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Appropriate data normalization range for daily river flow forecasting using an artificial neural network

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Abstract Advance time-step river flow forecasting is of paramount importance in controlling flood damage. For the last few years, artificial neural networks (ANN) have been used extensively in river flow forecasting and have proven to be an efficient technique. Various statistical techniques have been used to pre-process the input data sets before using them in ANN model training to reduce the forecasting error. Normalizing the input–output data sets between certain ranges is one of the methods of pre-processing the raw data; this improves input–output generalization to yield accurate forecasts. In the present study, 1-day, 2-day and 3-day advance flow forecasts were carried out at a site on the Brahmani River, on the east coast of India, using the ANN approach, utilizing the data sets normalized within four different ranges (–1.0 to +1.0; 0.0–1; 0.1–0.9 and 0.2–0.8). The results obtained using the normalized data of three different ranges were compared in terms of root mean square error (RMSE) and modelling efficiency (E) to determine the best range of data normalization. The study revealed that normalizing the data sets within any of the three ranges (0.0–1; 0.1–0.9 and 0.2–0.8), yielded significantly improved results compared to the range –1 to +1. In the case of the 1-day ahead forecast, all three data ranges produced comparable and satisfactory results, whereas for 2-day and 3-day ahead forecasts, the ANN model trained using the normalized data of the range 0.2–0.8 yielded the best result.

Key words river flow forecasting; data normalization