

## ***Interactive comment on “Low-hanging fruits in large-scale fluvial landscaping measures: trade-offs between flood hazard, costs, stakeholders and biodiversity” by Menno W. Straatsma et al.***

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R4: I am a MSc student in physical geography at Uppsala University, with an interest in this field of research. The attached comments are therefore of this particular academic level.

Reply: We laud the fact that students take the time to critically read papers under discussion, and we are grateful for the comments and feedback. Please find our replies below.

C1

R4: The study is altogether a pleasant read with interesting and most realistic take on potential parameters affecting the choice of flood hazard measures. The paper provides useful material for evaluation of landscaping flood measures, taking into account the balance of flood hazard reduction, biodiversity and number of local stakeholders. As presented in the results of this study, the number of stakeholders, and their specific aim and priorities had significant effects on the implementation on flood measures. I enjoyed the perspective of how the number of stakeholders presents problems for implementation as well as choice of flood measures. Higher number of stakeholders means more voices, with differing opinions, priorities and responsibilities. Private companies have in principle only responsibilities to their shareholders, and long-term flood safety might not be a high priority.

Reply: This is a concise representation of the paper.

R4: However, there are various aspects of the study that you could expand upon, or approach differently. Please see comments below. In the introduction you motivate the relevance and purpose of the study with increase in ongoing urbanization of flood deltas, global sea level rise and frequency/magnitude of alluvial floods. This is all relevant for the study as it quickly highlights why examinations of different flood measures are important in societies impacted by climate change. You mention a general increase in discharge but offer no explanation as to why. It could be worth to mention the trend of increasing precipitation. The precipitation in Netherlands has increased over the last 50 years, both in mean and extremes (Buishand et al., 2013; Daniels et al., 2014).

Reply: We referred to Hegnauer et al. (2014) to substantiate the choice for the increased discharge and did not give an explanation indeed. The suggested references (Buishand et al., 2013; Daniels et al., 2014) both analyse precipitation trends in the Netherlands, the Rhine discharge is largely created in the river basin upstream from our upstream boundary. So changes in precipitation in The Netherlands barely affect the Waal discharge. We now added the following sentence to explain the expected increase in discharge: “Projections of increased discharge are based on intensification

C2

of precipitation extremes (van Pelt, 2012) and changes in runoff generation and flood routing (Hegnauer, 2014 #409).”

Hegnauer, M., Beersma, J., Van den Boogaard, H.F.P., Buishand, T.A. and Passchier, R.H., 2014. Generator of rainfall and discharge extremes (GRADE) for the Rhine and Meuse basins. 1209424-004, Deltares, Delft.

van Pelt, S.C., Beersma, J.J., Buishand, T.A., van den Hurk, B.J.J.M. and Kabat, P., 2012. Future changes in extreme precipitation in the Rhine basin based on global and regional climate model simulations. *Hydrol. Earth Syst. Sci.*, 16(12): 4517-4530.

R4: A more thorough readthrough is needed to clear up a number of typos and small language mistakes. At some points you refer to different figures and tables which I could not find in the article. If there is supplementary data containing additional figures and tables, you need to be more specific when referring to it. On P7 line 23 you comment on the costs of landscaping measures in a way that, in my opinion, does not belong in a method section. This could be moved to results or discussion section. List of small language and reference errors:

1. In a number of places in the article Table 5 is referred to. I cannot find this table in the article. If said table is in the supplementary data, you need to say so.
2. P6, lines 11 and 12. In line 11 you write Delft3D Flexible mesh. In the next row you instead write Delft3D FlexibleMesh. This may or may not be a conscious decision.
3. P6, lines 33 and 34. Figure 3e is referred to. I cannot find a Figure 3e that matches the description. I assume you mean Figure 2e.
4. P7, line 15. Missing period at end of sentence.
5. P16, line 7. Misspelled was.
6. P19, line 28. Grammatical error.

Reply: we checked all reference again carefully and corrected them where needed.

C3

We are grateful for the list of errors. All were corrected.

R4: Figure 10, consisting of a number of scatterplots, may need more clear and distinct description in terms of axis titles. I understand the principle of using a X-axis description for the bottom graph, which then applies to all graphs above. It is neat. But other alternatives could be easier to understand.

Reply: The alternative would be to label both axes of each panel, which gives a lot of redundant information and requires a lot of space. We improved readability by increasing the font size of the tick labels and axes labels.

R4: You mention how private land owners often tend to oppose measurements that lead to more frequent but smaller floods, as it negatively affects their activities. It might be worth discussing this aspect of flooding and societal response, as this dynamic can lead to so-called "adaptation effects" or "levee effects". These interesting dynamics of interactions between floods and societal response, along with socio-hydrological models are discussed in DiBaldassarre et al. (2015) and Mechler & Bouwer (2014).

Reply: Social-hydrology provides an alternative and higher level frame for the content of our paper, but we believe that decision support is closer to the core of our work. We now refer to these papers for further reading.

R4: You may want to expand on the time aspect of the different measures. Large scale interventions can take considerable time, and implementation time can stretch out over long periods. In the Discussion you mention the assumption made - that all measures are implemented instantaneously. I fully understand the reason for this assumption. Further implementation of the time aspect on this area could be subject in future studies.

Reply: Correct, the paper is already quite long as it is.

See supplement at R1 for the revision

C4

