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Analysis on the phenomena of phase shift errors of data-driven flood forecasting models

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Artificial neural networks (ANN) are applied to be a common and powerful tool for flood forecasting in recent years. However, among the investigations that have examined, e.g. on the extrapolation behavior of ANN, there are only few studies on further limitations such as the phase shift error (PSE), which is recognized for different types of data-driven modelling techniques. In addition, often used integral performance measures as Nash-Sutcliffe coefficient of efficiency (NSE) tend to suggest good forecasting capabilities, even though a loss of performance with respect to time lagging can be observed. Thus, this study focuses on phenomena and causes of phase shift errors of ANN in flood forecasting applications. The analysis consists of: (i) the determination of the extent of PSE for ANN's applied to a large number of small catchments; (ii) to find correlations between the PSE and integral performance measures; and (iii) identification of the impact of the quality of input variables such as observed rainfall and discharge. This is done by a rather comprehensive evaluation of ANN modelling results of more than 50 catchments characterized by fast hydrological response. First results prove that the PSE can be observed in a high percentage of the considered catchments which may jeopardize the practical application of ANN's for flood forecasting.