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Enhancements of the French operational flash flood warning system, Vigicrues Flash

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The French national service in charge of flood forecasting (SCHAPI) has implemented, in collaboration with Irstea and Météo-France, a national flash flood warning system, Vigicrues Flash, to provide timely warnings for small-to-medium ungauged basins. Operational since March 2017 for about 10,000 municipalities, this system complements flood warnings produced by the Vigicrues procedure for French monitored rivers.

Vigicrues Flash is based on a discharge-threshold flood warning method called AIGA. In the current operational version, a simplified hourly distributed rainfall-runoff model ingests radar-gauge Quantitative Precipitation Estimate (QPE) grids from Météo-France at a 1-km^2 resolution to produce real-time peak discharge estimates on any river cell. This 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. Every 15 minutes, the discharges are compared to regionalized flood frequency estimates, which were derived from long-term streamflow simulations. The automated warning system determines rivers exceeding the high flood and very high flood thresholds (associated to years of return periods), as well as the associated municipalities that might be impacted. Flood hazard maps are published on a web platform and warning messages are automatically sent to registered users to help them better mitigate flood risk impacts.

To better anticipate flash flood events and extend the coverage of this automated service, the warning system is being enhanced to include a single fully distributed hydrologic model, run at sub-hourly time step. Several calibration and regionalization methods are being tested to better account for basins spatial heterogeneities while maintaining consistency across spatial scales. Evaluation is carried out for about 2000 French basins on the 2008-2018 period to show improvements in terms of flash flood event detection and effective warning lead time. Other enhancements include integrating high-resolution precipitation nowcasts available on a 6-hour forecast horizon, accounting for and reducing hydrometeorological uncertainties via ensemble forecasting and data assimilation, and incorporating a vulnerability assessment component to provide risk-based decision-relevant warnings.