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Evaluation of two automated inundation-mapping methods

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Flash Floods cause significant material and human damage worldwide. In France, they frequently hit small rivers of the Mediterranean area, often inducing catastrophic consequences.

Considering the large number of possibly affected small watercourses, the use of automated flood-mapping methods may be of great help for the identification of the possibly affected areas and the prediction of the potential consequences of this type of floods.

In 2019, a first evaluation of three automated inundation-mapping methods, directly implemented on high-resolution Digital Terrain Models (DTM) was presented (https://meetingorganizer.copernicus.org/EGU2019/EGU2019-15710-1.pdf). The automatically retrieved flood extent maps were compared with simulated reference maps from local expert studies.

As a continuation of this work, an application of the two best performing of these methods (1D caRtino approach and 2D Floodos approach), is presented here for the simulation of three recent flash flood events:

- The 15th of June 2010 flood on the Argens watershed: 25 deaths, more than 1 billion € of economic damage, 585 km of affected and simulated rivers.
- The 3rd – 4^{th,} of october 2015 floods in the French Riviera: 20 deaths, and 600 million € of economic damage, 131 km of affected and simulated rivers.
- The 15th - 16th of October 2018 flood on the Aude watershed: 15 deaths, approximatively 300 million € of economic damage, 569 km of affected and simulated rivers.

At first, the peak discharges for each reach of the stream network are estimated with a hydrological model (CINECAR), calibrated against discharge values based on extensive post-event surveys. The hydraulic simulations with the two methods are then run for each reach separately in steady-state regime, based on estimated peak discharges, to obtain simulated flood maps at the reach scale that are then combined to obtain a flood extent map for the simulated event. The computation times are calculated for the two methods and compared.

The simulation results are compared with observed flood extent maps and high water marks. The flood extent maps are compared based on a critical success index criterion (CSI), showing an overall very good correspondence. The simulated water levels show a difference of less than 50 cm with high water marks in most cases.

Finally, a sensitivity analysis to the quality of DTM input information and roughness coefficients is presented.