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Regional hydrological models for distributed flash-floods forecasting: towards an estimation of potential impacts and damages

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Hydrometeorological forecasting is an essential component of real-time flood management. The information it provides is of great help for crisis managers to anticipate the inundations and the associated risks. In the particular case of flash-floods, which may affect a large amount of small watersheds spread over the territory (up to 300 000 km of waterways considering a drained area of 5 km^2 minimum in France), appropriate flood forecasting systems are still under development. In France, highly distributed hydrological models have been implemented, enabling a real-time assessment of the potential intensity of flash-floods from the records of weather radars: AIGA-hydro system (Lavabre et al., 2005; Javelle et al., 2014), PreDiFlood project (Naulin et al., 2013).
The approach presented here aims to go one step further by offering a direct assessment of the potential impacts of the simulated floods on inhabited areas. This approach is based on an a priori analysis of the study area in order (1) to evaluate with a simplified hydraulic approach (DTM treatment) the potentially flooded areas for different discharge levels, and (2) to identify the associated buildings and/or population at risk from geographic databases. This preliminary analysis enables to build an impact model (discharge-impact curve) on each river reach, which is then used to directly estimate the potentially affected assets based on a distributed rainfall runoff model.
The overall principle of this approach was already presented at the 8th Hymex workshop. Therefore, the presentation will be here focused on the first validation results in terms of (1) accuracy of flooded areas simulated from DTM treatments, and (2) relevance of estimated impacts.
The inundated areas simulated were compared to the European Directive cartography results (where available), showing an overall good correspondence in a large majority of cases, but also very significant errors for approximatively 10% of the river reaches incorporated in the model. The stage/discharge relations obtained at gauging stations were also compared to the real rating curves, showing a very different behavior of the method depending on the local configuration of the considered site.
Some developments are now in progress in order to evaluate and validate, as far as possible, the results of the entire simulation chain at the event scale. This work relies on the comparison of simulation results (estimated flood impacts) with insurance losses data (provided by CCR) for several significant past flood events. The first results of this work will be presented.