# Evaluation of microphysics in mixed-phase clouds over the Southern Ocean in NICAM using Joint simulator

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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, Hoshino 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.

The purpose of this study is an evaluation and improvement of mixed-phase clouds over Southern Ocean in NICAM using a Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) and a satellite simulator. We evaluate microphysics schemes for thermodynamics phase of mixed phases clouds over the Southern Ocean between 45°S to 65°S and 170°E to 170°W following Yoshida et al. (2010) method. We investigate the impacts of microphysical processes on the characteristics of super-cooled water clouds. We improve super-cooled water clouds by changes of microphysical processes using a single column model. And we introduce the impact of super-cooled water clouds on the climate sensitivity tests using NICAM.