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Flash flood risk assessment following the European Water Framework Directive. The case of Marina Alta and Marina Baja (Alicante, Spain).

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ABSTRACT:

The European Water Framework Directive (2007/60), concerning flood risk assessment and management, fixes three stages to follow for the preparation of a basin management plan against floods. The first stage is the preliminary flood assessment, in order to identify the potential flood risk zones, the second one schedules a detailed hazard and risk cartography of these zones, and the third regards the elaboration of a management plan in order to reduce the flood risk where appropriate.
For these reasons, the River Júcar Water Board (Spain) commissioned a study in order to analyse the effect of flooding on different urban centres and hydraulic structures of two counties, Marina Alta and Marina Baja (Alicante, Spain), aiming to redact a basin management plan against risk. This zone is particularly known for especially high rainfalls (the “Cold Drop” effect) which suffered recent extreme flash floods, whose economical impact was very relevant, due to the high population density and tourism infrastructures.
The first stage, identification of potential flood risk zones, was carried out by coupling a stochastic extreme rainfall generation model (RAINGEN, Salsón and García Bartual, 2003) for extreme rainfall scenarios generation, a conceptual distributed hydrological model (TETIS, Francés et al, 2007) for rainfall-runoff modelling, and a hydraulic model (InfoWorks CS), for bidimensional modelling of flooded regions. The rainfall-runoff model provided the boundary conditions for the hydraulic modelling. 22 hydraulic models were set up with a total of 70 km2 of detailed bidimensional modelling based on digital elevation models 1x1m obtained by Lidar. Five synthetic flood events were chosen and simulated for each flood zone, corresponding to 10, 25, 50, 100 and 500 years of return period. The results are five maximum water level maps, associated with the 10, 25, 50, 100 and 500 years of return period, for each one of the flood zones.
In order to analyse the vulnerability and the economic impact of flooding, the European Water Framework directive was followed: the flood hazard was evaluated considering hydraulic variables (such as the maximum water level) and other variables such as the sediment production and the vulnerability was computed taking into account economical, social and environmental variables (number of affected inhabitants, possible sources of pollution, etc)
In order to evaluate the vulnerability as previously explained, it was necessary to elaborate water level – economical damage curves, which were calibrated following the economical damages subsequent to historical floods. Integrating these curves with the results of the hydraulics studies, the risks maps are obtained. Once determined the risk of the studied zones the next step is the elaboration of a management plan in order to reduce the flood risk.