

Nat. Hazards Earth Syst. Sci. Discuss., author comment AC3
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Reply on RC1

Midhat Fayaz et al.

Author comment on "Earthquake vulnerability assessment of the built environment in the city of Srinagar, Kashmir Himalaya, using a geographic information system" by Midhat Fayaz et al., Nat. Hazards Earth Syst. Sci. Discuss.,
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REFREE COMMENTS # 1

General comment: This manuscript is about earthquake vulnerability assessment in the Indian Himalayas. The topic and techniques are good. The paper is well-written yet has errors. Consider my remarks and ideas to improve the manuscript.

Response: Thank you very much for appreciating the work. We felt gratitude to you for your thoughtful review of our work. We have now carefully revised the manuscript in light of your comments and suggestions and the point-by-point response to your comments and suggestion is provided below:

Comment 1:-The authors utilized AHP for weighting and MCA-based TOPSIS for ranking wards. The integration of these two strategies has to be clarified in the methods section.

Response: Thank you for suggestion, we have added information about the advantage of the integrative use of the two approaches in the revised manuscript from line number 390 to 399 and the same is reproduced below:

The integrative use of these two models reduces the uncertainty in the input data and improves accuracy and validity. Furthermore, decision-making based on the integrated use of the AHP and TOPSIS leads to more robust and effective outcomes for addressing complex problems (Nyimbili et al., 2018). Many studies have recommended the integrated use of TOPSIS with AHP for determining criteria and conducting analyses regarding complex decision-making problems (Behzadian et al., 2012). Additionally, the integrated use of AHP and TOPSIS helps to resolve the weighting problem by incorporating expert opinions and preferences, thereby increasing the consistency of outputs for arriving at consensus in decision-making in earthquake disaster vulnerability analyses (Nyimbili et al., 2018).

Nyimbili, P. H., Erden, T., and Karaman, H.: Integration of GIS, AHP and TOPSIS for earthquake hazard analysis, *Natural hazards*, 92(3), 1523-1546.
<https://doi.org/10.1007/s11069-018-3262-7>, 2018

Behzadian, M., Otaghsara, S. K., Yazdani, M., Ignatius, J.: A state-of the-art survey of TOPSIS applications, *Expert Systems with Application*, 39(17):13051-13069

<https://doi.org/10.1016/j.eswa.2012.05.056>, 2012.

Comment 2:- Nevertheless, it would be helpful to the readers if the authors could include a quick general review of the SE vulnerability in this study. The authors did not include socio-economic vulnerability in this paper since they want to do that as part of another research.

Response: Thank you for the suggestion. As suggested, we have now added a general overview of the SE vulnerability of the Srinagar city in the revised manuscript under the section "Earthquake vulnerability analysis" from lines 566 to 578 and the same is reproduced below for your perusal:

The socio-economic conditions of an area play an important role in determining the vulnerability of an area to earthquake hazard. The Srinagar city has witnessed population explosion with the population having increased from 0.25 million in 1961 to 1.5 million in 2011. The city also has a high percentage of female and child population (59%) and a high population density of 4000 per sq.km. Migration from rural areas and population growth are the primary drivers of this enhanced population expansion (Nengroo et al., 2018). The city has been under pressure to expand its built-up area in order to cater to the population boom, which has also led to excessive resource depletion, widening wealth and poverty gaps, and detrimental environmental and socioeconomic concerns (Mitsova et al., 2010; Kamat and Mahasur, 1997). With the mounting demand for new housing, the quality and condition of houses have received negligible attention. These concerns of accelerated population progression, along with high urbanisation have increased the Socio-economic vulnerability of the built environment in the Srinagar city to earthquakes.

Nengroo, Z. A., Bhat, M. S., and Kuchay, N. A.: Measuring urban sprawl of Srinagar city, Jammu and Kashmir, India, *Journal of Urban Management*, 6(2), 45-55. <https://doi.org/10.1016/j.jum.2017.08.001>, 2017.

Mitsova, D., Shuster, W., and Wang, X.: A cellular automata model of land cover change to integrate urban growth with open space conservation, *Landscape and urban planning*, 99(2), 141-153. <https://doi.org/10.1016/j.landurbplan.2010.10.001> 2011.

Kamat, S. R., and Mahasur, A. A.: Air pollution: slow poisoning Chennai, *The Hindu Survey of Environment*, 1997.

Comment 3:- In the paper, I think it would be helpful to include a restriction of each of the two models.

Response: Thank you for the suggestion. We have added limitations of the two models in the revised manuscript line number 400 to 405 which is reproduced below:

The adopted methodology has a few limitations, much like any other modelling technique. In addition to the inherent flaws in Multi Criteria Decision Analysis (MCDA), there may be some limitations, such as the fact that certain layers become more dominant than others due to the weighting criteria used, which in turn depends upon the decision-makers' perceptions of which vulnerability parameters have the greatest impact on modelling outcomes in vulnerability analysis.

Comment 4:- Who, besides the writers, took part in the process of making the expert judgement, and what were their qualifications? Mention these individuals and the expertise that they bring to the table.

Response: Thank you for the comment. Though, only the four authors were involved in determining the expert judgement process, viz., Prof. Shakil Ahmad Romshoo, Ph.D

Remote Sensing and GIS, Dr. Irfan Rashid Ph.D Environmental Sciences, Dr. Rakesh Chandra, Ph.D Geology and Midhat Fayaz, M.Sc. (Geoinformatics) but a large body of literature was also consulted that informed the expert judgement process. A mention of the same has been made in the revised manuscript at line number 336 to 340.

Comment 5:- There is a lack of references to certain procedures, such as those pertaining to proximity, closeness, and separation.

Response: Thanks for the comment. We have added references for all the approaches used in paper in the revised manuscript.

Comment 6:-Both in the introduction and in the end, you made a reference to SDG-11. In the conclusion, however, you should go into more detail on how the findings of this study will contribute to the achievement of SDG-11.

Response: Thank you for the suggestion. We have added more details about the SDG-11 in the revised manuscript from line number 621 to 628 under Conclusion section.

The current study is in accordance with the 2030 Agenda for Sustainable Development Goals, which recognises and reiterates the urgent need to lower the risk of disasters. The study will help to reduce the exposure and vulnerability of people to disasters and build resilient infrastructure. The findings of this study will support sensible urban planning, which calls for the construction of resilient infrastructure to reduce vulnerability to natural disasters, as well as sustainable development in line with the SDG 11 and SDG 9, which demand manageable densities, user-friendly public spaces, and mixed-use urban development.

Comment 7:- There are several typos in the paper which need to be corrected.

Response: Thank you very much for this suggestion. We have now rectified all the typos and grammar errors in the revised manuscript

Please also note the supplement to this comment:

<https://nhess.copernicus.org/preprints/nhess-2022-155/nhess-2022-155-AC3-supplement.pdf>