



ETKF rescaling scheme in HIRLAM

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An ETKF rescaling scheme has been developed for the HIRLAM forecasting system, primarily in order to represent the uncertainty in the background state for variational data assimilation. Variational techniques are still considered to be the most appropriate for handling weak non-linearities in dynamical model data assimilation, mainly due to its full rank formulation. The main drawback is the static forecast error covariance matrix, applied at the start of the assimilation window. This problem can be addressed by using an ensemble of forecast states in a Hybrid Variational-Ensemble data assimilation scheme, bringing in flow- and data-dependencies.

The HIRLAM ETKF rescaling scheme has been tested for 2 weeks in August 2007. The scheme takes account of uncertainties on the lateral boundaries, via a global EPS system, in addition to regional scale uncertainties in the model domain. All types of observations used in the HIRLAM variational assimilation can influence the rescaling. The variance inflation factor seems to be crucial for the performance of the rescaling and it is fitted to the history of innovations.

The perturbations created by the HIRLAM ETKF rescaling scheme contain dynamically feasible structures, which account for dynamical instabilities and data density. Sensitivities of the rescaling scheme to the handling of surface variables, lateral boundary conditions and the observation data base have been studied. The validation of the rescaling includes studies of horizontal and vertical spectra of perturbations, the resolved range of innovation variance and the fastest energy growth of perturbations.