

Interactive comment on “Long-term entrenchment and consequences in present flood hazard in the Garona River (Val d’Aran, Central Pyrenees)” by A. Victoriano et al.

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Referee comments Manuscript title: Long-term entrenchment and consequences in present flood hazard in the Garona River (Val d’Aran, Central Pyrenees)

By A. Victoriano, M. Garcia-Silvestre, G. Furada, and J. Bordonau

1) General Comments: 1.1) Suggestions to support the practical relevance of the research findings: The authors present a very-detailed account on long-term entrenchment and current as well as potential future consequences with respect to flood hazard in the Garone River (Val d’Aran, Central Pyrenees). As a river corridor manager my aim

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is to contribute to the overall quality of the manuscript by stimulating the authors to better distill the relevance of their findings for a tangible enhancement of river corridor management at a local and regional scale. In fact, the authors claim in the concluding part of the abstract that their study helps to improve flood risk management, by taking into account long-term river dynamics. Later, in the introduction part, they assert that the analysis of the origin and evolution of geomorphic features allows us to understand the long-term fluvial tendency and to determine the entrenchment rate. Moreover, they postulate that the analysis of the flood effects and the evaluation of flood hazard allow a better management of the catchment and the design of effective defense strategies. In my view, existing approaches to river corridor management (compare for example the IDRAIM framework) following hydro-morphologic principles supported by mobile-bed hydrodynamic simulations (both short and mid-term) which take into account in correct way both initial and boundary conditions (flow-regimes, channel confinements, characteristics of the river bed, controls for short term morphologic evolution like levees, check dams and other instream structures) allow for correct interpretations of the rivers present state and its future evolution tendencies. I therefore invite the authors to put additional effort in revising the manuscript to highlight why and how the presented approach adds value to river management actions. Which are the specific strengths of the proposed long-term reconstruction of fluvial dynamics with respect to recently developed, integrated flood risk management approaches taking into proper consideration the geomorphic controls on local and regional scale.

1.2) Suggestions with respect to the balance of the single sections of the manuscript: In its present form more argumentations space should be deserved to the introduction part. The authors promise to bridge the gap between long- and short-term processes, by relating the regional geologic and geomorphologic setting with the present fluvial dynamics and flood events and mention that most of the previous works on fluvial systems exclusively deal with present processes or landforms, whereas other research lines focus on long-term landscape evolution, i.e. the geomorphologic and tectonic long-term processes that shape the landscape. In my view direct reference should be

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made to the body of previous work and to the specific limitations therein. As far as I'm aware of there is a long history dealing with fluvial geomorphology and the implications for river management (Schumm, Kondolf, Thorne, just to name a few).

2. Specific comments and suggestions

2.2) With respect to the obtained results in terms of river incision: From a hydrodynamic perspective the explanation of river incision and deposition is quite straightforward and quantitatively results from the numerical solution of the shallow water equations (continuity and momentum equations) coupled with the Exner-Equation controlling the bed elevation in space and time via the quantification of sediment transport rates. So knowing the flow regimes, channel geometries and the grain size characteristics the resulting changes in morphology can be determined with reasonable approximation. So coming to the point: knowing the initial conditions in terms of geometry, river bed characteristics and the hydrologic scenarios would enable river managers to make predictions and to design and evaluate defense structures. Please explain how your contribution enhances this task. I think that decision makers have to be also convinced that it is "worth" investigating fluvial dynamics from your perspective, before investing money into river training and restoration.

2.2) With respect to flood risk assessment: Integrating knowledge about long-term evolution and short-term (event-based) mobile-bed hydrodynamic simulations: Again from the viewpoint of river management, it is crucial to contextualize for decision making the relevance of long-term tendencies and foreseen (simulated) short term responses. The authors analyzed a case where a recently occurred event showed at least partially an alignment with the "superimposed" long term pattern. What if no disruptive event occurred in the recent past, but hydrodynamic simulations indicate flood patterns that diverge from the superimposed long-term tendencies mainly due to tipping points in the event unfolding induced by particular features of the built environment (e.g. bridge clogging). In my view, to set management priorities, it is essential to carefully weigh the relative importance of long-term tendencies with respect to the presence of re-

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cently constructed "hydraulic bottlenecks". I therefore invite the authors to extend the introduction and the discussion part accordingly.

3. Concluding remarks:

To summarize river managers have to be fully convinced that rivers have historical hangovers because of the lag between process change and landform response, so it is useful to consider over what timescales change. To conclude, my review did not question the very detailed geologic and geomorphologic analysis carried out to find concealing explanations of long and short term dynamics, rather, my intention is to stimulate the authors to make the usefulness of such an extended backtracking with respect to time fully clear to river managers. In fact, wicked problem settings (multiple demands, conflicting landuse prospects, conflicting goals etc.) are the rule and not the exception un modern river corridor management.

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