



Floods of the Segre River in Lleida (NE Iberian Peninsula) since 1600

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The Segre River, which drains the eastern sector of the southern face of the Pyrenees, is one of the two main tributaries of the Ebro River, one of the greatest rivers in the Iberian Peninsula. With its 11,370 km², the Segre River catchment is 13.5% of the Ebro basin area but its contribution to annual runoff is 19%; moreover, this contribution during extreme floods can reach 50%. Despite its weight in Ebro basin's hydrology, knowledge about Segre River is limited to a short systematic series of measurements of the 20th century and to a list of historical floods.

Moreover, the systematic series contains just a handful of maximum annual peak flows (Q_{ci}) and it lacks data corresponding to the heaviest floods in the 20th century (1907, 1937 and 1982). Thus, a flow frequency analysis using only these data would have a poor basis.

Our objective was to reconstruct the peak flows of the known historical floods occurred in Lleida since 1600. It was done with information about the maximum height reached by the water during each flood, with information about the river bed shape and other hydraulic variables, and with the use of a hydraulic modelling software. This software was the one-dimensional HEC-RAS v.4.1 under gradually varied, steady, mixed flow, running on a digital elevation model (DEM) manipulated to represent the river bed morphology and its obstacles (bridges, walls) at the time of each flood.

Information about water heights was obtained from historical documents in the form of either primary or secondary sources. Information about river bed shape and hydraulic variables (such as roughness coefficients) were also estimated from historical documents, accepting an inevitable uncertainty.

The results show that nine floods since 1600 reached or exceeded 3,000 m³•s⁻¹, which is the flooding flow for the right bank (the highest and historically most populated). Two periods with different flood frequency can be distinguished: 1600-1850 (3 floods or 1.2 floods per century) and 1850-2014 (6 floods or 3.7 floods per century). The heaviest reconstructed peak flow is that of 1787: 8,500 m³•s⁻¹, 100 times greater than the mean flow.