CONTRIBUTION OF HYDROGEOMORPHOLOGY FOR MAPPING FLOOD HAZARD IN MEDITERRANEAN EPHEMERAL STREAMS

VNIVERSITAT DE VALÈNCIA

Camarasa Belmonte, A.M. & Soriano García, J.
Departament de Geografia, Universitat de València

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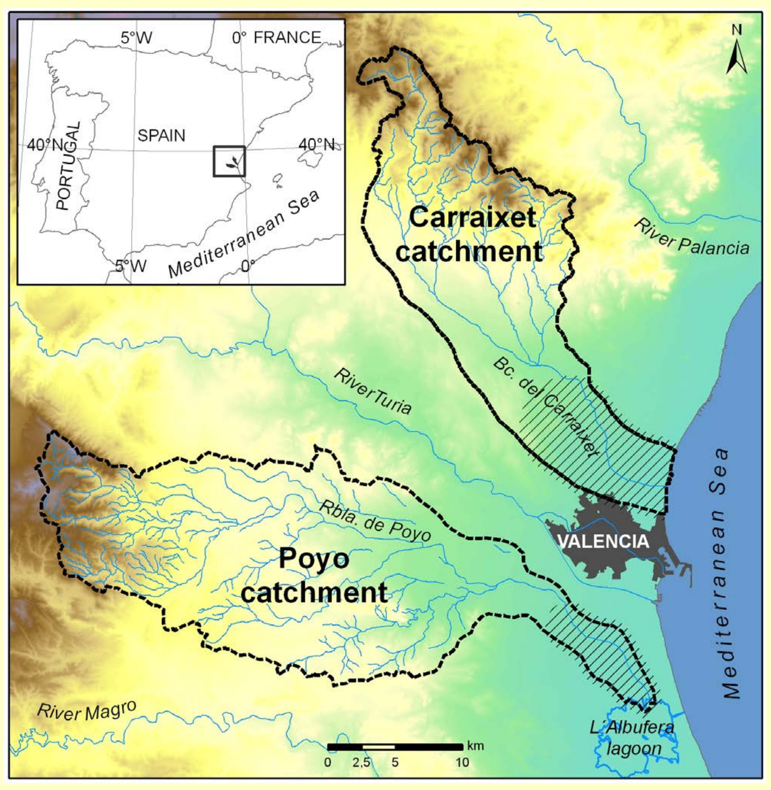
ABSTRACT

Flood hazard mapping can be performed using different methods that, generally speaking, can be grouped into four main categories: historical and paleohydrological methods, hydrogeomorphological methods, hydrological-hydraulic methods, and the recently developed dendrogeomorphological methods. These groups of methods are not mutually exclusive and, in fact, they should be used complementarily. Unfortunately, in the case of *ramblas*, this combination is hardly difficult. On the one hand, paleohydrological methods are not suitable for catchments so small and torrential as *ramblas* are and, on the other hand, hydrological-hydraulic methods demands a lot of hydrologic data, non available in the majority of these systems. Indeed, many authors assert the inadequacy of these methods to predict extreme floods in Mediterranean small catchments.

Anyway, hydrogeomorphological method is nowadays achieving more relevance. It is based on the location and typology of landforms and sediments generated during floods in order to delineate flooding areas and identify processes. It is a qualitative approach that gives a realistic image of the processes and it is enough for making decisions, with a minimum effort, in the 80% of the instances. Studies developed in the Mediterranean Region of southern France and north-western Spain have demonstrated the effectiveness of this method in ephemeral streams, where channel and floodplain morphology are highly variable and changeable over time and, in addition, hydrological information is scarce or nearly inexistent.

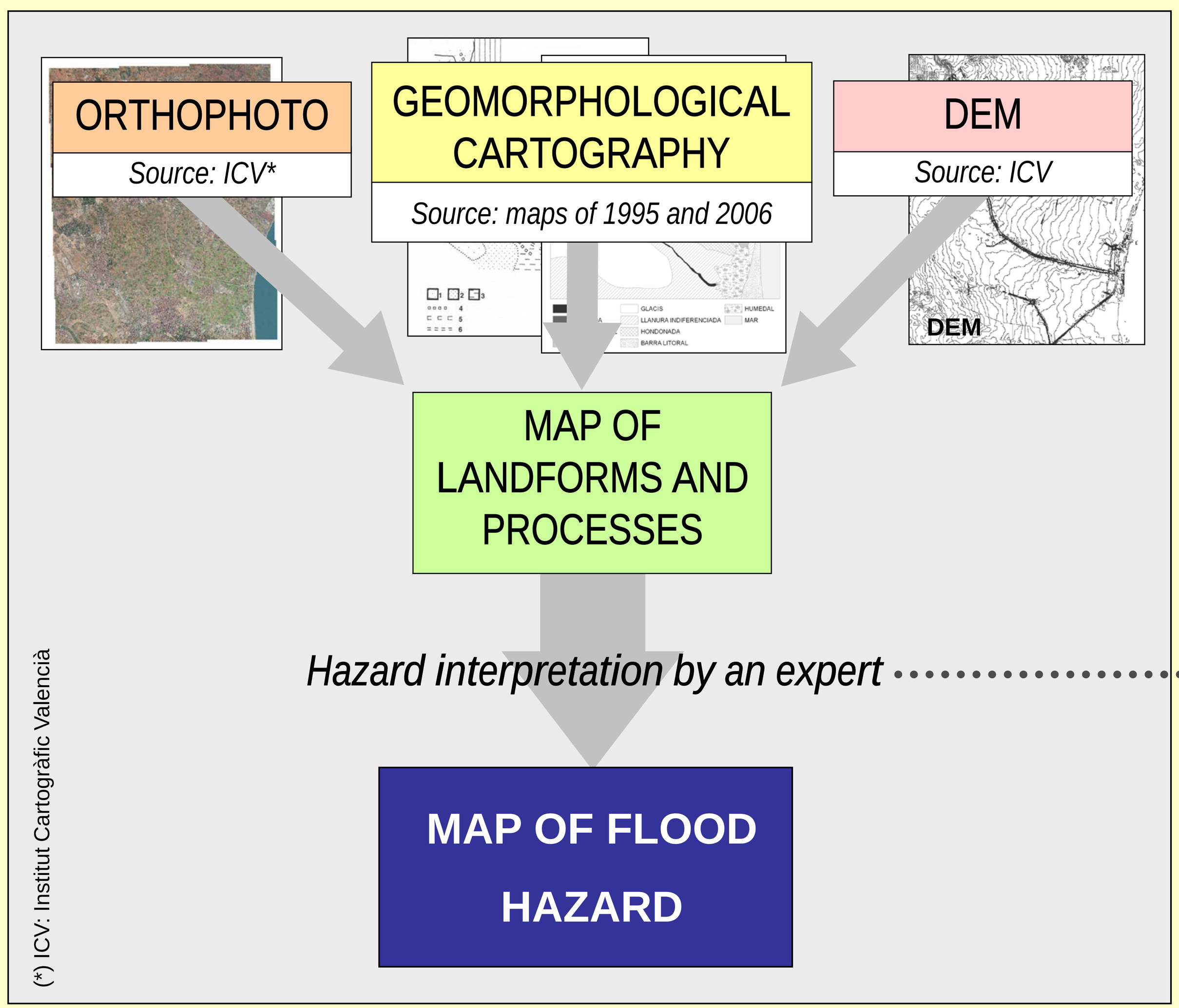
This work presents a method for mapping flood hazard in two Mediterranean small catchments -*Barranc de Carraixet* and *Rambla de Poyo*-, based on hydrogeomorphology interpretation. A synthetic hydrogeomorphological cartography was obtained supported by previous studies (carried out by Camarasa, Carmona and Ruiz) and taking into account the forms and processes developed during the great flood event of October 2000. Thirteen different landforms related to flooding processes where identified and valuated in terms of hazard, ranking from levels 1 to 8, in which level 1 represents the highest hazard (streams and critical points) and level 8 the safety areas (mountains and longshore bars).

STUDY AREA



Catchments of **Carraixet** (313 km^2) and **Poyo** (454 km^2). Average annual rainfall: 400-650 mm.

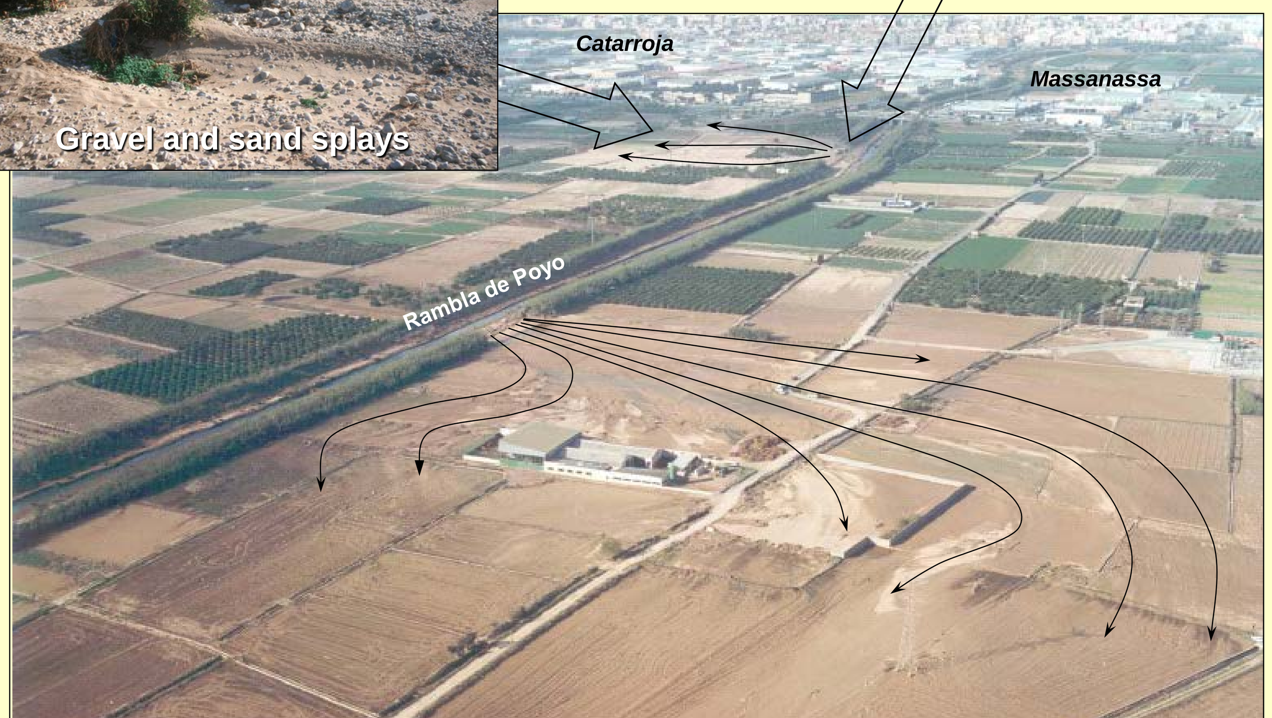
METHODOLOGY



EXPERT INTERPRETATION

LANDFORM OR PROCESS	DESCRIPTION	HAZARD RANKING
Channels	Channels are the main waterways, although in the Mediterranean are dry almost all the year. During flooding episodes, water deep is very high, as well as velocity, quantity and size of transported material.	1
Channel artificial diversion	Are spaces prone to overflow, due to a pronounced change of channel direction, so water tends to follow its natural way. Water flow in this point is concentrated and very fast.	1
Break prone points	Generated in areas where channel describes sharp bends, nearly to 90º. Among others, factors that helps the break of banks are: low slopes, lack of levées, low trenching, presence of obstacles in the channel and formation of pressure eddings in water. Flow velocity can be very high, transporting big size elements.	1
Channel disappearance and deficient drainage areas	Channel disappears when trenching in alluvial fans decreases -whereas stream water flows overland- or when arriving to low-lying areas, where water stagnates some time. Coarse deposits are present. Water height and flow velocity can be high.	2
Crevasses and splays	Are produced in levées (both natural and man-made) built with clay materials. When bankfull stage is exceeded, water overflows and falls through the crevasse channel eroding quickly the levée. The amount of water and its velocity are high. Coarse sediment load is very important (from the levée itself), generating splays.	2
Swamps	Swamps are places where waters overflowed from channels collects. Water flows overland, decreasing its velocity from channels. Water level and flooding length are high, due to its difficulty to run-off to the sea.	3
Streambeds and paleo-channels	They collect the runoff from overflowed water, either from the main channel or directly from the mountains. Great accumulation of water with high deeps. Drainage is difficult because water cannot breach the levées which flank the main stream.	4
Present floodplains	Floodplains have very flat surfaces, so that, waters that overflowed the river bank flows here overland. Water levels and velocities are not too high.	5
Alluvial fans	Channel disappears when intersecting alluvial fan surface, whereas stream water flows overland, covering the fan. Velocity and water level are low.	6
Levées	Flooded only in episodes when bankfull stage is exceeded. Deep and velocity of water are low. Scarce solid load, only fine elements.	6
Glacis	Flooding processes are very infrequent in glacis. Only are possible when very high magnitude and low frequency flooding episodes occurs. In this case, water level is very low.	7
Alluvium	Flood hazard very low or non-existent.	8
Offshore bars	Flood hazard very low or non-existent.	8
Mountains	Flood hazard very low or non-existent.	8

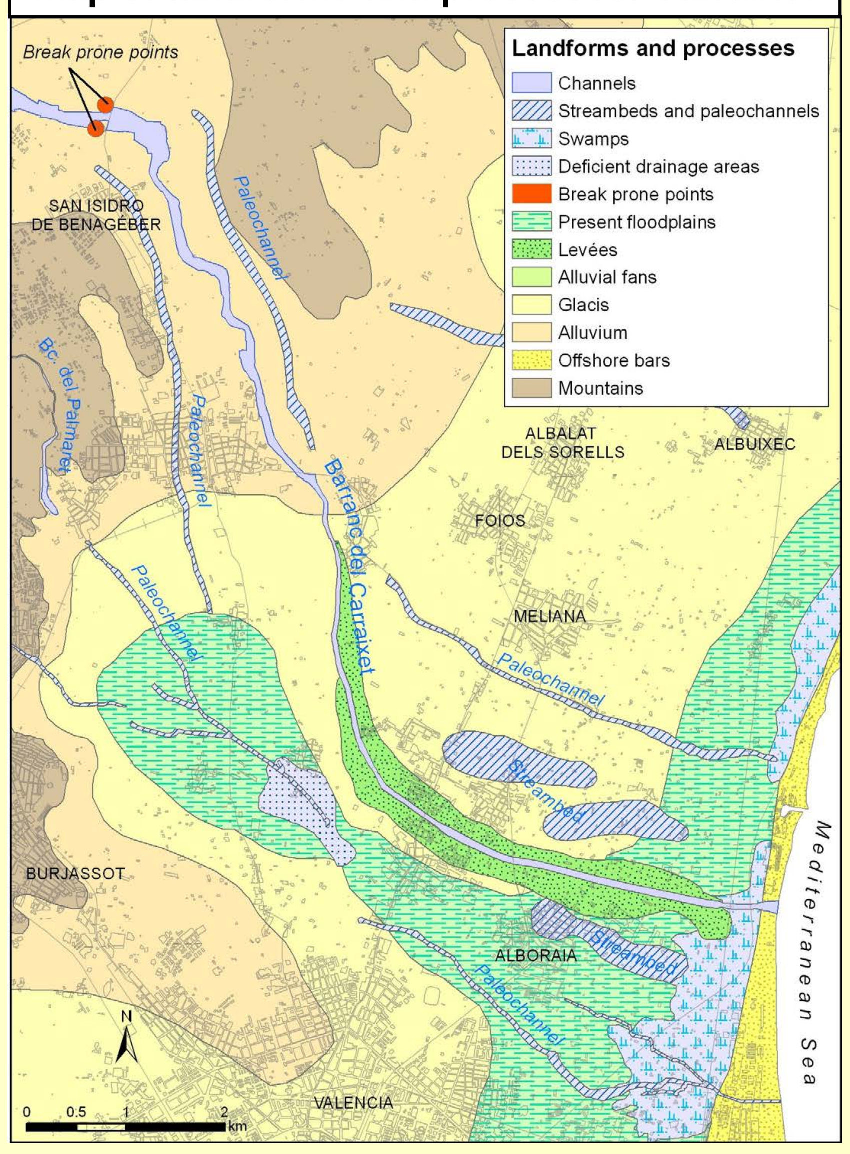
HAZARDOUS LANDFORMS AND HYDROGEOMORPHOLOGICAL PROCESSES



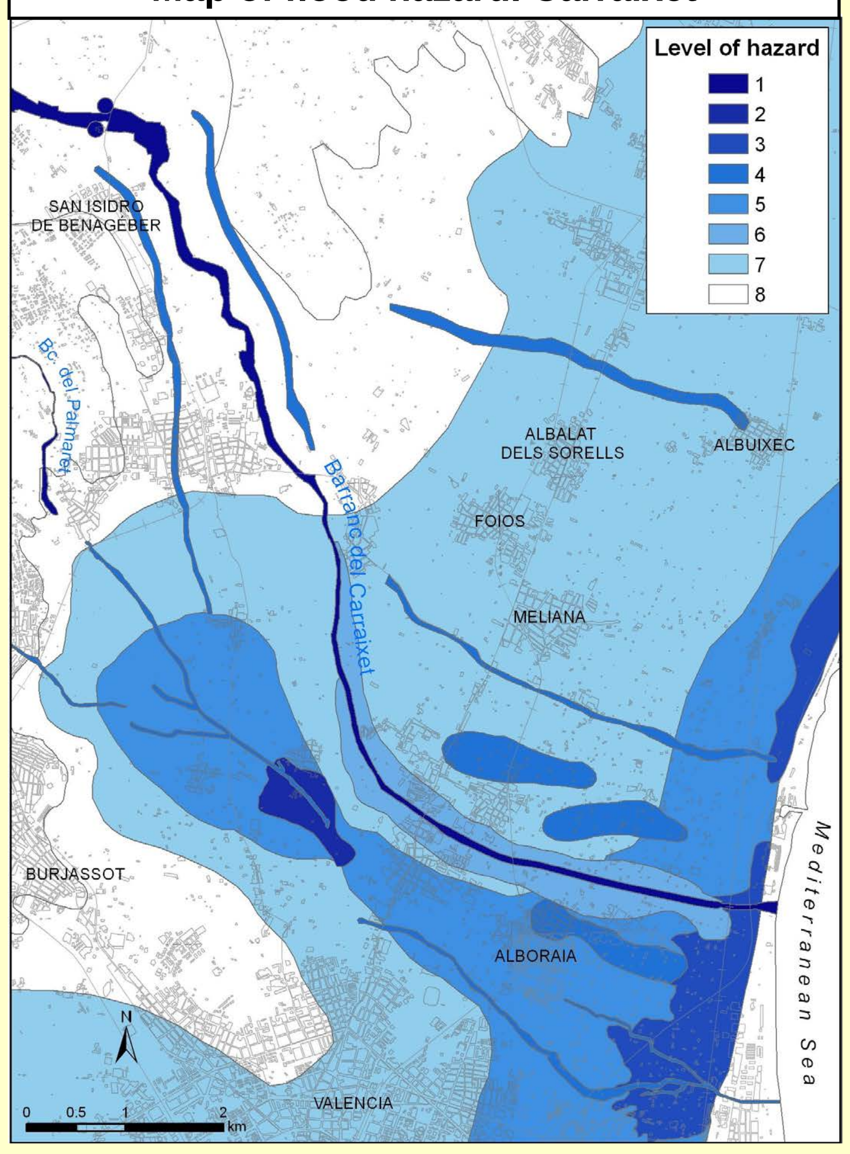
High hazard: crevasse splays originated in the flooding episode of October 2000 at lowlands of Poyo catchment.

RESULTS

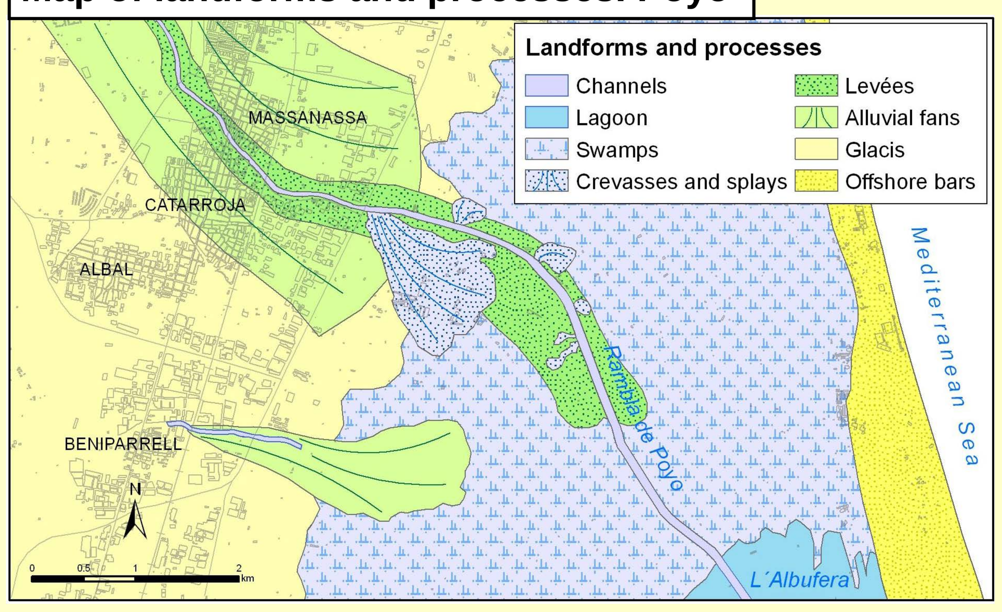
Map of landforms and processes. Carraixet



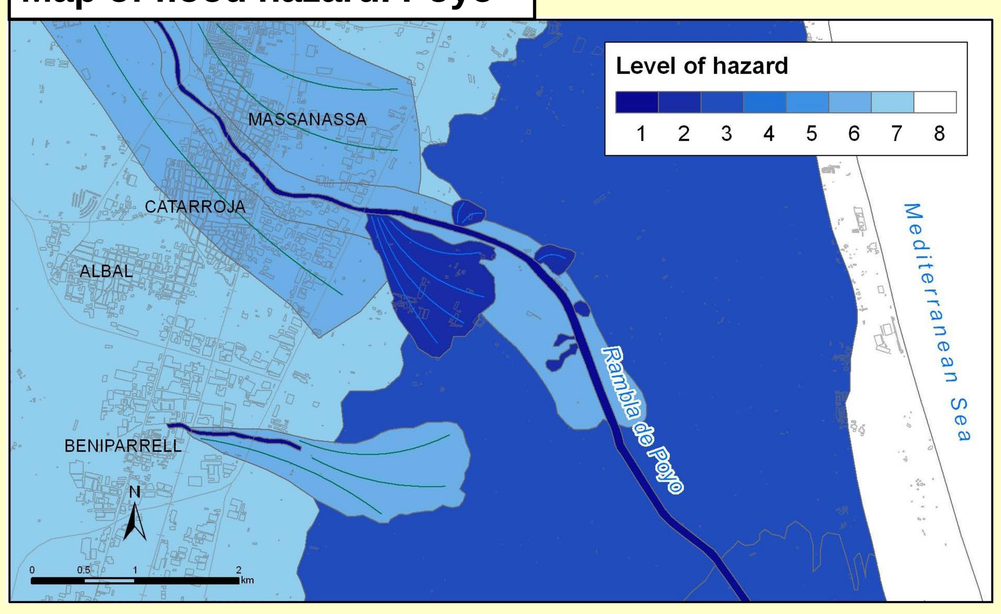
Map of flood hazard. Carraixet



Map of landforms and processes. Poyo



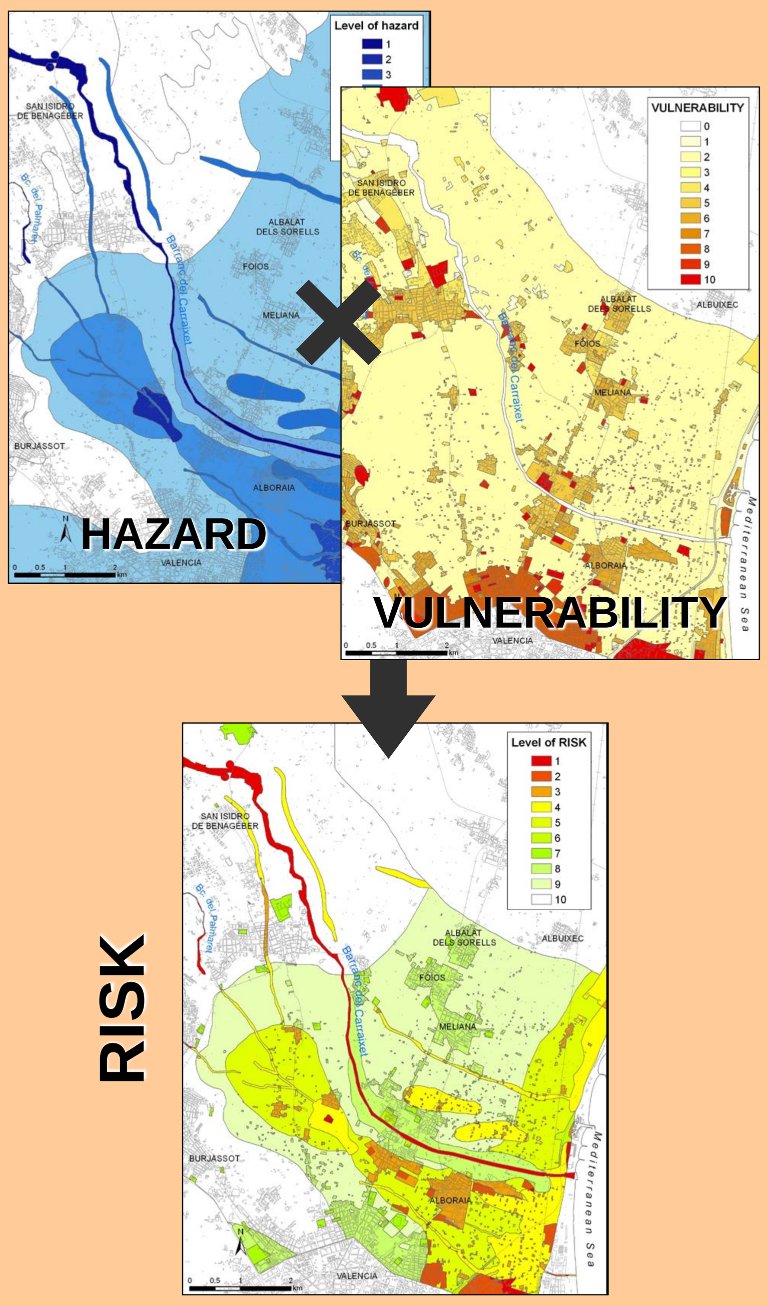
Map of flood hazard. Poyo



FURTHER APPLICATIONS

Combining the **hazard** map with a map representing the **vulnerability**, we can obtain a final map of flood **risk**.

RISK = HAZARD x VULNERABILITY



CONCLUSIONS

Hydrogeomorphological method has been demonstrated to be highly effective for mapping flood hazard in these kind of torrential ephemeral streams, where standard hydrological and hydraulic methods does not work properly. This method allows working with scarcity of hydrological data and, what is more, is quite adaptable to any change in flood area morphology (either natural or man made).