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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Earthquakes on the surface: earthquake location and area based on more than 14500 ShakeMaps" *by* Stephanie Lackner

Anonymous Referee #1

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The submitted paper presents a new approach to the topic of characterization of earthquake shaking trying to find new ways to its use in social sciences, insurances, etc. Earthquake hazard, cited many times on the text, mainly deals with the shaking of earthquakes "to come". Instead, this paper deals with the "past" shaking, giving some cues on how to analize and use such data for further research. It relies in the massive analysis of the information contained in the ShakeMaps acquired for more than 40 years by the USGS. It describes the used analysis methodology, introduces some new definitions with the aim of improving the analysis and presents some conclusions about the distribution of earthquake shaking around the world.

New, fresh approaches to problems are always welcome and as it the submitted research is really welcome. But, from another side, I think more in-depth knowledge of the topic of seismic hazard and risk, how it is assessed, communicated and managed is needed to draw proper conclusions. The common seismological terminology used and other existing approaches are not well presented and used.

Seismic hazard is a topic where, from the field of seismology, large efforts have been devoted. Specifically, and dealing with global approaches, on the 90's, during the UN/IDNDR, the GSHAP Global Seismic Hazard Map project was implemented. A large amount of information about it can be found in Giardini (1999) and in the (frozen) project website http://www.seismo.ethz.ch/static/GSHAP/index.html. One of the main outputs is a map depicting the global earthquake hazard as the 90% chance of non-exceedance in 50 years of plotted PGA values. As 50 years is the approximate period covered at present by the ShakeMaps it can be really instructive comparing the "true data" presented in this research with the much more classical probabilistic calculations obtained in the GSHAP. Nevertheless, it should be kept in mind that results plotted on the ShakeMaps are a mix of observed data and assumptions/calculations about how energy/shaking propagates. Thus, the overall results are not just observed quantitative data. Anyway, I think such an exercise can show some of the possibilities the submitted research opens and it is adding value to the presented results.

At present many efforts in this topic (always from the fields of seismology and earthquake engineering) are directed through the GEM project. How communicate seismic hazard and risk is an important issue on the project development. Much more information is available at the website https://www.globalquakemodel.org/.

Coming back to the submitted research, I think the final results about the shaking suffered around the globe, presented in a 2.5° x 2.5° world partitioning, are not so useful as such size is larger than usual administrative departments, districts, etc., and even of many not so big states. Even in case of many damaging earthquakes, such area exceeds the whole affected area (at least that where damage occurs) and just

in the case of the largest events can it be considered. Certainly, I think this is not a big deal as, if I understand properly, reducing the size of the area (e. g. 1.5° x 1.5°) just takes more computer memory and calculation time. As a résumé, I think the submitted paper presents new results, it is properly written and organized, with relevant bibliography. Thus I think the article should be accepted for publication but it needs revisions of some importance.

In addition to these general comments, I'm pointing in the next lines specific details.

Specific items.

Page 1. Line 5. ... Earthquake communication outside of seismology... An (old) review about how this problem is seen by seismologist can be found at O'Brien and Mileti (2003).

Page 1. Line 7. ...constructed and applied TO THE DETERMINATION OF GROUND SHAKING WORLDWIDE.

Page 1. Line 19. Practice... practical

Page 2. Line 17. (e. g. Shedlock et al., 2000)

Page 3. Line 2. Strong ground motion CAN BE EXPRESSED with different parameters, but...

Page 3. Line 5. But such data are not as...

Page 3. Line 16. I know it is really easy to find the USGS ShakeMaps, but it will be good to give an explicit link to the webpage.

Page 3. Line 27. As a result, the dataset.

Page 4. Line8. Earthquake shaking history is, to me, a good term; but it is not the first time such an approach is used. See the Italian macroseismic database where it

is possible to search the felt earthquakes at a town (https://emidius.mi.ingv.it/CPTI15-DBMI15/query_place/)

Page 4. Line 15. Second? There is not a "first". I understand the discussion in the previous paragraph is the "first" point. It is just a matter of some rewriting.

Page 5. Figure 3. Abscissa axis. The last number on the right does not fit.

Page 5. Line 4. ...points to characterize earthquake LOCATION.

Page 5. Line 7. ...is AT SEA.

Page 6. Line 6. (when it falls offshore)

Page 6. Line 13. When the epicenter lies offshore.

Page 7. Line 3. "This distance increases to 53 km when the epicenter is offshore". But this value is, for me, meaningless. It gives just a mean value of how distant from the coast are epicenters of earthquakes for which a ShakeMap is available. This value arises just because at the epicenter location there is no ground to shake. In fact, ShakeMap gives "calculated" PGA's in sea areas. Thus, it is possible to extent shaking centroid calculation at sea.

Page 8. Figure 6. I think this figure will improve if the color scale of scatter is added somewhere.

Page 8. Line 8. ...when the epicenter lies offshore.

Pages 9 – 11. I suggest, for future research, to use the ISC catalogue instead of the ComCat. It has the advantage that it is accepted as "authoritave" catalogue for the world seismicity and that event duplications are almost totally filtered. Instead, it has the problem it is published with 2-3 years of delay from present.

Page 10. Lines 16 and 25. I think a rounding accuracy of one degree in latitude is too wide. Much likely reducing the interval to .5 (or .25) may solve some of the possible

duplicities.

Page 11. Line 10. . . .each event FROM the significant EARTHQUAKE list

Page 11. Line 17. . . .some events in the significant earthquake list seem to have typos.

Page 16. Line 8. For those events a “RANDOM” candidate. . . I suggest, instead of a “random” candidate, to select the shaking center nearest to the epicenter. Such a criterion has the advantage of “repeatability”.

Bibliography

-Giardini, D. (Ed.) (1999). The Global Seismic Hazard Assessment Program (GSHAP): 1992-1999. Annali Geofis. 42(3-4), 272 pp.

-O’Brien, P. W. and D. S. Mileti (2003). The sociological Dimensions of Earthquake Mitigation, Preparedness, Response and Recovery. In Lee et al. (eds.): International Handbook of Earthquake and Engineering Seismology, Academic Press, Amsterdam, Part B, 1241-1252.

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