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Hydrology and Earth System Sciences Discussions

Interactive comment on "Probabilistic modelling of rainfall induced landslide hazard assessment" *by* S. Kawagoe et al.

S. Kawagoe et al.

P.Sarukkalige@curtin.edu.au

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Probabilistic modelling of rainfall induced landslide hazard assessment By S. Kawagoe, S. Kazama, and P. R. Sarukkalige

Response to Reviewer Comments RC C37

Thank you very much for your comments to improve the quality of the manuscript. We will address each of your points as below.

1. Authors do not use the terms: susceptibility, hazard, vulnerability and risk, correctly. I feel they do not have a clear idea about these terms when the bibliography is very

large. – I don't understand what "landslide hazard susceptibility" means. Susceptibility is not the same as hazard. – There are in the literature (i.e. Zezere et al.) examples of this type of analyses. –

Thank you for your invaluable comment which leads to correct the terminology, we used in the manuscript. Zezere (2002) explains on susceptibility analysis based on a statistical approach which is closer to this present study. It clearly explains the difference between susceptibility and hazard as "In fact, most regional landslide hazard assessments provide a ranking of terrain units only in terms of susceptibility, not including the temporal component of the hazard. Hence, the susceptibility expresses the likelihood that a landslide will occur in an area based on the local terrain conditions". In our study, we use "rainfall" as a temporal parameter. Therefore, we have to express our results in terms of "landslide hazard probability". Taking reviewer's comments into account, we replaced the term "susceptibility" with "probability" throughout the manuscript. In addition we have added some more literatures into the revised manuscript to clarify the concepts and terminology which defined and followed by other researchers (i.e. Fell at al, 2008; Van Westn, 2006; Nagarajan, 2000)

2. They talk about "factors affecting landslides" when are well known in literature "triggering and conditioning factors". - References are not the most cited in literature, I think authors must do a strong bibliographic revision. –

We have revised references and improve the bibliography. We added couple of more references to explain more on triggering factors. Also term "factors affecting landslides" has been replaced with "triggering factors".

3. Storms, in my opinion, are the main triggering factor for landsliding in Japan, not only the average rainfall that you consider. –

We have considered extreme rainfall in 5, 30 and 100 years return period, not the average rainfall. Therefore the extreme rainfalls (storms) have been considered as the main triggering factor in the analysis.

4. You are considering "relief energy" as a conditioning factor, I think is more appropriate consider "slope gradient". –

As explained clearly in the manuscript, relief energy is defined as “the elevation difference between the highest and the lowest elevation in each grid cell”. Therefore it represents the “slope gradient”.

5. From my point of view, you should estimate before susceptibility and then you should transform it (according to rainfall scenarios) in hazard. So, hazard is expressed by % and not susceptibility which have not units. –

This is again related to the first comment. We would like to highlight that this study presents a probabilistic assessment on landslide occurrence in Japan. As we use the “rainfall” which is a temporal parameter, we changed the final result format into “hazard”.

6. Authors define "landslide risk areas" and "no risk areas", on the basis of the percentage of susceptibility or hazard; it is not right. –

We define the areas having higher probability for hazards as “high risk” areas and lower probability areas as “low risk” areas. This is based on the possibility of landlside occurrence. We changed the “no risk areas” into “low risk areas” and this change has been incorporated to the revised manuscript.

7. I have found some sentences that are incorrect, for instance page 739 line 28 until page 740, lines 1-2. Please revise it. – They have been revised and improved in the revised manuscript.

8. At the end, they propose that similar results are obtained when they use 1km x 1km or 50m x 50m maps. The second ones will always offer better results than the first ones.

Yes we agree with the comment, finer resolution results are better than coarse resolution maps. What we highlighted is, from application point of view, R1000 (1 km$\times$1

km) maps are capable in assisting management decisions for infrastructural planning and development, as they can identify landslide-susceptible areas based on available the coarse resolution data. Fine resolution data (R50 (50m$\times$50m data) is not available in most of the areas and the data is available in coarse resolution such as R1000 (1 km$\times$1 km). Therefore we show that 1 km$\times$1 km is capable enough to use and produce the hazard maps. It does not mean that R1000 maps are better than R50 maps. Finer resolution maps always offer better results than the corse resolution maps.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 725, 2010.