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Improvements on river flow forecast by additional predictors using artificial neural networks

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This study analyses the evaluation of the performance of a streamflow forecast model for the river Ouse (UK), based on a feed-forward multilayer artificial neural network (FMANN), in the context of the Hydroinformatics Challenge II. Two different sets of FMANN models were developed: one for the 6-hour forecast horizon and the second for the 24-hour one. Each set is composed by ten models that differ from each other by a different set of inputs (predictors) and number of neurons in the hidden layer. Three layer FMANN models were trained using the back-propagation algorithm. The mean squared error function and cross validation stopping criterion were used for determining the best training stop moment. The tested predictors are: river flow at the site to be forecasted; streamflow increment between the last two time-steps immediately before the forecast issue at the same site; river flow at upstream sites; and precipitation at sites in the upper river basin. Different combinations of these predictors were tested and the performance of the trained FMANN was compared by means of a modified form of the Nash-Sutcliffe efficiency coefficient, and a efficiency coefficient obtained by comparison of the forecasts to naïve predictions based on streamflow persistency. In the case of the 6-hour forecasts, results show a clear improvement of forecasting performance when upstream streamflow information is included as an input. For the same forecasting horizon, the further inclusion of antecedent observed precipitation as input does not improve the model skill. In the case of the 24-hour horizon, both upstream streamflow and antecedent rainfall information improved the results very clearly, with the best performance obtained using a FMANN which receives as inputs all the tested

predictors. These results suggest that in this basin the antecedent precipitation seems to be more important for forecasting lead times longer than 6 hours.