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Discussions

Interactive comment on "Open space suitability analysis for emergency shelter after an earthquake" *by* J. Anhorn and B. Khazai

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On behalf of my co-author, I wish to thank Referee #2 for the comments.

I understand the referee's objection that this method provides a somewhat idealistic framework, looking at the large amount of data that is needed. On the other hand, the datasets used in this study (road network and building footprints) were readily available through official governmental units (e.g. KVDA, Dept. of Survey and others). Hence not all earthquake prone urban areas are considered data sparse. Remote sensing as well as VGI offer huge opportunities in acquiring data. I understand this research as a methodology proposed to put forward a risk-informed way of planning shelter sites, not necessarily for operational disaster response. Concerning the complex situation aris-

ing from the onset of a large earthquake in terms of post-disaster management, I think communication and information are key elements of any risk reduction policy; whether it be immediate or long term. Hence, tools for a better understanding and supporting decision making (even in a politicized environment) are necessary. Unfortunately limited (spatial) information about other hazards were available for Kathmandu. We have considered flood, landslide and fire hazard as part of the suitability indicators under the Environmental Considerations category (see Table 1). By considering at least the distance to critical sources of fire like gas and petrol stations, we aim to avoid exposing people in earthquake shelter to secondary threats. Nevertheless emergency response services (e.g. fire brigade) in Kathmandu are known to be very limited in personnel and equipment. As correctly raised by the referee, we would like to highlight the necessity to use the most recent available hazard information also considering cascading effects to avoid putting people at risk in designated shelter areas. In general the indicator based methodology allows for any incorporation of more detailed data (e.g. from flood hazard models). The assumed worst case scenario we are referring to is derived from an earthquake scenario (Mid-Nepal Earthquake 8.0 Mw). The OSSI results are not just represented by the number of shelter seekers within KMC, but by providing a tool for practitioners to identify the provision gap of open spaces for emergency shelter. As every model it has certain limitations and needs to be modified to reflect dynamic circumstances. I focused on developing a tool overcoming the spatial neglect, some emergency shelter tools have.

Some further points:

1) Shelter suitability are calculated for this case study as a function of immediate shelter needs derived from structural earthquake damage, availability of critical services (water) and individual shelter response strategies (p. 4277). The concept behind OSSI could be used for many other hazards, if shelter needs and suitability criteria (including the proposed scoring and weighting) as well as the time horizon are contextualized accordingly. Certainly there is no one-size-fits-all approach using any kind of model.

Here the paper focuses on immediate shelter suitability, not reconstruction of settlements which would most likely need different qualitative parameters.

2) "In the assessment most publicly owned cleared areas and smaller open spaces or courtyards were included" (p. 4276). The criteria for the identification can be found in the "Shelter Response Strategy and Plan for Earthquake Disasters For Kathmandu Valley, Nepal" (NSET, 2010, 2012). Other places (like the proposed unfinished RC buildings) are not considered stable enough to withstand aftershocks and should not be considered as an appropriate shelter in a planning tool (cf. Khazai and Hausler, 2005).

3) I would like to underline the general philosophical argument for computational science: Models by definition are a simplification of reality, but the value is to learn from the simulations to generate new insights; in this case to understand where potentially underserved, unsuitable shelter sites are in Kathmandu and take a more nuanced risk-informed way of allocating resources for shelter planning. The simulations should be calibrated against reality by people who know the conditions more precisely, but again, this is not the aim of our paper. That is the operationalization of this methodology in a consulting project.

4) I appreciate the idea to update the actual building block data with a more sophisticated modelling of population distribution including spatial zonation data and occupancy rates. Refinements on that scale are possible but still need to be feasible (e.g. data constraints). Just as mentioned previously, each and every model will have to deal with its uncertainties (aleatoric and epistemic) no matter how sophisticated it will be.

5) The use of VGI data on current road accessibility has already been used for emergency routing (cf. Neis and Zielstra, 2014; Neis et al., 2010). Using such services might improve shelter site placing in the transition phase from emergency shelter to temporary housing as well.

6) The "total shelter seeking population [. . .] derived from an earthquake risk assess-

ment [. . .]". This sentence might be misleading, we think earthquake risk should be understood as the integration of social vulnerability and geophysical hazard. Hence earthquake risk assessment should incorporate hazard assessment as well as earthquake loss estimation (ELE). The paper provides one example of how to derive shelter demand from ELE including social factors and urban fabric.

7) "Experts estimate that at least one million homeless people in need of immediate assistance can be expected" (p. 4275) quotes Moira Reddick, Coordinator of the Nepal Risk Reduction Consortium, as cited in the manuscript (NRRC, 2013; Minute 0:18).

Additional literature:

Neis, P. and Zielstra, D.: Recent Developments and Future Trends in Volunteered Geographic Information Research: The Case of OpenStreetMap, Future Internet, 6(1), 76–106, doi:10.3390/fi6010076, 2014.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 4263, 2014.