[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

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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-P01]Consistent evaluation of MIROC cloud properties with satellite observations and simulators

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Keywords:cloud radiative effect, global climate model, satellite simulator, cloud phase

Many of CMIP5 models, including MIROC, share common biases in cloud radiative effect (CRE) such as too large shortwave cooling effect in subtropical ocean and too small cooling effect in Southern Ocean and subtropical west coasts. Diagnosing inherent cloud biases is critical to mitigate the CRE biases. Such model diagnostics, particularly on the global scale, are enabled by comparisons to satellite observations. Notable in this regard is the recent emergence of active sensors on board satellites, i.e. CALIPSO and CloudSat, that provide vertical measurement of clouds, bringing unprecedented information for model evaluations. This is further facilitated by recent development of satellite simulators, such as COSP (CFMIP Observational Simulator Package), which.enable consistent comparisons between the models and satellite observations. This study utilizes these tools to quantitatively assess cloud properties and relevant radiative fields in MIROC in comparison to satellite observations. For this purpose, atmospheric component of MIROC5 was used to simulate climatological fields of clouds and radiation with T85 horizontal resolution and 40 vertical levels. The simulation was equipped with inline COSP to diagnose cloud phase and cloud fraction in the manner consistent with what is observed by CALIPSO. The simulated cloud properties and radiative fluxes were then evaluated against the satellite-observed cloud product (CALIPSO GOCCP v2.X) and radiative flux product (CERES-EBAF), respectively. A particular focus of this study is placed on evaluation of cloud phase, which is

represented in MIROC5 through parameterizations of microphysical processes, not a prescribed function of temperature. We analyzed how ice cloud ratio (ICR), defined as relative occurrence of ice clouds to total clouds, varies with temperature based on both the native model outputs and COSP-derived diagnostics in comparison to CALIPSO observations. The results show that while the original outputs from MIROC overestimate ICR at a given temperature, the ICR from COSP outputs well fitted to the satellite observation. This underscores the importance of using satellite simulators to make consistent model comparisons to satellite observations and thus to better characterize the inter-model spread of cloud phase dependence on temperature recently reported. Our result also suggests that the too negative CRE at high latitudes in MIROC5 is more like attributed to the less total cloud fraction than observed, rather than to cloud phase biases.