

Review of the paper “Long-term entrenchment and consequences in present flood hazard in the Garona River (Val d’Aran, Central Pyrenees)

General comments

In my opinion, this study fails to achieve its main objective, i.e., bridging the gap between long- and short-term fluvial processes in the Garona River. Actually, the analysis of short-term processes is limited to some observations of the geomorphic changes caused by a recent floods. Moreover, basic hydrologic information on this flood is missing.

This paper could be reconsidered for publication after major improvements, which should include collection and analysis of new data on the recent evolution of the Garona River in the Val d’Aran.

The authors state that “the long-term tendency of the fluvial system is reflected in short-term processes”. This statement, however, is far from being demonstrated. The only information on current processes involving the evolution of Garona River refers to one major flood that occurred in 2013. Evidences of fluvial incision for this flood are not sufficient to identify the recent evolution of the studied river reaches. The authors mention (page 6381, lines 5 and 6) three more major floods that occurred in 1937, 1963 and 1982. Some information on the geomorphic processes caused by these floods is probably available, at least for 1963 and 1982 floods, and deserves to be considered. It should also be reminded that major floods are not the only fluvial process effective in shaping channel morphology. The combined effect of large floods and smaller, more frequent floods should be investigated before drawing any conclusion on the present tendency of the fluvial system toward incision. This could be done, for instance, by analyzing multi-temporal topographic maps and aerial photos, and topographic surveys of channel cross sections.

The flood of June 2013 is not adequately documented. Basic information, such as peak discharge and return period of the flood, is missing. A sentence at page 6381 (lines 15-17) arises doubts on the real severity of the 2013 flood and does not clarify the basic issue of its return period. Peak discharge and, possibly, flood hydrographs would be of utmost importance for this study.

In the present version of the paper the comparison flooded area 2013 with inundation area for 50-years return period flood comparison is of small significance because no data on the return period of the 2013 flood has been provided. A comparison of the peak discharge of the 2013 flood with the 50-years return period flood used for mapping the inundation area is necessary for a sound comparison. Moreover, the possible influence of channel incision in reducing flooded area is still undemonstrated. A possible way to verify if channel incision caused by the 2013 flood could be responsible for reduction of inundation area would consist in simulating the 50-years return period flood using the post-flood topography.

Presence (or absence) of large dams in the Garona River basin deserves to be mentioned because of the influence of reservoirs in preventing downstream transfer of sediment, thus favoring channel incision.

Section 1.

Floods are a frequent and damaging process worldwide, not only in Catalonia. Papers documenting flood damage and flood casualties in different geographical regions could be considered (e.g., Jonkman, 2005; Barredo, 2007; Ashley and Ashley, 2008).

Ashley, S.T., Ashley, W.S., 2008. Flood fatalities in the United States. J. Appl. Meteorol. Climatol. 48, 805–818.

Barredo, J.I., 2007. Major flood disasters in Europe: 1950–2005. *Nat. Hazards* 42 (1), 125–148.

<http://dx.doi.org/10.1007/s11069-006-9065-2>HYPERLINK .

Jonkman, S.N., 2005. Global perspectives on loss of human life caused by floods. *Nat. Hazards* 34 (2), 151–175.

The introduction should give adequate credit to previous studies on morphological evolution of mountain rivers. More attention to the international literature is recommended.

The flood of June 2013 is briefly described in the introduction, whereas it would require a more complete and quantitative assessment (see previous comments) in separate section.

Page 6381, lines 15-17: “However, real data show that water discharge was lower than those recorded during known historical floods.” Quantitative data on peak discharge and return period of the 2013 flood are required (see previous comments).

Section 7.2

Page 6398, lines 27-28 and page 6399, lines 1-15: text not related to the study of Garona River; I wish to suggest to remove it.

Section 7.4

Page 6404, lines 9-24: I wish to suggest to expunge these general comments on the interactions between structures and river floods that are essentially unrelated to the study developed in Val d’Aran.

Specific comments

Abstract

Page 6380, lines 3 and 4: This sentence could be misleading. Perhaps the authors would like to stress that few studies have related floods to the geologic, tectonic and geomorphologic context. More attention to the international literature could lead to attenuate this point of view.

Section 2

Is land use change from agriculture to urban areas really relevant? According to the description of the study area, the population in Val d’Aran amounts to only 9993 inhabitants in 620 km².

Section 4

Page 6386, line 9: no need for advertising ESRI.

Section 5.1

Page 6388, lines 9-12. Obvious statements about channel slope and width could be omitted.

Page 6389, lines 11-29: What is the origin of alluvial fans? Bedload, debris flows of both?

Section 6.1

Page 6393, lines 12-13: “The channel were mapped as the areas of major water flow”. I suggest removing this redundant sentence.

Section 6.2

Page 6396, line 4: “where the river bed is impermeable”: possible rephrasing: “where the river bed is not erodible”.