[EE] Evening Poster | A (Atmospheric and Hydrospheric Sciences) | A-AS Atmospheric Sciences, Meteorology & Atmospheric Environment

[A-AS04]Towards integrated understandings of cloud and precipitation processes

convener:Kentaroh Suzuki(Atmosphere and Ocean Research Institute, University of Tokyo), Yukari Takayabu(Atmosphere and Ocean Research Institute, the University of Tokyo), Hirohiko Masunaga
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Clouds and precipitation are among the largest uncertainties in weather predictions and climate projections. To overcome this difficulty, substantial progresses are required in understandings of cloud and precipitation processes and their interactions with large-scale environment. Such progresses, however, have been hampered by historical separation of the science community into two, namely, one for clouds and the other for precipitation, despite the fact that clouds and precipitation are inseparable phenomena.

This session aims to integrate various studies of clouds and precipitation across the two communities over different spatial and temporal scales. A particular focus is placed on better understandings of fundamental processes governing the cloud and precipitation phenomena and their multi-scale interactions with environment through dynamical, thermodynamical and radiative processes. A wide variety of studies with theoretical, modeling and observational approaches are solicited in this session to seek a novel way for combining different methodologies to obtain unified, holistic understandings of the cloud and precipitation systems. The solicited area of research includes but is not limited to cloud microphysics, cloud-radiation interaction, convection dynamics, meso-scale phenomena and various multi-scale interactions including tropical aggregation of clouds, by means of a breadth of approaches encompassing in-situ and satellite observations, theoretical process studies and numerical modeling. Through discussion of presented papers, the session is also intended to enhance collaborations among different disciplines and communities for substantially advancing our understandings of cloud and precipitation processes.

[AAS04-P12]A modeling study of differing impacts of black carbon and sulfate aerosols on global precipitation

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Besides greenhouse gases, aerosols are also important forcing agents on climate change, which receive great expectations for potential short-term mitigations of global warming through their emission controls. Black carbon (BC) and sulfate (SF) are two kinds of aerosols with quite different optic properties and therefore interacting with the climate in different ways. This study explores the climatic effects of BC and SF on global precipitation with simulations using MIROC5 (5^{th} version of the Model for Interdisciplinary Research on Climate). Results show that BC causes a decrease in global annual mean precipitation, consisting of a large negative component of fast precipitation response (ΔP_{fast}) scaled with atmospheric absorption and a small positive component of slow precipitation response (ΔP_{slow}) scaled with the BC-caused global warming. SF also causes a decrease in global annual mean precipitation, which is dominated by ΔP_{slow}, corresponding to the surface cooling caused by SF. BC causes a northward shift of ITCZ (Intertropical Convergence Zone) mainly through ΔP_{fast}, whereas SF causes an obvious southward shift of ITCZ through ΔP_{slow}. The displacement of ITCZ caused by BC and SF is found to linearly correlate with the corresponding change in cross-equatorial heat transport

in the atmosphere, implying that the ITCZ shift occurs as a manifestation of the atmospheric heat transport in response to the BC and SF forcings. Comparing the ITCZ response caused by BC and SF between CGCM (atmosphere-ocean fully coupled model) and SOM (atmosphere-slab ocean coupled model), it is found that SOM exaggerates the cross-equatorial heat transport in the atmosphere and the ITCZ shift both for BC and SF. This underscores the importance of fully coupled ocean in modeling study of regional climate response.