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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Towards thresholds of disaster management performance under demographic change: exploring functional relationships using agent-based modelling" *by* G. Dressler et al.

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We appreciate the helpful comments to our manuscript, please find our responses below:

Page 1, Introductory section The first paragraph contains lots of common knowledge, would it be possible to underpin the statements by references?

Reply: Yes, we will add references to this section (this has also been requested by Referee #2).

Page 2, lines 1 ff.: The increase in events is one side, but what about losses? There are some articles around where the increase in losses is controversially discussed for Europe, see e.g. Barredo (2007, 2009).

Reply: We agree that the increase in events and losses are related. Both Barredo (2007, 2009) and Bouwer (2011) have shown that mostly anthropogenic changes, especially increases in exposure (e.g. increase of the number of properties in flood prone areas), are main drivers for an increase in disaster losses. We will add a sentence on that.

Barredo, J.I. (2007): Major flood disasters in Europe: 1950-2005, Natural Hazards, 42, 125-148.

Barredo, J.I. (2009): Normalised flood losses in Europe: 1970-2006. Natural Hazards Earth System Sciences 9, 97-104.

Bouwer, L.M. (2011): Have disaster losses increased due to anthropogenic climate change? Bulletin of the American Meteorological Society 92, 39-46.

Page 2, lines 7 ff.: Please insert some sentences on vulnerability and risk here. If the number of events is increasing, but the elements at risk are decreasing, what does this mean for the overall (collective) risk?

Reply: This question is not easily answerable. As Schulz (2012) is able to show in her case study in the state of Saxony, there is hardly any correlation between shrinkage and the demolition of the built environment and the reduction of exposure to flood risk. Shrinkage does not take place uniformly across space in the towns at risk. Historically, towns have grown around the river, so that the urban core is often more exposed to flood risk than districts further out. However, shrinkage often affects exactly these districts, whereas only little or no shrinkage occurs in the urban core. Therefore, a shrinking population does not necessarily imply a decrease in the elements of risk.

In addition, from an economic and planning perspective, a stronger centralization of shrinking cities is wanted by the municipality, as the maintenance of infrastructure in only sparsely populated districts is very costly. This contributes further to the fact that overall vulnerability of the community is not decreasing (no reduction of exposure versus potential loss of coping capacity), in spite of the predominant decline. We will add this to the text.

Schulz, A.-K. (2012): „Schrumpfung als Change zur Reduzierung des urbanen Hochwasserrisikos? – Zu den Möglichkeiten und Grenzen einer hochwassersensiblen Stadtentwicklung schrumpfender Städte", BA-Thesis, University of Leipzig.

Page 2, line 23: This may also be applicable to other regions of Europe, not only Germany. Is there work around on the decrease or increase in assets (for the Netherlands e.g., Jongman et al. (2014), another country report has recently been published by Fuchs et al. (2015))?

Reply: The two suggested papers focus mainly on trends in the exposure of properties to hazards and in both cases conclude that we can observe an increase in the number of buildings especially in hazard-prone areas, i.e. an increase in assets at risk – these findings largely hold for our study region as well (e.g. due to the concentration of the population and assets in the urban core, see previous response). However, in our context the trend in assets at risk is only one dimension that contributes to the vulnerability of the community. Kuhlicke et al. (2012) show that especially for shrinking cities we can observe a decline in adaptive and coping capacity, as the provision of essential public and private services (such as flood protection, fire brigades, etc.) is not possible anymore due to budget constraints. Therefore, on the one hand side we do not observe a significant decrease in assets at risk, while on the other hand side coping and adaptive capacity in many cities is in decline.

Kuhlicke, C. Kabisch, S., Krellenberg, K., Steinführer, A. (2012): Urban vulnerability

under conditions of global environmental change: conceptual reflections and empirical examples from growing and shrinking cities. In: S. Kabisch, A. Kunath, P., Schweizer-Ries, P., Steinführer, A. (eds.), Vulnerability, risks and complexity: impacts of global change on human habitats. Göttingen: Hogrefe (Advances in people and environment studies, 3). 27-38.

Page 4, description of the agent-based model Please refer to the supplementary material more prominently since key information is provided there.

Reply: Our intention was to keep the model description brief as NHESS is not primarily a modelling journal. However, we can strengthen the link to the supplemental material, e.g. giving a short overview which information can be found in the appendices.

Page 9, line 15: When comparing the description to Fig. 6 some questions came in my mind: If we compare the DMOs with and without full knowledge the difference in the number of disaster spots (10 versus 80) is obvious. But if we compare the DMOs with full knowledge against each other the number of DMOs does not show a large difference in the coping time performance (grey lines in Fig. 6). Does this mean that once DMOs have full knowledge (the "experts" from the local fire brigades) the number of disaster spots is not important [grey lines are plusminus on the same level for each number of DMOs]?

Reply: To some degree this statement is true, e.g. the difference in coping time for N_{DMO} = 80 for 10 and 80 disaster sites is only 2.5 hours. A reason for this lies in the fact that DMOs with full knowledge avoid any unnecessary double trips to disaster sites. However, this only holds because all simulations run for this concrete analysis have been run with a given total demand of sandbags. Therefore, changing the number of disaster sites did not change the total number of sandbags that need to be distributed – making ten trips to one site, or two trips to five different sites

should have indeed only little effect on the overall coping time, when DMOs have full information. (We have also run simulations where total demand increases with the number of disaster sites, however this makes it more difficult to determine the effect of information access, DMO capacity, etc. and therefore chose not to include them here.)

Page 11, discussion section

Section 4.1: Please make some clear statements here (or elsewhere in this section) on the effects of your case study on resilience and vulnerability since this is the umbrella for the envisaged Special Issue. See also Page 12, lines 12 f., from my point of view the aspect of resilience (if mentioned here) needs a bit broader explanation in the context of your model.

Reply: We agree that the link to resilience and vulnerability is not entirely clear in the current manuscript, so far. We will make the link to both concepts more prominent already in the introduction and methods section. We refer to the concept of SES resilience as we want to emphasize the aspects of coping capacity (i.e. how well can disaster management organizations cope with flood events, when they itself are subject to change?), adaptation and transformation (e.g. enhanced capacity or better information access of DMOs), with respect to the functioning of DMOs.

Page 12, lines 14 ff.: This may go to the very beginning of the entire manuscript since here also the state-of-the art is mentioned.

Reply: We already cite Zagorecki et al. (2008) in the introduction, but we agree that Dawson et al. (2011) should be mentioned there as well. However, as we relate our model results to their findings, we think that a more detailed explanation of their results in the introduction would result in a duplication of text, therefore we would argue that this section should remain in the discussion.

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