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Dear Editor,

We thank you to reconsider our revised manuscript for publication in NHESS.

Following your recommendations, we have modified the manuscript by addressing, point-by-point, all the issues raised. The proposed revisions in the updated manuscript are highlighted by yellow color.

We are looking forward to your assessment of the revised manuscript.

Yours sincerely,
Dr. N. Long, on behalf of the co-authors
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1. Representation of coastal area considering 19 districts of coastal area delineation map of Bangladesh.

Added in the text, section 5 "A socio-spatial vulnerability index" line 415:

"To identify places that are highly vulnerable to cyclonic flooding hazard, we focus on 16 coastal districts, the "district" being a spatial unit of reference (Fig. 1a). As widely discussed by the Program Development Office for Integrated Coastal Zone Management Plan (PDO-ICZMP, Uddin & Kaudstaal, 2003), the definition of a coastal zone is not simple and depends on selected criteria. According to the PDO-ICZMP classification, we have considered 12 "exposed" districts, i.e. ones adjacent to the sea and/or located in the lower estuaries (i.e Khulna, Satkhira, Barguna, Cox's Bazar, Bagerhat , Patuakhali, Pirojpur, Chittagong, Noakhali, Bhola, Lakshmipur and Feni). The interior coast districts (Jessore, Narail and Gopalganj) are less exposed to cyclone inundations, as the other districts facing the sea. Moreover, following the literature review (Fig. 1a, see Appendix B.b) and given the trajectories of major cyclones as Bhola, Gorky or Sidr, we considered that the districts in the mouth area, i.e Barisal, Shariatpur and Chandpur, are also highly exposed to cyclonic floodings. Finally, the district of Jhalokati, cited in the literature review and bounded by Barisal, Pirojpur and Barguna, is added to maintain a territorial coherence."

Uddin, A. M. K., & Kaudstaal, R. (2003). Delineation of the coastal zone. Program Development Office for Integrated Coastal Zone Management Plant (PDO-ICZMP), Dhaka, 1–42.

2. Significant variation of vulnerability can be found within a district (e.g., Khulna Sadar vs. Koyra Upazila), hence, analysing vulnerability at subdistrict level is essential.

Added in the text, section 6.2 "**Representativeness and quality of the data at the district scale**" line 631:

"The sub-district level case study presents advantages in data mining, the use of participatory methods and in capturing the fine complexity of vulnerability, but these studies are very local specific and therefore are difficult to compare with other regions. Moreover, the integration into a vulnerability index of different

local qualitative and quantitative data, which have their own logic of underlying scales and pattern, implies a loss of information and relevance (Fekete et al. 2010).

Here, using the "district" scale is related to the multifold aims of our research. One of the objectives was a spatial identification of hotspots of vulnerability to cyclonic flooding, intending both to identify the spatial variability linked to cyclonic flooding facing the district and the districts where the combined effects of multiple social, economic and environmental stressors are most prevalent regarding the cyclonic flooding. Therefore, the districts have been chosen as units of analysis for several motives: 1) districts are relatively homogeneous in size in comparison with sub-districts, municipalities or unions; 2) cyclonic hazard management are organized and supervised on the district level (e.g the alert and cyclone warnings dissemination system, maintaining cyclone shelters and assisting in evacuation procedures, Kulatunga et al., 2014); 3) a sufficient number of variables is freely available online from the Bangladesh Bureau of Statistics, 4) district unit can be more easily transposable and replicated on other delta regions (e.g applied in the 13 provinces of the Vietnamese Mekong Delta or in the 6 districts of the Ayeyarwady Delta); and 5) as administrative unit, the districts are easily understood by decision makers, planners and end-users.

Moreover, using this territorial delimitation enables us to zoom out the research fieldworks conducted from 2007, in order to show which zones have been under the scope of science and others very exposed and vulnerable but almost forgotten by researches. While most of the analyzed studies worked on local places, they did not give a whole picture to the reader about the work made in coastal Bangladesh. The distribution of the studies on the map (Fig.3) shows that two main districts on the west coast were over-studied (Shatkhira and Khulna) compared to the need of studying now the most vulnerable districts, situated in the mouth of the Delta."

Fekete, A., Damm, M., & Birkmann, J. (2010). Scales as a challenge for vulnerability assessment. Natural Hazards, 55(3), 729-747.

3a. Selection of vulnerability indicators based on scientific literature might not be adequate.

Modified and added in the text section 5 "A socio-spatial vulnerability index" line 428:

"There are two popular approaches to constructing a vulnerability index: the variable reduction and the variable addition. The first one is an inductive approach, a large set of variables is used, assuming that they have potentially larger or lesser influence (i.e. weight) on the index calculation. Principal Components Analysis, although fairly complex, is often used to estimate these weights to be assigned to each indicator (Cutter et al., 2003; Das et al., 2020; Quader et al., 2017; Uddin et al., 2019a). Although a large number of variables may be useful for descriptive purposes, including non-influential variables in the index aggregation may decrease both explanatory power and easiness of its use and understanding. On the contrary, the variable addition is a deductive approach. Deductive models can contain a few dozen variables, or less, which are normalized and aggregated to index, which could be separated into groups sharing the same underlying vulnerability dimension. This approach is the most common structure applied to vulnerability indices. Deductive approach, based on a data-driven mindset from expert knowledge (e.g literature review) and parsimony, helps to identify and trace underlying themes running through the data, opposite to inductive approach where the statistical models obfuscate underlying data. The literature review is a rich source to understand the main causes, translated as indicators of vulnerability, as well as their

relative importance and interactions. Therefore, we chose to apply this simple method, based on the vulnerability factors deduced from our literature review, to determine the SSVI. "

3b. Hence, a participatory approach or thorough justification is needed to validate selected indicators.

Added in the text, section 6.3 "Limits of the research" line 672:

"However, in this study, the objective of the SSVI mapping exercise is to open a dialogue around vulnerability to cyclonic flooding in Bangladesh, and to help stakeholders and researchers to identify the most vulnerable places that are understudied. Therefore, as the SSVI objective is not to participate at adaptation practice or decision-making, the validation question, while important, is not central (De Sherbinin et al. 2019). Moreover, as the SSVI is multidimensional and not directly observable, and because there are few published explicit procedures that outline how to validate it, this poses a persistent challenging validation question (Tate 2012; Rufat et al. 2019). Moreover, the human and economic cost from the cyclone impact reports, if available, are unusable to the SSVI validation because they address mainly the exposure component and undervalue the vulnerability. Nevertheless, some vulnerability index validation research tracks seem to emerge from them : 1) external validation from independent proxy data as death tolls, physical wounds, diseases, economic loss, and household survey; 2) internal validation from sensitivity analysis. Future SSVI to cyclonic flooding in Bangladesh research should investigate validation scheme based, for example, on qualitative work describing social stratification in pre- and post-disaster settings (Fekete et al. 2019) and from targeted surveys, and participatory approaches which would be conducted in different districts."

Tate, E. (2012). Social vulnerability indices: a comparative assessment using uncertainty and sensitivity analysis. Natural Hazards, 63(2), 325-347.

Fekete, A. (2019). Social vulnerability (re-) assessment in context to natural hazards: Review of the usefulness of the spatial indicator approach and investigations of validation demands. International Journal of Disaster Risk Science, 10(2), 220-232.

Rufat, S., Tate, E., Emrich, C. T., & Antolini, F. (2019). How valid are social vulnerability models?. Annals of the American Association of Geographers, 109(4), 1131-1153.

De Sherbinin, A., Bukvic, A., Rohat, G., Gall, M., McCusker, B., Preston, B., ... & Zhang, S. (2019). Climate vulnerability mapping: A systematic review and future prospects. Wiley Interdisciplinary Reviews: Climate Change, 10(5), e600.

4. Though title indicates, socio-spatial vulnerability, I found weak representation of social science here. e.g., no participatory approach, limited consideration of social indicators such as networks or collaboration pattern.

The title of the manuscript is : *"Bangladesh's vulnerability to cyclonic coastal flooding".*