

# ***Interactive comment on “Review Article: A Comparison of Flood and Earthquake Vulnerability Assessment Indicators” by Marleen C. de Ruiter et al.***

## **Anonymous Referee #3**

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### General comments

This manuscript proposes a comparative review of the vulnerability indicators that have been recently used in flood and earthquake vulnerability assessments, while distinguishing physical and social vulnerability indicators. The approach is based on a literature review of recent studies or vulnerability models, and the manuscript discusses which types of indicators are used in flood or in earthquake studies, and whether some lessons are to be respectively gained from these two fields.

The intent of the authors to examine and harmonize the research outcomes of several disciplines (i.e. earthquake risk and flood risk, engineering community and socio-economic community) is a timely and welcome effort, which should be of high interest

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for the audience of the NHSS journal.

However, this review lacks context, in the sense that the objective of the vulnerability assessment is not clearly specified: Is it for a risk or loss analysis? With the quantification of what type of impacts (direct or indirect, tangible or intangible, etc.)? Short term or long term risk? Is resilience taken into account? The various references and studies that have been selected to extract vulnerability indicators are mentioned in the tables without any information on their objectives and context. As a result, the conclusions of the review are undermined by this limitation, since – in its present form – it is not possible to exactly know why some vulnerability indicators have been taken into account or omitted by the various studies/models. Moreover, the paper concludes that some vulnerability indicators from earthquake analyses should be taken into account for flood analysis (and vice versa), whereas there is no proof or demonstration that such indicators would actually be relevant or useful for the subsequent risk analysis: this highlights once again the need to specify the aim and context of the so-called “vulnerability assessment”.

Regarding the form, the paper would benefit from a better presentation of the review results. Section 3 quickly becomes a long list of repetitive sentences, detailing which vulnerability indicator or model is mostly used for flood and earthquake studies. Therefore it is difficult for the reader to get a synthetic view of strong tendencies, which should be obtained from an in-depth analysis instead of solely a description of the content of the two tables. Moreover, one may argue that the availability of more or less advanced vulnerability models for flood or earthquake studies has a strong influence on the type of vulnerability indicators that are required – and thus collected in the various studies.

#### Specific comments

1. I. 155-160: Maybe the education level should be mentioned here as a vulnerability indicator, since it is discussed later on (Section 3).
2. I. 210-213: The discussion on vulnerability curves for flood damage holds in three

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lines, while earthquake vulnerability curves are described in one page. The authors should clarify this discrepancy and state whether flood vulnerability models are much scarcer than earthquake ones (and why).

3. p 6-7: There seems to be some confusion between vulnerability curves and fragility curves, which are not exactly the same mathematical object. Vulnerability curves are usually deterministic models that express a loss or damage rate with respect to a hazard parameter, while fragility curves are probabilistic models that provide the conditional probability of reach a given (discrete) damage state given a hazard parameter. The distinction between vulnerability indices and vulnerability curves is also debatable: for instance, the vulnerability assessment method by Giovinazzi et al. first generates a vulnerability index for the buildings, which is then used to generate a vulnerability curve.

4. I. 250-268: This sub-section (2.2.3) stands out from the rest of the section and is difficult to understand as it is (e.g. only two sentences to detail scaling issues). The authors should either remove it or ensure a better link with the previous sub-sections.

5. There is very little mention of the non-structural components or building contents as vulnerability indicators, even though they are usually responsible for most losses in the case of floods.

6. Table 2: There is no mention of the social indicators that have been identified in the SYNER-G project, for the development of shelter demand or healthcare demand models (no reference of this project in the table). See for instance Khazai et al. (2014).

7. English language style: the grammatical construction 'noun-based noun' is abused throughout the paper, especially without a '-' in many instances. A good example is the sentence at lines 564-565. I advise the authors to correct this in order to simplify some sentences and improve general readability.

Technical corrections

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- I.199: “and” is repeated twice. - I.357: “SYNER-G” instead of “SYNERG-G” - I.408: “take more indicators” instead of “make more indicators”. - I.494: “damage models” instead of “damage modes”. - I.517: “is introduced by” instead of “is introduces by”.

## References

Khazai, B., Daniell, J. E., Düzgün, Ş., Kunz-Plapp, T., & Wenzel, F. (2014). Framework for systemic socio-economic vulnerability and loss assessment. In SYNER-G: Systemic Seismic Vulnerability and Risk Assessment of Complex Urban, Utility, Lifeline Systems and Critical Facilities (pp. 89-130). Springer Netherlands.

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[Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., doi:10.5194/nhess-2017-45, 2017.](#)

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