Do EnKF compare to 4D-Var to retrieve model parameters? The case of a deterministic model assimilating deterministic and stochastic observations

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The Data Assimilation community is at a transition point at which operational centers may choose between the well known 4D-variational (4D-Var) methods and the relatively new Ensemble Kalman filters (EnKF) (Kalnay et al., 2007). However, before deciding which one of these types of data assimilation techniques is going to be the method of preference in operational centers, a number of methodological issues still need to be addressed. For example, it is not yet clear under what conditions which scheme will be the most appropriate to recover model parameters. In particular, for operational centers, it is important to check the performance of each one if observations contain more processes than the ones resolved by the model. As shown by Skachko et al. (2009), parameter estimation using EnKF has been shown to deal with model bias better than classical methods for statistically correcting it.

Using a simple predator-prey numerical model (Lawson et al., 1995), and its stochastic version, we address the issues of parameter estimation in two different experiment sets: i) the case in which observations come from the deterministic model; and ii) the case in which the observations come from the stochastic model.

The results show that, when observations come from the deterministic model, 4D-Var does always provide better parameter identification. In that case, when EnKF is used to estimate the parameters, an improvement is always obtained in terms of the sate of the system, even though the EnKF does not find the correct parameter values. On the contrary, when observations come from the stochastic model, better estimation results are obtained by the EnKF approach.