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Global model simulation of single scattering albedo: A sensitivity analysis

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Single scattering albedo (SSA) is a key parameter to calculate direct radiative forcing of aerosols in global climate models. In order to calculate SSA, models typically use Mie theory with assumptions for mixing state, refractive index, and size distribution of aerosols. However, these assumptions inevitably involve substantial uncertainties in SSA calculation. In this study, we examine the effect of different assumptions on global SSA calculation by using the global 3-D chemical transport model (GEOS-Chem v10-01), the aerosol optical properties calculation tool (FlexAOD), and global observations of aerosol concentrations and optical properties. We find that the model successfully reproduces observed surface PM2.5 and aerosol optical depth (AOD), but the model overestimates observed SSA (especially at 440 nm) from Aerosol robotic network (AERONET). Several sensitivity simulations with different input parameters are carried out and compared to the observation. Although aerosol mass concentrations are the same, the use of different input parameters leads to different AOD and SSA, which is discussed in details.