Improved Water Level Forecasting Performance by Using Optimal Steepness Coefficients in an Artificial Neural Network

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ABSTRACT
Developing water level forecasting models is essential in water resources management and flood prediction. Accurate water level forecasting helps achieve efficient and optimum use of water resources and minimize flooding damages. The artificial neural network (ANN) is a computing model that has been successfully tested in many forecasting studies, including river flow. Improving the ANN computational approach could help produce accurate forecasting results. Most studies conducted to date have used a sigmoid function in a multi-layer perceptron neural network as the basis of the ANN; however, they have not considered the effect of sigmoid steepness on the forecasting results. In this study, the effectiveness of the steepness coefficient (SC) in the sigmoid function of an ANN model designed to test the accuracy of 1-day water level forecasts was investigated. The performance of data training and data validation were evaluated using the statistical index efficiency coefficient and root mean square error. The weight initialization was fixed at 0.5 in the ANN so that even comparisons could be made between models. Three hundred rounds of data training were conducted using five ANN architectures, six datasets and 10 steepness coefficients. The results showed that the optimal SC improved the forecasting accuracy of the ANN data training and data validation when compared with the standard SC. Importantly, the performance of ANN data training improved significantly with utilization of the optimal SC.

KEYWORDS: Artificial neural networks; Sigmoid function; Steepness coefficient; Water level forecasting

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