

## ***Interactive comment on “Seismic hazard maps of Peshawar district for various return periods” by Khalid Mahmood et al.***

**Khalid Mahmood et al.**

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The authors are very grateful to the Editors and Associate Editors for the kind consideration and possible publication of our article in the Natural Hazards and Earth System Sciences. The authors would like to thank all reviewers for suggesting improvements for the manuscript. Point-wise reply/answer to each comment is provided below (comments are shown in BOLD, answers are shown in REGULAR). All suggestions have been addressed, but still if reviewers have any other point/reservation, the authors are happy to incorporate. Furthermore, the authors appreciate the editors and reviewers for the timely handling of review process. Point-wise response is also attached in .pdf format.

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## REVIEWER 2

1. Please justify why you opted for areal sources surpassing point and line sources. Or, why you did not opt for a combination of all?

The reviewer is thanked for pointing to this. The available catalogue and seismicity pattern is quite scattered and not very specific to suggest taking line/fault sources. There are not enough data (fault source information) to support line sources based hazard assessment. Moreover, due to the scattered seismicity pattern and large number of small fault-lines, the definition of fault line becomes challenging. Areal sources are reasonable approximation to idealize seismic sources and used in many similar studies. Few studies have used fault sources but that have resulted in very high seismic hazard, which is not justified by the history of earthquakes in Peshawar.

2. The attenuation relationship you are using is not from the Himalaya. Would it be possible to calibrate some subduction GMPE with the available records from Pakistan to obtain more realistic results?

The authors fully agree with the reviewer. Pakistan doesn't have specific GMPEs of its own, therefore, GMPEs from other similar region are adopted. The selected GMPEs were earlier tested in prediction of ground motion for selected earthquake events. The GMPEs, which have shown relatively better performance, were selected for hazard analysis. This is clarified in the revised manuscript.

3. As you contrasted yourself, the effects of deep earthquakes were pronounced recently in Pakistan yet you did not include the effect. Could you please reframe the logic tree in any way to incorporate this?

The authors fully agree with this. Deep sources were included in the hazard assessment, however, this had little influence on the final hazard maps. Possible reason seems to be the limited earthquake catalogue and the foreign GMPEs, which were not specific to the region. Also, the GMPEs lack to take into account the site effects com-

mon in Peshawar valley due to deep earthquakes. We didn't find any other alternative to manifest the deep sources effects accurately, however, we put this as a question for others to address.

4. The source zones are somehow interesting too. For instance, why zones 5, 6, and 7 have quite limited data? Could you please elucidate your zoning scheme?

The authors fully agree to the reviewer, however, the seismic sources used for shallow earthquakes were those obtained from the Building Code of Pakistan – Seismic Provisions. The deep sources were selected in consultation with the National Center of Excellence in Geology, Peshawar. Since, deep sources are not studied before for Peshawar. This is clarified in the revised manuscript.

5. As you have prepared the hazard maps for bedrock, I request you to consider hazard maps on the surface too [if possible]. If you have some site response/amplification studies, it would be interesting and also useful for the structural earthquake engineering communities. Please comment.

The authors fully agree to the reviewer, however, the focus of present study was to provide the base maps for hazard. Site-specific soil was not known so it was not addressed in the hazard assessment. Alternatively, the code suggests amplification factors for various soil from Type C to Type E as per NEHRP soil classification.

6. Please fix some grammatical bugs present in the manuscript.

The authors thank the reviewer for this suggestion, the revised manuscript is re-visited for English writing improvement.

Please also note the supplement to this comment:

<https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2019-299/nhess-2019-299-AC2-supplement.pdf>

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