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Hydrologic ensembles based on convection-permitting precipitation nowcasts for flash flood warnings

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In order to better anticipate flash flood events and provide timely warnings to communities at risk, the French national service in charge of flood forecasting (SCHAPI) is implementing a national flash flood warning system for small-to-medium ungauged basins. Based on a discharge-threshold flood warning method called AIGA (Javelle et al. 2014), the current version of the system runs a simplified hourly distributed hydrologic model with operational radar-gauge QPE grids from Météo-France at a 1-km^2 resolution every 15 minutes. This produces real-time peak discharge estimates along the river network, which are subsequently compared to regionalized flood frequency estimates to provide warnings according to the AIGA-estimated return period of the ongoing event.

To further extend the effective warning lead time while accounting for hydrometeorological uncertainties, the flash flood warning system is being enhanced to include Météo-France's AROME-NWC high-resolution precipitation nowcasts as time-lagged ensembles and multiple sets of hydrological regionalized parameters. The operational deterministic precipitation forecasts, from the nowcasting version of the AROME convection-permitting model (Auger et al. 2015), were provided at a 2.5-km resolution for a 6-hr forecast horizon for 9 significant rain events from September 2014 to June 2016. The time-lagged approach is a practical choice of accounting for the atmospheric forecast uncertainty when no extensive forecast archive is available for statistical modelling. The evaluation on 781 French basins showed significant improvements in terms of flash flood event detection and effective warning lead-time, compared to warnings from the current AIGA setup (without any future precipitation). We also discuss how to effectively communicate verification information to help determine decision-relevant warning thresholds for flood magnitude and probability.

Javelle, P., Demargne, J., Defrance, D., 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

Auger, L., Dupont, O., Hagelin, S., Brousseau, P., Brovelli, P., 2015. AROME–NWC: a new nowcasting tool based on an operational mesoscale forecasting system. Quarterly Journal of the Royal Meteorological Society, 141: 1603–1611, doi:10.1002/qj.2463