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Linking flood peak, flood volume and inundation extent: a DEM-based approach

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Traditionally, flood inundation maps are computed based on the Shallow Water Equations (SWE) in one or two dimensions, with various simplifications that have proved to give good results. However, the complexity of the SWEs often requires a numerical resolution which can need long computing time, as well as detailed cross section data: this often results in restricting these models to rather small areas abundant with high quality data.
This, along with the necessity for fast inundation mapping, are the reason why rapid inundation models are being designed, working for (almost) any river with a minimum amount of data and, above all, easily available data. Our model tries to follow this path by using a 100m DEM over France from which are extracted a drainage network and the associated drainage areas. It is based on two pre-existing methods: (1) SHYREG (Arnaud et al.,2013), a regionalized approach used to calculate the 2-year and 10-year flood quantiles (used as approximated bankfull flow and maximum discharge, respectively) for each river pixel of the DEM (below a 10 000 km^2 drainage area) and (2) SOCOSE (Mailhol,1980), which gives, amongst other things, an empirical formula of a characteristic flood duration (for each pixel) based on catchment area, average precipitation and temperature.
An overflow volume for each river pixel is extracted from a triangular shaped synthetic hydrograph designed with SHYREG quantiles and SOCOSE flood duration. The volume is then spread from downstream to upstream one river pixel at a time. When the entire hydrographic network is processed, the model stops and generates a map of potential inundation area associated with the 10-year flood quantile.
Our model can also be calibrated using past-events inundation maps by adjusting two parameters, one which modifies the overflow duration, and the other, equivalent to a minimum drainage area for river pixels to be flooded. Thus, in calibration on a sample of 42 basins, the first draft of the model showed a 0.51 median Fit (intersection of simulated and observed areas divided by the union of the two, Bates and De Roo, 2000) and a 0.74 maximum.
Obviously, this approach is quite rough, and would require testing on events of homogeneous return periods (which is not the case for now). The next steps in the test and the development of our method include the use of the AIGA distributed model to simulate past-events hydrographs, the search for a new way to automatically approach bankfull flow and the integration of the results in our model to build dynamic maps of the flood.

References
Arnaud, P., Eglin, Y., Janet, B., and Payrastre, O. (2013). Notice utilisateur : bases de données SHYREG-Débit. Méthode - Performances - Limites.

Bates, P. D. and De Roo, A. P. J. (2000). A simple raster-based model for flood inundation simulation. Journal of Hydrology, 236(1-2):54-77.

Mailhol, J. (1980). Pour une approche plus réaliste du temps caractéristique de crues des bassins versants. In Actes du Colloque d'Oxford, volume 129, pages 229-237, Oxford. IAHS-AISH.