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2012年5月6日の竜巻事例における二重偏波レーダーで推定された雨水量の同化
Assimilation of rainwater estimated by a polarimetric radar for tornado outbreaks on 6 May 2012

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On 6 May 2012, three tornadoes were generated almost simultaneously on the Kanto Plain at about 12:30 JST (Japan standard time). The southernmost one was estimated to be F3 in the Fujita scale, which is one of the strongest tornadoes in Japan. A low-level vortex associated with this tornado was observed by Meteorological Research Institute advanced C-band solid-state polarimetric (MACS-POL) radar. In this study, dense surface observation data and radar data were assimilated with a triple-nested Local Ensemble Transform Kalman Filter (LETKF) system with 32 ensemble members, and the impact of these observation data was evaluated by performing the extended forecast initialized with the LETKF analyses.

In LETKF-1 (horizontal grid interval: 15000 m), hourly operational observation data used in the Japan Meteorological Agency (JMA) operational meso-scale analysis were assimilated with 6 hours intervals. In LETKF-2 (horizontal grid interval: 1875 m), Doppler velocity observed by 4 radars and dense surface data (horizontal wind, temperature and relative humidity) observed by Automated Meteorological Data Acquisition System (AMeDAS) and Environmental Sensor Network (ESN) obtained every 10 minutes were assimilated with 1 hour intervals. In LETKF-3 (horizontal grid interval: 350 m), rainwater estimated from reflectivity and specific differential phase observed by MACS-POL radar as well as Doppler wind and surface data were assimilated with 10 minutes intervals. Using this LETKF-3 analysis at 12:30 JST as the initial condition, the extended forecast with the horizontal resolution of 50 m was performed. As a result, the simulated precipitation relating to the parent clouds of the tornadoes was stronger than that in the experiment without rainwater assimilation. In this case, assimilation of strong rain contributed to increase low-level water vapor in the LETKF-3 analysis through a positive correlation between amounts of low-level water vapor and rainwater. These results imply that the predictability of extreme weather may be improved by assimilating rainwater observations.

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