Impacts of Stratospheric Sulfur Injection Schemes on Aerosol Size Distribution using a Microphysical Sectional Aerosol Model coupled with a Whole Atmosphere General Circulation and Chemistry Model

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Abstract
Stratospheric sulfur injection is a leading geoengineering strategy to counteract temperature increases due to greenhouse gases. Although natural volcanic eruptions have demonstrated that tropospheric cooling is possible, there remain many unknowns regarding the efficacy and consequences of a continuous intentional sulfur injection to the stratosphere. The efficacy of temperature cooling is a function of sulfate aerosol size distribution, loading, and lifetime, but these quantities are difficult to constrain due to the competing interactions of aerosol nucleation, growth, evaporation, and coagulation. Here we use the Community Aerosol Radiation Model for Atmospheres (CARMA) coupled with the Whole Atmosphere Community Climate Model (WACCM) to study these processes. The WACCM/CARMA coupled three-dimensional model simulates aerosol nucleation, condensational growth, evaporation, coagulation, and wet and dry deposition, as well as full sulfur chemistry, with detailed vertical resolution between the earth's surface and the thermosphere. The impacts of different stratospheric sulfur injection schemes on aerosol size distribution, loading, and lifetime will be simulated and compared to a baseline simulation.