[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-P08]Detections of mountain lee wave signals due to water vapor fluctuation by ALOS-2 ScanSAR interferometry and numerical reproducible simulations

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The mountain trapped lee wave is one of the mountain wave mode that propagates horizontally in the lower troposphere downstream of the mountain crest under the stable conditions. Although lee waves sometimes cause serious aviation accidents due to the abrupt change in vertical winds, its observational studies are relatively less compared to theoretical studies. Here we demonstrate a uniqueness of the spatial water vapor observation by Interferometric Synthetic Aperture Radar (InSAR) for mountain lee wave studies. We also shows mesoscale numerical weather simulations to reproduce observed lee wave signals derived by InSAR observations.

We use SAR level 1.1 data acquired by the L-band PALSAR-2 SAR sensor onboard the ALOS-2 satellite, which was launched by JAXA, to generate interferograms. The interferometric processing is conducted with the RINC software version 0.37 (Ozawa et al. 2016) and the SNAPHU software was used for

unwrapping (Chen and Zepker 2002). The WRF version 3.7.0 was used to perform numerical weather simulations with 3 and 1 km grid spacing (one-way nested). The grid spacing in the finer domain is enough to reproduce explicitly resolve mountain lee wave phenomena because typical wavelength of lee waves are about 16 km (Ralph et al. 1997). The JMA's MSM and NCEP SST data were used for model's initial and boundary conditions.

Two interferograms were generate around the central Hokkaido and eastern part of Tohoku, both in Japan. Both of interferograms captured wave-like phase variations in the downstream side of mountain crests. Amplitudes of these phase variations reached up to 4-5 cm, corresponding to approximately 5 cm variations in PWV. In addition, the spatial patterns of these phase variations were very close to that detected by visible satellite images at the corresponding time. WRF simulations successfully reproduced observed amplitudes and wavelengths of lee waves, although simulated wave attenuated more rapidly than those of observed. A sensitivity experiment using different planetary boundary layer (PBL) schemes was performed and resulted in that different PBLs reproduced lee wave signatures with different wavelengths and attenuation rates, indicating the importance of accurate representation of turbulent kinetic energy in the boundary layer.