Geophysical Research Abstracts
Vol. 21, EGU2019-18139, 2019
EGU General Assembly 2019

Methods for estimating flood warning runoff thresholds in ungauged basins: comparison in terms of false alarms and missed events over two data sets in Austria and in the United States

Elena Toth (1), Juraj Parajka (2), and Mattia Neri (1)

(1) University of Bologna, DICAM, Bologna, Italy (elena.toth@unibo.it), (2) Vienna University of Technology, Vienna, Austria

Flood watches and warnings of flood alerts are generally triggered based on runoff thresholds, when either observed or forecasted streamflow is approaching the value that may produce flood damages ('flooding flow'). In absence of detailed information on each river cross-section, many national/regional flood forecasting systems assume that the runoff thresholds for activating warnings or mitigation measures correspond to the flow peaks with a given return period: often the 2-year one, that may be associated with the bankfull discharge, or higher flood quantiles, associated with increasing levels of risk.

At locations where the historical streamflow records are absent or very limited, the peak flow of given frequency to be associated with the watch/warning threshold can be estimated making use of the information available in hydrologically similar catchments (donors). We here propose two regionalisation approaches for estimating such thresholds in ungauged basins, testing them over two large data-sets in different hydrological regions (Austria and the United States CAMELS data set, see Addor et al., HESS, 2017), where both long meteo-hydrological time-series and catchment descriptors are available. The first approach estimates the quantiles for ungauged catchments on the simulated rather than on the observed streamflow time-series, applying a rainfall-runoff model (the TUWien model, a semi-distributed version of the HBV model, see Parajka et al, HESS, 2005) where the gauged catchments (donors) are used to identify the set of parameters in ungauged catchments. The second approach identifies regression-type empirical relationships between catchment descriptors that are available also for ungauged catchments and the desired flood quantile.

Adopting a warning threshold that is higher than the flow that actually produces flooding damages would lead to missing such events, failing to issue an alarm, whereas underestimating the threshold would result in false alarms. Since the consequences of an unwarned flood are generally much more severe than those of false alarms, misses usually have a lower level of acceptance from society than false warnings.

Different objective functions were applied in the parameterization of the TUW rainfall-runoff model, comparing the results in terms of both the sign and magnitude of the errors in the threshold estimates and of the corresponding skill-scores (numbers of false/missed alarms) of the flood warnings that would have been issued in the observation period using such estimates.

In order to reduce the number of unwarned flood events, we applied, for the regression-type approach, the procedure proposed in Toth (HESS, 2016), parameterising a non-linear regression model with an asymmetric error function (instead of using a traditional, symmetric square errors sum), thus penalizing more the overestimation errors (i.e. those leading to missed flood events) than the underestimations.

When the degree of asymmetry in the error function increases, overpredictions and ratio of missed events decrease, but, as expected, at expenses of more numerous false alarms. The appropriate degree of asymmetry of course depends on the risk-aversion of the specific flood-prone context and a discussion of hindcast analysis of false/missed alarms with the decision-makers/communities may help to identify the adequate degree of asymmetry for the specific study area.