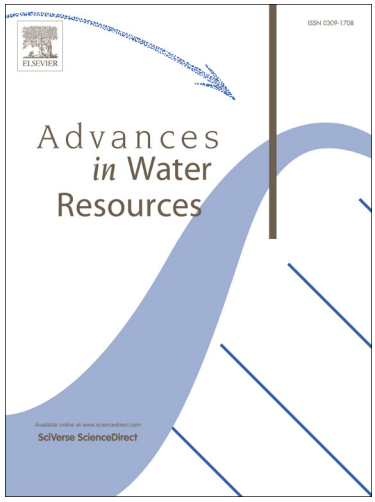

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PII: S0309-1708(13)00122-X
DOI: http://dx.doi.org/10.1016/j.advwatres.2013.07.007
Reference: ADWR 2074

To appear in: *Advances in Water Resources*

Received Date: 21 February 2013
Revised Date: 7 July 2013
Accepted Date: 10 July 2013

Please cite this article as: Dumedah, G., Coulibaly, P., Evaluating forecasting performance for data assimilation methods: the Ensemble Kalman Filter, the Particle Filter, and the Evolutionary-based assimilation, *Advances in Water Resources* (2013), doi: http://dx.doi.org/10.1016/j.advwatres.2013.07.007

Evaluating forecasting performance for data assimilation methods: the Ensemble Kalman Filter, the Particle Filter, and the Evolutionary-based assimilation

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Abstract

Data assimilation (DA) has facilitated the design and application of hydrological forecasting systems. DA methods such as the ensemble Kalman filter (EnKF) and the particle filter (PF) remain popular in the hydrological literature. But a comparative evaluation of these methods to alternative techniques like the evolutionary based data assimilation (EDA) has not been thoroughly conducted. Evolutionary algorithms have been widely applied in parameter estimation and it appears natural that its application in DA be compared to standard methods, particularly, to evaluate forecasting performance of these methods. This type of evaluation is important for the design of forecasting systems and has implications for real-time forecasting operations.

This study has applied the Sacramento Soil Moisture Accounting (SAC-SMA) model in the Spencer Creek catchment in southern Ontario, Canada to evaluate the performance of three DA methods. The methods assimilate streamflow into SAC-SMA, where the updated ensemble members are in turn applied to forecast streamflow for up to 30-day lead time after which they were compared to observation and open-loop estimates. The results showed that the increasing order of performance at assimilation stage and forecasting for short lead times of 10-day is the EnKF, the PF and the EDA. For longer lead times, the PF performs best and is preferable when forecasting for lead times beyond 10-day. The EnKF and the PF evolve members once between assimilation time steps whereas the EDA evolves members multi-

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