Robust Results From Climate Model Simulations of Geoengineering

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Solar geoengineering has been proposed as a temporary means of alleviating some of the consequences of anthropogenic greenhouse gas emissions. Single-model studies characterizing the resulting climate effects often used different greenhouse gas concentration profiles and different amounts of geoengineering, making intercomparison difficult. The Geoengineering Model Intercomparison Project (GeoMIP) created a framework of four core simulations, designed to reveal robust features and key uncertainties of climate model responses to geoengineering (B. Kravitz et al., The Geoengineering Model Intercomparison Project (GeoMIP), *Atmospheric Science Letters, 12*(2), 162–167, doi:10.1002/asl.316, 2011). These experiments simulate solar geoengineering via uniform solar reduction or creation of stratospheric sulfate aerosol layers using state-of-the-art climate models.

The third GeoMIP workshop, held at the Institute for Advanced Sustainability Studies (IASS), Potsdam, Germany, assessed the findings from GeoMIP regarding geoengineering: (1) Models widely agree on the sign of spatial patterns of temperature, precipitation, and net primary productivity responses. (2) All monsoon areas show reduced precipitation, manifested as reduced numbers of intense precipitation events. (3) Moisture availability for plants may be unaffected, as evapotranspiration is also reduced. (4) If geoengineering is abruptly ceased, the rate of climate change for several years after is many times greater than the rate caused by carbon dioxide increases alone. (5) Key uncertainties in aerosol formation, growth, and deposition and lack of ability to accurately simulate some of the dynamical effects of volcanic eruptions remain prominent limitations in geoengineering research.

The workshop involved discussions of nearly 30 planned peer-reviewed articles, including contributions to a GeoMIP special issue of *Journal of Geophysical Research-Atmospheres.* Three new GeoMIP experiments to investigate artificial brightening of marine stratocumulus clouds were outlined during the meeting. Also discussed was the provision of climate model output to the impacts assessment community, including coordination with the Inter-Sectoral Impact Model Intercomparison Project, a model intercomparison dealing with the impacts of climate change.

The interdisciplinary mission of IASS provided an atmosphere where physical and social scientists could directly interact. Social scientists at IASS presented legal and economic perspectives on geoengineering and studies of how GeoMIP has affected discourse. Further interdisciplinary discussions and studies are planned.

The workshop included 37 members of the physical and social science communities from 10 different countries. Results from 12 climate models are currently available, and continued analyses of the simulated climate effects are under way. The official GeoMIP Web page (http://climate.envsci.rutgers.edu/GeoMIP) discusses simulation specifics and current progress and will be updated as more information becomes available.

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