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Parameter perturbation and model error parameterization in an Ensemble Kalman Filter

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An Ensemble Kalman filter (EnKF) has been implemented in the non-linear and chaotic model of Lorenz (1963). A set of two data assimilation experiments are discussed here. In the first one, we follow the approach used by Evensen (1997) in which a fixed matrix Q (previously estimated by Evensen and Fario, 1997) is being added to the background ensemble error covariance. Using this approach, the filter allows to correctly assimilate observations of the model in such a way that the expected analysis error provided by the EnKF matches the covariance of the difference between the observations and the analysis field. In the second experiment, a model error is simulated by perturbing the three model parameters. In this case, the time evolution of each ensemble member is given by a numerical model that slightly differs in its model parameters. Using this approach, the method is able to reconstruct the trajectory of the system while providing a correct estimate of the analysis error. The latest approach has been able to provide meaningful results starting from arbitrary filter initialization and even when the time interval between observations is larger than the time scale of decorrelation, without the need of further modifications of the filter settings.