Experiments of Hybrid Ensemble Kalman Filter data assimilation in an operational NWP environment

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The Italian Weather Service runs an operational data assimilation cycle to provide its hydrostatic and non-hydrostatic NWP models with the initial conditions necessary for their forward integration in time. The objective analysis step is a multivariate variational 3D-PSAS analysis (Bonavita and Torrisi, 2005) where conventional and asynoptic observations (including aircraft observations, AMVs, Wind Profilers, Scatterometer winds and AMSU-A radiances) are ingested.

The First Guess (J_b) component of the cost function is currently modelled through a non-separable, partly analytic model whose parameters have been determined through the Hollingsworth-Lonnberg method. This approach has two obvious limitations:

- The stationarity of the forecast error covariance matrix;

- The inability to properly represent the complex nonlinear balance relationships which are present in the model equations and the atmosphere. These become increasingly important as the model and the analysis resolutions increase.

To tackle these problems the Ensemble Kalman Filter (EnKF) approach provides a coherent, though computationally expensive, framework. To compensate for the obvious sampling problems linked to the relatively small number of ensemble members, a variation of the hybrid technique first proposed by Hamill and Snyder (Hamill and Snyder, 2000) has been adopted. In a real world application the hybrid technique requires careful tuning of a number of parameters in order to reduce the sub-optimality of the actual filter implementation. A description of the tuning methodology and some early, promising results are given. Outstanding issues and future developments are also discussed.