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Comprehensive investigation of preprocessing approaches on artificial neural networks for flood forecasting

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Data-driven methods are widely used in hydrology, especially in the field of flood forecasting. These methods are only based on information contained in both, input and output data. Whereas process describing equations are not explicitly included in the model. However, the used data is more or less influenced by uncertainty caused by different sources, e.g. measurement errors. If the sources of uncertainty are unknown and the uncertainty cannot be quantified, the learning from data can be affected. Therefore, selecting relevant information from signals by a preprocessing of the data can be very important and could increase the prediction accuracy.
This study combines artificial neural networks (ANN) with two preprocessing approaches to filter the data - wavelet-transformation (WT) and singular spectrum analysis (SSA). Additionally, the analysis consists of three data sets, characterized by an increasing degree of determination: (i) real world data from a small, fast responding catchment with hourly resolution, (ii) conceptual data, where flow data is produced by a conceptual hydrological model, and (iii) synthetic data obtained from a sin function. The generated hybrid ANN models are compared with a benchmark ANN without preprocessing extension.
As a first result, the continuous preprocessing of the flow data allows to decrease predictions errors such as phase shift errors. However, this is not feasible under operational conditions since the filtering needs future values. In order to avoid this problem approaches for the estimation of the future values are discussed.