Deterministic analysis in the CNMCA-LETKF system

Lucio Torrisi[a] and Francesca Marcucci[b]

[a] *CNMCA-Italian National Meteorological Center, Rome, Italy, torrisi@meteoam.it,* [b] *CNMCA-Italian National Meteorological Center, Rome, Italy*

Many studies have clearly demonstrated the benefit of using an hybrid EnKF-variational data assimilation system. This would imply additional costs for a small operational centre that strives to have a single data assimilation (DA) system to develop, maintain, and run operationally. Recently the Italian National Meteorological Center (CNMCA) has moved from a variational (3D-VAR) to an ensemble based (LETKF [1]) data assimilation system because this approach provides "optimal" analysis errors estimates for ensemble forecasting and it overcomes the need for ad hoc inverse methods. However, the use of the ensemble mean, that is the best estimate of the true system state, as initial condition for the operational deterministic NWP system, smoothes out the short range forecast, because the average operator tends to filter out the low-predictable small scale features in the analysis.

The CNMCA has spent some effort in deriving a deterministic analysis from the LETKF, in order to avoid the expensive solution of an hybrid DA system. Along with the standard CNMCA-LETKF [2,3] state vector, a deterministic analysis is computed using the standard LETKF-Kalman gain, the deterministic short-range forecast and the corresponding innovation vector. The use of a deterministic state in the CNMCA system improves the first forecast hours with respect to the use of the mean state. The deterministic forecast could also run at a higher resolution than the LETKF one by interpolating the forecast perturbations. Different approaches to produce the deterministic background, including also the blending technique, have been investigated.

References

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