Geophysical Research Abstracts, Vol. 8, 02482, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02482

Simulation of aerosol effects on cloud and precipitation formation by aerosol climate model

T. Takemura (1), Y. Kaufman (2), L. Remer (2), and T. Nakajima (3)

(1) Research Institute for Applied Mechanics, Kyushu University (toshi@riam.kyushu-u.ac.jp / Fax: +81-92-583-7774), (2) NASA Goddard Space Flight Center, (3) Center for Climate System Research, University of Tokyo

An increase in the aerosol number concentration has the effect on cloud microphysics by forming smaller and numerous cloud droplets reducing precipitation and increasing cloud lifetime. There is, on the other hand, the aerosol-induced reduction in insolation of the Earth surface, resulting in decreases in the surface temperature, evaporation, and availability of water vapor to form clouds. The former effect is on the time scale of individual clouds, so that it can be detected by satellite data. The latter includes the feedback mechanism of the meteorological field on longer time scale. In this study, two climate equilibrium simulations are carried out using a general circulation model coupled with an on-line aerosol transport-radiation model, SPRINTARS, including both the aerosol direct and indirect effects. The one is an experiment with the fixed sea surface temperature and meteorological field to analyze the cloud microphysical effect. The other are coupled with a mixed-layer ocean model to allow the feedbacks of the sea surface temperature and meteorological field to the aerosol effects. The simulated results show that aerosols increase the cloud water path through the cloud microphysical effect, similar to the recent analysis of satellite data. Almost over the Atlantic Ocean, however, the aerosol-induced changes in surface insolation, evaporation, and regional meteorology decrease the cloud water path. The simulation also suggest that observed trend of precipitation in the 20th century can be partly explained by the aerosol effect.