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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Effects of variability in probable maximum precipitation patterns on flood losses" *by* Andreas Paul Zischg et al.

Anonymous Referee #1

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This paper presents a model-chain sensitivity analysis for flood loss estimation using the probable maximum flood (PMF) approach. While many authors have studied the sensitivity of flood characteristics to the spatio-temporal distribution of rainfall, the novelty of this paper is to look at the sensitivity of estimated flood losses, which is at the end of the risk assessment chain.

The paper is well written and properly concise. I am not a big fan of the concept of PMF but I understand that, since it is used in practice, research on it is noteworthy. My main comments/suggestions are the following:

- Reading Page 5, lines 7-12, it seems that you assume multiplicative space-time separability for rainfall, meaning that storm movements are not accounted for. Based on my experience, and since you are interested in synchronisation of floods, the fact that the

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storm moves over the catchment may have a significant impact on the flood peak at the outlet (and maybe on the flood losses). Given that the models that you use seem to be capable of accounting for it, you should explain why you did not consider this aspect, or to include it in your analysis.

- Analogously, it seems that flow velocities are not accounted for in the flood loss modelling part. You should motivate why you believe this is not necessary. By the way, may the fact that, in your results, flood losses correlate more with the lake levels than the river discharges at the outlet be due to considering water levels only and not velocities in the loss model?

- I know that, in different research areas, the definition of "uncertainty analysis" and "sensitivity analysis" are different and sometimes exchangeable. In my view, what you do in this paper is a sensitivity analysis on the assumptions you make (which of course are affected by uncertainty). To me, an uncertainty analysis requires to model statistically the uncertainties in the assumptions made, i.e., through probability distributions, and to propagate these distributions through the model chain to the output distributions. You somehow do this for the rainfall spatial patterns, using the Monte-Carlo approach, but not for other choices such as for the vulnerability functions or the parameters of the models. It would be useful to state, for example after line 10 at page 4, how you define "sensitivity analysis" and "uncertainty analysis" and what you are going to show in the paper.

Additional detailed comments:

Page 4, line 24: what does "assessing uncertainties in the model output" mean?

Page 8, eq. (1) (and Figure 7 at page 14): I guess the sum of RUR for the different factors does not equal 100% (i.e., global sensitivity is normally not the sum of local sensitivities). Am I right? If so, RUR does not quantify the relative contribution of the different components to the total uncertainty but it is somehow related to it (it would be interesting to understand how it is).

Page 10, line 13 (and legend of Fig. 4): how can the flood inundation maps be “probabilistic” if the probability of the PMP is unknown? I guess you mean the maps represent estimates of the conditional probability of inundation, conditional to the PMF to have occurred.

Page 13, line 3: do you really think that the total uncertainty range has been quantified in the study? It is to me the range of sensitivity to the different assumptions made.

Page 15, line 17: I would say that, given the range of assumptions made here, the sensitivity of flood losses to the variability of spatial distribution of rainfall is larger than for other factors.

Page 16, line 2: could the superimposition of flood waves be quantified for your scenarios?

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