Geophysical Research Abstracts
Vol. 21, EGU2019-8465, 2019
EGU General Assembly 2019

Assessment of peak flow error metrics and error weights for data-driven riverine flow forecasting models

Usman T Khan and Everett Snieder
Civil Engineering, York University, Toronto, Canada (usman.khan@lassonde.yorku.ca)

Riverine flood risk and vulnerability in cities are expected to increase in coming years due to climate change and rapid urbanization. Flood damage can be mitigated using early warning systems that forecast flow, and provide emergency services with an advanced notice of the likelihood of a flood. The performance of these models is typically assessed based on multiple error metrics (e.g. Nash Sutcliffe efficiency, NSE and root mean squared error, RMSE), as different metrics capture different model characteristics. For models used in early warning systems, model accuracy during the rising limb and at the peak discharge of large hydrological events are particularly important. Standard error metrics are not reliably representative of model performance during this period; therefore, there is a need to investigate alternative error metrics for more accurately assessing peak flow performance.

The main objective of this study is to provide a comprehensive assessment of various peak flow error metrics. The metrics considered in this study include: mean average peak timing error (MAPTE), timing error (TE), persistence index (PI), series distance (SD), and information mean squared error (IMSE). These metrics quantify model behaviour such as timing error and peak flow amplitude error, which cannot be explicitly quantified using standard metrics such as NSE and RMSE.

This research uses feedforward artificial neural networks (ANNs) to generate hourly flow forecasts for the Don River in Toronto, Canada, using upstream hydro-meteorological data. The performance of the models is measured and compared using each peak error metric and the standard error metrics. Additionally, hydrographs for the largest flood events within the 10-year dataset area analysed to provide a visual baseline for model behaviour. Several different scenarios generated by changing the amount of upstream data used in the model, as to induce peak flow error are analysed. This research also investigates the impact of error-weighting in the cost-function of the ANN training and optimisation procedure has on peak flow prediction performance. Error weighting has been successfully used in image recognition models, however it has not been widely documented for hydrological models.

This study will help modellers select better error metrics for flood forecasting models by providing an improved understanding of the several peak error metrics. While results from this research focus on ANN models, an assessment of peak error metrics is valuable to physically-based flood forecasting models as well.