Nat. Hazards Earth Syst. Sci. Discuss.,
doi:10.5194/nhess-2016-408-AC3, 2017

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Construction of an Integrated Social Vulnerability Index in urban areas prone to flash flooding" *by* Estefania Aroca-Jimenez et al.

Estefania Aroca-Jimenez et al.

estefaniacarmen.aroca@alu.uclm.es

Received and published: 17 May 2017

Dear Referee #1,

We are very grateful for your helpful comments on our manuscript.

In spite of some confusion around the use of the vulnerability terminology, there is a certain consensus about what issues should be assessed to its characterization. The vulnerability analysis carried out in this paper has followed a hybrid approach (Eakin and Luers, 2006) between risk-hazard approaches, which considers that vulnerability depends on the biophysical risk factors and the potential loss of a particular exposed population (e.g. the hazards-of-place model of vulnerability (Cutter, 1996); and politi-

cal economy/political ecology approaches, which emphasize the political, cultural and socioeconomic factors that explain the differential exposure, impacts and capacities to recover from an impact (e.g. the pressure and release model (Blaikie et al., 1994). Taking into account the key parameters for the vulnerability research that highlight the above-mentioned approaches, we understand that vulnerability depends on the social system's exposure and sensitivity to stress (exposure and sensitivity components of our Integrated Social Vulnerability Index, ISVI) as well as its capacity to absorb or cope with the effects of these stressors (resilience component of our ISVI) (Eakin and Luers, 2006;Adger, 2006;Birkmann et al., 2013). In this context, we define 'exposure' as the people and assets susceptible to be harmed; 'sensitivity' as the level to which people and assets can be damaged; and 'resilience' as the ability to absorb, cope with and recover from the effects of a disaster.

Furthermore, the social dimension of vulnerability (i.e. social vulnerability) has been traditionally estimated through the construction of indexes, which are composed of several vulnerability factors (usually derived from a factor analysis or principal component analysis)(Cutter et al., 2003). Each vulnerability factor is in turn composed of several variables (variables considered as a means of explaining social vulnerability, such as age, gender, unemployment...). Traditional social vulnerability analysis usually shows the results for each vulnerability factor and for the total social vulnerability (i.e. the combination of the above vulnerability factors), but they do not analyze the results by component. We have constructed a social vulnerability index using an integrating approach (i.e. integrating elements from risk-hazard and political economy/political ecology approaches)(Eakin and Luers, 2006), which has been called Integrated Social Vulnerability Index (ISVI). This enables us to find out the involvement of each vulnerability component (i.e. sensitivity, exposure and resilience) to the total vulnerability and their interactions (Frazier et al., 2014), which also facilitates the incorporation of the analysis results into the flood risk management plans, particularly at regional scales.

We are aware of the complexity of the methodology section, so we appreciate your

comments about Figure 2. We will try to simplify Figure 2 in order to make it clearer, easier to understand and to avoid misunderstandings.

With regard to the identification of urban areas prone to flash flooding, we have used the scenario of low or exceptional probability (500-year flood) because it is the flood hazard zone that is the most comprehensive representation of urban areas that could be affected by flash floods at regional scale, according to the European Flood Directive (Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks).

In agreement with the reviewer, we will create a new subsection with the database generation. Moreover, we will extend this subsection including more information about the variables included and how they were gathered, as the reviewer recommend.

Regarding the comment about further describing the idea behind the equation's modification from the original one presented by Frazier et al. (2014), this author also used an integrated approach in the development of their Spatially Explicit Resilience-Vulnerability (SERV) model. However, the equations used in our ISVI represent an adaptation from the ones used in the above-mentioned article, since we have adapted the equations to our terminology (i.e. changing the term 'adaptive capacity' to 'resilience') and we have used a different method to weigh the vulnerability factors (i.e. using tolerance statistic instead of the percentage of explained variance).

As the reviewer recommend, we will review the text of the results section in order to remove those parts that describe methodology or discussion.

We agree with the reviewer that by including the description of the variables on Figure 3 this would increase reader's friendliness, so Figure 3 will be modified in the revised draft of the manuscript.

Finally, we appreciate the comments about the conclusions. They will be amended in order to express clearer how the methodology proposed here constitutes an improve-

ment on the state of the art and the extent to which the results may be included in flood risk management plans and therefore improve flood risk management, which is the main objective of this social vulnerability analysis.

Best regards,

Estefania Aroca-Jiménez.

CITED REFERENCES:

Adger, W. N.: Vulnerability, Global Environmental Change-Human and Policy Dimensions, 16, 268-281, 10.1016/j.gloenvcha.2006.02.006, 2006. Birkmann, J., Cardona, O. D., Carreno, M. L., Barbat, A. H., Pelling, M., Schneiderbauer, S., Kienberger, S., Keiler, M., Alexander, D., Zeil, P., and Welle, T.: Framing vulnerability, risk and societal responses: the MOVE framework, Natural Hazards, 67, 193-211, http://dx.doi.org/110.1007/s11069-11013-10558-11065, 10.1007/s11069-013-0558-5, 2013. Blaikie, P., Cannon, T., Davis, I., and Wisner, B.: At risk: natural hazards, people's vulnerability, and disasters, Routledge, London, 304 pp., 1994. Cutter, S. L.: Vulnerability to environmental hazards, Progress in Human Geography, 20, 529-539, 10.1177/030913259602000407, 1996. Cutter, S. L., Boruff, B. J., and Shirley, W. L.: Social vulnerability to environmental hazards, Social Science Quarterly, 84, 242-261, http://dx.doi.org/210.1111/1540-6237.8402002, 10.1111/1540-6237.8402002, 2003. Eakin, H., and Luers, A. L.: Assessing the vulnerability of social-environmental systems, Annual Review of Environment and Resources, 31, 365-394, http://dx.doi.org/310.1146/annurev.energy.1130.050504.144352, 10.1146/annurev.energy.30.050504.144352, 2006. Frazier, T. G., Thompson, C. M., and Dezzani, R. J.: A framework for the development of the SERV model: A Spatially Explicit Resilience-Vulnerability model, Applied Geography, 51, 158-172, http://dx.doi.org/110.1016/j.apgeog.2014.1004.1004, 10.1016/j.apgeog.2014.04.004, 2014.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., doi:10.5194/nhess-2016-408,

2017.

C5