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Impact of phased-array radar assimilation on predicting the afternoon thunderstorm in the Taipei basin: An OSSE experiment based on the event on 22 July 2019

ABSTRACT

Severe storms often evolve rapidly with complex physical processes. However, the spatial and temporal resolution of the conventional weather radar is not sufficient to obtain observations that can accurately represent the development of the storms. Another limitation is the mechanical scanning on elevations. However, phased-array weather radars (PAWR), which provide high spatial and temporal resolution, can detect the more detailed evolution process of convective storms, including development, intensification, and weakening processes.

This study investigates the impact of PAWR assimilation on afternoon thunderstorm in the Taipei basin with an observation simulation system experiment (OSSE). The nature run of the OSSE is generated with the Weather Research and Forecasting Model (WRF) with a 200-m grid spacing, and it is used as the true atmospheric state to produce PAWR-like observations. Then, the Local Ensemble Transform Kalman Filter for Scalable Computing for Advanced Library and Environment model (SCALE-LETKF) developed by the Institute of Physical and Chemical Research (RIKEN) is used to assimilate reflectivity and radial velocity to capture rapid convection. Here, we design experiments to use different assimilation frequencies (5 and 1 min) to investigate how it affects the describing the convection structure in Taipei metro area. This study shows that a higher frequency can capture a better pattern of reflectivity and reduce error rapidly at the beginning of assimilation, the maximum intensity is less satisfactory.

Keyword

Kullback-Leibler divergence (KLD)
Local Ensemble Transform Kalman Filter (LETKF)