Application of Back Propagation Neural Network in Forecasting River Flows in the Mulungushi Sub-basin, Zambia.

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Abstract

Use of Artificial Neural Network (ANN) models are some of the latest advancements in hydrological forecasting in order that complex transformation processes of a riverine system with limited data can be captured easily. This can then be made use of in making flow forecasts such that appropriate water management strategies can be made in advance. This study attempts to develop an appropriate network which can be used for forecasting the observed river flows based on monthly rainfall and evaporation data in the Mulungushi sub-basin of the Zambezi basin in Zambia. This can be used for undertaking flow forecasts and in particular a 5 months ahead forecast of the river flows prior to start of the dry season. An optimal Backpropagation neural network thus developed with early stopping and normalised input variables yielded correlation coefficients of 0.970, 0.955 and 0.969 during training, validation and testing sub-sets of data used respectively. The performance of the model was also assessed through other efficiency terms such as Mean Error (ME), Mean Squared Error (MSE), and Root Mean Squared Error (RMSE) and was found to be above 70% in terms of efficiency during the testing conditions. The model when used for making five months ahead forecast particularly ahead of dry season, a correlation coefficient of 0.998 was obtained between the observed and the forecast flows, thus making the viability of the proposed model for future use where most of the short memory type of models usually fails to achieve.

Keywords: Artificial neural network; Back propagation neural network; Forecasting; Root mean squared error.