NTS ALERT

Consortium of Non-Traditional Security Studies in Asia

NTS Alert April 2011 (Issue 1)

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WHY WE NEED A DEBATE ABOUT GEOENGINEERING GOVERNANCE ... NOW

By Jochen Prantl

Geoengineering techniques are currently experiencing a surge of interest, as it has become widely accepted that global warming is both real and potentially problematic. The historical failure to control emissions and the possibility that so-called tipping points in the Earth's climate system are close to hand have generated a degree of urgency in efforts to research and implement potential solutions. The discourse has thus far been driven by scholarly communities in Europe and the US, and thus lacks perspectives from other key regions such as the Asia-Pacific. This has to change. As a region that may be significantly affected by climate change, Asia needs to have a voice in this emerging debate.

Casting a net on Mother Nature. Sea level rise and other impacts of climate change could threaten the livelihood of island communities, hence the recent interest in geoengineering.

Credit: UN Photo.

Contents:

Introduction

Geoengineering is 'the deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change' (The Royal Society, 2009:1). Geoengineering techniques are currently experiencing a surge of interest, as it has now become widely accepted that global warming is both real and potentially problematic.

The historical failure to control emissions and the possibility that so-called tipping points in the Earth's climate system are close at hand have generated a degree of urgency in efforts to research and implement potential solutions (Lenton et al., 2008). Those tipping points are held to have the potential to trigger runaway changes that are extremely difficult to control. The weakening of the North Atlantic Current and monsoon transformation as a result of massive shifts in atmospheric circulation are two examples often used to illustrate this point (German Advisory Council on Global Change, 2008).[1] Small island and coastal states, whether located in the tropics or other latitudes, have characteristics which could make them especially vulnerable to the effects of climate change such as sea level rise and extreme events (AOSIS, 2009).[2] According to some, climate change confronts us with the challenge of avoiding the

- **RSIS Centre for NTS Studies Website**

Recommended Citation: Prantl, Jochen, 2011, 'Why We Need a Debate about Geoengineering Governance … Now', *NTS Alert*, April (Issue 1), Singapore: RSIS Centre for Non-Traditional Security (NTS) Studies for NTS-Asia.

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unmanageable and of managing the unavoidable (SEG, 2007).

The new discourse has thus far been driven by scholarly communities in Europe and the US. The perspectives of key regions such as Africa and the Asia-Pacific have not been given much attention. As these are the regions that may be significantly affected by climate change, the situation has to change. These regions have to have a voice in the emerging debate.

This is the first NTS Alert in a two-part series aimed at introducing geoengineering to the Asia-Pacific discourse on climate change mitigation and adaptation. This NTS Alert first addresses the promise and problems of geoengineering. It then looks into the historical context of weather and climate control, which is essential to achieving a better understanding of the political and ethical challenges of geoengineering. The conclusion introduces a set of tentative rules and principles for geoengineering governance, with the aim of establishing a platform for further debate.

^ To the top

The Promise and Problems of Geoengineering

Geoengineering techniques can be split into two broad categories (Table 1). The first category comprises techniques aimed at the removal of carbon dioxide (CO2) from the atmosphere. An example would be the sequestering and locking of CO2 in geological formations, which includes direct methods such as CO2 air capture and indirect methods such as ocean iron fertilisation. The second category consists of techniques to reflect solar radiation, such as the injection of sulphate aerosols into the stratosphere to mimic the cooling effect caused by large volcanic eruptions.

Advocates of geoengineering have argued that it 'could provide a useful defense for the planet – an emergency shield that could be deployed if surprisingly nasty climatic shifts put vital ecosystems and billions of people at risk' (Victor et al., 2009:67).

However, it could also be argued that introducing geoengineering as the new Plan B to tackle climate emissions may create even greater problems, since the full effects of various geoengineering techniques are not well understood. As with many new technologies there is no general consensus that geoengineering is safe, appropriate or effective. Geoengineering could also be perceived as a moral hazard, as there is the possibility that it could decrease the political and social impetus to reduce carbon emissions. In other words, turning to geoengineering may come across as this generation's declaration of surrender in addressing one of humankind's most pressing problems.

Table 1: Geoengineering techniques.

Carbon Dioxide Removal (CDR) Techniques	**Solar Radiation Management (SRM) Techniques**
Direct methods, e.g., carbon dioxide air capture	Stratospheric aerosols
Indirect methods, e.g., ocean iron fertilisation	Space reflectors
↓	↓
Removing greenhouse gases from the atmosphere	**Offsetting effects of increased greenhouse gas concentration**

^ To the top

Looking Back: The Power and Perils of Weather Modification

Geoengineering is not an idea that has emerged only this century. The current surge of interest in geoengineering techniques is preceded by two cycles in the history of weather modification, which displayed, according to science historian James Rodger Fleming (2006), a number of pathological features that need to be highlighted.

Weather modification projects in the 19th century

The first cycle of weather modification projects occurred in the 1840s and lasted about a century. Primarily based in the US, the early history of weather modification is a rather quixotic story that illustrates not only the promise but also the perils and pitfalls of attaining 'weather on demand'.

The more serious projects in this cycle were associated with the scientific programme of James Pollard Espy (1785–1860), who introduced the idea that the cutting and burning of vast tracts of forest could lead to significant levels of precipitation (Fleming, 2010:54). Others with fewer scientific credentials sought to explore the link between artillery engagements on the battlefield and subsequent levels of rain. This received considerable US federal funding in the 1870s. The theory that rain can be artificially generated by large-scale explosions gained a certain popularity at that time, though it was not backed by strong empirical evidence.

After an extended period of drought in the 1890s, the US Congress approved further funding for a new series of field experiments in Texas to investigate the inter-relationship between the detonation of explosives at various altitudes and instances of precipitation. Executed by a patent lawyer from Washington, DC, with no scientific or military background, the government project attracted significant public criticism for 'the silliest performance that human ingenuity could devise' (Fleming, 2006:10).

Cloud seeding projects, 1946–1978

The period after World War II saw a resurgence of commercial rainmakers. This second cycle of weather modification projects began at the General Electric Research Laboratory in New York State. There, cloud seeding was invented by US chemist and meteorologist Vincent Schaefer (1906–1993). He modified clouds by seeding them with dry ice. However, there was a potential side effect which made large-scale experimentation with, and application of, cloud seeding extremely difficult: even small amounts of agents such as dry ice or silver iodide were believed to be able to potentially cause a chain reaction in clouds 'that would release as much energy as an atomic bomb, but without radioactive fallout' (Fleming, 2006:10).

The destructive potential of cloud seeding generated significant interest on the military side to test the weaponisation of the technology. At the same time, the fear of lawsuits as a result of unanticipated side effects from cloud seeding experiments forced General Electric to later transfer the programme to the military where it was developed further. As Victor et al. (2009:66) have observed: 'By the late 1940s, both the United States and the Soviet Union had begun exploring strategies for modifying the weather to gain battlefield advantage'. The Cold War zeitgeist of applying weather modification means to achieve military ends is perhaps best captured by General George C. Kenney of the US Strategic Air Command, who asserted in 1947 that '[t]he nation that first learns to plot the paths of air masses accurately and learns to control the time and place of precipitation will dominate the globe' (Fleming, 2006:10). Others lobbied for a new Manhattan Project to acquire global mastery in weather control. In the Soviet Union, Joseph Stalin introduced in 1948 his Great Plan for the Transformation of Nature to expand the Soviet economy by developing weather and climate control technology. In sum, there was a clear understanding that if an unfriendly country assumed control over large-scale weather patterns, the result could be disastrous.

The power and pathology of weather modification techniques became particularly pronounced during the Vietnam War. Between 1967 and 1972, the US Air Weather Service flew over 2,600 secret cloud seeding sorties in the jungles of North and South Vietnam, Lao PDR and Cambodia to reduce traffic on the Ho Chi Minh Trail. This project – known as Operation Popeye – became infamous as the Watergate of weather warfare (Fleming, 2006:14). It subsequently led to the adoption of a global regulatory framework to ban weather modification as a means of warfare, that is, the UN Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, which entered into force in 1978. As a result, US federal funding for weather modification projects ceased.

^ To the top

Looking Forward: Governing Geoengineering in the 21st Century

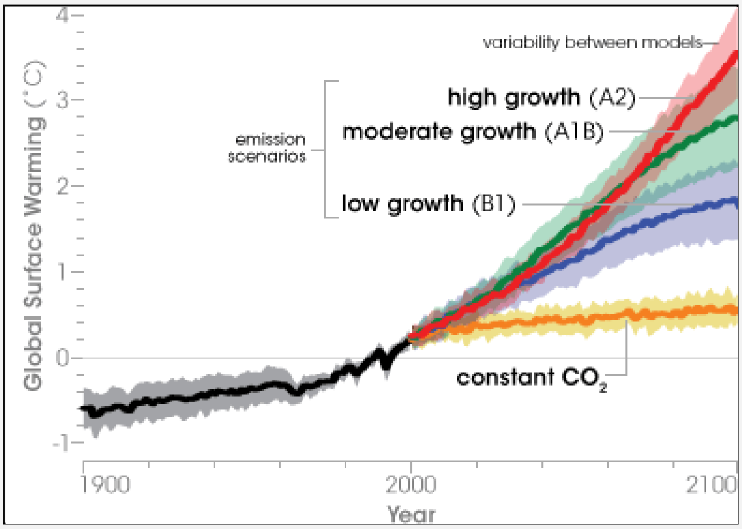
In 1965, US President Lyndon B. Johnson's Science Advisory Committee tabled a report, *Restoring the Quality of Our Environment*, calling for large-scale research into possibilities of counteracting climate change in response to the anticipated future increase of anthropogenic CO2 (President's Science Advisory Committee, 1965). The Advisory Committee suggested potential counter-measures such as the enhancement of the Earth's albedo by dispersing reflective particles on the sea surface.

Almost five decades later, the geoengineering option is back on the table. The limits of mitigation and adaptation in responding to climate change, coupled with the risk of reaching or passing tipping points in the Earth's climate system, make it extremely difficult for policymakers to categorically exclude the geoengineering option as a potential Plan B for tackling carbon emissions.

The shortcomings and uncertainties inherent in the present understanding of, and responses to, climate change mitigation and adaptation are illustrated in the findings and recommendations of a 2007 Intergovernmental Panel on Climate Change (IPCC) report. In that report, the IPCC (2007) projects a range of global average temperature increases over the course of the 21st century, given different 'emission scenarios' (Figure 1). These scenarios are based on various assumptions about global economic development and technological change. At the moment, global emissions is increasing at about 3 per cent per annum, which will result in a projected increase of 2 degrees Celsius by the year 2040 and 4 degrees Celsius by 2100. This scenario places the globe already at the top of the curves in Figure 1. The IPCC recommends limiting the rise in average global temperatures to a maximum of 2 degrees Celsius. However, achieving the stabilisation of global warming at its current rate would require an international 60–80 per cent cut in emissions, which is extremely unlikely under present circumstances. In addition, there is a considerable time lag between changes in atmospheric CO2 concentrations and predicted climatic responses. The probability that the IPCC recommendations will be superseded is therefore very high, leading to, as mentioned earlier, the need to consider geoengineering as an option.

However, fully-fledged geoengineering technologies do not yet exist – though some of the components are already available or being developed. If geoengineering is to be further advanced, it is important to reduce the possibility of situations where there will be winners and losers associated with the implementation of any new geoengineering technology. At present, there are no regulatory frameworks governing the broad application of geoengineering technology. This opens up the possibility that the technology could be applied unilaterally by single countries, businesses or even individuals, without concern for their side effects or the transboundary implications.

Figure 1: Intergovernmental Panel on Climate Change (IPCC) emission scenarios.



Source: Riebeek (2010), based on IPCC (2007: Figure 10.4).

The development and exploitation of geoengineering technology may therefore require that a set of governance mechanisms be established in accordance with the potential risks and benefits to societies across different regions. Identifying and assessing those risks and benefits would be a necessary first step. A tentative set of normative rules and principles to govern geoengineering from research to potential deployment may look as follows (Rayner et al., 2009):

- Geoengineering should be regulated as a global public good within a well-defined public interest framework.
- Such a public interest framework should be defined via broad public participation and consultation, globally and regionally.
- Geoengineering research should be subject to disclosure and open publication.
- There should be an independent assessment of the possible impacts of any geoengineering research enterprise.
- Geoengineering governance arrangements should be in place before the deployment of any new technology.

These tentative principles are an invitation to start rather than conclude a much-needed debate on geoengineering governance, a debate which has thus far been driven by transatlantic scholarly communities. As the Asia-Pacific region may be greatly affected by climate change, it needs to have a voice in this emerging debate.

^ To the top

Notes

1. For Asia, any significant change in the monsoon – its weakening or strengthening, or more marked fluctuations and thereby a loss of predictability – can have major consequences for agriculture and therefore for the food supply for people in the region.
2. Sea level rise is expected to exacerbate inundation, storm surge, erosion and other coastal hazards, thus threatening vital infrastructure, settlements and facilities that support the livelihood of island communities.

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^ To the top

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In 2009, the Centre was chosen by the MacArthur Foundation as a lead institution for the MacArthur Asia Security Initiative, to develop policy research capacity and recommend policies on the critical security challenges facing the Asia-Pacific.

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