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Using Wavelet Analysis to Assess Timing Errors in Streamflow Predictions

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Hydrologic forecasts typically contain errors in both timing and magnitude. Since these two different types of errors may originate from different components of a forecast system, a distinction between them should lead to more targeted improvements in hydrologic forecasts. Timing error information is important for several practical applications, such as flood forecasting, navigation rules based on tidally influenced forecasts, river regulation (e.g. dam releases), and snowmelt-driven water supply forecasting. In the case of real-time forecasting, distinct information on timing errors, such as flood warnings with the time-to-peak uncertainty assessed, should allow emergency managers and other forecast users to make better informed decisions. However, information on the timing errors in hydrologic prediction is rarely provided, either in a diagnostic or a real-time forecasting context. We present an approach to evaluating the timing errors in hydrologic predictions using the cross wavelet transform (XWT) technique. The XWT technique transforms the paired time series of predictions and observations into a two-dimensional scale-time space and provides information on scale-dependent timing differences between the two time series. Results from applying XWT to hydrologic predictions in a number of test basins in the service areas of the U.S. National Weather Service River Forecast Centers will be presented, along with a discussion on how timing error information could be used in various hydrologic applications including calibration and verification.