Improvements of the double-moment bulk cloud microphysics scheme in the Nonhydrostatic ICosahedral Atmospheric Model (NICAM)

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This study revised the collisional growth in a double-moment bulk cloud microphysics implemented in the Nonhydrostatic ICosahedral Atmospheric Model (NICAM). The revised cloud microphysical processes were tested by 10-day global simulations with a horizontal resolution of 14 km.
It was found that both the aggregation of cloud ice with smaller diameters and the graupel production by riming were overestimated in current schemes. A new method that numerically integrates the collection kernel solves this issue, and consequently, the lifetime of cloud ice is reasonably extended. In addition, the results indicate that a reduction in graupel modulates the convective intensity, particularly in intense rainfall systems. The new version of the cloud microphysics scheme successfully improves outgoing longwave radiation, particularly over the intertropical convergence zone, in reference to satellite observations. Thus, the revision is beneficial for both long-term climate simulations and severe disaster prediction.

Keywords: cloud microphysics, cloud radiative forcing, global cloud resolving model

