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

Anonymous Referee #2

Received and published: 7 July 2014

Review of the paper “Open space suitability analysis for emergency shelter after an earthquake”, Anhorn and Khazai

The paper addresses the issue of post-disaster (specifically post-earthquake) shelter, the identification of demand, and the identification of suitable sites, using GIS analysis. Kathmandu is used as a case study.

Post-disaster response, especially for large events, tends to be a major challenge, and the problem of timely provision and management of suitable shelter space is one of the main reasons. Hence work on understanding better where shelters can be erected and doing that ideally before a disaster occurs, is interesting and useful. The research presented here includes a number of parameters in the shelter site suitability assessment,

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including environmental requirements and constraints, but also actual need, practicality, accessibility, etc.

In term of conceptualisation and GIS-based implementation the approach appears to be sound. My main concern is that it's a rather mechanistic and idealistic exercise; I have doubts that much of this is very realistic in a real preparedness or response situation. The authors write "On the supply side, a comprehensive database of available candidate sites is needed, spatially covering the study area. The CAMOS at the same time relies on fully functional and topological correct road network." I have serious doubts that this information is frequently available .

Disaster responses in recent years have been highly variable. Perhaps a broad general line can be drawn between economically more and less developed countries, or those with a well-established government at various administrative levels, and those with weak government, though events such as Katrina have shown that distinction to have limitations, while in poor (but autocratic) countries such as Cuba effective disaster preparedness and response seems possible.

When I look at the study, and the detailed data needs (building footprints, detailed road network hazard and risk maps, etc.), I really have doubts as to how far this realistically can take us. In addition, the immediate post-disaster situation tends to be one frequently marked by multiple and conflicting interests, overwhelmed authorities, opportunists, false information and rumors, etc., all helping to create a scenario where facts are quickly established (people staying put or fleeing in panic, or setting up a personal shelter wherever they can find space vs one where government activity does manage to centralize efforts. Haiti, while being an extreme case, is illustrative in many ways. Most people in need of shelter seemed to set up a makeshift dwelling wherever there was space, with NGOs and government later on trying to create some order (which on some locations was achieved). My point is that the analysis presented here looks good on paper, like those great evacuation plans where there is much interest in the first drill, and then no one shown up again.

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Another point of concern is the shelter suitability being a function of hazard exposure. Important point. However, (i) that requires detailed multi-hazard analysis results being available (also for flooding in a place like Kathmandu – I have doubts that detailed information exists), but (ii) this situation changes during the disaster. An earthquake causing few landslides along the hillslopes that block the river, and the flood hazard changes rather dramatically. After Haiti I was contacted by an NGO for flood hazard/risk information to be used in their shelter siting, yet I could not point out any available data. And indeed much of what might have existed would have been compromised by the event itself. I think this problem can't be ignored in the paper. Other considerations, such as "secondary hazards like potential fire eruption from nearby hazardous materials (e.g. gas and petrol sellers) need to be taken into account and avoided by the choice for a suitable shelter area", seem naïve to me. In a massive disaster response situation this type of hazards seems impossible to control.

The case described here treated as a worst case, yet the assumptions are not all that clear (unless I missed it not even the actual population of Kathmandu is provided), yet in the end very precise numbers for shelter speakers etc. are provided (342 300 persons). Given the many issues and uncertainties raised above I have serious doubts that those precise numbers mean very much. The authors themselves state that scenarios are climate and weather dependent, etc.,

I think the paper need a more critical attitude, contrasting the nice theoretical results with experiences we had had in real post-disaster situation, especially those where planning did not really match reality (and the reasons for that mismatch).

Some further points: - It's not really clear why the study is limited to earthquake situation. It is correctly stated that those some suddenly; but the same can be said for a tsunami, or a Cyclone Haiyan situation in Tacloban (expected windstorm, unexpected storm surge that left many homeless and in need of shelter) - As stated in the paper, there are different interests and time horizons at play after a disaster – some caring about immediate survival, others about eventual rehabilitation. Now, steps taken in the

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first hours tend to have a lasting effect – a site opportunistically chosen for shelter turns into a lasting tent city. Haiti has also shown how shelter planning (or more specifically in this case resettlement construction failed, because they were located too far from Port-au-Prince, without income opportunities - nice effort, but no interest. Some of those real shelter issues need to be critically discussed - It's not clearly defined what open spaces are. I see in the result that the stadium in Katmandu was identified as a suitable shelter, which is good (this was also the case in Port-au-Prince [in New Orleans less so...]). But also unfinished buildings (those RC structures where only the floors and columns so far exist, proved useful for long-terms shelter, yet those are not really open spaces - There is no work on validation of the results. Ok, it's not easy, but here only some equations, assumption and results are presented as truth. How can those results at all be validated. Surely it must be possible to think of strategies to evaluation those figures and sites. - More than 70,000 building footprints were digitized from QB data. I wonder if footprint I really enough information to say something about who lives there, how many people, etc. Also this should be critically discussed (land cover vs use, need for better cadastral information for some actual urban functional modelling – see work by Aubrecht and others) - I'm also not convinced that some VGI data on current road accessibility can be meaningfully used in a complex situation unfolding to make adjustments on shelter site placing. What evidence exists that this has been/can be done? - P4274 "...ratio between the total shelter seeking population within the one kilometer service area of each candidate shelter site (POPOS) derived from an earthquake risk assessment" Can it? Is the amount of shelter seeking people part of a seismic risk assessment? That's new to me - P4275 "Experts estimate that at least one million homeless people in need of immediate assistance can be expected."- too vague. Which experts? For which scenario?

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

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