A Localized Particle Filter for High-Dimensional Models

Zhenwu Wang (1), Rolf Hut (2), and Nick van de Giesen (3)

(1) Delft University of Technology, Water management, Delft, Netherlands (zhenwu.wang@tudelft.nl), (2) Delft University of Technology, Water management, Delft, Netherlands (r.w.hut@tudelft.nl), (3) Delft University of Technology, Water management, Delft, Netherlands (N.C.vandeGiesen@tudelft.nl)

A new particle filter with localization is proposed in this study. It is difficult to apply the standard particle filter(PF) in high-dimensional models, because the standard PF needs a large number of particles to represent the distribution of model states. The localization method in LETKF(Local Ensemble Transformation Kalman Filter) is combined with the particle filter to overcome the problem of high dimensionality. Gamma test theory is applied to correct the variance of updated particles in model space. A set of experiments is conducted to evaluate the performance of the proposed method by using a Lorenz model with 40 variables. The results show that this method is stable and can avoid the collapse of the standard PF in high-dimensional systems.