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Combining empirical approaches and error modelling to enhance predictive uncertainty estimation in extrapolation for operational flood forecasting. Tests on flood events on the Loire basin, France.

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An increasing number of operational flood forecasting centres assess the predictive uncertainty associated with their forecasts and communicate it to the end users. This information can match the end-users needs (i.e. prove to be useful for an efficient crisis management) only if it is reliable: reliability is therefore a key quality for operational flood forecasts.

In 2015, the French flood forecasting national and regional services (Vigicrues network; www.vigicrues.gouv.fr) implemented a framework to compute quantitative discharge and water level forecasts and to assess the predictive uncertainty. Among the possible technical options to achieve this goal, a statistical analysis of past forecasting errors of deterministic models has been selected (QUOIQUE method, Bourgin, 2014). It is a data-based and non-parametric approach based on as few assumptions as possible about the forecasting error mathematical structure. In particular, a very simple assumption is made regarding the predictive uncertainty distributions for large events outside the range of the calibration data: the multiplicative error distribution is assumed to be constant, whatever the magnitude of the flood. Indeed, the predictive distributions may not be reliable in extrapolation. However, estimating the predictive uncertainty for these rare events is crucial when major floods are of concern.

In order to improve the forecasts reliability for major floods, an attempt at combining the operational strength of the empirical statistical analysis and a simple error modelling is done. Since the heteroscedasticity of forecast errors can considerably weaken the predictive reliability for large floods, this error modelling is based on the log-sinh transformation which proved to reduce significantly the heteroscedasticity of the transformed error in a simulation context, even for flood peaks (Wang et al., 2012).

Exploratory tests on some operational forecasts issued during the recent floods experienced in France (major spring floods in June 2016 on the Loire river tributaries and flash floods in fall 2016) will be shown and discussed.

References

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