



A weak-constraint 4DEnsembleVar

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4DEnsembleVar is a hybrid data assimilation method which, besides making use of flow-dependent ensemble covariance information, avoids the computation of tangent-linear and adjoint models for the evolution and observation operators. In this method, the information from the observation time is communicated to the initial time via 4D cross-time covariances. Large systems require localisation of covariance matrices to suppress long-distance spurious elements. In a 4D covariance, however, using static localisation matrices (as it is done in practice) can eliminate the effect of observations if their location (at observational time) is far from that of the variable they are influencing (at the initial time). In lack of time-dependent localisation functions, in this work we propose a simpler option to ameliorate this problem. We exploit the presence of model error to spread the information of observations to more time steps, introducing a weak-constrained 4DEnsembleVar. The benefits of this method are illustrated in the Korteweg-de-Vries system, the Lorenz 1996 system, and a modified shallow water system with simulated convection.