



A GIS-based model for the hydrological and hydraulic reconstruction of historical flash-floods in urban areas. The case of the river Turia in Valencia (1957)

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Flash-floods are recurrent events in the Mediterranean arch, mostly derived from cold air pool phenomena triggering hydro-geomorphic high-intensity processes, combining high discharge and low frequency. In urban environments the complexity of the processes become higher due to the existence of very fast-response basins and quick-response runoff. However, immediate activities of cleaning up and restoration delete the urban marks. After a short time both significance and dimension of the hydro-geomorphic event become completely unrecognizable. Nevertheless, these episodes generate extensive administrative documentation which is testimony of the processes in almost real time. Exploiting this source typology in order to reconstruct events far in time within urban areas, which may lack database sufficiently rich, is necessary to understand the hydrological and hydraulic derived processes. This is particularly the case of the Valencia flash-flood (1957), located in the lower Turia River basin (6.400 km²).

Within a short interval (15 hours) there were registered two flood peaks (estimated at that time at 2.500 and 3.700 m³/s). The double overflowing inundated a large proportion of the urban area. The flash-flood activated fast processes with high energy that left numerous hydro-geomorphic marks. Although those tracks were deleted in a short while after the flood, it remains a legacy that had not yet been exploited, consisting of immediate aerial and oblique high resolution photography, pictures at street level, water level record and administrative records, such as claim files for compensation. Paradoxically, despite the event is considered as a milestone on metropolitan territorial planning and it was decided to divert the river Turia definitely through a major project (12 km of channeling, known as South Solution), being the scenario notably altered, the analysis of the hydrological and hydraulic process has never been reviewed. Undoubtedly, a modern study would ensure a more effective and accurate risk management within the Valencian metropolitan area.

The development of a GIS-based model enables the utilization of these materials, most of them unpublished. This non-systematic information can be treated jointly from a new perspective. In short, this model facilitates the provision of a database through a vast amount of organized, structured and georeferenced information about the event. In a second stage, it makes possible to interpret the hydro-geomorphic processes from the 1957 event (trenches along barrier beaches, erosion, deposition processes...) and hydraulic processes (main flow encroachment versus quasi-hydrostatic-flood, or 1D versus 2D flood behavior), which can be identified in order to obtain georeferenced information about spatial variability, directional information of flows and point distribution of water levels and flooded points. It is also necessary to carry out photo-interpretation works to clarify some unresolved issues with the objective of establishing the real order of magnitude of the flash-flood concerning the discharge rank. In the same way, some other elements can be identified such as urban streams along the streets, levees overtopping and breaks, flooded area, etc. Lastly, in the future the GIS database will enable to obtain a more accurate both hydraulic mathematical modelling and calibration/validation.