Representation of model error in convective scale data assimilation

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Abstract

The convection-permitting numerical weather prediction models are able resolve highly nonlinear dynamics and physics. However, they often fail to capture processes that trigger convection or miss intensity and location of convective storms. Due to the very short-scale and stochastic properties of convection, as well as boundary condition errors, it is extremely difficult to parameterize the model error for convection permitting models. We investigated a variety of methods for treating the model error in ensemble based convective scale data assimilation. The experiments are done using the convection-permitting models and data assimilation system KENDA of German weather service. Conventional and radar observations are assimilated hourly by the LETKF. The model error due to unresolved scales and processes, is represented with samples coming from the difference between high-resolution model run and low-resolution experiment, through warm bubble initialization, stochastic boundary layer perturbations, perturbation in microphysics variables as well as through parameter estimation. It is shown that the additive noise approach, contributes greatly to ensemble spread, and considerably improves the skill of precipitation forecasts up to six hours. Combining the additive noise with time evolving estimates of model error, for example, either the stochastic boundary layer perturbations, parameter estimation or the warm bubble technique even further improves the skill of the precipitation forecasts.

Keywords: convective scale DA, model error

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