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2D numerical flow modelling of a river confluence oriented to know geomorphic consequences of the backwater effect

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A 2D numerical flow modelling of a river confluence has allowed the development of a method valuation of average discharge based on the backwater effect produced upstream of a natural channel constriction. The modelling allows the extension of the quantification up to Holocene palaeofloods.

It is known that backwater effect produces an energetic rebound and increases water level upstream from a constriction by means of which it is possible to quantify discharges that pass through it. As a result of a periodic repetition of this effect in a river reach, sinuosity is generated to make room in the channel for downstream flow and for the backwater effect. The method consists of making a rating curve in the river constriction. The increment of volume added in the channel reach by sinuosity has to be calculated. The increment in water volume is the result of a problem of water storage in the channel reach, which is created by the arrival of a determined hydrograph. At this point, a hydrograph has to be simulated to fit the volume of water storage and the rating curve.

What is relevant in order to apply the numerical model is determine the range of the backwater effect upstream from the constriction. Chow (1956) defined the end point of the backwater effect as the place where the rise in water begins to cause downstream damage. Generally, it is difficult to establish the position of the end point, especially in an average way, which it would be for formative palaeofloods. In special cases, as in the one presented, it is possible to calibrate the position of the end point in the upstream direction. This calibration can be established by means of a tributary also affected by this effect and which flows into the main river between the constriction and the end point.

The river Ter, NE of Iberian Peninsula, has developed a high sinuosity pattern upstream from an important lithological constriction through which it leaves a strike valley (basin sink). By the analysis of the first couple of meanders just upstream of the constriction, duplicated in a tributary, it is possible to evaluate the range of the backwater effect upstream from the constriction and the average formative discharges from the Holocene.