Issues regarding maintaining ensemble spreads, balance, and high-resolution information in rapid-update-cycle radar data assimilation with the LETKF

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Assimilation of meteorological radar data has been proven useful for analyses and short-range forecasts of convective storms. At RIKEN, we have been investigating the feasibility and usefulness of advancing the resolution of radar data assimilation with the LETKF, using the K computer resource. Ideally, it is desirable to assimilate the radar data at high spatial and temporal resolution, hopefully to extract most high-resolution information in the observation. Running a rapid-update data assimilation cycle is also thought to be beneficial in terms that it could avoid the linearization errors of highly nonlinear evolution of convective systems. However, with a typical ensemble data assimilation method, several important issues, such as the maintenance of the ensemble spreads and model balance, could prevent us from effectively using the observation information at high spatial and temporal resolution. It is very difficult to overcome all problems, but we find several techniques that are practically useful and suitable for the high-resolution convective-scale data assimilation. We will discuss these techniques, such as additive noise, observation number limit, and the deterministic analysis member, with some experimental results that show promise.

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