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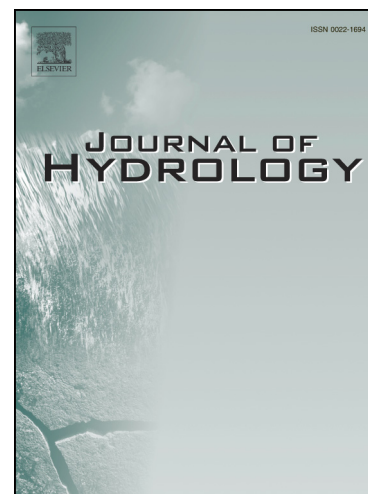
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Are hybrid models integrated with data preprocessing techniques suitable for monthly streamflow forecasting? Some experiment evidences

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Abstract A number of hydrological studies have proven the superior prediction performance of hybrid models coupled with data preprocessing techniques. However, many studies first decompose the entire data series into components and later divide each component into calibration and validation datasets to establish models, which sends some amount of future information into the decomposition and reconstruction processes. As a consequence, the resulting components used to forecast the value of a particular moment are computed using information from future values, which are not available at that particular moment in a forecasting exercise. Since most papers don't present their model framework in detail, it is difficult to identify whether they are performing a real forecast or not. Even though several other papers have explicitly stated which experiment they are performing, a comparison between results in two experiments is still missing. Therefore, it is necessary to investigate and compare the performance of these hybrid models in the hindcast and forecast experiments in order to estimate whether they are suitable for real forecasting. With the combination of three preprocessing techniques, such as wavelet analysis (WA), empirical mode decomposition (EMD) and singular spectrum analysis (SSA), and two modeling methods (i.e. ANN model and ARMA model), six hybrid models are developed in this study, including WA-ANN, WA-ARMA, EMD-ANN, EMD-ARMA, SSA-ANN and SSA-ARMA. Preprocessing techniques are

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