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Microphysical studies of climate mitigation via increased OCS emission using WACCM/CARMA

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We present three-dimensional microphysical studies of the impacts of climate mitigation by increasing anthropogenic carbonyl sulfide (OCS) production as a source of stratospheric aerosol. We increase the flux of OCS in our model until solar radiation is diminished by about 1% to offset global warming. OCS photolyzes in the upper part of the sulfate layer, providing particles at higher altitudes than SO_2 and aerosol transported from the troposphere and injected by volcanoes. Heterogeneous reactions on sulfates affecting catalytic cycles involved in ozone loss have been studied mostly in the lower stratosphere, where volcanic enhancements are important. We show the impact of enhanced sulfates from OCS on reactions affecting stratospheric ozone in comparison to effects from the 1991 eruption of Pinatubo. We also present analyses of the lifetime of these aerosols, which increases with altitude. Model calculations of the horizontal patterns of surface cooling will also be discussed. OCS is the dominant source of stratospheric sulfate in non-volcanic periods. It is produced naturally in soils and oceans, and anthropogenically by combustion processes that oxidize organic sulfur compounds. Coal-fired power plants, which emit sulfur mostly as SO_2, may be converted to emit OCS through adjustments to the combustion process. Up to 80% of OCS emitted in the troposphere is destroyed before reaching the stratosphere, largely due to uptake by vegetation. We consider such sinks in calculating the mass of OCS required to offset anthropogenic warming. We have incorporated sulfur chemistry and aerosol microphysics into WACCM3, a comprehensive community climate model that spans the range of altitude from the Earth's surface to the thermosphere, merged with

the CARMA bin microphysics code adapted for stratospheric sulfates.