3.054 Surface Ozone Concentration Impacts on Agriculture From Stratospheric Sulfate Injection.

Early Career Scientist

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Abstract:

Solar radiation management using stratospheric aerosols has been proposed to reduce anthropogenic global warming, and studies have shown that its cooling effects, along with precipitation and solar radiation reduction, would influence agriculture production differently in different regions. However, surface ozone concentration change has not been considered in any previous agriculture studies. Simulated solar radiation management impacts the ozone budget. We use the G4 Specified Stratospheric Aerosol (G4SSA) scenario, in which 8 Tg SO_2 is injected into the stratosphere each year from 2020 to 2069 to counteract warming from RCP6.0 forcing. Under G4SSA, surface ozone would decrease over agricultural regions compared with RCP6.0. We assess how surface ozone changes under G4SSA impacts agriculture production, and whether this surface ozone change is as important as the cooling and precipitation changes. We use the crop model in the Community Land Model, version 5 (CLM5-crop) coupled with an ozone damage module and simulate rice, maize, winter wheat, soybean, cotton and sugarcane in the current planting regions. We perform two sets of crop simulations (with/without ozone damage) for G4SSA and for the global warming reference run RCP6.0. Agriculture practice (e.g., fertilizer usage and seeds) and planting area are fixed in both runs. With the ozone damage module turned on, regional ozone concentration changes would alter stomatal conductance and photosynthesis rate, and hence change crop production. With less ozone in most agriculture regions in G4SSA compared with RCP6.0, ozone changes show positive impacts on crop yields in most regions. The crop production increases due to reduced surface ozone under G4SSA are less than the benefit from cooling effect.