Improved Hydrometeor Simulations Using Cloud Resolving WRF and Multi-Scale Data Assimilation and Augmented Forcing for Single Column Models

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A set of numerical experiments for convective cloud and precipitation cases occurring over the Atmospheric Radiation Measurement (ARM) Southern Great Plains (SGP) site have been conducted using the WRF-based multi-scale data assimilation system. This system was developed for the FASTER project to examine the influence of the assimilating ARM surface meteorological observations and Balloon-Borne Sounding (SONDE) profiles along with conventional and satellite radiance data processed by the National Centers for Environmental Prediction (NCEP). In addition to further improvements on meteorological fields, the results demonstrate significant impact of ARM observations on modeled clouds and precipitation. Assessments show that the data assimilation improves the fits of domain-averaged mixing ratios of both liquid- and frozen-phase hydrometeors to satellite observations, the vertical structure of clouds via comparisons to radar reflectivity at the SGP central facility, and the spatial structure and amount of precipitation. Hydrometeor-related quantities derived from the data assimilation system are used to initialize and drive Single Column Models (SCMs). The influences are assessed by comparison of the simulations to those by conventional SCM simulations that do not use the hydrometeor- related quantities derived from the data assimilation system.