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Assimilation of Radar Data for Thunderstorm Prediction Using Ensemble Kalman Filter and Using 3DVAR and Cloud Analysis

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The assimilation of Doppler radar data as well as other observations for initializing storm-scale numerical weather prediction models using the ensemble Kalman filter (EnKF) method has enjoyed very encouraging successes recently in studies using simulated observations [e.g., 1, 2]. The assimilation of real radar data or other real observations using EnKF method has been very limited, however. At the same time, reasonable results have been obtained analyzing real radar data in a cycled mode with a 3DVAR scheme in combination with complex cloud analysis, and the predictions of individual storm cells have been reasonable for up to several hours [3,4].

In this study, we apply a recently-developed EnKF system to a tornadic thunderstorm case [2, 5]. The assimilation system is based on the nonhydrostatic ARPS model which includes complex multi-phase microphysics. Radial velocity and reflectivity data from a WSR-88D radar are assimilated. The initial storm environment is defined either by a sounding or by a 3DVAR analysis that takes into account other types of observations. The results of the EnKF analysis and the subsequent forecast will be verified against other observations and compared with the results from cycled 3DVAR and cloud analysis. The strength and weakness of these methods will be discussed.

Keywords: Radar, data assimilation, ensemble Kalman filter, 3DVAR, cloud analysis, thunderstorm forecast.

References

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