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Comparison Experiments of Different Model Error Schemes in Ensemble Kalman Filter Soil Moisture Assimilation

Suping Nie (1), Jiang Zhu (2), and Yong Luo (3)

(1) National Climate Center, Beijing, China (niesp@cma.gov.cn), (2) Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, China (jzhu@mail.iap.ac.cn), (3) National Climate Center, Beijing, China (yluo@cma.gov.cn)

The purpose of this study is to explore the performances of different model error scheme in soil moisture data assimilation. Based on the ensemble Kalman filter (EnKF) and the atmosphere-vegetation interaction model (AVIM), point-scale analysis results for three schemes, 1) covariance inflation (CI), 2) direct random disturbance (DRD), and 3) error source random disturbance (ESRD), are combined under conditions of different observational error estimations, different observation layers, and different observation intervals using a series of idealized experiments. The results shows that all these schemes obtain good assimilation results when the assumed observational error is an accurate statistical representation of the actual error used to perturb the original truth value, and the ESRD scheme has the least root mean square error (RMSE). Overestimation or underestimation of the observational errors can affect the assimilation results of CI and DRD schemes sensitively. The performances of these two schemes deteriorate obviously while the ESRD scheme keeps its capability well. When the observation layers or observation interval increase, the performances of both CI and DRD schemes decline evidently. But for the ESRD scheme, as it can assimilate multi-layer observations coordinately, the increased observations improve the assimilation results further. Moreover, as the ESRD scheme contains a certain amount of model error estimation functions in its assimilation process, it also has a good performance in assimilating sparse-time observations.