



Geoengineering and the International System

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There are several important climate change impacts that are ignored or insufficiently addressed by the current international framework, but in this memo, I will focus less on the direct impact of anthropogenic climate change than on the ecological and geopolitical implications of one potential international policy response – geoengineering. An unfortunate reality is that the world is effectively out of time to reduce emissions to a level that can be safely assumed to prevent dangerous climate change. Conversely, the risk of runaway climate change, and the rapid and unpredictable climate effects that entails, is quickly rising. This unfortunate reality makes it more likely that the world, or some portion of it, will turn to what is effectively a last-ditch, break-the-glass-in-case-of-emergency solution: geoengineering. There are many forms of geoengineering, but in this memo, I will focus on two of the least complex and costly, stratospheric aerosol injection (SAI) and marine cloud brightening (MCB). I hasten to add that no existing geoengineering proposal is a simple, straightforward, or complete solution to climate change, and all come with considerable risks and drawbacks. But it is increasingly likely that the world will need to deploy some form of geoengineering, for some length of time, to avoid the worst effects of climate change. That makes it prudent to consider the potential ecological and geopolitical implications now.

What distinguishes SAI and MCB from other potential forms of geoengineering is that they are comparatively cheap and

easy to deploy – so much so that they could conceivably be deployed by small island developing states heavily exposed to climate risks, by non-state actors including environmental groups or foundations, or even by very wealthy individuals. SAI and MCB both center on the idea of using clouds to help cool the earth, thereby mitigating global warming itself but, critically, not altering the accumulation of greenhouse gases, which drives other impacts, such as ocean acidification. SAI and MCB both envision using small particles to act as nuclei for cloud formation, thereby artificially increasing cloud cover. While SAI usually envisions injecting these particles into the upper atmosphere, MCB envisions doing so from sea level over the ocean, where cloud nuclei are otherwise much less common than over land. SAI could be accomplished using a fleet of aircraft, balloons, rockets, or other delivery vehicles, while MCB could be accomplished using a fleet of specially equipped ships. Estimates of the cost of SAI usually run into the tens of billions annually, while for MCB in the low billions annually. Both SAI and MCB could conceivably be undertaken unilaterally, either by a single nation-state or non-state actors, and yet have global or regional climactic impacts. MCB is especially noteworthy in this regard because a fleet of unmanned ships (a realistic technological possibility) could theoretically operate for long periods in international waters, effectively beyond the jurisdiction of any nation-state. Both SAI and MCB therefore present the possibility that, in the face of dramatic

climate change, one or more state or non-state actors decide to undertake a modification to the earth's climate system that may have significant and possibly unanticipated effects on the world at large.

To be clear, neither SAI nor MCB appear to be especially high-risk activities. The effect of SAI can be reliably modelled because it effectively replicates the effect of observed volcanic eruptions. But the risk of both approaches is still significant, and could involve considerable changes to rainfall patterns, ocean currents, fisheries, and ecosystems. It is therefore imperative that an international framework be developed to regulate the use of geoengineering by both state and non-state actors. While several existing international agreements have provisions that might be relevant to geoengineering, at this stage what is most needed is a wide-ranging, multi-lateral dialogue, especially between the large economies that are the principal sources of greenhouse gas emissions, the small island developing states that are among those most affected by climate change, and the non-state actors, including global environmental organizations, foundations, and others that play an increasingly important role in climate governance. Given its well-established convening power and role in organizing the multi-stakeholder COPs, the UN Framework Convention on Climate Change is the natural party to take on leading responsibility for initiating global, multi-stakeholder dialogue on the uses and potential abuses of geoengineering.