

Interactive comment on “Improvement of an index oriented methodology for consequence analysis of natural hazards: application to the Upper Guil Catchment (Southern French Alps)” by Benoît Carlier et al.

Anonymous Referee #1

Received and published: 5 October 2017

I have now read the paper titled: “Improvement of an index oriented methodology for consequence analysis of natural hazards: application to the Upper Guil Catchment (Southern French Alps)”. The paper focuses on the topic of vulnerability/damage/consequences and constitutes a significant effort to combine social and physical vulnerability under a global index. The combination of the two “sides” of vulnerability is indeed interesting, however, in my opinion, the paper needs some major modifications and improvements in order to be accepted for publication. The main issues are outlined as follows:

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1. Title: The title represents the content of the paper, however, it could sound a lot more attractive (and more suitable) if the word “improvement” would be replaced with “Upgrading” or “Extend/Expand”. Moreover, the term “consequence analysis” shows the inconsistency in using the terms within the entire paper. “Consequence analysis” in the title is considered the same as “vulnerability assessment” and “potential damage” in the text.

2. Clarifications of hazard type, intensity and scenarios: some basic information is missing from the text. Which type of hazard is addressed in the study? The PDI was originally developed for landslides. Nevertheless, the area under study is susceptible to torrential flooding, rock fall, debris flow and avalanches (page 3, line 80 and page 4, line 85-86) and, apparently, the questionnaire was about all hazards. There is a discussion in the literature about vulnerability being hazard or non-hazard related. Physical vulnerability is considered usually hazard related and the social not. This discussion is very relevant to the paper and I strongly believe that it has to be included in the introduction (page 2, paragraph 2). Moreover, the question that often has to be answered when doing vulnerability assessment is “vulnerability to what?”. The issue of intensity in vulnerability studies is a challenging one. How can we include the intensity of a process within the vulnerability assessment? For example, why do you use indicators such as $wall > 1,5m$? (figure 4) What if the height of the flood or debris (we still do not know which type of hazard is considered here) is less than 1m? Are you considering a specific scenario before conducting the analysis? And if yes, which one? Please include the issues of including intensity in the assessment of vulnerability and explain clearly how you include it in this study.

3. Incomplete literature review: There is some reference to similar studies in the paper, however, there are more studies that focus on the combination of social and physical vulnerability for a number of hazard types and are not referred to in the paper. For example, Armas and Gavris (2013) combine social and economic vulnerability with housing quality and Chang et al (2015) use vulnerability indicators considering the

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economic, social, built and natural capital. Moreover, institutional vulnerability indicators have been used by Rogelis et al (2016). Additionally, the studies regarding social vulnerability assessment listed in Table 1 are rather old. Studies like the one of Cutter (2003) should definitely be included but only 4 out of 12 studies listed in Table 1 were carried out in the last 5 years.

A discussion on the use of indicators in general and other alternatives is crucial for the paper. The authors begin to do so in page 2 (paragraph 2) but more benefits and limitations of using indicators should be added from the following publication:

Papathoma-Köhle, M., Gems, B., Sturm, M., Fuchs, S. 2017. Matrices, curves and indicators: a review of approaches to assess physical vulnerability to debris flow. *Earth-Science reviews*, 171, 272-288.

Finally, references to other methods of assessing physical vulnerability (e.g. vulnerability curves), is in my opinion, also absolutely necessary.

4. The theoretical background of the paper is rather weak. Different terms are used to describe the same concept throughout the text (see comment 1). This is also evident by statements such as "it was necessary to reassess vulnerability and risk in the area" (page 4, line 90) and "social and institutional vulnerability index" (page 4, line 116). The authors do not conduct risk assessment and they do not assess institutional vulnerability. What is institutional vulnerability anyway and which would be the relevant indicators?

5. Serious scale issues: the scale used in the study is not clear from the beginning. The social vulnerability index seems to be calculated at community level. However, the PDI is calculated at building level. These two, however, are added in a last step. In my opinion, this needs to be thoroughly discussed in the discussion section and the loss of information and associated uncertainties have to be outlined.

6. The aim of the study and the end users of the method are not clearly demonstrated

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within the paper. Tangible examples of the usefulness of the maps should be more evident and should highlight the importance of the method.

7. Mapping: the maps in figures 6 and 7 are difficult to read and interpret. Who can use them and how? Is it necessary to map the results in this case or would a table showing the scores for each municipality be enough?

8. The study on the risk perception sounds very interesting. More information on the questionnaire (questionnaire as appendix?) is desirable since this study apparently has not been published individually somewhere else. Some important information should be also included here, for example, what is your confidence level with such a small sample (around 70%?). Is the sample 5% for each municipality? (probably not). How did you manage to have a representative view of the socio-economic characteristics?

9. Some aspects of the methodology are not clear: -Are all the indicators equally important or did you weight them as well? -Why three indices to make a SIVI when all three are dependent from more or less the same variables? -EaR-C: are older houses more robust than new ones (ok, the old farmer houses in some mountain areas have very thick walls and might be stronger). Is this what you mean? (Fig.4) -which score do you give a building which has more than one of the characteristics listed under Ear-D? -Score 0 needs to be discussed. Are you 100% sure that these buildings will not be damaged at all? This brings us back to the discussion about the intensity. A building that is more than 50m away from the torrent will NOT be damaged. For which event are we talking about? -the Cemetery and the Car park in EaR-J are not buildings. -Why are the different land cover classes (e.g. alluvium or bare rock) relevant? For me this type of information is more relevant to the hazard than the vulnerability. -why very important indicators regarding participation, existence of information campaigns and insurance are not considered in the Preparedness, Crisis management and Recovery indices? -why are winter activities (0,8) more "vulnerable" than summer activities?

10. Not clear what is the difference between CV and AV and why comparing them.

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Is it necessary and why you do not refer to it before page 9? Please consider it as part of the methodology and explain clearly what is the difference between the two approaches. Why “Classic” and not “Universal” or “General”?

11. Since you present a new methodological approach you should be critical with it at the end. Were there any limitations and assumptions? Which indicators are missing? What are the sources of uncertainty? What are the benefits of the methodology and what are the drawbacks? How can it be improved in the future?

12. The main aim of the paper is the combination of a physical damage index with the social vulnerability. Yet, there is no discussion about the added value of this action. Why is it important to combine them? What are the interactions or relationship between the two faces of vulnerability?

13. Last but not least, there is a fair amount of grammatical mistakes and typos. The text should be revised if possible by a native speaker.

Please see the specific comments in the text.

Please also note the supplement to this comment:

<https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2017-323/nhess-2017-323-RC1-supplement.pdf>

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2017-323>, 2017.