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A novel approach to parameter uncertainty analysis of hydrological models using neural networks

D. L. Shrestha[1], N. Kayastha[2], and D. P. Solomatine[1,3]
[1]UNESCO-IHE Institute for Water Education, Delft, The Netherlands
[2]MULTI Disciplinary Consultants Ltd, Kathmandu, Nepal
[3]Water Resources Section, Delft University of Technology, The Netherlands

Abstract. In this study, a methodology has been developed to emulate a time consuming Monte Carlo (MC) simulation by using an Artificial Neural Network (ANN) for the assessment of model parametric uncertainty. First, MC simulation of a given process model is run. Then an ANN is trained to approximate the functional relationships between the input variables of the process model and the synthetic uncertainty descriptors estimated from the MC realizations. The trained ANN model encapsulates the underlying characteristics of the parameter uncertainty and can be used to predict uncertainty descriptors for the new data vectors. This approach was validated by comparing the uncertainty descriptors in the verification data set with those obtained by the MC simulation. The method is applied to estimate the parameter uncertainty of a lumped conceptual hydrological model, HBV, for the Brue catchment in the United Kingdom. The results are quite promising as the prediction intervals estimated by the ANN are reasonably accurate. The proposed techniques could be useful in real time applications when it is not practicable to run a large number of simulations for complex hydrological models and when the forecast lead time is very short.

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