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Lower tropospheric COS as main source of stratospheric background aerosol, a CCM study

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The modular atmospheric chemistry circulation model EMAC with the aerosol module gmxe and high vertical resolution has been used for multiyear simulations of atmospheric aerosol. As lower boundary condition observed concentrations of COS and other longlived source gases are used, together with emissions of shorter lived gas and aerosol species. The parameters for the aerosol size distribution in the 7 modes are the same for troposphere and middle atmosphere. Evaporation of sulfate particles in the middle atmosphere is taken into account. We show that the oxidation of COS transported into the stratosphere explains most of the stratospheric background aerosol (Junge layer) and SO_2 observed by satellites (SAGE, Space Shuttle), including the modulation by the (internally calculated) Quasi-Biennial Oscillation. Tropospheric SO_2 has a minimum below the tropopause due to scavenging and cannot be a large contribution to stratospheric sulfur.

We show also, that the model is able to build up the aerosol from a volcanic SO_2 injection, and discuss some radiation effects. For both, the background, and the volcanic aerosol, the sedimentation is critical.