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A localized particle filter for data assimilation in high-dimensional geophysical models.

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This talk introduces an ensemble data assimilation approach based on the particle filter (PF) that has potential for nonlinear/non-Gaussian applications in geoscience. PFs make no assumptions regarding prior and posterior error distributions, allowing them to perform well for most applications provided with a sufficiently large number of particles. The proposed method is similar to the PF in that ensemble realizations of the model state are weighted based on the likelihood of observations to approximate posterior probabilities of the system state. The new approach, denoted the local PF, reduces the influence of distant observations on the weight calculations via a localization function. Unlike standard PFs, the local PF provides accurate results using ensemble sizes small enough to be affordable for large models. Comparisons of the local PF and ensemble Kalman filters using a simplified atmospheric general circulation model (with 25 particles) demonstrate that the new method is a viable data assimilation technique for large geophysical systems. The local PF also shows substantial benefits over the EnKF when observation networks consist of measurements that relate nonlinearly to the model state—analogous to remotely sensed data used frequently in atmospheric analyses.