Implicit thinning and localization of dense observation data in the LETKF: A case of phased array weather radar

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Observation data from advanced remote-sensing platforms are getting bigger and bigger. Past studies have shown that, to effectively assimilate dense observations, a proper thinning or superobing method to reduce the data density is usually necessary. In general, these techniques have been employed to deal with various factors such as observation error correlations, representativeness errors, and computational costs. However, they also unavoidably decrease the resolution of data, which is contradictory to the pursuit of high-resolution observing systems and numerical models.
We point out that, when using an ensemble data assimilation method, another important, but likely neglected reason to thin the data is to stay in the range that all observations can be effectively assimilated by the limited ensemble size. This issue has been usually addressed by covariance localization methods, but probably not in an optimal way. Recently, the LETKF systems at European Centre for Medium-Range Weather Forecasts (ECMWF) and Deutscher Wetterdienst (DWD) have adopted an “implicit localization” method that significantly reduces the assimilated observation numbers while preserving high-resolution information, by selecting N nearest neighbors of observations from the analyzed grid point. We demonstrate the usefulness of this method on the assimilation of very dense phased array weather radar data, and explain it as an ideal combination of thinning and localization.

Keywords: localization, thinning, LETKF, dense observation, radar assimilation

