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Assessing the Predictability of Convection using Ensemble Data Assimilation of Simulated Radar Observations in an LETKF system

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This study uses the Local Ensemble Transform Kalman Filter (LETKF) to perform storm-scale Data Assimilation of simulated Doppler radar observations into the non-hydrostatic, convection-permitting COSMO model. In perfect model experiments (OSSEs), it is investigated how the limited predictability of convective storms affects precipitation forecasts. The study compares a fine analysis scheme with small RMS errors to a coarse scheme that allows for errors in position, shape and occurrence of storms in the ensemble. The coarse scheme uses superobservations, a coarser grid for analysis weights, a larger localization radius and larger observation error that allow a broadening of the Gaussian error statistics.

Three hour forecasts of convective systems (with typical lifetimes exceeding 6 hours) from the detailed analyses of the fine scheme are found to be advantageous to those of the coarse scheme during the first 1-2 hours, with respect to the predicted storm positions. After 3 hours in the convective regime used here, the forecast quality of the two schemes appears indiscernible, judging by RMSE and verification methods for rain-fields and objects. It is concluded that, for operational assimilation systems, the analysis scheme might not necessarily need to be detailed to the grid scale of the model. Depending on the forecast lead time, and on the presence of orographic or synoptic forcing that enhance the predictability of storm occurrences, analyses from a coarser scheme might suffice.