Assimilating every 30-second phased array weather radar data in a torrential rainfall event on July 6, 2018 around Kobe city

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Abstract

To investigate the impact of every 30-second phased array weather radar (PAWR; Yoshikawa et al. 2013, Ushio et al. 2014) observation on a simulation of a severe rainfall event occurred on July 6, 2018 around Kobe city, we perform 30-second-update 100-m-mesh data assimilation (DA) experiments using the Local Ensemble Transform Kalman Filter (LETKF; Hunt et al. 2007) with the Scalable Computing for Advanced Library and Environment (SCALE; Nishizawa et al. 2015) regional numerical weather prediction model. Two experiments were performed: the test experiment with every 30-second PAWR observation (TEST), and the other without observation (NO-DA).

Figure 1 shows radar reflectivity at the 2-km elevation at 1040 JST on July 6, 2018 after 50 LETKF cycles. The TEST analysis shows intense rainfalls with detailed structure of active convection, better matching with the PAWR observation compared to NO-DA analysis (Fig. 1).

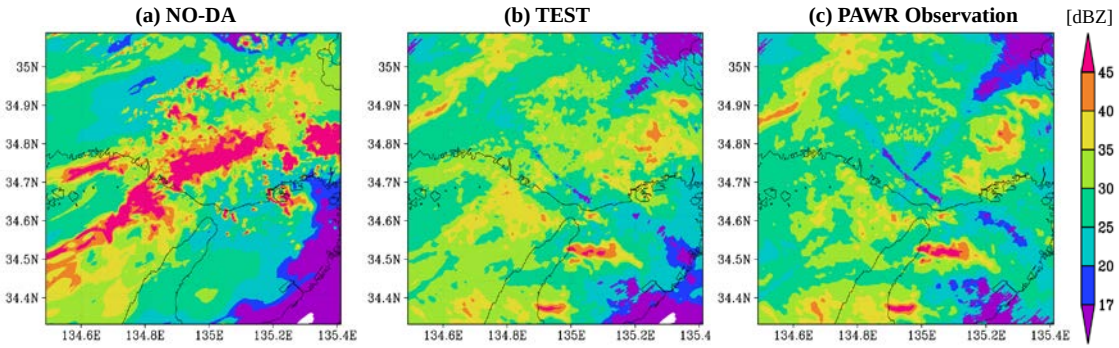

Fig.1: Radar reflectivity at the 2-km elevation at 1040 JST on July 6, 2018 after 50 LETKF cycles for (a) NO-DA analysis, (b) TEST analysis and (c) PAWR observation.

Figure 2 shows the time series of the root mean squared error (RMSE) of radar reflectivity at the 2-km elevation. The black and blue lines show the ensemble mean of the analysis of NO-DA and TEST, respectively. Consistently with Fig. 1, TEST analysis is clearly better than NO-DA analysis. The red line shows a forecast initialized by the ensemble mean of the TEST analysis at 1040 JST. Compared with NO-DA, the forecast is skillful for 20 minutes, although the skill is decreased rapidly. The results suggest that the PAWR DA have a potential to improve the numerical simulation for this torrential rainfall event.

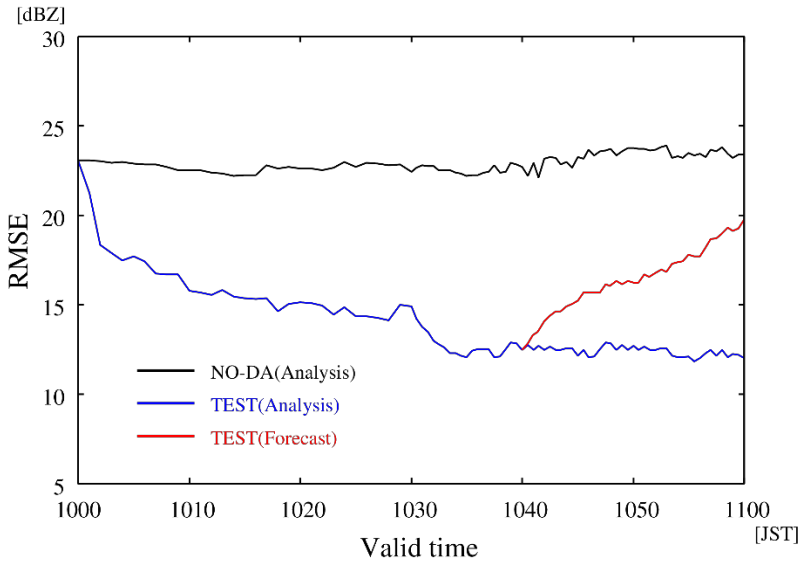

Fig. 2: Time series of RMSE for radar reflectivity [dBZ] at the 2-km elevation on July 6, 2018. Black, blue and red lines correspond to the NO-DA analysis, TEST analysis, and TEST forecast initialized at 1040 JST, respectively.

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