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Modeling Stream Flow with Prediction Uncertainty by Using SWAT Hydrologic and RBNN Neural Network Models for Agricultural Watershed in India

Authors : Ajai Singh

Abstract : Simulation of hydrological processes at the watershed outlet through modelling approach is essential for proper planning and implementation of appropriate soil conservation measures in Damodar Barakar catchment, Hazaribagh, India where soil erosion is a dominant problem. This study quantifies the parametric uncertainty involved in simulation of stream flow using Soil and Water Assessment Tool (SWAT), a watershed scale model and Radial Basis Neural Network (RBNN), an artificial neural network model. Both the models were calibrated and validated based on measured stream flow and quantification of the uncertainty in SWAT model output was assessed using ''Sequential Uncertainty Fitting Algorithm'' (SUFI-2). Though both the model predicted satisfactorily, but RBNN model performed better than SWAT with R2 and NSE values of 0.92 and 0.92 during training, and 0.71 and 0.70 during validation period, respectively. Comparison of the results of the two models also indicates a wider prediction interval for the results of the SWAT model. The values of P-factor related to each model shows that the percentage of observed stream flow values bracketed by the 95PPU in the RBNN model as 91% is higher than the P-factor in SWAT as 87%. In other words the RBNN model estimates the stream flow values more accurately and with less uncertainty. It could be stated that RBNN model based on simple input could be used for estimation of monthly stream flow, missing data, and testing the accuracy and performance of other models.

Keywords : SWAT, RBNN, SUFI 2, bootstrap technique, stream flow, simulation
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