An Advanced Double-Moment Cloud Microphysics Parameterization Scheme for Global Weather Forecasting

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An advanced double-moment parameterization for NOAA's unified forecast system (UFS) is developed for global forecasting. A main ingredient of the scheme utilizes a concept to represent the partial cloudiness effect on the microphysical processes, following the study of Kim and Hong (2018). The underlying assumption is that all the microphysical processes occur in a cloudy part of the grid box. Based on the long-term evaluation of the WRF Single-Moment (WSM) and WRF Double-Moment (WDM) schemes by WRF community, several revisions are made in microphysics terms, along with a newly introduced aerosol effect. A mass-conserving Semi-Lagrangian sedimentation is re-configured for double-moment physics. The new scheme reproduces the storm structure in an idealized 2D testbed, accompanying better organized front-to-rear jets, cold pools, and convective updrafts, as compared to the results in the case of conventional microphysics. The new scheme demonstrates a competitive or better skill in a statistical measure of the forecast skill in the global UFS as compared to that from the Thompson scheme