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Reply on RC1

Luana Lavagnoli Moreira et al.

Author comment on "Review article: A systematic review and future prospects of flood vulnerability indices" by Luana Lavagnoli Moreira et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2021-34-AC1>, 2021

Reviewer 1

- The paper "A systematic review and future prospects of vulnerability indices" presents a relevant discussion about the state-of-art of flood vulnerability indices. The authors offer an overview of the main stages for the development of vulnerability indices. I consider the main contribution of the paper is to point out the gaps in the flood vulnerability assessment (Section 5). The paper is well-structured and presents a logical order of the ideas.

A: We are thankful for the thorough review and constructive comments. We addressed all comments and explained how the manuscript was modified in light of these suggestions.

- **Line 7:** I would like to suggest to the authors to replace the first sentence of the abstract for the idea express in lines 58-59 (...no study has conducted a systematic review of flood vulnerability indices with a focus on the different stages involved in the construction of flood vulnerability indices). This is the main contribution of the paper and it draw attention of the reader.

A: Thanks for the suggestion. We changed the first sentence for "Despite the increasing body of research on flood vulnerability, a review of the methods used in the construction of vulnerability indices is missing. Here, we address this gap by providing a state-of-art account on flood vulnerability indices, highlighting worldwide trends and future research directions" (lines 8-10).

- **Lines 24-25:** Vulnerability as a neglected dimension is a controversial statement that may jeopardize the paper; otherwise, how could it be possible to select 95 peer-reviewed papers?

A: We agree with the comment and removed the expression "yet still neglected" (line 29).

- **Lines 34-38:** It is not essential for a review paper to present concept adopted in the manuscript. The discussion is based on many studies (i.e., 95 papers) – which used different vulnerability concepts. If the authors opt for maintaining the concepts, please quote the most updated reference of UNDRR (2017). I also recommend consulting

Kelman (2018) for a broad comprehension of disaster risk science vocabulary. Kelman, I. Lost for Words Amongst Disaster Risk Science Vocabulary?. Int J Disaster Risk Sci 9, 281–291 (2018). <https://doi.org/10.1007/s13753-018-0188-3>

A: We agree with the suggestion. We added the references as suggested to the text (UNDRR, 2017). We removed the concept adopted in the paper as well. (line 34). Furthermore, we added the following paragraph to the discussion session:

“Besides the aforementioned methodological gaps, it is important to emphasize that the theoretical framework adopted influences the methodological choices that are made when constructing vulnerability indices. Even though we have not analyzed the theoretical constructs used by each study, when reading the articles it became clear that several of them do not specify how they conceptualize vulnerability. Furthermore, there are ambiguities in how vulnerability is understood (Kelman, 2018). For instance, some authors consider coping and adaptive capacity as components of flood vulnerability (e.g. de Brito et al., 2018; Feizizadeh and Kienberger, 2017). Others include flood hazard characteristics or exposure (e.g. Carlier et al., 2018; Chaliha et al., 2012) as part of vulnerability. Hence, we argue that a stronger theoretical underpinning of research is needed for producing scientifically rigorous and comparable research. Within this context, future work could investigate how different terminologies and theoretical constructs are defined and applied across different case studies. “ (lines 335-343).

- **Lines 75-114:** The Section 2 is a concise basis for the readers to understand the discussion in the next segments.

A: Thanks for the comment.

- **Lines 115-129:** Please inform the period of time (month/year) that the literature review was performed in WoS.

A: Thanks for the suggestion. The review was conducted from January of 2002 to December of 2019. We modified the text to include this information (line 124).

- **Line 119:** I would like to recommend avoiding some expressions such as “irrelevant articles”. They were not useful for the purpose of the present manuscript but probably they are relevant for another studies.

A: We agree with the suggestion and changed the expression “irrelevant” for “articles that are not useful for the purpose of the present study” (lines 125).

- **Lines 122-123:** Please consider providing a better description of the 11 articles included in the analysis. All the 84 papers quoted them? Which database are they indexed? Would be necessary to include another database, in addition to the Web of Science?

A: Thanks for the observation. We apologize for this misunderstanding. In fact all 95 articles are included in the Web of Science database. However, 11 key publications were not included in our original search as even though they build vulnerability indices, the keywords “(“index” OR “composite indicator” were not mentioned in the title, abstract or keywords. This is a limitation of our methodology as by narrowing down the terms we face the risk of excluding relevant articles. We mentioned this in the manuscript.

The text now reads: “An additional of 11 key articles were included. They were

not originally included in our search as even though they built vulnerability indices, the keywords "index" or "composite indicator" were not mentioned in the article's abstract, title and keywords. Hence, this limitation should be acknowledged as relevant articles may have been disregarded." (lines 126-129).

- **Lines 133-135:** I am not totally convinced with the reasons attributed by the authors for the increasing of papers published since 2015. Before the Sendai Framework for Disaster Risk Reduction some other international agendas were agreed by the countries, such as the Hyogo Framework for Action and the International Decade for Natural Disaster Reduction (the 1990s). The discussion about vulnerability topic therefore is not recent. Another reason pointed by the authors (i.e. "the easiness of using indices") sounds quite superficial.

A: Thanks for the comment. We agree that this is only a speculation. We toned it down in the text and removed the reference to the Sendai Framework from Figure 2a. We believe that indices are more prominent than other methods for assessing vulnerability due to the data needed. We changed the text to clarify this argument:

"the growing number of publications may result from the increasing awareness of flood-disasters prevention and reduction policies. The increasing number of vulnerability indices studies could also be attributed of the easiness of using indices to address complex and multidimensional issues such as flood vulnerability in contrast to other data-demanding methods (e.g. damage curves)" (lines 139-142).

- **Line 163:** Please consider including an additional sentence to affirm that the data scarcity of rural areas is a worldwide issue (or at least for the 38 countries).

A: Thanks for the suggestion. We included this information and added some references to support our claim (line 173).

- **Lines 168-175:** Please consider reviewing this paragraph, the main idea is not clear. Are the indicators obtained by Rufat et al (2015) similar or not to the results found by the authors?

A: Thanks for the suggestion. We changed the sentence indicate the most of results found by Rufat (2015) are similar to our results (line 181).

- **Line 176:** Table 4, please provide more information in Methods section about how the minimum number of papers (i.e., 4 papers) was defined as the most commonly used indicators.

A: More than 600 flood vulnerability indicators were mentioned in these 95 articles. In order to be able to interpret the results, we chose a minimum number paper that used the same indicators. We clarified this in the legend of Table 4. The text now reads: "This cut-off-point was defined for clarity purposes as more than 600 different indicators were mentioned in the 95 reviewed articles." (line 186).

- **Lines 256-257:** It is possible to develop study at the national scale aggregating census tracts.

A: Thanks for pointing this out. We modified the text accordingly. The text now reads: "Despite the availability of census data at the country level, there were no studies at the national level and only 8 papers (8.4%) constructed vulnerability

indices using data at the basin scale. ” (lines 267-268).

- **Lines 264-265:** Please provide a brief comment about the framework presented by Jamshed et al (2020).

A: Thanks for the suggestion. We included a brief comment about this framework: “This framework considers, either qualitatively or quantitatively, how rural-urban linkages can influence the occurrence of floods and how these shapes the vulnerability of rural households.” (lines 276-278).

- **Lines 271-273; 321-322:** More than time and financial resources, including risk perception or past flood experience in studies requires a multidisciplinary team. It is still a challenge for disaster risk science nowadays.

A: Thanks for the suggestion. We included this information (lines 285-286).

Technical corrections

- **Lines 14 and 306:** analyses instead of analyzes.

A: Thanks for the observation. We corrected these (lines 16 and 349).

- **Lines 25-27:** please review the sentence, it seems incomplete.

A: We modified the sentence: “In this regard, vulnerability plays an important role in flood risk assessment. It encompasses multiple the social, economic, physical, cultural, environmental and institutional characteristics which influence the susceptibility of the exposed elements to the impact of hazards” (lines 28-31).

- **Line 133:** SFDRR was not created, it is an agreement among the Member States.

A: Thanks for the observation. We corrected this (line 139).

- **Line 162:** repeated in in.

A: Thanks for the observation. We corrected this (line 183).

- **Lines 187 and 188:** see punctuation and typing errors.

A: Thanks for the observation. We corrected these (lines 199-200).

- **Lines 117, 233 and 237, 267, 321:** see typing errors.

A: Thanks for the observation. We corrected these (lines 121, 244-246, 280, 351)

- **Lines 254-255; 276; 290-291; 308-309:** please rewrite some sentences in order to avoid the repetition of words (e.g. research; use and used; differentiated and different; difficult, difficulties and difficulty). I recommend a detailed revision of the manuscript to correct grammatical errors and improve the quality of the text.

A: Thanks for the observation. We corrected these (lines 265-266; 294; 309-310; 330-331)

- **Table S1**: it is a lengthy table, please repeat table header in each page.

A: Thanks for the observation. We modified this (Supplement file).

Please also note the supplement to this comment:

<https://nhess.copernicus.org/preprints/nhess-2021-34/nhess-2021-34-AC1-supplement.pdf>