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Discussions

Interactive comment on "Enhancement of large-scale flood damage assessments using building-material-based vulnerability curves for an object-based approach" *by* Johanna Englhardt et al.

Anonymous Referee #1

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Referee report on NHESS-2019-32, "Enhancement of large-scale flood damage assessments using building-material-based vulnerability curves for an object-based approach"

The authors present an approach for a nation-wide (large-scale) flood risk assessment based on available data on hazard frequency and magnitude, downscaled vulnerability information to allow for an object-based assessment, and corresponding information on elements at risk. As such, their approach is timely, and allows for computation of risk. The work will be of considerable importance to the readers of NHESS. There-

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fore, I recommend acceptance of the Discussion manuscript to NHESS, given some clarifications outlined below.

First of all, I recommend to adjuste the title to better reflect the content of the work, examples include "Enhancement of nation-wide flood risk assessment using building-specific vulnerability curves for an object-based approach" because (a) large-scale could be misleading within the geo community (1:1 = large scale, 1:1,000,000 = small-scale) and (b) the overall framework presented in the introduction of this work is related to risk, not damage (or loss) assessment. Moreover, even "Africa" could be included in the title.

Second, I would remove the sentence on "multi-risk" from the Abstract since the paper focuses on flood risk. With respect to the use of this term, however, the authors might wish to include some sentences on flood characteristics in Ethiopia, as in many countries with semi-arid climate "flood" may also contain fast-onset processes such as flash floods which are in their characteristics and assessment different from "traditional river flooding", and I was not sure whether or not these types of hazards are also included in the dataset used for hazard assessment in the study.

Third, in the introduction page 2, line 1 f. the authors include their risk concept following the UNISDR definition. In the third paragraph, in contrast, the authors are reporting on a vulnerability curve which "is generally developed for each of the aggregated land-use categories used to represent exposure (Ward et al., 2013)" – this is contradictory to the above-mentioned definition, and is also not followed throughout the paper. The authors also mentioned this challenge on page 2, lines 21-25. Maybe here also some sentences on the conceptualization of "vulnerability" may be useful, as the paper deals with what is named "physical vulnerability" in many works, in contrast to e.g. "social" and "institutional" vulnerability.

Fourth, the paragraph on literature related to "flood" vulnerability of buildings would surely also gain from a more thorough distinction between different flood types (such

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as the above-mentioned flash floods), examples may be found in recent NHESS publications (and not only these from the [Dutch] flood communities). In particular with respect to the challenge of structural vulnerability, other scholarly articles may be found in the Journal of Hydrology, Geomorphology, Engineering Geology, or Water Resources Research, all of them focusing on the consideration of the mentioned building type, quality, height, and material during vulnerability assessment. This could be used to expand the statement made on page 3, lines 14 ff.: "Compared to risk assessments in the earthquake domain where they are essential components (de Ruiter et al., 2017), or in 15 local-scale studies focusing on physical vulnerability to debris flows (Papathoma-Köhle et al., 2017), construction types and building materials have only played a minor role as indicators for flood vulnerability. Large-scale flood risk assessments could be improved by using object-based characteristics to represent exposure and vulnerability [. . .]"; examples may include Milanesi et al. (2018), Sturm et al. (2018a, b), Zhang et al. (2016; 2018), Kang and Kim (2016), Godfrey et al. (2015), or Thouret et al. (2014).

Fifth, with respect to Table 1 and the related text body I was wondering if and how results from different country setting such as e.g., Germany, Japan, China and Malawi could be better combined – in many countries building laws, design criteria, construction types and technical knowledge as well as economic feasibilities are different, leading to significantly different resistance to flood hazards (independent of which flood type). So the authors could better explain how they concluded or deduced their classification scheme of four building classes (which in practice is good), maybe by only focusing on the situation in Africa. Elsewhere, the authors cite the recent review of Papathoma-Köhle et al. (2017), where a main conclusion was that "environmental, as well as the socio-economic context of areas subject to (. . .)[floods] varies around the world. A one size fits all method is difficult to be developed, on the other hand, investing time and effort in the development of tools that are tailor made only for a specific area is also counterproductive. Methodologies may be transferred to other areas, however, this is not always the case for the final tools (e.g. a vulnerability curves). To which extent a vulnerability curve or a specific weighting of indicators is transferable to another area has to be further investigated."

Sixth, I would like to recommend a discussion on the vulnerability curves shown in Figure 2 and used within the present study. Their shape is considerably different from the shape of either traditional flood loss models (e.g., Kreibich et al., 2010) but also from models used in flash-flood vulnerability assessments such as those presented by Karagiorgos et al. (2016) or even from hydrological hazards in mountain areas (such as e.g., Totschnig and Fuchs 2013). Moreover, the curves provided in Figure 2 clearly show that the main damage already occurs with relatively small flood intensities up to 1.0 m, which could be worth to discuss further – as such, the use of a 1:1,000 year flood hazard map seems a bit over-ambiguous if we assess recent flood events over the African continent (already 1:50 to 1:100 year events are responsible for high loss rates and those should be better included in any hazard and risk mitigation strategy); moreover, the mentioned informal settlements are very often located in flood plains which are even affected by larger frequencies.

Seventh, even if the authors discussed sources of uncertainty for every risk factor used during the set of calculations, it would be great to have a summarizing chapter on the overall sources of uncertainty and spread (maybe including an overview Table) – such as e.g. discussed with respect to Figure 4, there are many sources of uncertainty to be considered when applying "large-scale" nation-wide risk assessment (such as e.g. discussed on page 16, lines 20 ff.: "...varies by an order of magnitude", or further down in lines 26 ff.: "...mismatches, for instance in informal settlements...". This issues is also shown on page 20, lines 14 ff: "Using the single curve from GLOFRIS leads to a higher total estimate of risk by 41%. Therefore, the correct [btw: what exactly do you mean with "correct"?] estimation of maximum damage values and improved representation of vulnerability are important considerations for large-scale flood risk modelling." Other examples include page 21, lines 18 ff: "Consistent with other studies (...), the sensitivity analysis showed that the value of the exposed buildings deserves considerable attention as we see large differences in the model output. The results further showed that aggregated vulnerability as used in large-scale land-use-based models affects the results to a great extent."

Some small items:

- Please carefully check the use of "damages" versus "damage" since in the insurance industry, "damages" is used slightly different.

- Page 2. Line 30: "therefore" instead of "therefor"

I think that considering these items will result in a more concise presentation of methods and results, and will considerably improve the valuable study presented in NHESSD. Therefore I kindly encourage the authors to proceed with their works, and undertake these revisions.

Please note that the references cited in this review are for clarification and illustration purpose only, the decision which to include in a revised version shall definitely be with the authors of this NHESS manuscript.

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