

## ***Interactive comment on “Microphysical simulations of sulfur burdens from stratospheric sulfur geoengineering” by J. M. English et al.***

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Review of “Microphysical simulations of sulfur burdens from stratospheric sulfur geoengineering” by English et al.

This paper presents a review of how stratospheric and tropospheric sulfur burdens and optical depths will change due to stratospheric sulfur geoengineering. The authors test the sensitivity of their results to injection location and the emitted species.

The paper is of interest to the ACP readership and may be published once some comments and concerns have been addressed.

P2520 L23: The global portion of Pierce et al. (2010) as well as the aerosol microphysics in Heckendorn et al. (2009) was done in a 2-D CTM.

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P2521 L5: “tropospheric SO<sub>2</sub> injections”, probably more clear to call this “tropospheric anthropogenic SO<sub>2</sub> emissions” since “injections” to me seems more like its intentional (e.g. Geoengineering).

P2522 L21: If you are using Euler stepping for nucleation and condensation, [H<sub>2</sub>SO<sub>4</sub>] would still drop by >50% within one time step even after cutting the timestep in half (and preventing [H<sub>2</sub>SO<sub>4</sub>] from going negative. This would cause an overprediction of the nucleation rate since the large oscillations between chemical production (increasing [H<sub>2</sub>SO<sub>4</sub>]) and nuc/cond would cause [H<sub>2</sub>SO<sub>4</sub>] to always be high at the start of the timestep. This might not matter considering the uncertainties in nucleation parameterizations and the strong dampening of particle concentrations to changes in nucleation rates (e.g. English et al. 2011).

P2526 L6: I suggest rewriting the sentence for clarity, “The particle size also increases \*more dramatically\* at lower levels of the stratosphere (90 hPa compared to 39 hPa)...”. Also are these concentrations given at STP conditions or ambient? This information is critical for comparing aerosol distributions at different pressures.

P2527 L26: Line 294: Please define effective radius. I’m assuming 3rd moment of radius divided by 2nd moment of radius, but please state explicitly.

P2528 L17: “latitudes” should be “longitudes”.

P2529 L1: Please say “that injecting H<sub>2</sub>SO<sub>4</sub> gas \*that is instantly well-mixed throughout the gridbox\* does not produce...”

P2529 L22: We did test the sensitivity to expansion/mixing rate. We did, however, assume that the plume was well-mixed radially. This would be a better uncertainty to point out.

P2532 L21: How good is the tropospheric aerosol simulation in WACCM/CARMA? Please move the discussion around P2533 L14 to the beginning of the discussion on tropospheric aerosols.

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