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Climate Geo-engineering: Uncertainties and Implications

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Synopsis

Geo-engineering, which involves artificial intervention in the global climate, is attracting growing attention. What is geo-engineering and what are its security implications? What kind of governance is required to manage its adverse effects?

Commentary

GEO-ENGINEERING IS emerging as an option to address the adverse impacts of climate change. It involves largescale artificial intervention in the climate. Two main methods of geo-engineering are Solar Radiation Management (SRM) and Carbon Dioxide Removal (CDR).

Concerns revolve around the adverse effects of geo-engineering as it intervenes in the regular system and natural order of the world's climate. A special kind of governance is required at the global level to develop and monitor geo-engineering.

What is Geo-engineering?

Geo-engineering denotes large-scale direct human intervention in the Earth's natural system to counter the adverse impacts of climate change. Geo-engineering is often considered as the last option to save the Earth from the worst effects of climate change.

One way being explored in geo-engineering is to divert some sunlight from reaching the Earth's surface and thus reduce the average temperature of the Earth. Another way deals with the extraction of carbon dioxide directly from the Earth's atmosphere thus reducing the global temperature.

Solar Radiation Management (SRM) implies developing artificial barriers so that solar radiation can only reach the Earth's surface at a controlled level. It incorporates a number of mechanisms. One tool is to float small mirrors in space so that they may reflect sun rays away from the Earth. Another possible tool is throwing sulphate aerosols in the stratosphere with the purpose of enhancing the reflectivity of light.

In 1991, the eruption from Mount Pinatubo volcano in the Philippines ejected more than 20 million tonnes of sulfur dioxide and subsequently produced sulphate aerosol spreading particles in the stratosphere. These particles scattered and obstructed light from reaching the surface of the Earth. In the following two years, global temperatures declined by 0.6 degrees C.

Whereas SRM does not take into account the issue of carbon dioxide and its other impacts, another approach known as Carbon Dioxide Removal (CDR) directly deals with the elimination of carbon dioxide from the Earth's environment. One tool within CDR is setting sophisticated machines to pull carbon dioxide out of the air. Another tool is known as 'Ocean Fertilisation' that implies mixing nutrients such as iron with ocean water to increase the rate of photosynthesis.

The higher rate of photosynthesis requires more atmospheric carbon dioxide which is absorbed in the process. Thus, atmospheric carbon dioxide declines. Another way is to bury underground large amounts of charcoal that is actually carbon so that they cannot enter the carbon cycle.

Geo-engineering Efforts

Large-scale interventions on climate change are still at the level of research. However, some field-level experiments have taken place recently. An American businessman dumped around 100 tonnes of iron sulphate into the Pacific Ocean near Canada. Satellite image has shown that the chemicals produced large amounts of plankton spreading for 10,000 square kilometres.

The planktons, after absorbing the carbon dioxide, sank and inundated the sea-bed. The experiment adversely affected the surrounding ecosystems, producing toxic tides and increasing ocean acidification -- triggering criticism from environment groups.

Security Implications of Geo-engineering

The most serious concern is that the consequences of geo-engineering are unknown and uncertain. Neither have we game-planned nor have done any modelling on potential adverse consequences of its deployment on an already fragile climate. It is quite likely that the impacts will go beyond our control, possibly leading to dire consequences on the global climate and on a global scale.

Also there is a high possibility that in the guise of addressing the global climate, geo-engineering technology will be weaponised. Advanced countries can exploit geo-engineering for their military and political objectives over other countries. While executing geo-engineering a comprehensive approach is required. A piecemeal application will rather generate new adverse consequences.

The deployment mechanism of geo-engineering is too sophisticated for civilian institutions to effectively handle it. Hence there will be the need for the involvement of the military, usually the most organised and best equipped of national institutions. Thus, geo-engineering might trigger a race for military expansion and be exploited for military purposes.

Large military establishments in the duty of implementing geo-engineering may be targets of militant or military attacks. Competition among countries over geo-engineering will likely militarise outer space. Mistrust and suspicion among governments will rise as countries can deploy geo-engineering for narrow benefits to the detriment of other nations. Therefore, the suspicion and blame-game can give rise to 'weather war'.

It is important to note that once started, there is no going back on geo-engineering; it must be continued for an extended period of time, perhaps even indefinitely. If the process is stopped abruptly, we may experience termination shock that will negate whatever successes of geo-engineering achieved and the global temperature will rise again dramatically. While dealing with climate change, mitigation strategies should be the main priority. Geo-engineering should be considered only as a last resort.

Governance Structure Needed

Right now obscurity clouds the emerging field of geo-engineering. There is no accepted oversight body to monitor the issue. Much opacity prevails regarding research and experimentations. It is arduous to keep updated on research and experiments on geo-engineering that are going on worldwide. It is high time that the governance structure be fixed to avoid unmanageable circumstances in the future.

Wider debate on every aspect of geo-engineering technology at the international level is needed, as are rules and regulations to govern this application. An international body to oversee and regulate the mechanism is a must, perhaps under the aegis of the United Nations.

There should also be a verification regime to accurately monitor the impacts post-deployment. There is a high possibility that things may not go on as planned. So contingency planning should be done beforehand at the global level.

In the final analysis, there should be a global moratorium on large-scale geo-engineering intervention in the world's climate until everything is in place: rules and regulations to be formulated must be accepted at the global level while sufficient research and pilot experiments must be carried out. A global research pool has also to be formed. Recent findings regarding geo-engineering must be transparent and open to access by all.

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