

Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC1
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Comment on nhess-2022-214

Anonymous Referee #1

Referee comment on "A non-extensive approach to probabilistic seismic hazard analysis" by Sasan Motaghed et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2022-214-RC1>, 2022

Moatghed et al. in their paper "A non-extensive approach to probabilistic seismic hazard analysis" present a new approach for the probabilistic seismic hazard analysis (PSHA), in which they use the fragment-asperity model of Sotolongo-Costa and Posadas (SCP) to describe the frequency-magnitude distribution of earthquakes, instead of the well-known Gutenberg-Richter (GR) scaling law. Various studies during the last two decades have demonstrated that the SCP model, based on the concept of Tsallis entropy, it provides a physical model for the energy distribution of earthquakes. In addition, it provides in various cases a better fit to the observed frequency-magnitude distribution over a wider range of magnitudes compared to the GR law. Nonetheless, the well-known b-value can be deduced as a particular case in the SCP model. In this framework, the generalization of the classic PSHA by using the SCP model may provide better results regarding the estimation of seismic hazard. The paper presented by Moatghed et al. aims to contribute to this field and clearly falls within the scope of Natural Hazards and Earth System Sciences. The paper is generally well written and structured, but it needs some revisions before it can be further considered for publication. Some points that require further clarification are listed below.

The main issue concerns the application of PSHA in the Tehran region in Section 4.

1) The spatial distribution of earthquakes used in the analysis should be shown in a Figure, perhaps Fig.1.

2) The authors use earthquakes since 1900AD. Which is the magnitude of completeness of the catalogue during this period?

3) Present a Figure showing the cumulative number of earthquakes used in the analysis and the cumulative number after declustering to show its effectiveness.

4) Which method was used to estimate the GR parameters? Obviously, in Fig.2 the GR law is not well implemented.

5) Provide confidence intervals for the parameter values in Table 1.

6) Revise all calculations of PSHA based on the better estimation of the GR parameters. Show in Fig.3-5 the revised calculations and the corresponding confidence intervals.

7) Provide more information on how the uniform hazard spectra are calculated.

Some minor comments concern:

1) Correct to "Posadas" in Line 185.

2) Correct to "NEPSHA" in Line 135.

3) Refer to other relevant studies that use the Tsallis entropy approach to identify precursors in the earthquake generation process, such as Vallianatos et al. (2014), *Physica A*.

4) Refer to other relevant studies that review the non-extensive approach in earthquakes and tectonics, such as Vallianatos et al. (2016), *Proc. R. Soc. A*.