EMS Annual Meeting Abstracts
Vol. 12, EMS2015-115, 2015
15th EMS / 12th ECAM

Data assimilation using convective scale covariance structures

Clarissa Figura (1), Liselotte Bach (1), Jan D. Keller (2,3), and Andreas Hense (1)

(1) Meteorological Institute, University of Bonn, Germany, (2) Climate Monitoring Branch, Hans-Ertel Centre for Weather Research, Bonn, Germany, (3) Deutscher Wetterdienst, Offenbach, Germany

Convective scale events often lead to severe weather phenomena. However, accurate forecasts of convective scale events are still quite difficult due to representativeness and initial condition errors. In order to address these issues, ensemble forecasts are used to not only enhance the forecast, but also to predict its uncertainty. Therefore, the new data assimilation scheme for the convection-permitting model COSMO-DE of the German Meteorological Service (DWD) is based on the Local Ensemble Transform Kalman Filter (LETKF) approach by Hunt et al. (2007). Nevertheless, as the covariance structures are taken from continuous ensemble forecasts, convective uncertainty structures are likely to dissipate to larger scales. Hence, we propose the application of the selfbreeding method to improve the covariance structures in the LETKF for the convective scale and to represent evolving uncertainty structures. From a set of realisations of such perturbations, the covariance structures in space and between variables can be estimated.

The selfbreeding technique estimates uncertainty structures aiming at localising the fastest growing error modes. The technique is based on an initialisation-growing-rescaling process that makes use of the full nonlinear weather prediction model. Iterative cycling around a short fixed time interval allows for targeting the uncertainty of mesoscale processes. After a number of selfbreeding cycles, the bred vectors, i.e. the perturbations between control run and ensemble members, are supposed to be consistent with the dynamics of the convective scale.

We applied the convective scale covariance structures in the LETKF scheme for a case study of convective scale events over Central Europe. Different configurations are tested, the pure operational-mode ensemble, multiple mixed ensembles and a pure selfbreeding based ensemble. The evaluation focuses on parameters relevant for the convective scale, such as precipitaion and cloud structures.