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Data-driven flood prediction: from regional to detailed analyses

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Data-driven approaches, especially artificial neural networks (ANN), have become a common and powerful tool for flood forecasting in recent years. However, many studies are focused on only a few catchments. Hence, this analysis aims a differentiated assessment of the potential of ANN on flood forecasting, using a large data basis. This is done by the evaluation of ANN for 50 fast responding catchments and detailed analyses of prediction errors. Thus, the study consists of (i) a regional analysis, where the forecast performance of ANN is compared to that of an equivalent conceptual model, quantified by both, integral and threshold-based measures. And (ii) a detailed analysis of the outcomes of the ANN. Results of the regional performance analysis indicate a higher forecast quality of the data-driven technique over several lead times against the conceptual model. Whereas, the detailed analysis of ANN show essential deficiencies in terms of prediction accuracy and practical usability. As a consequence, three main issues with a high percentage occurrence were identified: phase shift error, oscillations and excessive loss of information. The found errors reduce the quality of ANN predictions measured by common integral measures. Thus, the setup as well as the evaluation of data-driven techniques must be reconsidered for the practical flood forecasting applications.