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Discussions

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

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Dear Referee #2,

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

We appreciate the grammatical comments, and we will further review the text of the manuscript.

As you point out, exposure is commonly included in the social vulnerability analysis. Although exposure and vulnerability are two different components of risk, currently exposure is included in the social vulnerability assessments in order to provide a holistic characterization of vulnerability, since it is not possible to talk about potential for loss

(i.e. vulnerability) in the absence of exposure (Frazier et al., 2014). In the same way, resilience is also included in social vulnerability analysis, since the potential for loss also depends on the ability to absorb, cope with and recover from the effects of a disaster. Thus, a comprehensive social vulnerability assessment should include 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). Therefore, we will clarify this point explaining in the revised version of the manuscript that the inclusion of exposure in social vulnerability analysis is a common practice in the social vulnerability field as you recommend.

Considering the comments received by both reviewers about Figure 2, we will try to simplify it in order to make it clearer and easier to understand. We will take advantage of the opportunity to homogenize the use of 'municipalities' and 'urban areas' terms. As you recommend, we will add a third color in Figure 2 in order to show the final results with more clarity. We appreciate your comments about Figure 2 and we will review its design in order to avoid misunderstandings.

The Euclidean distance is a type of distance measure, but it is not a spatial distance. From a statistical point of view, distance measures belong to the so-called similarity measures. We have used the Euclidean distance to evaluate how similar to each other the variables were, as the Euclidean distance definition included in the paper explains. The greater the distance among variables, the less similar the variables are. Therefore, the Hierarchical Segmentation Analysis (HSA) groups the variables according to their similarity rather than the spatial distance.

We understand your comment about captions of Figure 4 and Figure 5, but we decided to shorten them in order to have a more balanced length of the text of this section. On the other hand, Figure 3 and Table 2 do not show the same information. Figure 3 corresponds to HSA output while Table 2 corresponds to the Factor Analysis (FA) output, which includes factor loadings that are necessary to construct the ISVI. HSA helps to overcome the Principal Components Analysis (PCA) sample size limitations, so we think that including the HSA output (i.e. the Dendrogram) into the results section of this paper is an interesting approach.

As you recommend, we will extend the information about the BIC and the CAIC criteria in the text. BIC and CAIC are two statistics that enable to establish the optimum number of clusters in which the urban areas considered can be divided, which can be used in flood management. We used the BIC and the CAIC criteria in order to select the more parsimonious number of clusters (i.e. the number of clusters that provides as much information as possible taking into account the number of parameters to estimate by the model). The more information that is explained by the model, the greater the number of estimated parameters will be. In our case, the minimum values of the BIC and the CAIC statistics are reached with a model of 3 clusters of urban areas, which marks the point in which an increase in the number of clusters and therefore in the number of estimated parameters by the model do not represent a significant increase in the explained information. From a practical point of view, the above means that a greater level of disaggregation from the considered as optimum (i.e. considering 3 clusters of urban areas) would split a fairly homogeneous cluster of urban areas into several subgroups which would not be very different from each other, which would not help to improve the implementation of different flood risk mitigation measures for each cluster of urban areas.

We appreciate your comment about the discussion section. We will review the text and we will try to move those parts that interpret the results from this section to the methodology section in order to strengthen the results of the paper.

As you recommend, we will extend the text of the 'policy implications' section trying to emphasize the practical utility from a policy making perspective of the Latent Class Cluster Analysis (LCCA). For this purpose, we will include practical examples of specific mitigation measures that can be proposed for each cluster of urban areas identified by the LCCA.

Finally, we thank you for your comments about the conclusions. They will be amended in order to express clearer how the methodology proposed here constitutes an improvement 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:

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