

The Use of Climate Engineering and Climate Change Law

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Houston, Texas
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Geoengineering trials get under way

Updated 17:10 14 September 2011 by [Michael Marshall](#)

Magazine issue [2829](#).



Volcanic ash inspires sunshade (Image: Arctic Images/Corbis)

- **Update 14 September 2011:** *The field test will be conducted at an abandoned airfield in Sculthorpe, UK. Matthew Watson of the University of Bristol, UK, presented details of the project at the [British Science Festival](#) in Bradford, UK.*

Field trials for experiments to engineer the climate have begun. Next month a team of UK researchers will hoist one end of a 1-kilometre-long hose aloft using a balloon, then attempt to pump water up it and spray it into the atmosphere.

US scientists launch world's biggest solar geoengineering study

Research programme will send aerosol injections into the earth's upper atmosphere to study the risks and benefits of a future solar tech-fix for climate change



Scientists say the planet could be covered with a solar shield for as little as \$10bn a year. Photograph: ISS/Nasa

Arthur Neslen

Friday 24 March 2017 08.39 EDT

US scientists are set to send aerosol injections 20km up into the earth's stratosphere in the world's biggest solar geoengineering programme to date, to study the potential of a future tech-fix for global warming.

In the news...



Climate Intervention: Reflecting Sunlight to Cool Earth

Committee on Geoengineering Climate:
Technical Evaluation and Discussion of Impacts

Board on Atmospheric Sciences and Climate

Ocean Studies Board

Division on Earth and Life Studies

In the news...



COMMITTEE ON
SCIENCE, SPACE, & TECHNOLOGY
Lamar Smith, Chairman

For Immediate Release
November 8, 2017

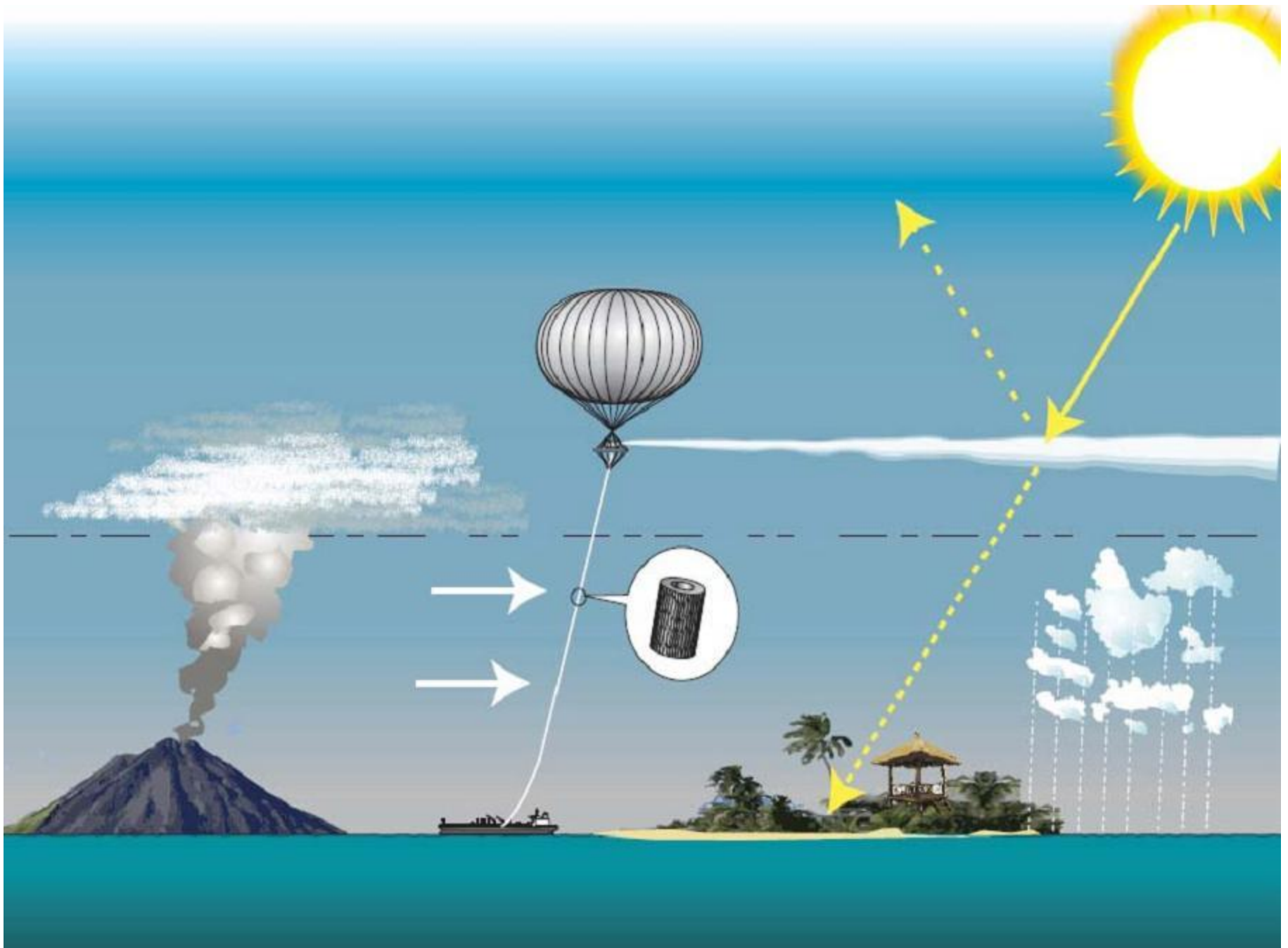
Media Contacts: Thea McDonald, Brandon VerVelde
(202) 225-6371

Statement from Chairman Lamar Smith (R-Texas)
Geoengineering: Innovation, Research, and Technology

Chairman Smith: First, I want to thank you, the Chairman of the Environment Subcommittee, and the Chairman of the Energy Subcommittee, Rep. Weber of Texas, for holding this important hearing, and Rep. McNerney of California for his persistent interest in this subject.

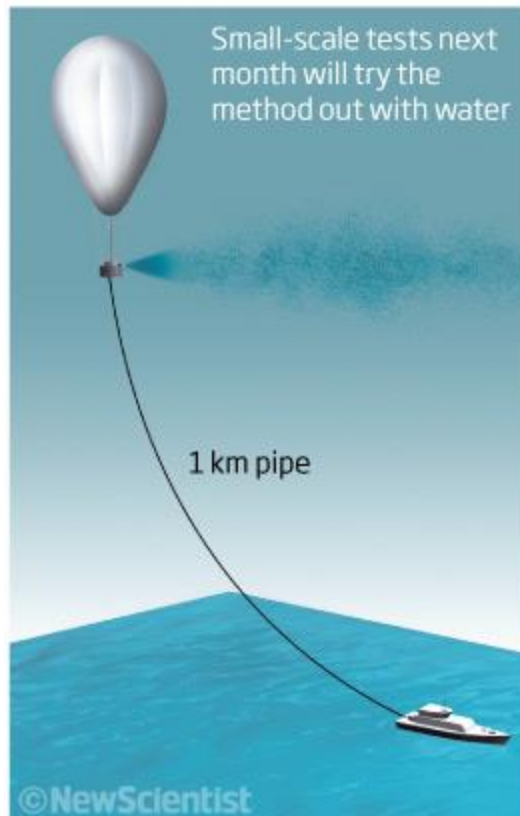
Geoengineering's potential is worth exploring. Generally, we know that the technologies associated with geoengineering could have positive effects on the Earth's atmosphere.

These innovations could help reduce global temperatures or pull excess greenhouse gases out of the atmosphere.



Longest garden hose

All it takes to create an atmospheric sunshade is a balloon and a very long pipe spraying sulphate aerosols



Climate Change and The Search for Solutions



- Climate Change – a “Super Wicked” Problem
 - Requires collective action, already accumulated CO₂ “debt”
 - Immediate sacrifice for remote gains by future generations
 - Justice and equity concerns
- Not surprisingly, difficult to achieve consistent and coordinated action
 - No domestic U.S. legislation; limited mitigation under current laws
 - Paris Agreement and Trump Administration withdrawal
 - Further major international or domestic action unlikely soon
- Some have proposed geoengineering or climate engineering as an important fall-back strategy



Geoengineering - “Plan B”?

- Geoengineering is

the deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change

- Treated as a fringe subject for decades, and still controversial
- Key turning point: proposal by Dr. Paul Crutzen in 2006

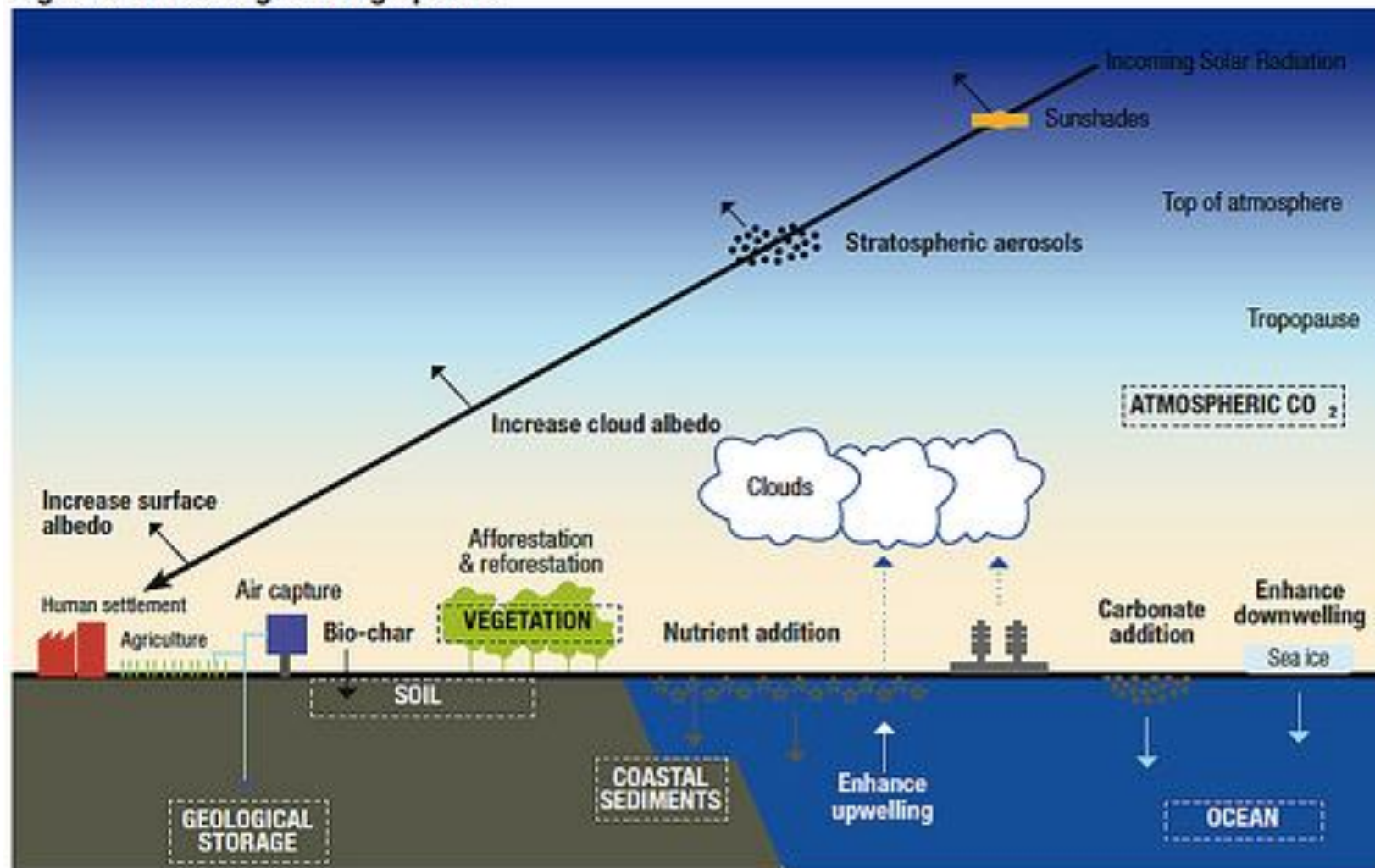


Types of Climate Engineering



- Solar Radiation Management
- Carbon Dioxide Removal
- Sink Temperature Management
- Regional Chemical Strategies

Figure 5.4: Geoengineering options



Solar Radiation Management



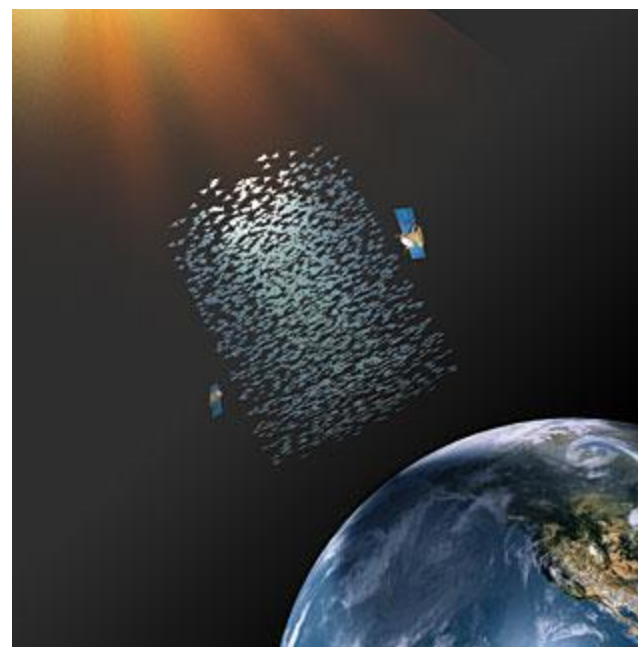
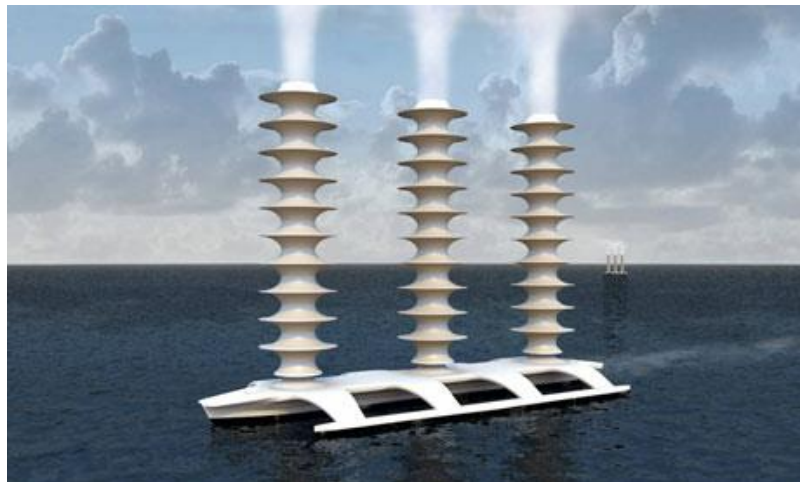
- Focus on reducing the amount of solar energy reaching the Earth's surface
- Key examples
 - Stratospheric aerosol releases
 - Cloud whitening
 - Surface albedo enhancement
 - Satellite reflectors

Stratospheric Aerosol Releases



- Mimics global cooling caused by volcanic eruptions
- Effectiveness: half-ounce of SO₂ offsets one ton of CO₂
global temperatures reduced by 2 degrees C
- Requirements: 5 million tons of SO₂ annually
\$1 billion to \$50 billion annually

Other Solar Radiation Management Options





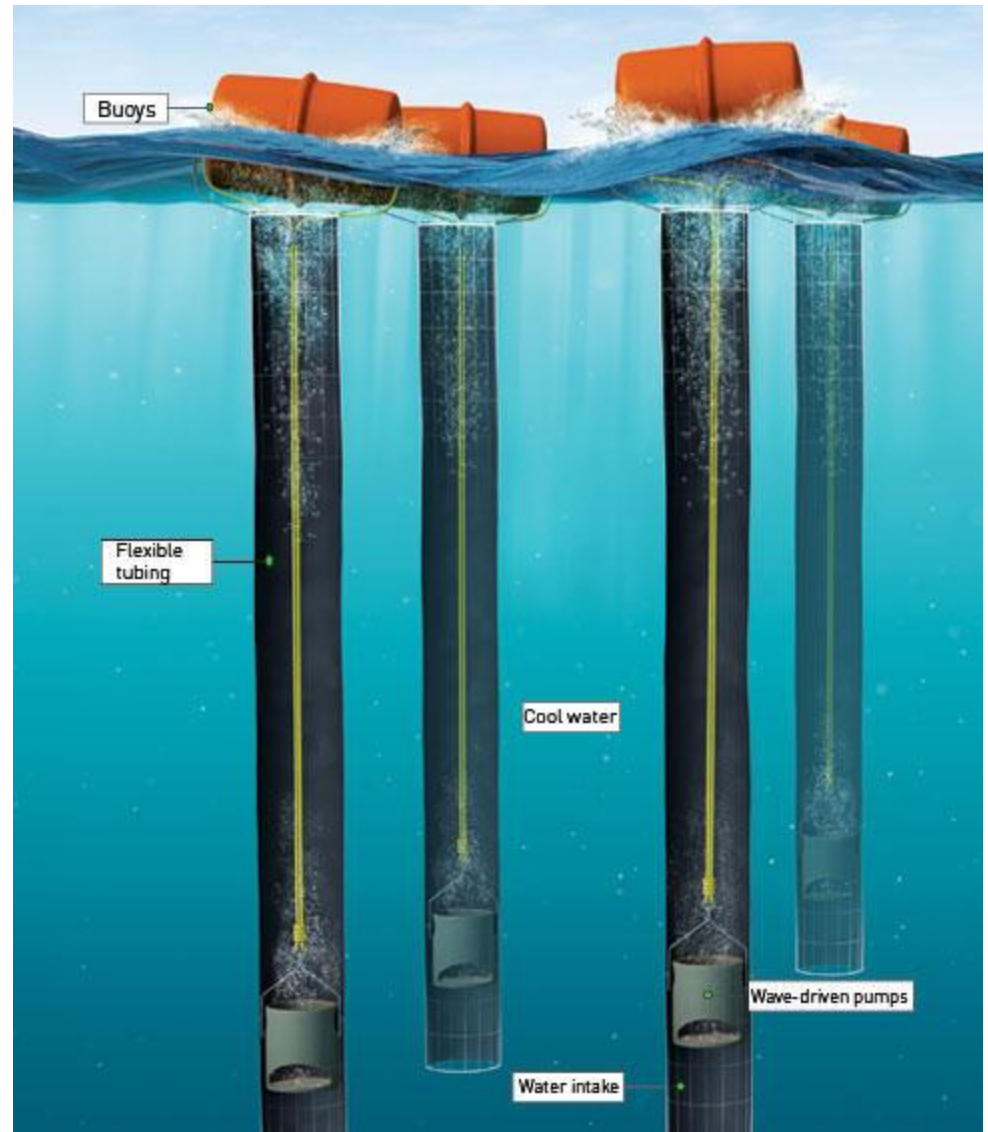
Carbon Dioxide Management

- Enhance absorption of carbon dioxide and other greenhouse gases from atmosphere
- Techniques:
 - Afforestation
 - Ocean fertilization
 - Mechanical removal of CO₂
 - Biochar



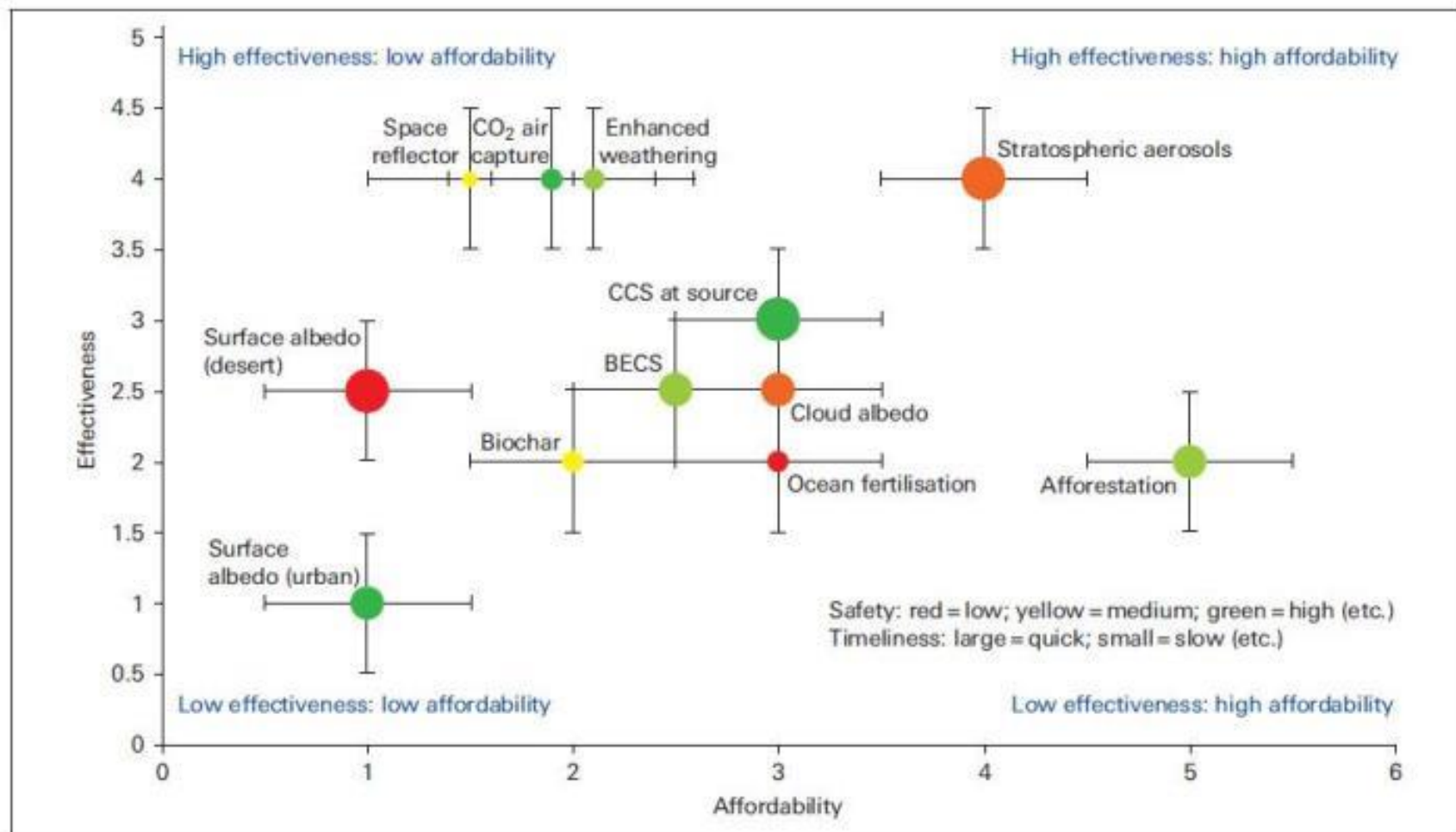
Heat Sink Temperature Management

- Evens out temperature differences that can drive disruptive weather and water events
- Example: ocean heat pumps driven by wave energy





Comparison of Climate Engineering Options and Risks



What International Laws Might Apply to Climate Engineering Projects?



- UNFCCC and the Paris Agreement
- Convention on Biological Diversity
- London Convention and London Protocol
- UNCLOS, ENMOD, Space Treaty, treaties related to polar regions
- Customary International Law

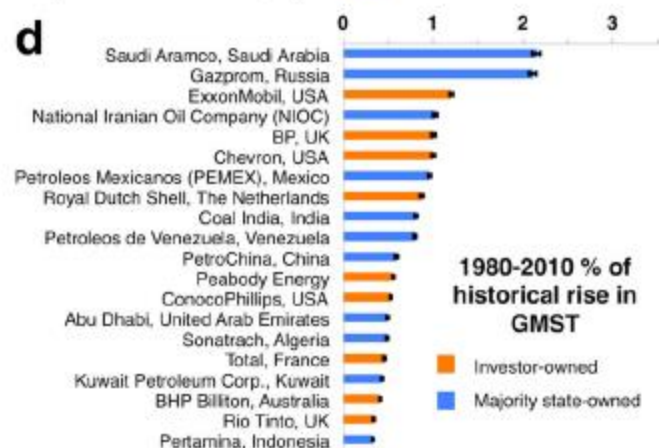
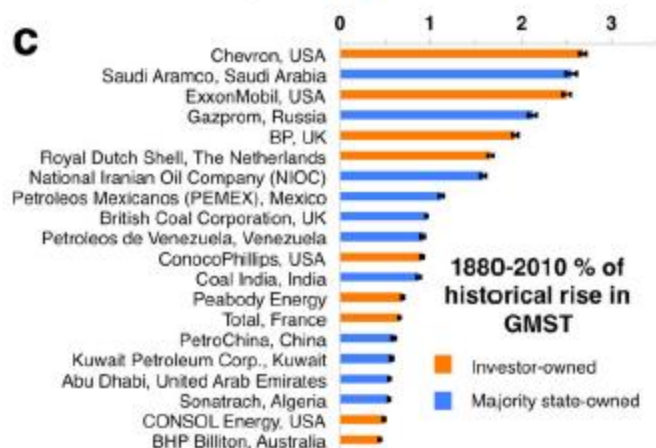
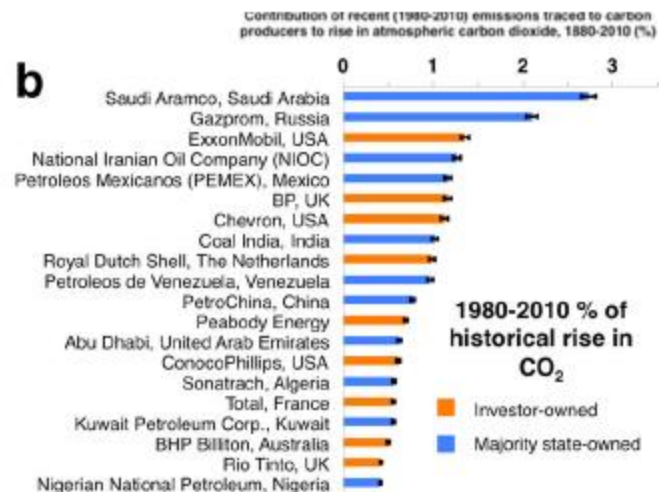
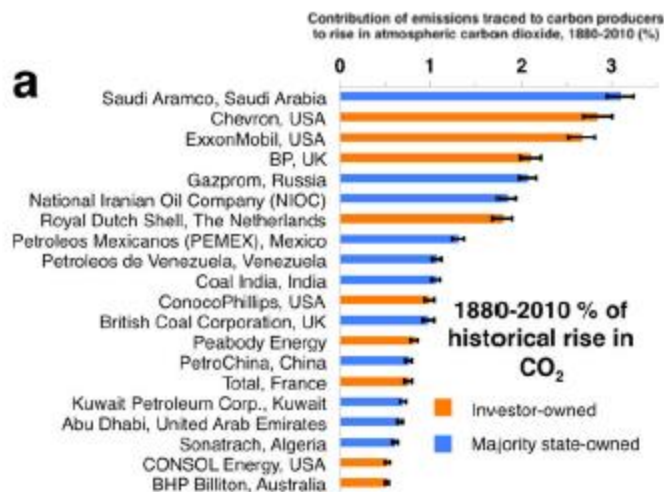
Problems: Treaties may not be ratified by important parties, are focused on sovereigns, and are difficult to enforce

Another possible tool for climate engineering governance: domestic law



- Logical that stakeholders would turn to national laws if international law cannot offer immediate relief.
- Acknowledges that climate engineering is already regulated – albeit indirectly, unintentionally and in highly fragmented way

http://www.youtube.com/watch?feature=player_embedded&v=s2unEYk9XnY&t=82



Levels of Domestic Law that Could Apply to Climate Engineering

Level one – sue in national court system to enforce an international legal obligation that might apply to climate engineering project.

- Some national laws directly incorporate international legal obligations (e.g., U.S. considers customary international law as federal common law)
- Problems:
 - Limited ability for private parties to bring claims
 - Act of State doctrine
 - Ability of legislature to override domestic obligations under international law
 - Justiciability (political question doctrine)

Levels of Domestic Law that Could Apply to Climate Engineering

Level two – sue to claim that national environmental, natural resource or safety laws apply to the climate engineering project

- In U.S., could include Clean Air Act, Clean Water Act, Endangered Species Act, CERCLA (“Superfund”), NEPA
- Special ability for private parties to sue over enforcement (citizen suits)
- Problems: standing, proving causation, procedural requirements for suits.
- State or local laws can impose stricter obligations and requirements.

Levels of Domestic Law that Could Apply to Climate Engineering

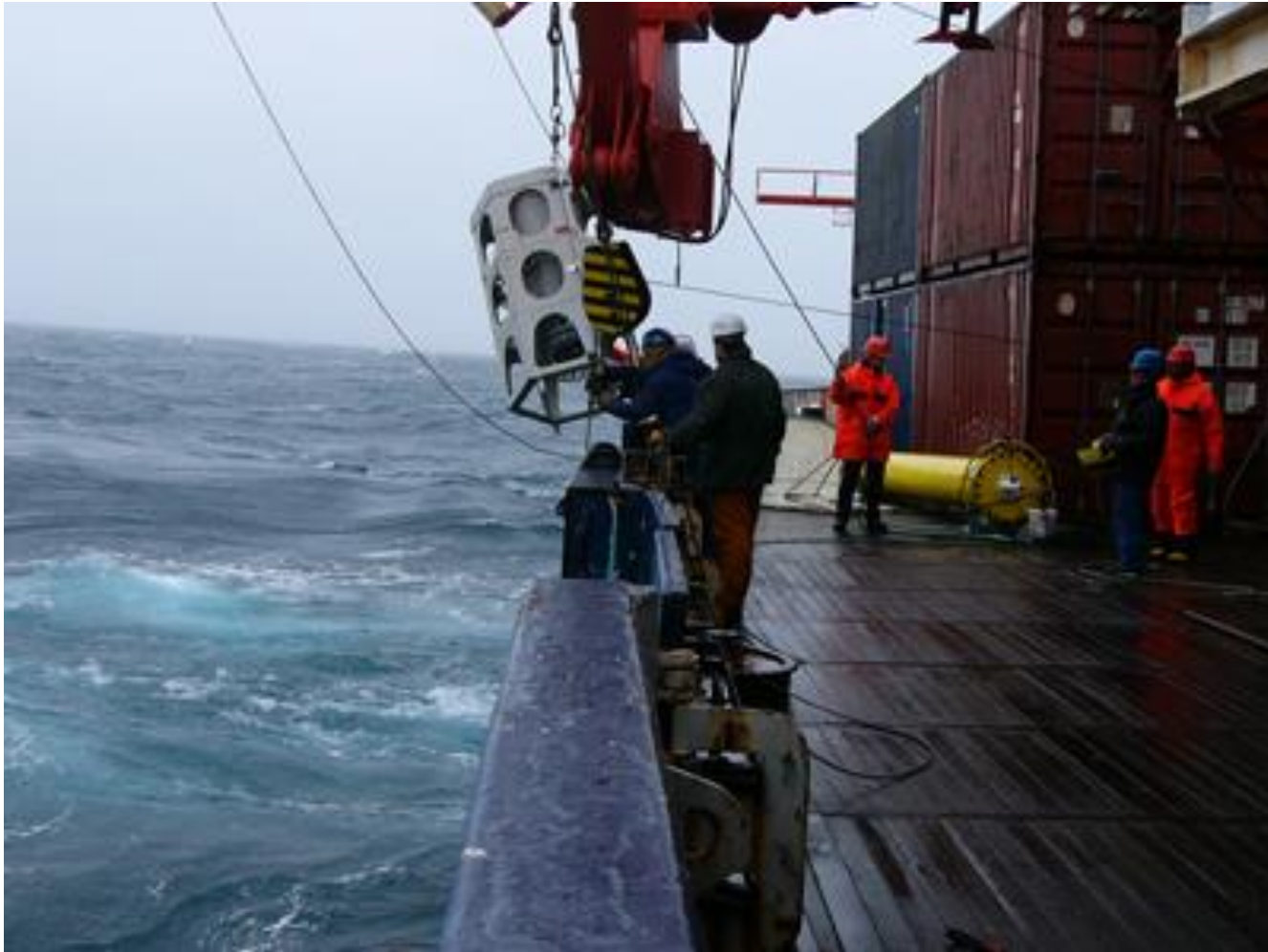
Level three - common law, typically tort or personal injury.

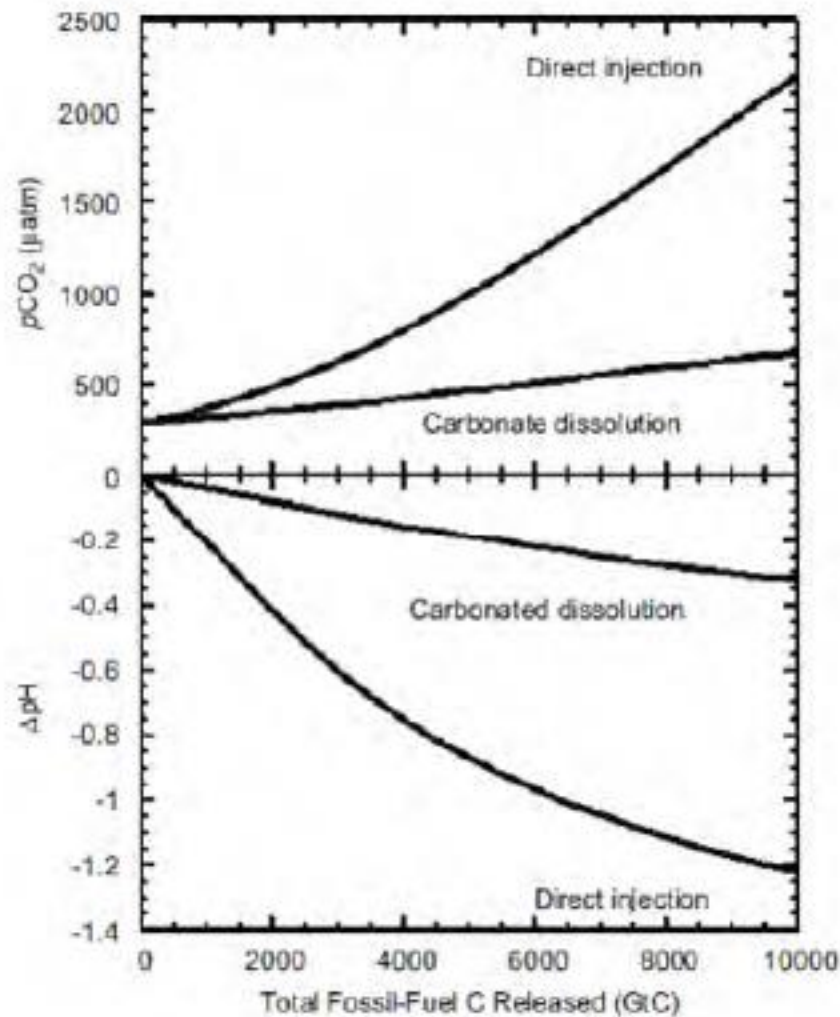
- Climate change torts have had little success in U.S. federal courts (standing, political question, displacement/preemption)
- May see new theories of liability in response (state law, public trust)

NOTE: All of these frameworks can shift dramatically if you make simple changes to the core facts of the climate engineering project.

- Who is doing the project? (governmental or private?)
- Where is the project being done?
- Exactly how is the project going to work?

Early legal tests: Ocean Iron Fertilization





Comparison of the effects on atmospheric CO_2 content (top panel) and on deep-ocean pH (bottom panel) 1000 years after the injection of the specified quantities of either molecular CO_2 or carbonate dissolution effluent into the deep-ocean (mean depth: 1950 m). If the ocean's anthropogenic carbon capacity

Haida Ocean Fertilization



100 tons of iron sulfate

Dispersed into coastal waters off British Columbia in July 2012

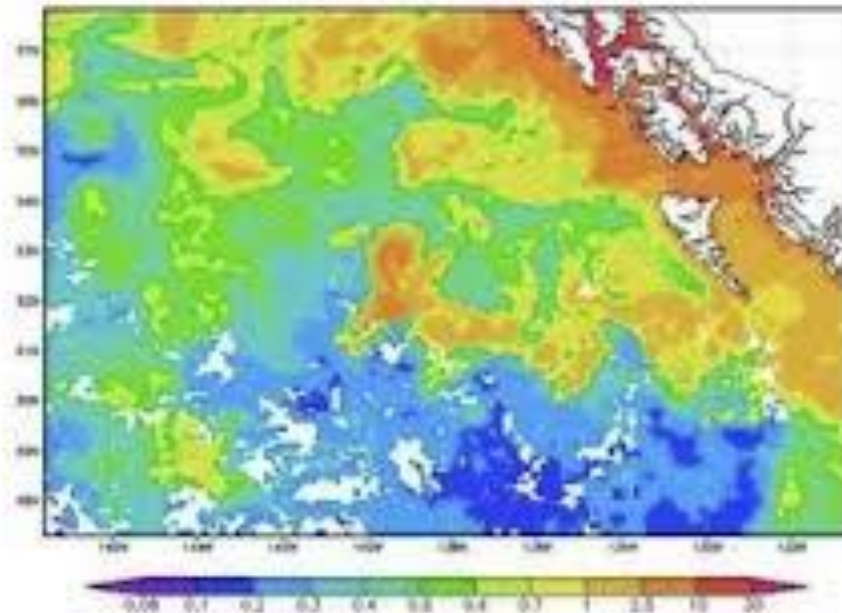
Plankton bloom and salmon runs

By Haida Salmon Restoration Corp.



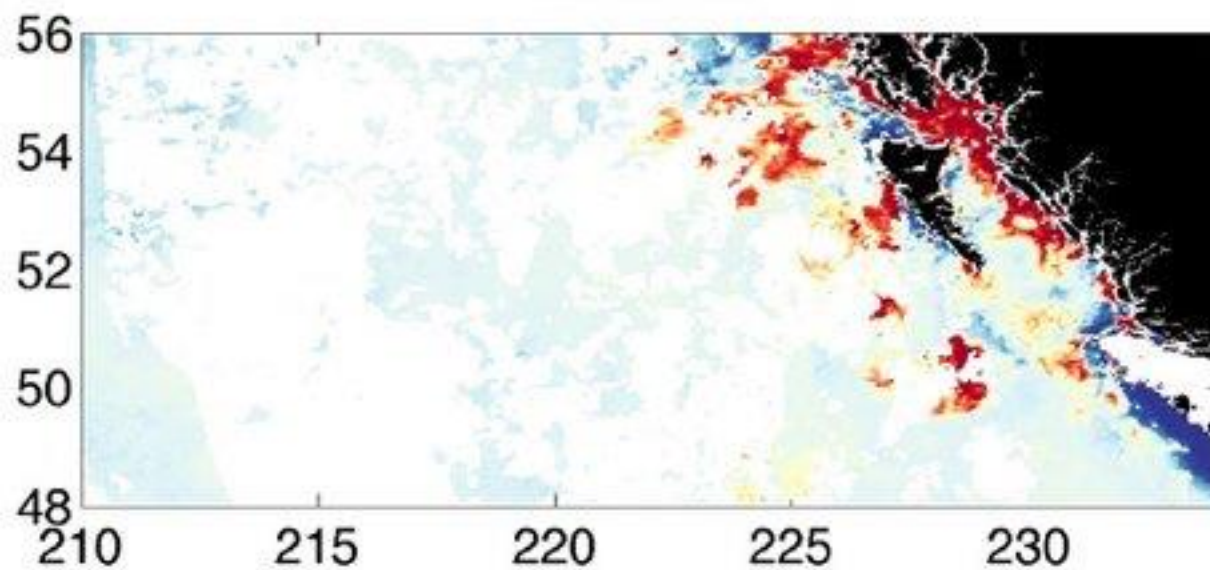
Search warrants
executed by Canada
Environment

Chlorophyll during August 2012 during Russ George
iron fertilization experiment

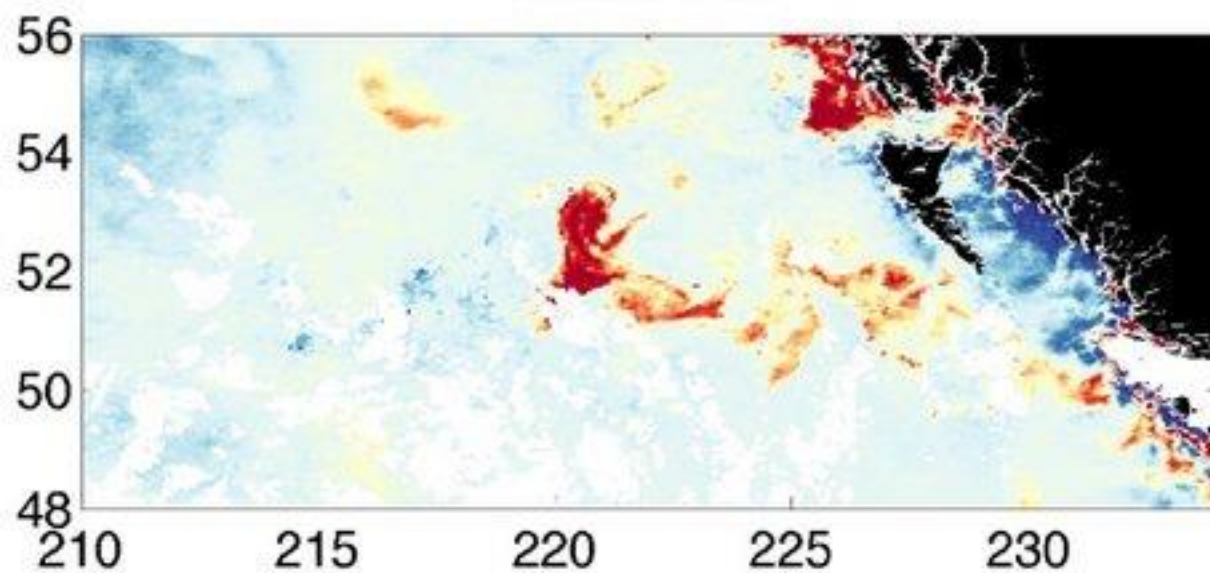


Originally planned to
renew iron fertilization in
2013; now halted

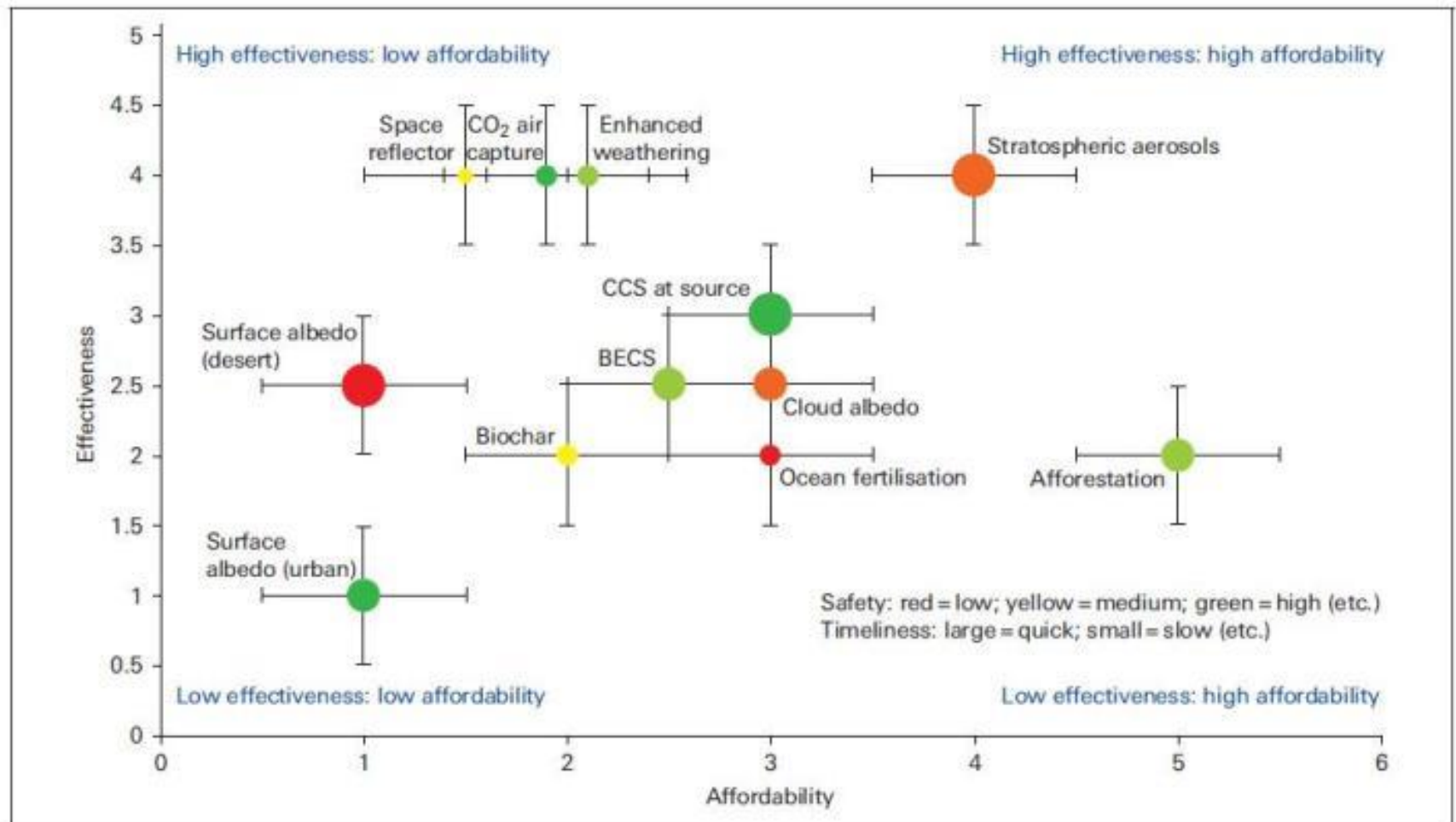
2012/JUL



2012/AUG



Recasting Climate Engineering Risks as Legal Hotspots



So What Has Changed?

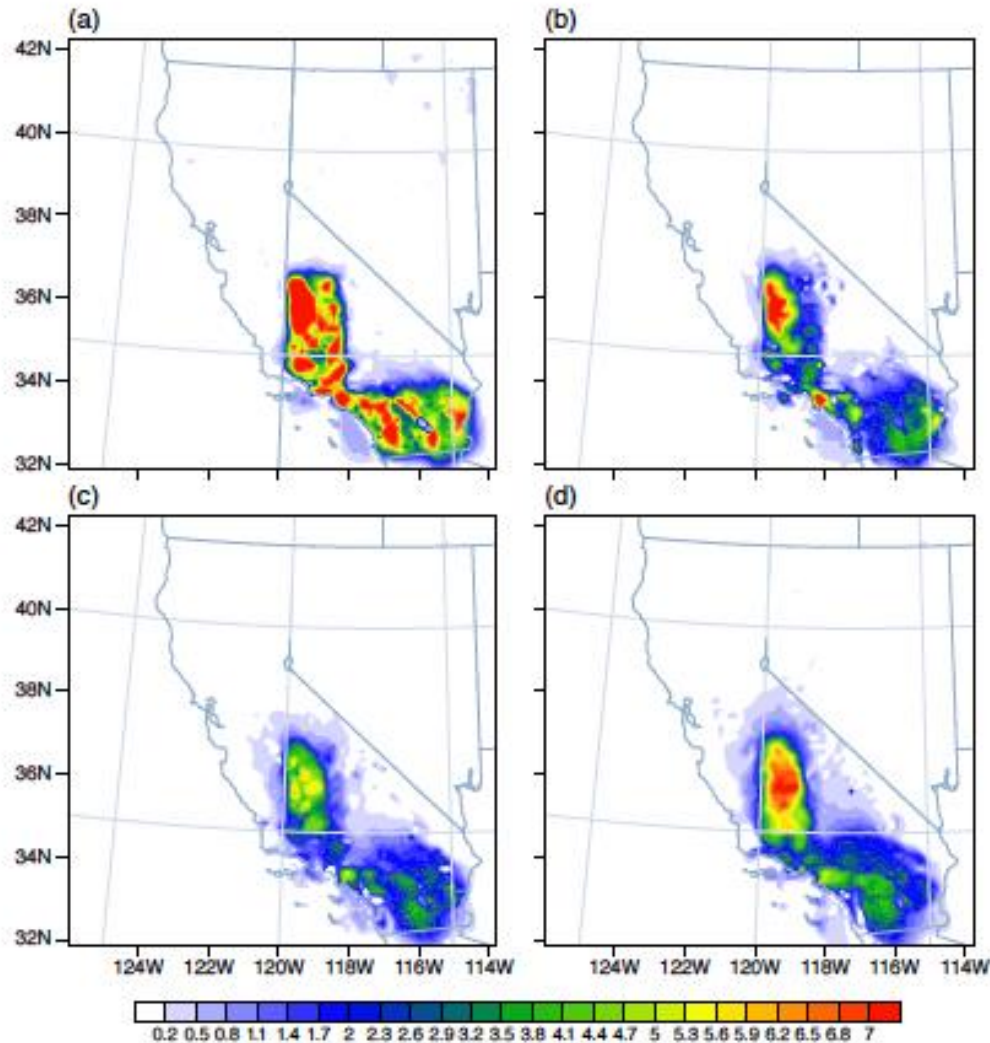
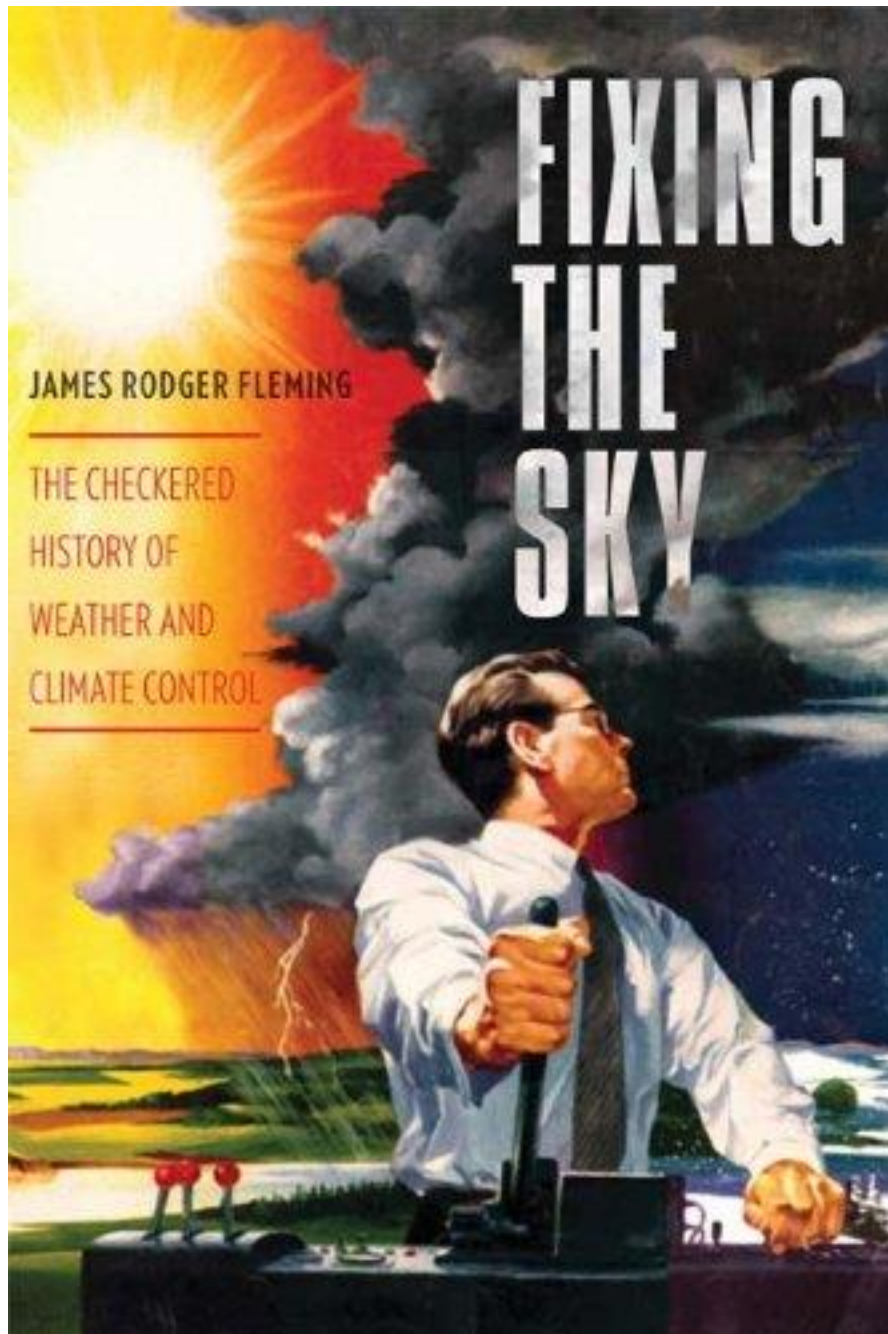


Fig. 12. Surface air temperature differences [$^{\circ}\text{C}$] on 22 July at hours (a) 10:00 LT, (b) 12:00 LT, (c) 14:00 LT, and (d) 16:00 LT for the smaller-scale injection experiments.



Future developments and domestic laws

- Climate attribution
- Regional climate engineering
- Unilateral regulation, or coordination of laws among nations
- Intellectual Property
- Rights of minorities and human rights implications

The Next Step

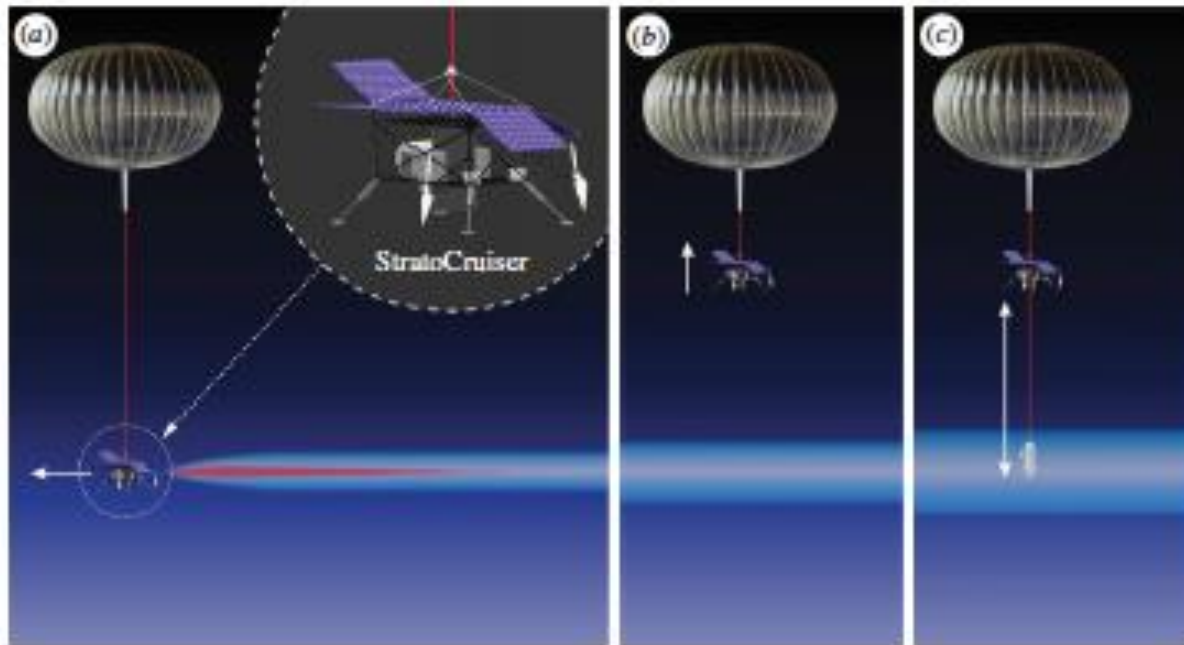


Figure 4. The concept of operations for the proposed experiment is initiated by seeding a 1 km length of stratospheric air with a combination of water vapour and sulfate aerosol using the propulsive capability of the StratoCruiser (a). Using a combination of its altitude and propulsive capabilities, the StratoCruiser manoeuvres past and above the seeded volume, which continues to expand owing to the turbulent wake generated by the propellers. The suspended instrument payload is reeled through the seeded volume to measure aerosols, water vapour and chemical species including HCl and ClO (b). The propulsion capability together with the LIDAR surveillance is used to track the seeded volume as it drifts with ambient wind and to make repeated measurements with the suspended payload, resolving the chemical evolution within the seeded volume as a function of time (c).



Questions?

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