

Interactive comment on “An adaptive regional vulnerability assessment model: Review and concepts for data-scarce regions” by Mark Bawa Malgwi et al.

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The authors would like to thank Referee #1 for his/her insightful comments. Below, answers to the concerns raised are provided step-by-step.

The paper brings an important contribution to the field of disaster risk reduction and is worth of publication. However, an important effort of synthesis is required. Often the information is repetitive, little elaborated and some other times not relevant enough with respect to the objectives and subject of the paper. This makes difficult to review the paper. For instance, sections 2.1 and 2.2 present many subsections and secondary information which are too general and more relevant for the format of a report than

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for a scientific article. The authors should make an effort to reduce redundancy and secondary information to streamline the message and render the paper readable by better targeting the specific gap they are addressing.

Authors: Thank you for the comment. We will make a substantial effort to streamline, reorganize and reduce the manuscript (especially in sections 1, 2 and 3). Suggested changes will include the following; Section 1 - Repetitive information will be removed and details provided will be limited to a general overview and the gaps we plan to address Section 2 - Subsections in 2.1 will be contracted into one paragraph (background). Section 2.2 (application) will be reduced to better focus the methodology on expert-based approaches which will be implemented in the conceptual framework. Section 2.3 will focus on current challenges/gaps and specific areas the conceptual framework will address Section 3 – Information provided will be reduced and reorganized into the background (section 3.1), application (section 3.2) and challenges/gaps and specific areas the conceptual framework seeks to address Section 4, 5, 6 – Information will be streamlined and reorganized.

Title: if the all method is tailored only to flood perhaps include this in the title. Also, perhaps “adaptive” is little informative and generates confusion with the adaptation component frequently used in the DRR literature. I suggest using the word “generic”: “A generic regional flood vulnerability assessment model: Review and concepts for data-scarce regions”

Authors: Thank you for the suggestion. We will change the title to “A generic physical vulnerability model for floods: review and concepts for data-scarce regions”

Line 13: is this physical vulnerability to floods only? Perhaps add “to floods” after physical vulnerability

Authors: Changes will be made accordingly. See also a suggestion for a new title.

Line 16: not clear what “local protection elements stand for in the context of that sen-

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tence.

Authors: Local protection in the context of our study was defined (now slightly modified) in Line 508-513 as deliberate or non-deliberate measures that are put in place and can reduce the impact of floods on a building. These measures can be directly included in the building structure e.g. elevation of the entrance door, or measures located in the immediate surrounding of a building. While many local structural protection measures may not be primarily constructed as a protection mechanism against floods, they reduce the impact of floods on a building e.g. fencing wall (Attems et al., 2020; Holub et al., 2012; Holub and Fuchs, 2008). Due to a suggestion by referee #2, the sentence will be removed from the abstract.

Lines 61-62: insert commas after “e.g.”

Authors: Thank you for the comment. Changes will be made accordingly.

Lines 72-78: perhaps have this paragraph in this format: “. . . studies earthquakes (cite cite cite), landslides (cite cite cite), tsunamis (cite cite cite). . .” and so on.

Authors: Thank you for the comment. Changes will be made accordingly.

Line 80: you mean “physical vulnerability assessment methods”? I'd always add “physical” to “vulnerability” to specify that you look at this type of vulnerability

Authors: Thank you for the comment. We will add the term ‘physical’ vulnerability to other parts of the manuscript to be more specific.

Line 82: “Vulnerability assessment methods are mainly used to estimate damage or loss.” It's a repetition from line 68

Authors: Thank you for the comment. Changes will be made accordingly.

Lines 82-83: this is a repetition from lines 35-37

Authors: Thank you for the comment. Changes will be made accordingly.

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Lines 82-98: perhaps connect this part on models with the previous part in which you also review methods to assess physical vulnerability. Is there any overlap?

Authors: Thank you for the comment. Since we were planning on combining the vulnerability indicator method and damage grades, the idea was to introduce them separately. Firstly, we review ‘approaches’ for physical vulnerability assessment (vulnerability curves, indicators, matrices, and multivariate methods) and secondly we report on their application (monetary loss and damage grade prediction). However, we will combine the parts on commonly applied physical vulnerability assessment methods which are also used for damage grade prediction (vulnerability curves and the multivariate method) and then discuss the vulnerability indicator method separately. The suggested change in linking the paragraph: “Generally, both the stage-damage curves and the multivariate methods have been used to predict flood damage. This ability to predict damage is increasingly seen as an important step towards disaster risk reduction (Merz et al., 2010). These models used to predict building damage due to flood impact are commonly referred to as flood damage models.”

Lines 121-123: not clear

Authors: We refer to the uncertainties resulting from two factors, (1) the use of vulnerability curves from other regions which do not have comparable building or hazard characteristics and (2) from the use of meso-scale aggregated data which can overlook certain characteristics of a community that is only assessable through micro-scale assessment. Thus, lines 121-123 highlights that these two factors can contribute to higher uncertainties. We will streamline this in a revised version.

Line 128: what do you mean by “combination of methods” expert based and modeling?

Authors: By a combination of methods, we mean merging (or integrating) approaches or techniques from two different physical vulnerability assessment methods into a new method. For example, combining vulnerability curves (data-driven) with vulnerability indicators (expert-based) as demonstrated in (Godfrey et al., 2015). We will clarify this

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in a revised version of the manuscript.

Section 2: there is overlap and repetition with Lines 64-81. Perhaps reduce section 1 to the main points you want to bring forward in the study and move those lines to section 2.

Authors: Thank you for the comment. Section 1 will be reduced and further overview of vulnerability indicators will be moved to section 2.

Line 162: you mean "buildings' vulnerability"?

Authors: Thank you for the comment. We meant the vulnerability of buildings and we will undertake necessary changes in a revised version of the manuscript.

What is it meant by "framing indicator schemes"?

Authors: Framing indicator schemes here means 'setting the underlying (theoretical) framework for indicators'. We will clarify this in a revised version.

Line 165: revise punctuation here.

Authors: Thank you for the comment. Changes will be made accordingly.

Line 170: use Papathoma-Koehle instead of Papathoma

Authors: Thank you for the comment. Changes will be made accordingly.

Line 175-177: this is a repetition from Line 165.

Authors: Thank you for the comment. The repeated part will be deleted in a revised manuscript version.

Section 2.2.1 this section might be reduced to a sentence. There seems no need to have a separate section. Also, most of the information contained in this subsection is always consistent with the title of the section. The numbering of the section does not seem to be correct

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Authors: Thank you for the comment. In section 2.2.1, it was important to highlight three main issues relating to indicator selection; (a) Recommended criteria for selecting indicators (b) number of indicators, and (c) different approaches and stages used for selecting indicators. The conceptual framework to be introduced in section 5 will require such information as a basis for future studies that implement the framework. We will streamline and reduce the details provided in the section.

Lines 198-199: the sentence is unclear

Authors: According to Birkmann (2006), the choice of including different dimensions of vulnerability might be related to data availability. For example, in countries where there are regularly-updated and available demographic data (e.g., income level, gender, age, employment, etc.) it is common to find studies that combine physical and social vulnerability. We will clarify this in a revised version.

Section 2.1.4: Application of what? The title of the section is not informative enough. Overall the section seems to provide redundant information

Authors: Thank you for your comment. We meant 'Application of the vulnerability index in the risk cycle'. Section 2.1.4 provides information that the vulnerability index can be applied to different stages of the risk cycle. For example, it can be applied for disaster preparedness, disaster response, and disaster mitigation. In addition, it highlights that most studies use developed indices for preparedness and mitigation. Generally, knowledge of the application of the index will guide the selection and weighting of the indicators. We will streamline and reduce the information provided in the section.

Lines 216-218: Perhaps change to "Spatial scales for assessing vulnerability can be micro-, meso- or macro".

Authors: Thank you for the comment. Changes will be made accordingly.

And you mean indices or indicators?

Authors: Thank you for the comment. "Indicators" is the correct term. Changes will be

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made accordingly.

Line 223: “smaller” or “bigger”?

Authors: Thank you for the comment. The correct term is ‘bigger’. Changes will be made accordingly.

Section 2.1.5: you use interchangeably micro, small and local. To be consistent please chose one formulation.

Authors: Thank you for the comment. Changes will be made accordingly.

Lines 226-227: not sure about the information provided in this sentence.

Authors: According to Eriksen and Kelly (2007), the basic scale of vulnerability is the local scale since it is at this scale that communities differ. Consequently, assessing vulnerability at either a regional or national scale leads to information loss from averaging or aggregation. Due to this loss of information, vulnerability assessment at a higher scale (macro or meso) requires careful interpretation. We will modify the sentence to clarify the intended idea. The suggested change is “Since the basic scale of vulnerability, at which communities differ, is at the micro-scale (Eriksen and Kelly, 2007), care must be taken when aggregating information for meso- and macro-scale assessment”. Changes will be made accordingly.

References

Attems, M., Thaler, T., Genovese, E. and Fuchs, S.: Implementation of property-level flood risk adaptation (PLFRA) measures: Choices and decisions, *Wiley Interdiscip. Rev. Water*, 7(1), e1404, 2020. Eriksen, S. H. and Kelly, P. M.: Developing credible vulnerability indicators for climate adaptation policy assessment, *Mitig. Adapt. Strateg. Glob. Chang.*, 12(4), 495–524, doi:10.1007/s11027-006-3460-6, 2007. Godfrey, A., Ciurean, R. L., van Westen, C. J., Kingma, N. C. and Glade, T.: Assessing vulnerability of buildings to hydro-meteorological hazards using an expert based approach - An application in Nehoiu Valley, Romania, *Int. J. Disaster Risk Reduct.*, 13,

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