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Comment on esurf-2021-91

Saraswati Thapa (Referee)

Referee comment on "Numerical modelling of the evolution of a river reach with a complex morphology to help define future sustainable restoration decisions" by Rabab Yassine et al., Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2021-91-RC3>, 2022

Review of "Numerical modelling of the evolution of a river reach with a complex morphology to help define future sustainable restoration decisions", submitted to Earth Surface Dynamics, January 2022.

Dear editor and dear authors,

This review has been done jointly by Saraswati Thapa and Mikael Attal. We have read this manuscript with great interest: the research topic is very valuable in its content and we like that the paper highlights the importance of the numerical modelling approach for the evolution of a river reach in response to extreme flood events. We need more studies such as this one, that do combine high resolution pre and post surveys with numerical modelling, to test and calibrate models, and to assess their ability to replicate a range of features of importance to scientists and policy-makers, e.g., volumes eroded and deposited, changes in elevation and morphology, predicted response to anthropogenic changes (land use or risk management).

We enjoyed reading this manuscript that presents a very nice set of experiments using the TELEMAC-MASCARET model to reproduce the dramatic changes that occurred in a reach of the Gave de Pau. The results are enlightening, providing answers to a series of scientific questions and directions for future work. However, there are issues that need to be addressed before publication.

One of the main issues is the weak motivation for using this model in this particular example. We feel this could be better motivated, in particular when it appears, as we go through the results, that this model is not very good at reproducing braiding or suspended sediment transport (and this is a braided reach with ~90% sediment transport in suspension!) There are many landscape evolution models considering many sediment transport equations and multiple grain sizes available. The model in this study used two

bed load transport equations and neglected suspended load. The study area has very heterogeneous grain size, however, the model used single grain size D_{50} for the MPM formula and the D_{84} for the Recking formula rather than multiple grain size distribution (see for example Ramirez, J. A. et al. (2020) 'Modeling the geomorphic response to early river engineering works using CAESAR-Lisflood', *Anthropocene*, 32. doi:10.1016/j.ancene.2020.100266).

We made recommendations in the annotated manuscript, and one of the suggestions is that you could highlight the strengths and weaknesses of the model from the onset, highlight that the strengths make this model a good potential candidate to model the changes in the study area (it is one of a few models available that are able to model morphodynamics (erosion and deposition) during large flood events), and that here you use this well constrained example to assess the model's ability to reproduce volumes and cross-sections, and assess its suitability as a tool to inform policy makers" (or something along these lines). Having a clear motivation for the use of the model and clear aims will strengthen the argument, as the reader will know what to expect as they progress through the paper. You can also build on these aims to justify the strategy for modelling, that is, which parameters you are planning to test (or not) and why. The information is there in the text, but we feel it would help if that were presented clearly at the onset. It is also important to build the argument on literature, and we have made suggestions throughout the text.

In general, the paper could do with more details in many sections: description of the model and parameters, description of how data were collected, description of results. There are also places where the outcomes of the model could be evaluated in a more quantitative way. This is particularly crucial for the last section where the impact of restoration scenarios is assessed through a couple of cross-sections, when the previous section demonstrated that the model was not very good at modelling cross-sections and better at modelling volumes.

Finally, the writing can be improved. We have made suggestions in the attached annotated manuscript.

This is an original study. Very few studies have attempted to apply numerical models to natural / real examples to model morphological changes on these space and time scales. We believe there is potential for a strong publication. We hope you find these suggestions useful and wish you all the best with your revisions.

Please also note the supplement to this comment:

<https://esurf.copernicus.org/preprints/esurf-2021-91/esurf-2021-91-RC3-supplement.pdf>