

How important are sediments in the flood peaks generated by a Mediterranean catchment?

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Currently, soil erosion and sediment yield have increased their importance because of their impact on the increase in flood peaks, in addition to the sedimentation in reservoirs, channels and flooded urban areas. Hence, this research wants to be a contribution in that sense. The aim was to evaluate the importance of the incorporation of sediment cycle to hydrological models in order to improve the reliability of the simulated floods. It was focused on the flood that took place in Valencia, Spain, in 1957. This flood produced two straight floods, of 2700 and 3700 m³/s peak flows, as a consequence of two heavy rainy days (above 100mm precipitations in 24h), preceded by two rainy days. As a result, it caused 81 dead, thousands homeless and high material damage. The amount of sediments deposited in the city was slightly lower than 2 hm³. Cleaning up tasks lasted more than a month and, although less than one seventh of the sediments volume were removed, public expenditures exceed 23.500.000€ (2015 currency value).

In order to carry out this study, it was necessary to make a reconstruction of the event. The first step was to calibrate a distributed hydrological model in the Turia River basin. The total catchment area is 6350 km², but only the catchment downstream the Benagéber Reservoir was active during the flood. The parameters needed for the calibration were obtained from a 100x100 m Digital Elevation Model, the land use map and the physical characteristics of the basin. The model was calibrated using a time step of one hour and the observed discharge in the outlet point from the period 1990-2013. Previously, a daily model was calibrated and used for the computation of the initial conditions of the hourly model. Once calibrated, a reconstruction of precipitation at hourly discretization for the 1957 event was made. Finally, the sedimentological sub-model was calibrated using only data from the amount of sediments deposited in the city during the overflowing. All this, taking into account the land use changes.

The historical event simulation demonstrated that the influence of sediments in flood peaks was not very important in the city: the contribution to the flood peaks was a 12% in the first flood wave and a 5% during the second one, with a maximum of 13%. But it must be underlined that the city is on the coast. In fact, upstream the maximum contribution was a 31%. In addition, soil erosion was higher than 53 hm³, sediments deposited volume in the catchment was 34.4 hm³, sediment discharge in the outlet was 18.7 hm³, and water discharge was 192 hm³.

In conclusion, although the incorporation of sediment simulation to the hydrological model was not crucial in the flood simulation in the city of Valencia, it can be in other situations and, in any case, from the point of view of sociologic and economic damages, it is not negligible.