Geophysical Research Abstracts
Vol. 16, EGU2014-10474, 2014
EGU General Assembly 2014

Kernel Density Independence Sampling based Monte Carlo Scheme (KISMCS) to infer posterior hydrologic parameter distributions

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Posterior sampling methods are increasingly being used to describe parameter and model predictive uncertainty in hydrologic modelling. This paper proposes an alternative to random walk chains (such as DREAM); independence chains with an embedded feature of standardized importance weights based on Kernel density estimates. A Markov Chain Monte Carlo sampling algorithm has been proposed with Metropolis-Hastings (M-H) updates using an independence sampler. The independence sampler ensures that candidate observations are drawn independently of the current state of a chain, thereby ensuring efficient exploration of the target distribution. The M-H acceptance-rejection criteria is used to sample across 3 chains, which ensures that the chains are well mixed. Kernel density estimation on last 600 samples in a chain is used to calculate standardized importance weights within the independence sampler to ensure fast convergence of sampled points to the target distribution. Its performance with a benchmark algorithm, Differential Evolution Adaptive Metropolis (DREAM), are provided based on synthetic and real world case studies. The comparison of KISMCS and DREAM is done based on accuracy of convergence to 'true' posterior parameter distributions in case of synthetics case studies and the rate of convergence to a stationary distribution in case of real world hydrological modelling case studies.