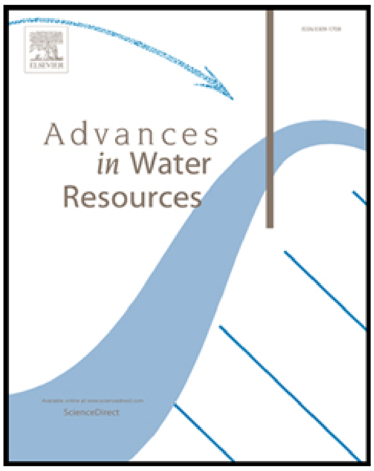

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Accounting for model error in Bayesian solutions to hydrogeophysical inverse problems using a local basis approach

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Abstract

Bayesian solutions to geophysical and hydrological inverse problems are dependent upon a forward model linking subsurface physical properties to measured data, which is typically assumed to be perfectly known in the inversion procedure. However, to make the stochastic solution of the inverse problem computationally tractable using methods such as Markov-chain-Monte-Carlo (MCMC), fast approximations of the forward model are commonly employed. This gives rise to model error, which has the potential to significantly bias posterior statistics if not properly accounted for. Here, we present a new methodology for dealing with the model error arising from the use of approximate forward solvers in Bayesian solutions to hydrogeophysical inverse problems. Our approach is geared towards the common case where this error cannot be (i) effectively characterized through some parametric statistical distribution; or (ii) estimated by interpolating between a small number of computed model-error realizations. To this end, we focus on identification and removal of the model-error component of the residual during MCMC using a projection-based approach, whereby the orthogonal basis employed for the projection is derived in each iteration from the K-nearest-neighboring entries in a model-error dictionary. The latter is

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