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Analysis of the River Tagus morphology during the last 30 years

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River Tagus has one of the largest watersheds of the Iberia Peninsula. It cuts longitudinally the Peninsula with a dominant East-West orientation covering an area of more than 80,000 km2, 69% being in Spain and 31% in Portugal. The 827 km length in Spain is followed by a reach of 43 km at the border of Spain with Portugal and 230 km in Portugal.

After the Portugal-Spain boundary, River Tagus enters in a strong rock reach. Afterwards it reaches a movable river bed with rocky banks and then begins the 70 km estuary.

The construction of dams to control the river discharges changed the river regime after 1943, being stabilized since 1983. Presently, there are higher low flow discharges and lower high flow discharges than the natural regime. The annual discharge module is about 360 m3/s, but it may vary between about 1000 m3/s in wet years and 90 m3/s in dry years.

In Portugal, the hydrological monitoring system of River Tagus consists in three hydrometric gauges:

1 Tramagal (100 km from the downstream reference, Vila Franca de Xira),

2 Almourol (85 km),

3 Ómnias (45 km).

With the purpose of calibrate the rating curve of the hydrometric stations, the river bed was surveyed when velocity measurements were done. In Tramagal and Almourol stations, the analysed data were collected between the hydrological years 1986/1987 and 2004/2005, i.e., a total of 18 years. In the Ómnias station, the analysed data were collected between the hydrological years 1977/1978 and 1998/199, i.e., a total of 21 years.

As a result, a total of more than 600 bed profiles are available which allows the researchers to know the variation of the bottom of the river since 1977. This information is continuous and it includes important flood periods.

In the present paper, these data are analyzed. Plotting the instantaneous discharge and the bottom level in the same chart for each hydrological station, several conclusions could be made. For instance, during a significant flood event (with a return period of 100 years) the river bottom could decrease more than 5 m. Among other issues, these effects are extremely important for bridge piers design.

Analyzing the available data, a persistent feature of river process is recognized, the “elastic” behavior of the river bed. After the generalized erosion caused by a flood event a slower process of deposition restores the river bed level in the following months. This type of indirect measurement leads us to some conclusions about the variation of the river bed and consequently the erosion produced by the river flow.