

Improvement of a single moment bulk microphysics scheme for mixed-phases clouds over the Southern Ocean using Joint simulator and CALIPSO

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It is important to evaluate and improve the cloud properties in global non-hydrostatic models like a Nonhydrostatic ICosahedral Atmospheric Model (NICAM, Satoh et al. 2014) using observation data. One of the methods is a radiance-based evaluation using satellite data and a satellite simulator (here Joint simulator, Hashino et al. 2013), which avoids making different settings of the microphysics between retrieval algorithms and NICAM. One of the challenging issues is an evaluation of mixed-phase clouds, which consist of water vapor, ice particles, and supercooled water droplets. It is known one of the main reasons why climate models reveal large errors about the reflection of solar radiation over the Southern Ocean and Arctic. This study is an evaluation and improvement of mixed-phase clouds over the Southern Ocean in NICAM using a Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) and a satellite simulator. We evaluated thermodynamics phase of mixed phases clouds over the Southern Ocean in a regional version of NICAM between 45°S to 65°S and 170°E to 170°W following Yoshida et al. (2010) method. We found underestimation of supercooled water clouds in our single moment scheme. We improved the single moment microphysics scheme using a double moment microphysics and a single column model. If I have time, I will introduce the recent development progresses of Joint simulator shortly.

Key words: Mixed-phases clouds, Southern Ocean, CALIPSO, NICAM

References

- Hashino, T., M. Satoh, Y. Hagihara, T. Kubota, T. Matsui, T. Nasuno, and H. Okamoto, 2013: Evaluating cloud microphysics from NICAM against CloudSat and CALIPSO. *J. Geophys. Res.*, 118, 1-20, doi:10.1002/jgrd.50564.
- Yoshida, R., H. Okamoto, Y. Hagihara, and H. Ishimoto, 2010: Global analysis of cloud phase and ice crystal orientation from cloud-aerosol lidar and infrared pathfinder satellite observation (CALIPSO) data using attenuated backscattering and depolarization ratio, *J. Geophys. Res.*, 115, D00H32, doi:10.1029/2009JD012334.