Manuscript “Probabilistic seismic hazard assessment of Sweden”

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The manuscript presents a seismic hazard analysis for Sweden, a low-seismicity country in northern Europe. It includes information about seismicity, geology, the available earthquake catalog, and post-glacial faults there. The preprocessing of the earthquake catalog is explained in detail. The ground-motion logic tree is perused. As outcomes, the manuscript presents two seismic hazard maps for Sweden, with mean estimates for peak ground acceleration corresponding to return periods of 475 and 2500 years, and new hazard curves for four plus one sites. The previous seismic hazard analyses in the country are reviewed and the new results are compared to the new ones. The new hazard maps are also compared to the European Seismic Hazard Map 2020 (ESHM20). My main suggestion is to strengthen the results and align with the previous work for Sweden over 20 years ago by augmenting disaggregation. The line-by-line suggestions mainly deal with lesser issues.

Below I provide line-by-line suggestions:

Abstract

lines 10-11: “the high seismic activity on the post-glacial faults”: this is meant in the national context, but since the calculated ground motion for the 475-yr return period barely reaches the threshold of engineering interest, 0.05g, it would be better to rephrase the expression, the same with “relatively high hazard”

1 Introduction

L37: in essence it is waste, the term “spent nuclear fuel” is also available

2 Earthquake activity in Sweden

L77: “Areas of high seismic activity”, cf. above

L85-86: How do you know there are Burtraesk earthquakes among the pre-instrumental data?
-On L511 it is stated that macroseismic magnitudes have significant uncertainties. 4-4.5 does not appear that significant.

L90: The family name of the author is Muir Wood, not Wood.

3 Previous seismic hazard assessments for Sweden

L130-134: It seems that the most important previous hazard analysis for Sweden is by Wahlstroem and Gruenthal in the early 2000s. They provided disaggregation, which is the main argument for also providing disaggregation plots in the present work. The current version of the manuscript will be strengthened in the results part. Disaggregation is a basic calculation to identify the earthquake scenarios that contribute the most to a specified exceedance probability of ground-motion levels. It will add to the value of the work.

4.2 Seismic source areas

lines 152, 172, 208, 284, 285, 290 (possibly elsewhere as well):
Seismic source area (SSA) is not commonly used in PSHA. I would suggest replacing it with seismic source zone (SSZ) throughout the manuscript.

4.4 Calculating recurrence parameters

L345-346: "Although the first seismograph in Fennoscandia was installed in Sweden in 1904, the completeness magnitude of the catalogue has varied during the 20th century from about M4 to about M2." The first part and the second part of the sentence do not resonate well.

4.6 Ground Motion Models

L392 (report Goulet et al. 2018) the article for the NGA-East suite of GMPEs has been published:

Goulet CA, Bozorgnia Y, Kuehn N, Al Atik L, Youngs RR, Graves RW, Atkinson GM. NGA-East ground-motion characterization model part I: Summary of products and model development. Earthquake Spectra 37(S1), 1231-1282, 2021. https://doi.org/10.1177/87552930211018723

5.1 Seismic hazard maps for Sweden

L462: The input catalog spans 150 years according to Figure 3. How do the authors perceive the added value of the seismic hazard map with 2500-yr return period? Low exceedance probabilities imply rather high-magnitude earthquakes. Do you think the large earthquakes will occur in the areas with recurrent small earthquakes?

5.2 Hazard curves for seismogenic areas

L477-480: Four sites were picked up to represent areas of enhanced seismicity within the territory, and hazard curves are presented for the four sites in Figure 9.
Figure 1 shows five "sites of interest". What were the grounds for picking up the fifth site? It is located in an area with less seismicity than the other four sites.

6 Discussion

L498 “high seismic hazard”, cf. above

Conclusions

L601-632: this is mostly more like a summary

Figures

Figure 1: add scale and/or coordinates to the map

The dashed black lines showing the Sorgenfrei-Tornquist etc. zones are very thin.

Caption: it is more conventional to separate the sites in the map and describe the symbols in the caption, what P, B, H, U, LV mean for instance.

Figure 2: The blue dots should be explained in the figure caption.

Figure 3: L223 states that your base catalog begins in 1375, supposedly this applies to Sweden as well. Did you remove dependent events and homogenize magnitude for data from 1875 onwards only? Better to repeat the years in the caption, now it is stated that this is all the Swedish earthquake data.

Figure 4: Coordinates are typically given on the figure frame. At least a scale should be provided.

Figure 6: Not all readers read the text from the beginning to the end, so writing more complete figure captions is an option to seriously consider throughout the manuscript.

Figure 7 caption states that “solid lines show the mean”: cannot discern any solid lines in the figure

Figure 8: When displaying the two maps parallel, it is not ideal that the darkest shade refers to lower ground motion than the shade used for the largest ground-motion values.

There are four figures with the figure number preceded by the letter A (A1 to A4). Are they meant to constitute an Appendix? No reference to an appendix can be found.

The first three A-figures are referred to in the text, but Figure A4 is not.

Figure A2: a more logical scale would be gray – blue – green – orange – red showing the largest clusters

References

L837, L874, and others: BSSA abbreviation is misspelled: “Seimol”

L870: the author of this article is R. Muir Wood, not R. M. Wood, cf. L90