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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "The role of spatial dependence for large-scale flood risk estimation" *by* Ayse Duha Metin et al.

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MANUSCRIPT TILE THE ROLE OF SPATIAL DEPENDENCE FOR LARGE-SCALE FLOOD RISK ESTIMATION

AUTHORS: Metin, A. D., Dung, N. V., Schröter, K., Vorogushyn, S., Guse, B., Kreibich, H., and Merz, B.

GENERAL COMMENT

I congratulate with the authors for their very interesting manuscript on the impact of spatial dependence of hydrologic and hydraulic forcing on flood risk assessment. This

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study addresses a very relevant issue in flood risk assessment, that is the value and impact of a commonly assumed working hypothesis, i.e. homogeneous return period of flood events across large geographical areas and regions. This common hypothesis implies a complete dependence (i.e. perfect spatial correlation) of flood events and should be rather regarded as an extreme condition. The hypothesis is contrasted in the study to the opposite extreme situation, namely complete spatial independence of hydrological/hydraulic forcing, and with an intermediate condition that models the real spatial dependence through an ad hoc modelling chain. Impacts of these three hypotheses are quantitatively compared in terms estimated annual damage and risk curve (across different spatial scales) for a large river basin (Elbe river). I found the manuscript to be well structured and sufficiently clear (see comments below) and I only have moderate and minor comments on it.

My recommendation is therefore: return to authors for moderate revisions.

I hope the authors will find my comments useful while revising their manuscript.

With kind regards, Attilio Castellarin

MAJOR CONCERNS

- Levee breaching is neglected

The authors clearly state that they neglected levee-breaching in their analysis. This is a rather strong assumption because it is far from real conditions (once an earthen levee is over-topped, it will most likely breach) and because the formation of a breach has serious implication on the hazard downstream (lower flood peaks and volumes downstream the breach) and in the inundated area (larger outflow volumes if a breach is present relative to the no-breach case). I would suggest deepening the discussion on this main assumption.

- Only direct losses to residential buildings

The authors apply a multiple-variable damage model that considers only direct dam-

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ages to residential buildings. Given the strong expertise on flood damage modeling of the GFZ research team, I would like to see some discussion on this assumption as well. Based on their previous research activities, could the authors speculate if the same results of the study should apply also to other kind of damages (direct damages to the industrial/agricultural sector, indirect damages)? Are the three hypotheses on spatial dependence really interchangeable if indirect damages (e.g. disruption of services) are considered instead of direct ones?

- Complete spatial dependence / independence

I believe I understood the technicalities for simulating flood damages and assessing flood risk under the hypotheses: (i) complete spatial dependence and (iii) complete independence. Yet, I would say that while the analysis framework is extremely clear for (ii) "modeled dependence" (perhaps also due to the flowchart of Fig. 2), I my opinion the description of the technicalities of how flood risk is modeled under hypotheses (i) and (iii) is not as clear (hydrological simulation is repeated, or streamflow time series are simply resampled?). This is a pity because the manuscript could serve as a blueprint for repeating the same modeling exercise in different areas or at larger scales (continental, global) considering all three spatial dependence typologies. Suggestion: it would be goo to have an illustration on what differs in the flowchart of Fig. 2 when hypotheses (i) and (iii) are considered instead of (ii).

SPECIFIC REMARKS

* L.29 “there were 3062 floods”, consider using a rounded figure, floods may occur without impacting people and therefore without being recorded

* Fig. 2, consider enhancing readability (e.g. by using larger fonts)

* Sections 3.1.1 and 3.1.2 consider commenting on the limitations associated with the simulation timescale (daily) relative to result in validation (poorer results in some small catchments)

* L.188, is the continuity of the levee crest ensured using a 10m res. DEM

*L. 193, consider including Manning's roughness units

* Fig.4, I am surprised by the remarkable narrowness of the confidence interval for the fully independent case, is it associated with the size of resampled sets? The authors should comment on this.

* Fig.6, panels could be reported (also) in a standardized form concerning the y-axes, so that the size of each region is neglected, the three curves are more complete in all panes and similarities/dissimilarities between different cases can be better illustrated

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