- Accessibility
- Email alerts
- RSS feeds
- Contact us

www.parliament.uk

Search

- Home
- Parliamentary business
- MPs, Lords & offices
- About Parliament
- Get involved
- Visiting
- Education

- House of Commons
- House of Lords
- What's on
- Bills & legislation
- Committees
- Publications & records
- Parliament TV
- News
- Topics

You are here: Parliament home page > Parliamentary business > Publications and Records > Committee Publications > All Select Committee Publications > Commons Select Committees > Science and Technology > Science and Technology

The Regulation of Geoengineering - Science and Technology Committee Contents

---

Memorandum submitted by Dr Jason Blackstock (GEO 12)

THE INTERNATIONAL POLITICS OF GEOENGINEERING RESEARCH

EXECUTIVE SUMMARY

1. The recent scientific reviews of geoengineering found existing concepts to be fraught with uncertainties and potential negative side effects, making geoengineering unsuitable as an alternative to dramatic emission reductions.

2. As the global risk of unabated climate change could prove far worse than the risk of geoengineering, expanded research into geoengineering as a possible recourse for limiting at least the most severe potential climate change impacts is recommended.

3. A broadly accessible, transparent and international political process—one that particularly engages vulnerable developing countries—is needed to develop international regulation and coordination of geoengineering research. Such a process will necessarily take many years to develop and evolve, and should be informed by further scientific and socio-political research conducted in the interim.

4. Countries commencing geoengineering research prior to an internationally agreed framework being in place need to make voluntary commitments to full international collaboration and transparency. National geoengineering research that fails to make or meet such commitments could spark international mistrust over future intentions, and disrupt the already inadequate progress toward essential mitigation.

5. This remainder of this memorandum describes the two main categories of geoengieering, the main stages of research that may be undertaken for solar radiation management (SRM) geoengineering, and the international political issues each stage of SRM research might raise. The focus on SRM has been chosen because the international political issues it presents are more accute than for carbon dioxide removal (CDR) geoengineering (though the general issues raised should be considered for both categories).

ABOUT THE AUTHOR

6. Jason Blackstock is a scientist and international affairs scholar whose research presently focuses on evaluating the climatic and international political implications of geoengineering. He is a lead author of the report "Climate Engineering Responses to Climate Emergencies" (2009), a prominent scientific review study of solar radiation management geoengineering via stratospheric aerosol injection. Jason has received his Master of Physics (Edinburgh, 2001), his PhD in physics (Alberta, 2005), his Graduate Certificate in International Security (Stanford, 2006), and his Master of Public Administration (Harvard, 2008).

BACKGROUND CONTEXT

7. Despite mounting evidence that climate change could be more severe and rapid than estimated by the IPCC Fourth Assessment Report (AR4), progress toward globally reducing carbon emissions remains alarmingly slow. Concern over the global failure to act on climate change has been the dominant motivation behind scientists' recent convening of several prominent reviews of geoengineering—the intentional, large-scale alteration of the climate system—as a potential recourse for moderating the impacts of climate change. These scientific reviews (*particularly the Royal Society and Novim reports on geoengineering in 2009*) found existing geoengineering concepts to be fraught with uncertainties and potential negative side effects, making them unsuitable as an alternative to dramatic emission reductions. Nevertheless, they recommend greatly expanding research, as the risks of unabated climate change could prove far worse than the risks of geoengineering.

8. As geoengineering schemes are now attracting national political attention and research funding in several developed countries, the implications for international climate politics need to be carefully considered.[1] Similar to climate change, for many geoengineering schemes both the benefits and the potential risk of severe unintended consequences would be unequally distributed between regions or nations. As a result, national geoengineering research programs could spark international mistrust over future intentions, and serve to further disrupt the already inadequate progress toward essential mitigation commitments. To limit such tensions and preserve options for future cooperation, countries starting geoengineering research should make early preventive commitments to full international collaboration and transparency, and avoid any appearance of pursuing national interests at the expense of global public welfare.

GEOENGINEERING CONCEPTS

9. Geoengineering schemes can be divided into two categories, with very different characteristics: carbon dioxide removal (CDR) and solar radiation management (SRM). By removing the cause from the atmosphere, CDR schemes such as direct air capture or ocean fertilization would be effective at diminishing climate change impacts. But technical challenges and large uncertainties surrounding large-scale CDR deployment, along with the long delays in the climatic response to carbon forcing, mean it would take at least decades for CDR to have notable climatic effect. While important for long-term negative emission scenarios, CDR cannot offer rapid climatic influence if severe climate change manifests too quickly for adaptation to avoid substantial damages.

10. Conversely, SRM could substantially influence the climate in months—but with much greater uncertainty about the net climatic effects. SRM schemes such as stratospheric aerosols and cloud brightening aim to cool the planet by reflecting a fraction of the incoming sunlight away from Earth. Natural experiments caused by volcanoes have demonstrated the rapid impact potential of SRM, and the recent reviews show such schemes should be technically simple to deploy at low cost relative to mitigation. But these reviews also stress that SRM would at best unevenly ameliorate regional climatic change, and may generate serious unintended consequences. For example, SRM could produce droughts with severe implications for regional and global food production, and delay the recovery of the ozone layer by decades, while doing almost nothing to address ocean acidification. This makes SRM unsuitable as an alternative to mitigation.

GEOENGINEERING RESEARCH

11. In spite of the limitations and risks, avoiding SRM research would be a mistake. The ability to rapidly influence the climate means SRM might be the only recourse should a climate crisis materialize. Since severe climate change could bring about such national or regional crises within decades, prudence suggests we should improve our understanding of the likely feasibility, effectiveness and dangers of SRM interventions. Without prior research, uninformed and rash unilateral action by less responsible actors becomes more likely. Moreover, near-term authoritative research will help discredit ungrounded fringe claims that SRM could provide an alternative to dramatic near-term emission reductions. Finally, establishing good governance of SRM requires good understanding of the schemes and risks to be governed, which first requires research.

12. But who should conduct this research, how should it be managed and who would control any generated technologies? These are politically loaded questions with international significance, particularly given that the rapid impact, easy implementation and low cost characteristics of SRM schemes make unilateral deployment a very real possibility for a large number of countries.

13. The table below summarizes the stages of SRM research that could be undertaken, along with the environmental risks and political issues each raises. Until recently, SRM research had been limited to model studies published in the open literature. With no environmental impact and the generated knowledge being transparent and public, such research raises minimal political issues. The main critique of this research is that it could encourage complacency on mitigation by suggesting an illusory alternative. However recent research suggests the opposite may occur; by appearing frighteningly risky to the public, SRM might reduce such complacency by creating a desire to avoid needing it. But emerging stages of research may not prove so politically innocuous.

The Stages, Status and Political Issues for Solar Radiation Management (SRM) Geoengineering Research

Environmental Impacts	Stages of Research	*Description*	International Political and Governance Issues	*Current Status*
No Environmental Impact	Theory and Modelling	*Paper and computational studies of the anticipated climatic impacts of SRM.*	May reduce or enhance public motivation to rapidly mitigate carbon emissions. (7)	*Limited climate model studies of SRM are ongoing. Much more comprehensive modelling is called for by recent studies. (6,7)*
	Technology Development	*Laboratory development of SRM deployment technologies.*	Could create international tension over technology control and subsequent decisions regarding testing and use.	*Initial research on deployment technologies for the SRM schemes of stratospheric aerosol and cloud brightening have recently begun to emerge, including the first sub-scale field testing of aerosol deployment. (7,14)*
Negligible Environmental Impacts	Subscale Field Testing	*Feasibility testing of SRM deployment technologies at levels posing 'demonstrably negligible' environmental and transboundary risks.*	Could exacerbate these international tensions, particularly regarding decisions on acceptable scale of testing.	
	Internationally Agreed Definition of 'Demonstrably Negligible' Risks is Required			
Increasing Transboundary Environmental Impacts	Climate Impact Testing ? Low-Level Climatic Intervention	*Testing of the climatic impacts of SRM deployment, nominally at scales below actual deployment, but with notable transboundary environmental impacts.*	Could spark a "crisis of legitimacy" (13) if conducted without international approval. Presents challenging liability issues.	*No experiments have been seriously proposed or planned at this stage.*

Depiction of the level of environmental impacts and the type international political issues associated with each progressive stage of SRM research.

14. The increased scientific attention stratospheric aerosols and cloud brightening have been receiving has recently sparked the development and subscale field testing of SRM deployment technologies. Even lab-based development of SRM technologies raises the prospect that national or corporate interests might try (or just be perceived as trying) to control or profiteer from nascent SRM technologies. And a national security framing of emerging SRM research, especially if classified, would dangerously provoke such international perceptions. Nonetheless, in 2009 the U.S. Defense Advanced Research Projects Agency (DARPA) held a meeting to consider pursuing geoengineering research highlights the potential for such developments.

15. As technology development graduates to the stage of subscale field tests, these same issues could be further exacerbated—and the first such tests have very recently been conducted in Russia (Izrael, 2009). Field experiments designed to have demonstrably negligible environmental and transboundary risks are valuable for feasibility testing deployment technologies, and for exploring local-scale physical, chemical and biological interactions that could damage the environment when scaled up. But the signals that unilateral subscale tests, no matter how environmentally benign, might send to the international community need to be very carefully considered.

16. The controversy surrounding an Indo-German ocean fertilization (CDR) experiment conducted in early 2009 demonstrates the political sensitivities any geoengineering experiments can evoke (Nature Geoscience Editorial, 2009). At the core of this controversy was also the difficulty of defining politically acceptable (national and international) scientific standards and oversight mechanisms for ensuring the environmental and transboundary risks of nominally subscale geoengineering field tests are in fact "demonstrably negligible."

17. Robust understanding of SRM will eventually require tests with demonstrable climatic impacts. Confidence in SRM climate model predictions can only come from "poking" the climate system and comparing the predicted and observed responses. But due to the natural complexity and variability of the climate system, signal-to-noise issues will plague the attribution of climatic impacts and unintended consequences to a particular test. For any SRM scheme it might prove impossible to test for most impacts with "pokes" below a scale considered (at least politically) to constitute deployment of a low-level climatic intervention. And the testing of multiple SRM schemes by different groups would only further complicate the situation.

18. Attribution challenges also underlie another international political challenge facing SRM—that of liability for real or perceived damages. For example, if the Asian or African monsoon were to have a weak year following an SRM test—a year at the edge of natural variability, but still inducing droughts and food shortages—scientific uncertainty about causation may just exacerbate accusations of responsibility. There would almost certainly be a global "crisis of legitimacy" (Victor, 2009) should a SRM climatic impacts test be conducted without international approval. And since by definition any test would be an intentional act, even nominally subscale field tests could open the door for spurious diplomatic, political or legal disputes (however unscientific) over liability for alleged nonlocal damages.

CREATING NORMS AND REGULATION FOR GEOENGINEERING RESEARCH

19. Anticipation of unevenly distributed benefits and damages could easily steer any international discourse on development and testing of SRM technologies

into disputes over national interests. Nonpublic SRM research would exacerbate international mistrust about unilateral control, provoking such disputes and potentially sparking a proliferation of similarly closed programs. This could even encourage the development and unilateral testing of SRM schemes targeted to benefit specific regional climates, regardless of other impacts. And any such developments could prejudice many countries against cooperation on broader climate issues—including mitigation.

20. A valuable first step for addressing some of these issues will be the creation of international norms and best practices for scientists conducting geoengineering research. The upcoming Asilomar conference on Climate Intervention Technologies in March 2010 will bring together ~150 scientists to begin this process. However, for most political issues the truly relevant actors are not scientists, but rather the decision makers representing national (or corporate) interests. Questions regarding acceptable risks for subscale field tests, if/when/where climatic impacts testing should begin, or how and by whom SRM technologies should be managed, cannot and should not be answered by scientists alone. A broadly accessible, transparent and international political process is needed to address these issues—one that particularly engages vulnerable developing country perspectives thus far absent from SRM discussions. Whether existing frameworks could facilitate this, and what the target products should be (eg new treaties, organizations, etc), are open questions that urgently need both research and international stakeholder consideration.

21. To encourage international climate cooperation, countries beginning SRM research need to take early steps to encourage the collective international exploration of SRM as a possible means for insuring global public welfare in the face of highly uncertain climate change. This means making several preventive commitments. First, to foreswear climatic impacts testing—and very conservatively limit subscale field testing—until approved by a broad and legitimate international process. Second, to keep all SRM research, including generated knowledge and technologies, in the public domain. Third, to integrate all SRM research into any subsequent international research framework.

22. Given the preexisting mistrust on global climate issues, further steps should also be taken to foster international confidence and cooperation. National SRM programs should explicitly involve international scientists, particularly including those from vulnerable developing countries. More importantly, these programs should give priority to research on SRM schemes that may preserve global public welfare, rather than focusing on narrowly defined national interests.

23. As national geoengineering research emerges, these preventive steps cannot guarantee future climate cooperation. But they would at least limit the new problems this research heaps on the already strained global climate agenda.

BIBLIOGRAPHY

Blackstock, J J *et al.*, *Climate Engineering Responses to Climate Emergencies* (Novim, 2009), available at http://arxiv.org/pdf/0907.5140.

IZRAEL, Y A ET *AL.*, *RUSSIAN METEOROLOGY AND HYDROLOGY* 34, 265 (2009).

McMullen, C P and J Jabbour, Eds., *Climate Change Science Compendium 2009* (U.N. Environment Programme, Nairobi, 2009).

Nature Geoscience Editorial, *Nature Geoscience* 2, 153 (2009).

Shepherd J *et al.*, *Geoengineering the climate: science, governance and uncertainty* (The Royal Society, London, UK, 2009).

Victor, D G, *et al.*, *Foreign Aff.* 88, 64 (2009).

Dr Jason J Blackstock (jblackstock@cigionline.org)

Centre for International Governance Innovation, Canada (Fellow)

International Institute for Applied Systems Analysis, Austria (Research Scholar)

---

1 To the best knowledge of the author, as of the date of this memo, only the EU and (*separately*) the UK have formally announced national level funding for geoengineering research. Through its framework-7 programme, the EU has funded a multi-institutional research consortium for ~3yrs to computationally model the science and potential economics of solar radiation management concepts (see http://implicc.zmaw.de/for details). Through the Engineering and Physical Sciences Research Councils' Energy Programme, the UK has publicly announced £3 million research funding for geoengineering research. Back

Previous Contents Next

Commons Parliament Lords Search Enquiries Index

© Parliamentary copyright 2010 *Prepared 18 March 2010*

- A-Z index

- Glossary
- Contact us
- Freedom of Information
- Jobs
- Using this website
- Copyright