The Segre River is one of the main tributaries of the Ebro River, one of the greatest rivers in NE Iberian Peninsula (Figure 1). The Segre River drains the eastern sector of the Pyrenees. Its catchment’s area (12,500 km²) is 13.5% of Ebro’s and its contribution to Ebro’s mean annual runoff is 19%.

However, knowledge about Segre River is limited to a short, incomplete systematic series of measurements of the 20th century and to a list of historical floods.

Our objective was to reconstruct the peak flows of the 20 known historical floods occurred in Lleida since 1500. The software used was the one-dimensional HEC-RAS v.4.1 under gradually varied, steady, mixed flow in a 7750 m long reach with 18 cross sections (Figure 8).

The digital elevations model (DEM) was manipulated to adapt to the time of each flood the many changes in the river bed morphology and its obstacles (bridges, walls) (Figure 2).

Information about changes in morphology and roughness and about floods was varied and abundant (written accounts, maps, drawings, photos; Figures 2-8). Roughness coefficients were estimated as: 0.045 (channel), 0.05 (banks and flood plain) and 0.1 (town).

The results (Table 1) show that at least 20 floods since 1500 reached or exceeded 3000 m³ s⁻¹, which is the flooding flow for the right bank (the highest and historically most populated). Three periods with different flood frequency can be distinguished: 1500-1625 (9 floods or 7.4 floods per century), 1626-1725 (0 floods) and 1726-2014 (11 floods or 3.8 floods per century). The two heaviest reconstructed peak flows are 13300 m³ s⁻¹ (1597) and 12000 m³ s⁻¹ (1787), between 120 and 130 times greater than the mean flow, and with K indexes of 5.2.

Segre’s contribution to peak flows in Tortosa (near Ebro’s mouth, Figure 1) can reach 100% and is usually above 50% during the heaviest floods. The Old Bridge (in its different versions across history) is a big obstacle that increases water level by as much as 2.5 m during the heaviest floods.

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References


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