

Modelling maximum rain intensity and discharge of the Santa Tecla flash flood (1874) in Conesa (Catalonia, NE Iberian Peninsula)



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Introduction

Santa Tecla flood (22-23 September 1874) is one of the most devastating flash floods events in Catalonia. We are thoroughly studying it since 2010 (Ruiz-Bellet et al., 2015). In this study, we provide new results in the small town of Conesa, in the headwaters of the Corb River basin (Figures 1 and 2).

Objective and methods

We calculated 1874 flood's peak flow and the rainstorm's hyetograph using flood marks and hydraulic and hydrological models HEC-RAS v.5 and HEC-HMS v.4.2 (Figures 3 and 4). The hydrological model was calibrated with the 2-3 November 2015 flood event (Figure 5).

Results

Santa Tecla flood in Conesa was caused by a rain of 188 mm in six hours, with a maximum intensity of $84 \text{ mm} \cdot \text{h}^{-1}$ (Figure 6; Jurado, 2016). The peak flow was $60 \text{ m}^3 \cdot \text{s}^{-1}$ that is, a specific peak flow of $18.8 \text{ m}^3 \cdot \text{s}^{-1} \cdot \text{km}^{-2}$ for a 3.2 km^2 basin. These high values confirm the exceptional nature of the event, and place it among the most extreme known events in the Mediterranean region (Figure 7). It has an approximate return period of 500 years. A sensitivity analysis on the hydrologic modelling estimated a minimum error of 10-15%, which is acceptable in this kind of study. Rainfall and maximum intensity evolution along the Corb River (Figure 8) confirm our hypothesis that the core of 1874 storm was located over the catchment's headwaters ridges.



Figure 1. Location of Conesa in the Iberian Peninsula

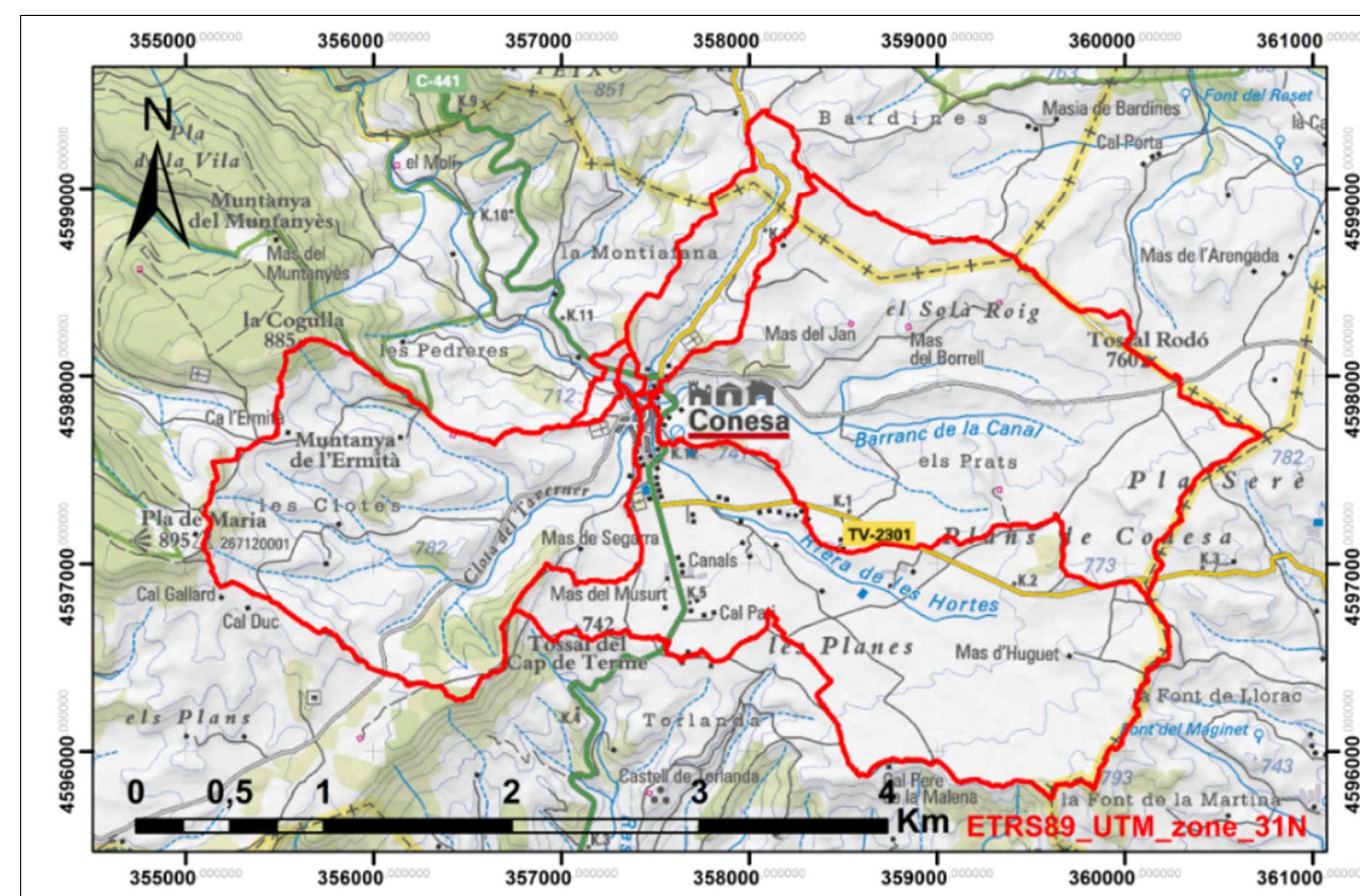


Figure 2. The seven subcatchments that meet at Conesa (Map by www.icgc.cat)

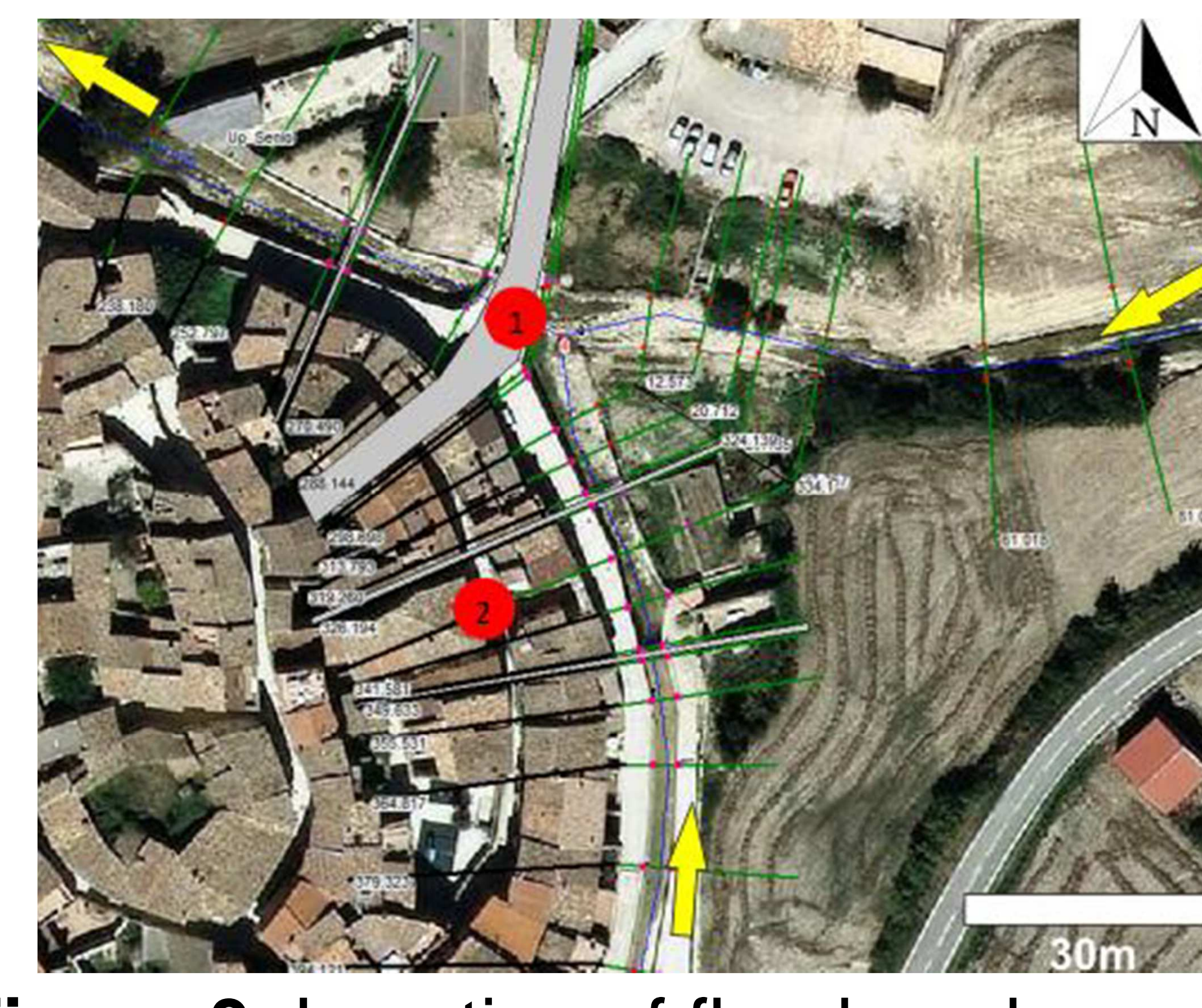


Figure 3. Location of flood marks used (1: 2-3/Nov/2015 (see Figure 5) and 2: 23/Sep/1874) and cross sections of the hydraulic model (Photo by www.icgc.cat)

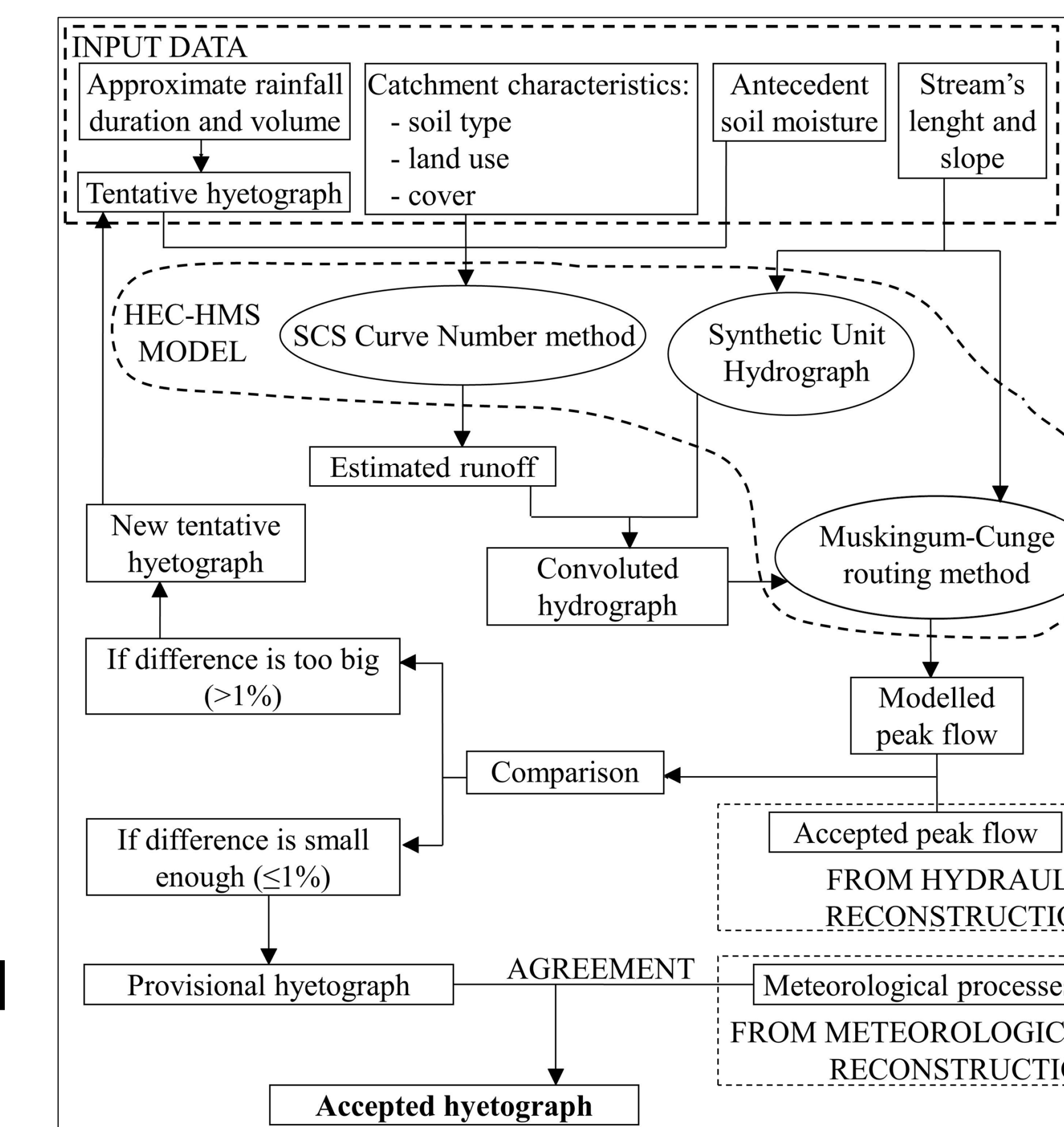


Figure 4. Hyetograph estimation with a hydrological model



Figure 5. Mark of 2015 flood at Riera de les Hortes and Riera de la Canal junction (see Figure 3)

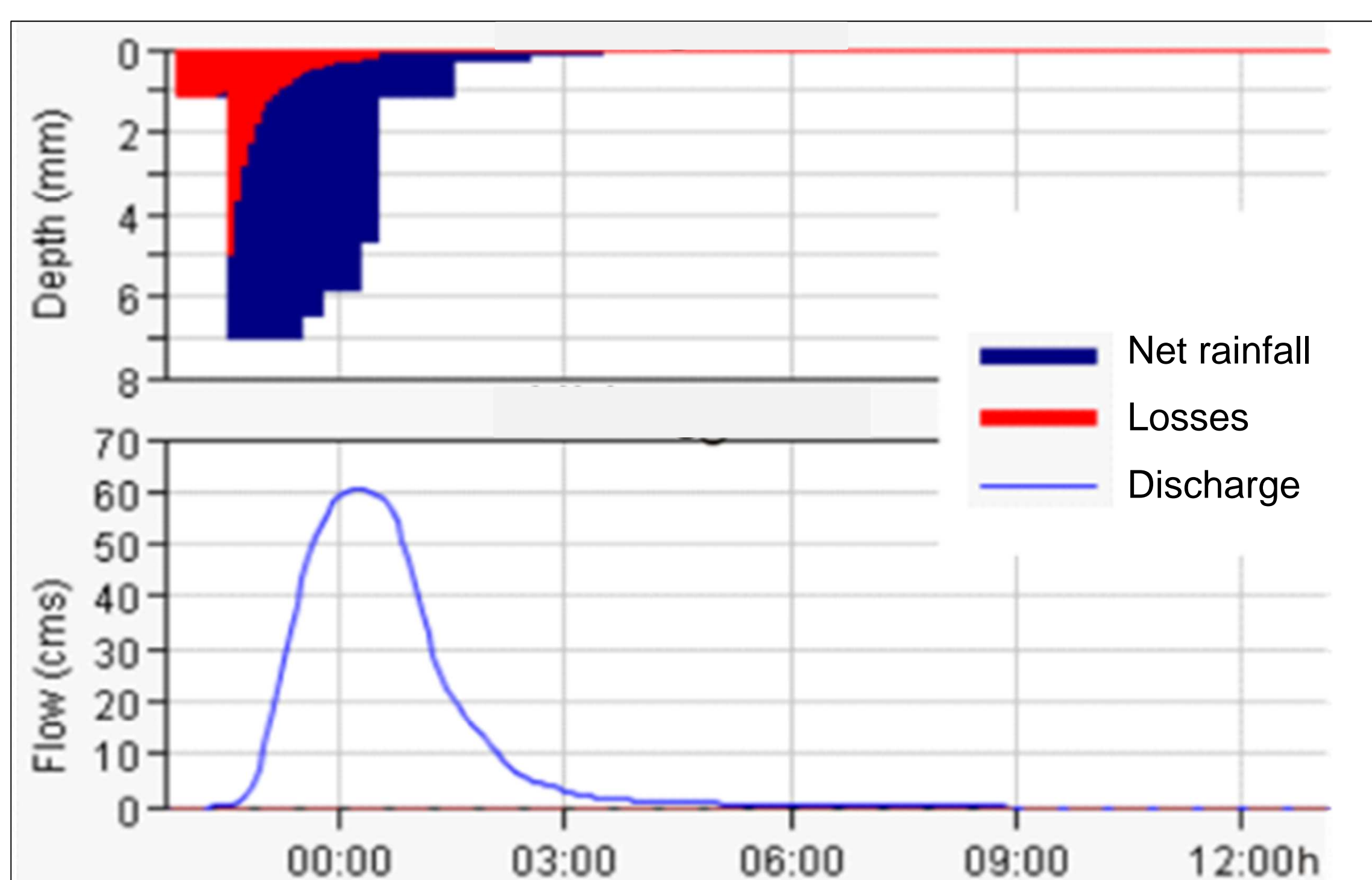


Figure 6. Modelled rainfall and discharge for 1874 flood in Riera de les Hortes subcatchment (Jurado, 2016)

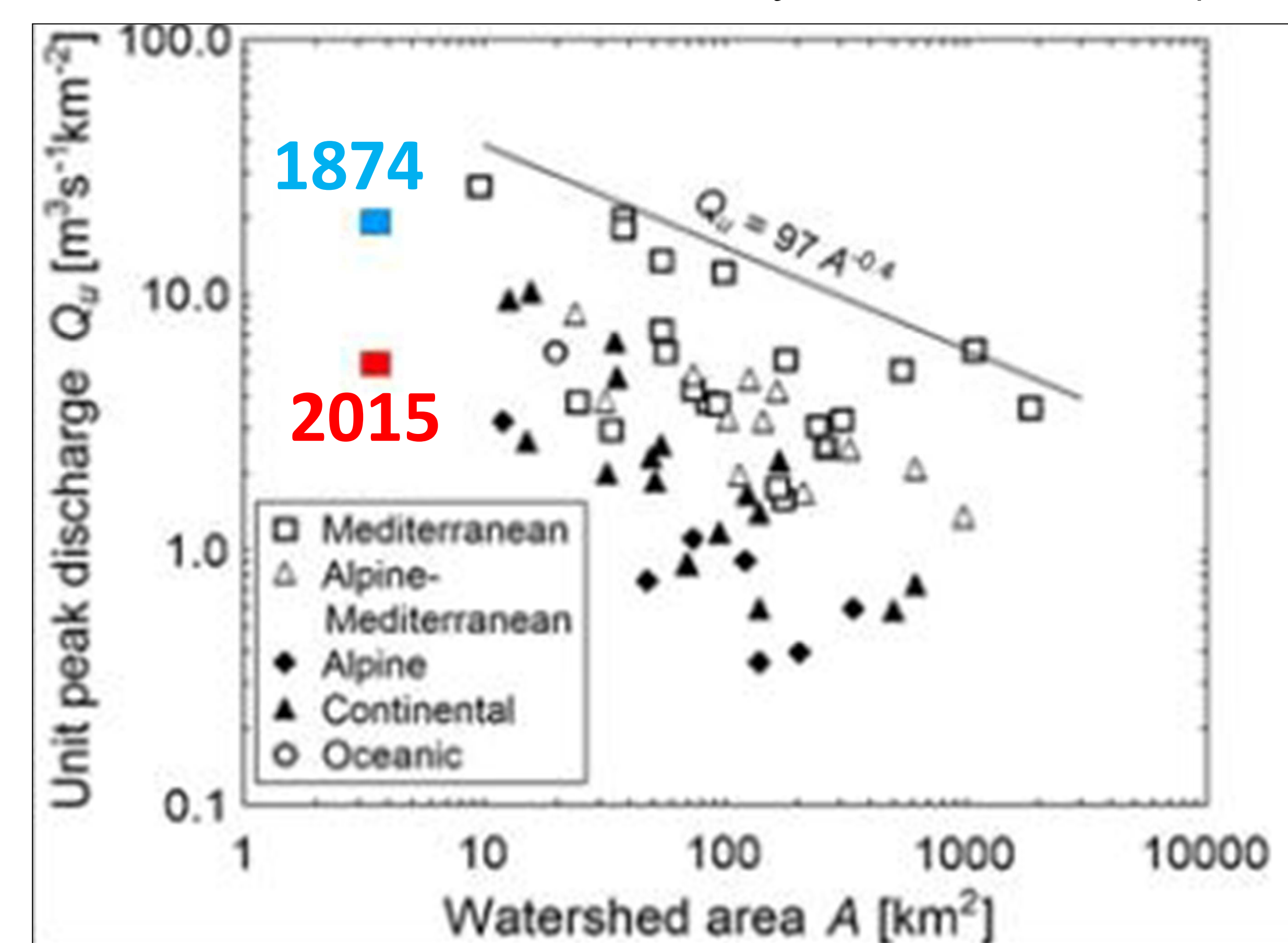


Figure 7. Specific peak flows of 1874 and 2015 floods in Conesa, compared to the highest values ever modelled in the Mediterranean basin. (Adapted from Marchi et al., 2010)

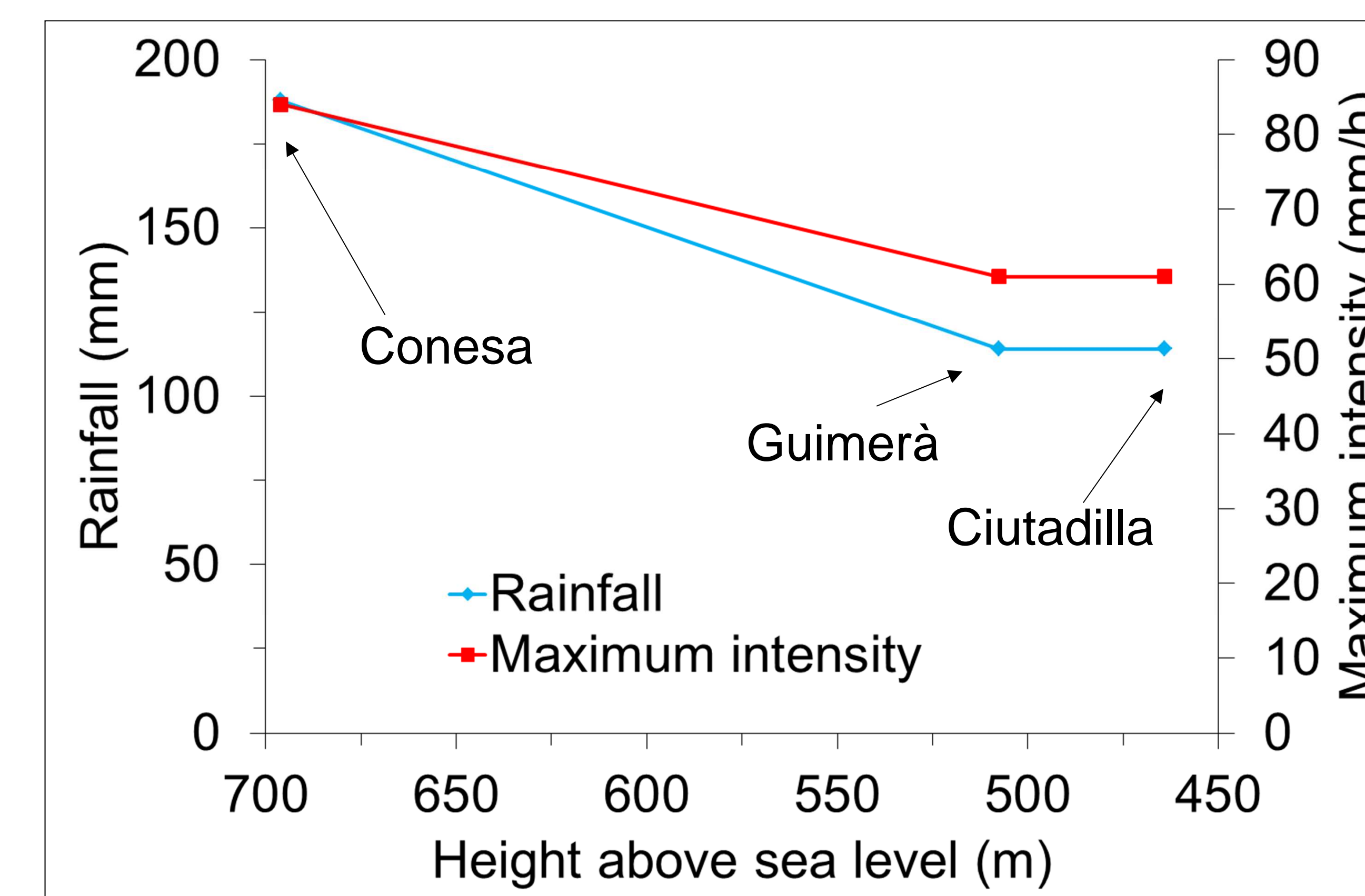


Figure 8. Evolution of modelled rainfall and maximum intensity at the towns of Conesa, Guimerà and Ciutadilla along the Corb River (Data from Jurado, 2016 and Ruiz-Bellet et al., 2015)

Aknowledgements

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More info in:

Jurado K. (2016) Reconstrucció de l'aiguat de Santa Tecla (1874) a Conesa (capçalera del riu Corb) amb informació històrica i models de simulació. Master's thesis. Universitat de Barcelona. 25 pp

Ruiz-Bellet, J.L; Balasch J.C; Tuset, J; Barriandos, M; Mazon, J; & Pino, D. (2015) Historical, hydraulic, hydrological and meteorological reconstruction of 1874 Santa Tecla flash floods in Catalonia (NE Iberian Peninsula). *Journal of Hydrology*. 524, 279–295



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