[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
Tue. May 22, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

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-P06]Numerical experiments for weather modification in arid and semi arid regions

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Keywords:Weather modification, Numerical simulation, Hygroscopic seeding

The United Arab Emirates (UAE) launched the UAE Research Program (UAEREP) for Rain Enhancement Science in order to promote scientific advancement and the development of new technology. In the project “Advanced Study on Precipitation Enhancement in Arid and Semi-Arid Regions,” which was one of the three projects awarded the UAEREP prize in 2016, the authors plan to apply the cloud seeding model (Hashimoto and Murakami, 2016) to the assessment of seedability and to the evaluation of cloud seeding effects, after necessary modifications (Hashimoto, Murakami and Haginoya, 2017) and new developments.

At first for this purpose, we investigate performances of the model in terms of reproducibility of seasonal distributions of cloud and precipitation in the arid and semi-arid regions in the UAE and its sensitivity to grid spacing. Hindcast numerical simulations have been conducted throughout one year (from February 2015 to January 2016) with 5- and 1-km horizontal resolutions. The model shows a good

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performance in both of the 5- and 1-km horizontal resolutions after some modifications for land surface parameters. Hindcast simulations are extended to finer resolution up to 200 m for 30 days in September 2015. The seasonal or monthly distributions of accumulated precipitation amount are roughly the same among the different resolutions. However, with finer resolution, finer structures appear in the precipitation distributions, especially over desert areas for spring and summer seasons, where the precipitation is mainly brought by small-scale cloud systems generated by thermal convections. Since microphysical features of a cloud such as the mass and number concentration of cloud droplets is dependent on the fine-scale dynamics, finer grid spacings are required for assessment of seedability and planning of seeding experiments, although it is still unclear what is the resolution fine enough to obtain robust results.

To perform numerical seeding simulations, a hygroscopic seeding scheme has been incorporated in the bulk microphysics framework of our model. This scheme is based on a lookup table (LUT) which is able to represent the number concentration of nucleated droplets as a function of updraft velocity and number concentrations of two types of cloud condensation nuclei (CCN); ammonium-sulfate (AS) and sodium chloride (SC) particles. Using the LUT-based hygroscopic seeding scheme, we are performing test simulations, which show the enhancement of rainwater production is dependent not only on a seeding rate but also on dilution of SC particles during the transportation from the seeding point to the cloud base.

Acknowledgement

This study was supported by the Ministry of Presidential Affairs and the NCMS, the UAE, under the project in the UAEREP for Rain Enhancement Science, “Advanced Study on Precipitation Enhancement in Arid and Semi-Arid Regions.”

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