A Smooth Ensemble Kalman Filter for Parameter estimation

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Parameter estimation is a promising extension of data assimilation techniques that provides an optimal value for the uncertain model parameters, based on the information provided by the observations and the sensitivity of the model to the parameters. One of the main issues of this technique is that model errors can produce noisy oscillations in the value of the estimated parameters. In this work the Lorenz's 1963 model is used to study the performance of parameter estimation in the context of an imperfect model. The Ensemble Kalman Filter (EnKF) is used to estimate one of the three parameters that appears in the model equations while the other two parameters are set to an incorrect value in order to simulate the effect of model error (imperfect model). Under these conditions, the estimated parameter shows high temporal variability during the assimilation cycle.

In further experiments an Smooth Ensemble Kalman Filter (SEnKF) [1] has been applied by adding a new restriction over the time derivative of the estimated parameter which results in a reduction of its temporal variability. The analysis and short range forecast error has been quantified in order to evaluate the impact of the SEnKF upon the assimilation cycle. Results shows that SEnKF is a promising approach that can improve the short range forecast by reducing the effect of model error upon the estimated parameters.

References

[1] Craig J. Johns and Jan Mandel. "A two stage ensemble Kalman filter for smooth data," *Environmental and Ecological Statistics*, 15, 101-110, Marzo 2008. (Journal Article)