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Assimilation experiment by using localizations considering horizontal scale of error correlation in rainfall area

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In ensemble Kalman filter, localization is used to remove spurious error correlations between distant locations which are derived from limited ensemble size. We should use optimum localization radii by considering spatial scales of error correlations which differ depending on phenomena. Aonashi (2011) reported that horizontal scale of error correlations in precipitating region is smaller than that in non-precipitating region and dual scale sampling error damping by spectral localization is useful. However, effects of using smaller localization radius for precipitating regions have not been studied yet in a method of observation localization. The objective of this study is to investigate its effect on a simulation of rainfall distribution by using LETKF (Local Ensemble Transform Kalman Filter).

JMA-NHM (Japan Meteorological Agency Non-Hydrostatic Model) (Saito et al., 2007) and a nested NHM-LETKF system (Seko et al., 2013) which consists of outer (15 km grid) and inner (1.875 km grid) LETKFs were used. We targeted to reproduce rain bands which caused Uji heavy rainfall on 13-14 August 2012. GPS derived PWV (precipitable water vapor) data observed by our hyper-dense network installed in Uji with 1 km resolution (Sato et al., 2013) and GPS receivers of GEONET (GPS Earth Observation NETwork) were assimilated. Intense precipitating areas where rain rates are more than 10 mm/h were detected from radar data. We adopted 1 grid scale of localization radius for intense precipitating region and 5 grid scale for the other regions in inner LETKF. RMSEs of 1 hour rainfall of first guess averaged around rain band were calculated for 8 cycles of inner LETKF.

As a result of using smaller localization radius for intense precipitating area, RMSE became smaller in 5 cycles and became large only in 1 cycle. In 8th cycle when intensity of the rain band was at its peak, RMSE was improved about 10%.

Keywords: GPS derived PWV, Data assimilation, LETKF, Localization