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## Neural networks and non-parametric methods for improving real-time flood forecasting through conceptual hydrological models

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**Abstract.** Time-series analysis techniques for improving the real-time flood forecasts issued by a deterministic lumped rainfall-runoff model are presented. Such techniques are applied for forecasting the short-term future rainfall to be used as real-time input in a rainfall-runoff model and for updating the discharge predictions provided by the model. Along with traditional linear stochastic models, both stationary (ARMA) and non-stationary (ARIMA), the application of non-linear time-series models is proposed such as Artificial Neural Networks (ANNs) and the 'nearest-neighbours' method, which is a non-parametric regression methodology. For both rainfall forecasting and discharge updating, the implementation of each time-series technique is investigated and the forecasting schemes which perform best are identified. The performances of the models are then compared and the improvement in the efficiency of the discharge forecasts achievable is demonstrated when i) short-term rainfall forecasting is performed, ii) the discharge is updated and iii) both rainfall forecasting and discharge updating are performed in cascade. The proposed techniques, especially those based on ANNs, allow a remarkable improvement in the discharge forecast, compared with the use of heuristic rainfall prediction approaches or the not-updated discharge forecasts given by the deterministic rainfall-runoff model alone.

**Keywords:** real-time flood forecasting, precipitation prediction, discharge updating, time-series analysis techniques

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