.

BY GREG WALTERS · APRIL 11, 2017 · 8:19 AM EDT



Harvard Researchers Launch Solar Geoengineering Moonshot

By AKSHITHA RAMACHANDRAN , CRIMSON STAFF WRITER 3 days ago

Harvard scientists have launched the largest-ever research program into "solar geoengineering," a controversial technique involving the injection of aerosols into the stratosphere with the goal of cooling the planet and reversing climate change.

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MOST READ

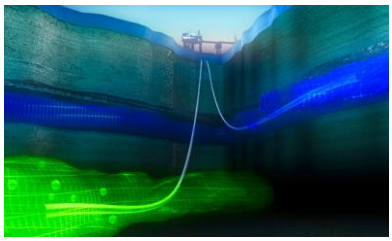
Volcano Effect

- When volcanoes erupt, they release particles of dust and ash, sulfur dioxide, and greenhouse gases into the atmosphere
  - These particles shade sunlight → temporary cooling
- Sulfur dioxide is much more effective than ash particles at cooling the climate
  - Sulfur dioxide moves into the stratosphere and combines with water to form sulfuric acid aerosols
  - Sulfuric acid makes a haze of tiny droplets that reflects incoming solar radiation → cooling

A huge cloud of volcanic ash and gas rises above Mount Pinatubo, Philippines, on June 12, 1991. Three days later, the volcano exploded in the second-largest volcanic eruption on Earth in the 20th century. Credit: USGS

Carbon Capture & Storage (CCS)

- Capture carbon dioxide (CO_2) emissions and store them so that they are unable to enter the atmosphere
- Possible locations for storing carbon: former gas and oil fields, deep saline formations or depleting oil fields
- Once injected into the rock, the CO_2 will move up through the microscopic pores within the rock where it will become indefinitely trapped within the formation

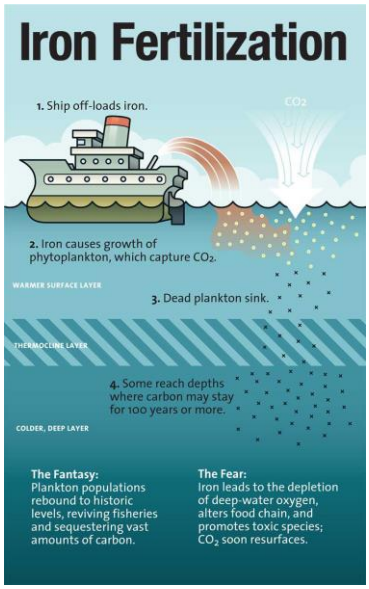


IPCC report proposes sucking carbon out of the air as climate fix

Technique of burning biomass then pumping released carbon underground included in leaked draft from UN climate panel

Ocean Fertilization

- Iron fertilization is the intentional introduction of iron to the upper ocean to stimulate a phytoplankton bloom
- This is intended to enhance biological productivity, which can benefit the marine food chain in hopes of increasing carbon dioxide removal from the atmosphere



Space Mirrors

- Reflect sunlight back into space → cooling