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Implementing the national AIGA flash flood warning system in France

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The French national hydro-meteorological and flood forecasting centre (SCHAPI) aims to implement a national flash flood warning system to improve flood alerts for small-to-medium (up to 1000 km2) ungauged basins. This system is based on the AIGA method, co-developed by IRSTEA these last 10 years. The method, initially set up for the Mediterranean area, is based on a simple event-based hourly hydrologic distributed model run every 15 minutes (Javelle et al. 2014). The hydrologic model ingests operational radar-gauge rainfall grids from Météo-France at a 1-km^2 resolution to produce discharges for successive outlets along the river network. Discharges are then compared to regionalized flood quantiles of given return periods and warnings (expressed as the range of the return period estimated in real-time) are provided on a river network map. The main interest of the method is to provide forecasters and emergency services with a synthetic view in real time of the ongoing flood situation, information that is especially critical in ungauged flood prone areas.

In its enhanced national version, the hourly event-based distributed model is coupled to a continuous daily rainfall-runoff model which provides baseflow and a soil moisture index (for each 1-km^2 pixel) at the beginning of the hourly simulation. The rainfall-runoff models were calibrated on a selection of 700 French hydrometric stations with Météo-France radar-gauge reanalysis dataset for the 2002-2006 period. To estimate model parameters for ungauged basins, the 2 hydrologic models were regionalised by testing both regressions (using different catchment attributes, such as catchment area, soil type, and climate characteristic) and spatial proximity techniques (transposing parameters from neighbouring donor catchments), as well as different homogeneous hydrological areas. The most valuable regionalisation method was determined for each model through jack-knife cross-validation. The system performance was then evaluated with contingency criteria (e.g., Critical Success Index, Probability Of Detection, Success Ratio) using operational rainfall radar-gauge products from Météo-France for the 2009-2012 period. The regionalised parameters of the distributed model were finally adjusted for each homogeneous hydrological area to optimize the Heidke skill score (HSS) calculated with three levels of warnings (2-, 10- and 50-year flood quantiles).

This work is currently being implemented by the SCHAPI to set up an automated national flash flood warning system by 2016. Planned improvements include developing a unique continuous model to be run at a sub-hourly timestep, discharge assimilation, as well as integrating precipitation forecasts while accounting for the main sources of forecast uncertainty.

Javelle, P., Demargne, J., Defrance, D., and Arnaud, P. 2014. Evaluating flash flood warnings at ungauged locations using post-event surveys: a case study with the AIGA warning system. Hydrological Sciences Journal, DOI: 10.1080/02626667.2014.923970