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Uncertainty of simulated aerosol optical properties derived from prescribed optical parameters in Asian region

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Aerosols can effectively scatter and absorb solar fluxes and so change the earth's radiation budget. The magnitude for the scattering and absorbing depends on size distribution and hygroscopicity, so these parameters are very important for estimating the aerosol radiative forcings. Basically, these parameters are variable and very complex in the atmosphere. So prescribing the values of these parameters in the simulations by most global aerosol models brings uncertainty for estimating the aerosol radiative forcings. In this study, we investigated sensitivities of the prescribed parameters such as aerosol size distribution to aerosol optical thickness (AOT) and single scattering albedo (SSA) using a global aerosol model (SPRINTARS) developed by Takemura et al. [2005]. This investigation enables us to not only clarify the uncertainty among global aerosol models but also estimate how do the differences in the prescribed parameters explain the differences between the simulation and observation. In this study, we concentrated on Asian region during 2001-2005 years.
Firstly, we compared simulated AOT and SSA in SPRINTARS with retrieved AOT and SSA from Aerosol Robotic Network (AERONET) [Holben et al., 1998]. This is a unique point in this study, because previous studies such as Lesins and Lohmann (2003) and Myhre et al. (2004) did similar sensitive experiments of the prescribed parameters without concentrating on SSA products. Simulated AOT and SSA were in good agreement with the AERONET-observed AOT and SSA. The differences in AOT and SSA between simulation and observation were smaller at a wavelength of 440 nm than those at a wavelength of 870 nm. At the same time, simulated AOT and SSA at a wavelength of 870 nm were overestimated compared to the AERONET-observed AOT and SSA, so it suggests that scatter components in large size ranges are overestimated. That is why the multi-wavelength comparison with AOT and SSA can be a useful method to find some problems in aerosol modelings. In this conference, we also would like to show a summary for impacts of the various prescribed parameters (size, hygroscopicity, etc) to the calculated optical properties and thus derive some problems in current aerosol modelings in terms of optical parameters.

Keywords: aerosol, aerosol optical thickness, single scattering albedo, GCM