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Real-Time Updating of Stochastic Flow Forecasting Models

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Much of the recent research on data assimilation and real-time updating in hydrological forecasting has been focussed on stochastic methods that exploit computationally intensive ensemble averaging of some kind, such as the Ensemble Kalman Filter (EnKF), the Particle Filter (PF) and the Unscented Kalman Filter (UKF). However, data-based catchment models tend to be of the special Hammerstein form, so that a simple combination of the standard Kalman Filter and an optimal recursive parameter estimation algorithm, provides an alternative stochastic approach which may have some practical advantages. This paper describes such an approach and evaluates it on rainfall-flow data from the Leaf River in the USA. This enables comparison with other studies that have applied computationally more intensive approaches, based on the EnKF and PF, to these same data. The paper will also raise questions about model identifiability, joint or separate parameter/state estimation and the estimation of statistical hyper-parameters. In addition, it will outline a new approach to large computer model 'emulation' that exploits 'dominant mode' models and suggest that this provides alternative approach to data assimilation and real-time updating when forecasting is based on such large models.