

Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC3  
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## Comment on nhess-2022-60

Anonymous Referee #3

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Referee comment on "An updated area-source seismogenic model (MA4) for seismic hazard of Italy" by Francesco Visini et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2022-60-RC3>, 2022

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### Summary

This manuscript describes the updated area-source seismogenic model MA4, which is one of the 11 sets of earthquake rupture forecasts (ERFs) in the new probabilistic seismic hazard model MPS19 for Italy. MA4 is the combination of an area-source model (defined by geographic boundaries, upper and lower seismogenic depth, hypocentral depth distribution and style of faulting) and a logic tree to calculate the earthquake occurrence rates, and hence the ERFs. The manuscript describes how these models have evolved, which datasets have been used, how the area sources have been defined, how their seismogenic parameters have been determined, and the choices that have been made (defining the different branches in the logic tree) to calculate the earthquake occurrence rates. This model is then used, in combination with the ground-motion models (GMMs) selected in MPS19, to compute probabilistic seismic hazard for Italy. The results are presented along with a brief analysis of the uncertainties, followed by a short discussion.

### Main comments

The manuscript is well organized, clearly written, the results are sound and supported by the data, the references are adequate and most figures are clear. However, the manuscript is rather technical and relatively short, allowing only a superficial analysis. In addition, there are several issues that need to be improved or clarified:

- At some points, the text is too concise to fully understand, for example:
  - §2.4 "We also considered the regional strain rate fields ... and the ...  $S_{hmax}$  orientation to qualitatively check the homogeneity of the strain rate values within the area sources": it is not clear how this is done, perhaps it could be shown in a map in the electronic supplement.

- §3.1, e) “be consistent with the CPTI15 earthquake catalogue”: how specifically?
- §3.2 “We considered only the earthquakes that can be related to active crustal seismicity based on the crustal models by ...”: it is not clear which (types of) events are rejected
- §3.3 “in each source zone we obtained a representative moment tensor”: how was this done?
- The description of methods iv and v to calculate seismic rates in §3.4.3 is too concise.
- The introduction is actually a summary of the various seismic hazard models in Italy and their evolution during the past 2 decades. Considering the numerous abbreviations, a sketch depicting the model hierarchies and histories would be useful.
- Declustering of earthquake catalogs is an important issue in modern, state-of-the-art probabilistic seismic hazard assessments, but is not really investigated in this study. Although many different methods are available, only a single one is used. It is not clear to me why this would be less important than for instance the different methods to estimate the completeness. The latter are captured in a branching level of the logic tree, but declustering is not.
- The logic-tree structure used to calculate the ERFs is described at the beginning of §4 (seismic hazard calculation), but I would prefer to move this to §3.4, as it provides the rationale for the choices made in the subsections of §3.4.
- Figures 9 and 10 show hazard results for 3 selected sites, but there is no discussion about what we can learn from the differences between these sites.
- I have not been able to understand the analysis of ERF and GMM uncertainties at the end of §4 and in Fig. 13. According to the text, the curves grouped by GMM are used to analyse the ERF uncertainty, whereas I would think that these curves show the differences in uncertainty among the different GMMs (e.g., there is a clear divergence for the Bindi et al (2012) GMM at low APOE in L’Aquila and Siracusa). Furthermore, it is not clear to me how we should compare the other set of curves (with marker symbols) with the ones grouped by GMM, considering that the former represent 3 branches and the latter 20 branches. It may be a misunderstanding on my part, but I think it would be more useful to also group these curves by completeness model, by Mwmax model and by AR model. This would also reduce the number of curves in Fig. 13. If this is not what the authors intend to show, then a more clear description will be needed to understand the conclusion that “there is a clear trend that ERF uncertainty gives larger CoV than GMM uncertainty”.
- Figure 13 is too dense: it shows 24 curves with different colors, line styles and marker symbols, but many of them cannot be properly distinguished.
- There is no caption for the tables in the electronic supplement.

## **Recommendation**

Moderate revision

## **Detailed comments**

I have annotated a number of minor comments, corrections and suggestions in the attached PDF. The easiest way to view these is by opening the Comment side panel in Adobe Acrobat Reader.

Please also note the supplement to this comment:

<https://nhess.copernicus.org/preprints/nhess-2022-60/nhess-2022-60-RC3-supplement.pdf>