Adaptive Neuro-Fuzzy Inference System for Long-term Streamflow Forecasts Using K-fold Cross-validation: Taleghan basin, Iran

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Abstract

Streamflow forecasting is an important issue in water resource management. In this paper, the application of Adaptive Neuro-fuzzy Inference System (ANFIS) is investigated in modeling monthly and seasonal streamflow forecasts. Moreover, K-fold as the cross-validation method is used to evaluate test-training data in the model. Results are compared with those of the typical method (i.e., using 75% of data for training and the remaining 25% for testing the validity of the trained model). Study area is Taleghan basin located at northwestern Tehran, Iran. The data used in this research consists of 19 years of monthly streamflow, precipitation and temperature records. To apply temperature and precipitation data in the model, the whole basin was divided into sub-basins and average values of each parameter for each sub-basin were allocated as model input. Finally, results are compared with those of the ANN model. It was found that the forecasting models using K-fold are more reliable. In addition, the ANFIS model shows better performance than the ANN model in predicting peak flows and other model evaluation indices including the Nash-Sutcliffe Efficiency Index and Scatter Index.

Keywords: Streamflow forecasting, Tehran, ANFIS, K-fold, ANN.

1- Introduction

Streamflow forecasting is an important issue in water resource management (e.g. flood control, drought management, reservoir design, etc.). Streamflow forecasting can be approached in many ways by considering different time steps and methods (conceptual, physical, and black box).

Maidment et al. (1985) used short-term time series for forecasting daily water demands in the United States. Dariane et al. (2004) predicted long-term streamflow in Dez River located in southwestern Iran using satellite images along with regression methods. In recent decades, artificial neural networks have been considerably used in streamflow forecasting. ANNs have succeeded in replacing regression methods in most applications where the relationships among the variables are non-linear and complex.

Kisi (2004) used neural networks and autoregressive methods (AR) for monthly streamflow prediction at Goksudere River in Turkey and concluded that the ANN approach has better