A Two-Moment Cloud Microphysics Parameterization in the Global Model

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Abstract

Recently several two-moment cloud microphysics schemes have been implemented in regional and global model. With the additional moment that tracks the number concentration of cloud hydrometers such as cloud drop, cloud condensation nuclei, (CCN) rain drop, ice nuclei and so on, we can simulate the cloud microphysical process on more detailed physical basis. The influence of background aerosol concentration could be included in the simulation, and the latent heat release in the microphysical processes that might alter the mesoscale system structure such as typhoon could be explicitly represented.

In this study, we implemented a two-moment cloud microphysics scheme (CLR scheme) in Model for Prediction Across Scales, (MPAS) MPAS is the newly-released NCAR global model with horizontally variable-resolution Voronoi grid that allows local focus on desired area with increased horizontal resolution. The CLR scheme tracks the numbers and mass of the hydrometers in both liquid and ice phases. We analyze the precipitation from different microphysics schemes and study the impact of the addition of the second moment on precipitation. Also the impact of background aerosol concentration on precipitation as well as on the mesoscale weather systems is also shown. The performance of CLR scheme in MPAS is evaluated with the severe-rainfall events. The possibility of incorporation of the CLR scheme with other cloud physics scheme in MPAS to make the whole physics package scale-aware will also be discussed.

Key word: two-moment microphysics scheme, MPAS, global model, variable-resolution grid