Session: B9 Oral presentation

Projection of aerosol radiative forcings along the Representative Concentration Pathways (RCPs) with a global aerosol-climate model

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Climate change in the 21st century due to aerosols along the emission scenarios of the Representative Concentration Pathways (RCPs) is simulated by an aerosol global climate model, SPRINTARS (Takemura et al. 2000, 2002, 2005, 2009) in this study. It is driven by an atmosphere-ocean general circulation model, MIROC (Watanabe et al. 2010), developed by the Atmosphere and Ocean Research Institute (AORI)/University of Tokyo, National Institute for Environmental Studies (NIES), and Japan Agency for Marine-Earth Science and Technology (JAMSTEC). It includes the radiation, cloud, and precipitation processes related with the aerosol direct, semi-direct, and indirect effects of main tropospheric aerosols (black carbon (BC), organic matter, sulfate, soil dust, and sea salt) as well as the transport processes (emission, advection, diffusion, sulfur chemistry, and deposition). The model treats not only the aerosol mass mixing ratios but also the number concentrations of cloud droplets and ice crystals as prognostic variables. The nucleation processes of cloud droplets and ice crystals and the cloud/precipitation processes depend on the number concentrations of each aerosol species. All the RCPs' scenarios (RCP2.6, RCP4.5, RCP6.0, and RCP8.5) which are used in simulations by climate models for the Fifth Assessment Report of the Intergovenmental Panel on Climate Change (IPCC AR5) are applied in this study. Sulfate aerosols that have the negative direct radiative forcing and a role of cloud condensation nuclei are estimated to be gradually decreasing almost over the globe during the 21st century. On the other hand, BC aerosols that have the positive direct radiative forcing and a role of ice nuclei are still increasing. Therefore the total aerosol effects on the climate system may be largely different between 20th and 21st centuries. The time evolution of the radiative forcings due to the aerosol direct and indirect effects during the 21st century both at the tropopause and surface will be shown for all the RCPs in the presentation. Acknowledgments We would like to thank the contributors of development of SPRINTARS and MIROC. This study is partly supported by the Funding Program for Next Generation World-Leading Researchers by Cabinet Office, Government of Japan (GR079). References Takemura et al. (2000), J. Geophys. Res. 105, 17853-17873. Takemura et al. (2002), J. Clim. 15, 333-352. Takemura et al. (2005), J. Geophys. Res. 110, doi:10.1029/2004JD005029. Takemura et al. (2009), Atmos. Chem. Phys., 9, 3061-3073. Watanabe et al. (2010), J. Clim. 23, 6312-6335.