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FORECASTING HYDROLOGICAL TIME SERIES IN THE FACE OF CLIMATE CHANGE

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ABSTRACT The importance of highly accurate flow forecasts, especially in flood-prone areas, has increased significantly in Canada over the last few years as extreme events have become more frequent, severe, and costly due to climate change and other factors. A problem with presently available data-based forecasting methods is that they have limitations handling non-stationary data due to, among other things, climate change. Wavelets are, for intrinsic reasons, well suited for dealing with non-stationary time series since they automatically filter the non-stationary component of the signal instead of trying to de-trend or suppress quasi-periodic smooth components as, for example, in the classical non-stationary autoregressive integrated moving average approach. In this study, a method based on coupling discrete wavelet transforms and artificial neural networks for flood forecasting applications is proposed. The discrete wavelet transform is used to decompose stream flow time series data into wavelet coefficients. The wavelet coefficients are then used as inputs into artificial neural network models to streamflow. The relative performance of the coupled wavelet-neural network models were compared to regular artificial neural network models for flood forecasting with a lead time of one month. The coupled wavelet-neural network models were found to provide more accurate streamflow forecasts than the artificial neural network models. The results indicate that coupled wavelet-neural network models are a promising new method of flood forecasting.

Keywords: time series; floods; forecasting; wavelets; artificial neural networks