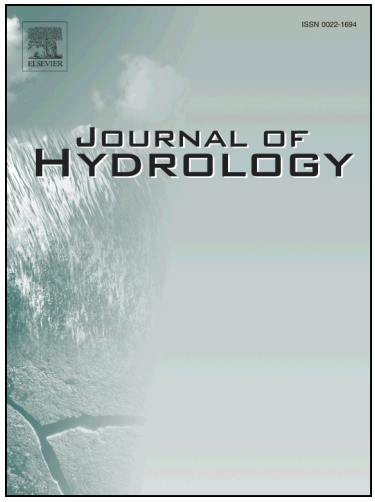

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Forecasting daily streamflow using online sequential extreme learning machines

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Abstract

While nonlinear machine methods have been widely used in environmental forecasting, in situations where new data arrive continuously, the need to make frequent model updates can become cumbersome and computationally costly. To alleviate this problem, an online sequential learning algorithm for single hidden layer feedforward neural networks – the online sequential extreme learning machine (OSELM) – is automatically updated inexpensively as new data arrive (and the new data can then be discarded). OSELM was applied to forecast daily streamflow at two small watersheds in British Columbia, Canada, at lead times of 1-3 days. Predictors used were weather forecast data generated by the NOAA Global Ensemble Forecasting System (GEFS), and local hydrometeorological observations. OSELM forecasts were tested with daily, monthly or yearly model updates. More frequent updating gave smaller forecast errors, including errors for data above the 90th percentile. Larger datasets used in the initial training of OSELM helped to find better parameters (number of hidden nodes) for the model, yielding better predictions. With the online sequential multiple linear regression (OSMLR) as benchmark, we concluded that OSELM is an attractive approach as it easily outperformed OSMLR in forecast accuracy.

Keywords: Streamflow, Forecast, Extreme learning machine (ELM), online sequential ELM (OSELM), Machine Learning

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