

## **Second Review of the manuscript egusphere-2024-787**

After reading this manuscript again, I am delighted to know its significant improvement. Most of the reviewers' comments have been considered. However, I still have some comments and questions, listed below. There are a few adjustments, which could improve the manuscripts.

In many cases, the reviewers' comments have been addressed by adding citations only and without going into details. I think the authors should explain some points better to make this manuscript a stand-alone paper which could be understood by the readers without checking the references. Some explanations, which are provided in the authors' response file, should be included in the manuscript, such as the response to Line 181, the response to Figure 4, and the response to Line 269 by the 2nd reviewer.

Some more points are the following.

- 1) The addition to the section conclusion is very little, it still seems to be more a summary than a section Conclusion. The strengths and limitations of the study could be better highlighted.
- 2) I would not completely agree that the comparison between this study and the geodetic model for Italy is outside the scope of this manuscript since it could validate and strengthen the analysis conducted here.
- 3) There are still editorial issues with the use of parentheticals for citing references, e.g (e.g. Zeng et al. (2018)) should be (e.g. Zeng et al., 2018) on line 56; (see Danciu et al. (2021)) should be (see Danciu et al., 2021) on line 101-102; Fault-Source Model 2020 EFSM20, Basili et al. (2023)) should be Fault-Source Model 2020 EFSM20, Basili et al., 2023) on Line 81; Marinier et al. (2021)) should be Marinier et al., 2021); etc.
- 4) I would suggest an English proofreading before the final version is ready to be published because the English language is quite poor in some parts. I report only some of them below.

Below there are a few (technical or editorial) comments on the manuscript.

Line 9: Replace “high activity zones” with “highly seismic activity zones”.

Line 11: What does “local disparities underscore” mean? I would suggest rephrasing it.

Line 12: Replace “low-to-moderate activity zones” with “low-to-moderate seismic activity zones”.

Line 20: replace “and its update the European” with “the updated European”.

Line 21: Faults are actually included in the seismic source models in active countries, such as South Europe, Turkey, Japan, California, etc. So probably the sentence “In regions where active faults are rather well-characterized, they must be accounted for in the hazard estimations” should be corrected.

Line 26: replace “in the past, as the two” with “in the past, such as the two”.

Line 33: Delete the second and third “on”.

Line 41: Delete the second “if”.

Lines 55-56: It is not enough to add only a citation to describe the Italian geodetic model. The authors should briefly explain what “the method of Carafa et al, (2017)” is. How does the

approach used to derive the Italian geodetic data differ from that used to derive the model of Piña-Valdés et al. (2022)? This is not beyond the scope of this manuscript since it gives the background and explains what already exists in the literature.

Line 56: Including one reference only contradicts “A number of studies...”. Include more references. Also, did they use the same approaches?

Line 69: Delete “the” in “the most the compatibility”.

Line 72: Replace “ESHM20 aims” with “ESHM20 aimed”. Also, update the citation Danciu et al. (2021) with the peer-reviewed article Danciu et al. (2024) throughout the manuscript.

Line 73: Remove the space before the colon (in components :). This editorial typo appears often in the text, including in the caption of Figure 10 (seismic moment rate : 1 : ITAS308, 2 : ITAS331, 3 : ITAS339, 4 : BGAS043, 5 : FRAS164, 6: DEAS113, 7 : DEAS109, 8 : CHAS071 ).

Lines 74-75: “that” is repeated twice in the same sentence. I would suggest rephrasing it for better readability.

Line 87: Add “and” after the comma in “geologic features, seismicity pattern”.

Line 89: Add “catalogue” before “completeness”.

Line 91: Note that form 2 is not capital letter throughout the manuscript. The authors should check this.

Formula 1: Explain what  $M_{max}$ ,  $N(m)$ ,  $a$  and  $b$  are. Also, does the minimum magnitude not appear in equation 1?

Line 94-95: It is still unclear what the corner magnitude is. Is the bending at large magnitudes? How does it relate to the minimum magnitude for the calculations of the recurrence parameters? It would be useful to include the formula perhaps.

Line 100: Leonard (2014) is an update of Leonard (2010) for stable continental regions only. Which one was used? Leonard (2010) for active shallow and subduction regions and Leonard (2014) for stable continental regions? The authors should be more precise. Also, replace “it” with “and”.

Lines 100-101: I do not see more explanation added here to explain the smoothed seismicity model and the adaptive kernels. Adding only a citation is not enough to make this manuscript a stand-alone, independent paper. It would be useful to include the size of the spatial cells as indicated in the response file.

Line 108: Move “recurrence models” after Pareto.

Line 122: Replace “at the scale of Europe” with “at the European scale”.

Line 127: Add a colon after “inverse problem” (without any space after “problem”).

Line 132: Add a full stop before “however”.

Line 134: Add “, i.e.” after “categories”.

Line 136: Delete finally.

Line 142: Leave a space between 142 and km. A space between a number and km should be checked throughout the manuscript.

Line 143: Change “the radius is increased, the” with “the radius increases, the”.

Line 144: Add “is” after “this radius”.

Line 147: Change “a number of decisions are required that may impact” to “a number of required decisions may impact”.

Lines 149-150: Quadratic and Azimuthal should not have capital letters.

Formula 3: Explain what  $n$  is.

Line 167: Remove the comma before “uses”.

Line 172: remove the comma before “propose”.

Formula 7: What is  $AX$ ?

Line 172: remove the comma before “uses” and remove the  $s$  in “uses”. As indicated in my previous review, the use of the comma should be checked more carefully.

Line 179: Remove “focused” and add “of  $C_g$ ” after two values.

Line 180: Replace “consider two values,” with “consider two  $C_g$  values,”. It is unclear how the selected values of 2 and 2.6 were computed for  $\text{dip} = 25^\circ$  and  $65^\circ$ . Since one of them is  $C_g = 2$  as in Stevens and Avouac (2021), I assume that the dip angle should be also the same, i.e.  $45^\circ$ , and not  $25^\circ$ . Something here seems to be incorrect.

Lines 182-183: It is not enough to cite the work of Dziewonski and Anderson (1981) to justify the alternative values of the shear modulus. A brief explanation should be added here.

Lines 187-194: For the selection of the seismogenic thickness, using the case study of eastern North America does not seem correct for the highly seismic South Europe. Also, how to justify a thickness between 5 and 15 km for the seismicity with hypocentral depths of 20-25 km, which is present in Europe?

Line 204: Replace “the most” with mainly or mostly.

Line 215: Remove the comma after “variability”.

Line 223: Replace “substantial” with “strong”.

Lines 230-231: What is the impact of using different equations to calculate the geodetic moment since it is non-negligible? This sentence should be expanded.

Figure 5: In the caption replace “Full” with “Full distribution” as indicated in the x-axis. The labels in the y-axis of the top plots are still missing.

Line 245: Replace “realistic the model is” with “realistic ESHM20 is”.

Line 257: Replace “stay” with “are” or “lie”. Furthermore, this sentence is unclear because 1) the brackets are misplaced since it seems to be related to low-seismicity regions; 2) the sentence “seismic moment rates go down to much lower values” seems to be incomplete [than what??] and which regions are these seismic moment rates related to?

Lines 274-275: This sentence is unclear so the authors should rephrase it for better readability.

Line 299: The beginning of the first sentence should be rephrased because beginning with Let's is not suitable for a manuscript.

Line 305: “ The source zones 305 CHAS071 (Switzerland), DEAS113 and DEAS109 (Germany) are not as active” [as WHAT??]. This sentence does not seem to be complete.

Line 311: Replace “is inferred both from the larger macrozone and from the number of earthquakes” with “is inferred from both the larger macrozone and the number of earthquakes”. Also, the citation should be (Danciu et al., 2021) and should be replaced with the updated citation Danciu et al., 2024.

Lines 210-312: How was the final a value computed? Using the macrozones or the individual zones? This sentence could be improved to make clearer how the activity rate was estimated.

Lines 331-332: Include references for this sentence.

Lines 332-334: Include references for this sentence.

Line 370: Remove one bracket in “part))”.

Lines 389-390: replace “As a consequence, and as seen at the scale of macrozones (Fig. 11), this discrepancy is reduced at a larger scale because of a spatial smoothing of the signal.” with “This discrepancy is reduced at a larger scale because of a spatial smoothing of the signal as seen at the scale of macrozones (Fig. 11).”.

Line 425: Replace “within” with “in”.

Line 430-431: Why does FRAS164 behave differently from the surrounding zones?

Conclusions: Report examples of the regions when describing the results, for example, “in areas with small characteristic distances, such as XXX” in line 440; “In some of these areas, such as XXX-XX” in line 447; “whereas in others (e.g. XX-XXX)” in line 448; etc.

Lines 445-446: Include references for this sentence.

Lines 456-457: I don’t find this sentence correct. In regions of slow deformation and low seismicity, it is often difficult to include the tectonic structures as fault sources in the seismic source model because the information on their geometry, the rupture behaviour, and the maximum magnitude they are capable of generating is incomplete or unknown. Furthermore, although the overall deformation rate in the region may be known, it is difficult to partition it among the active tectonic structures and thus estimate the activity rate of the individual faults.

## References

Danciu, L., Giardini, D., Weatherill, G., Basili, R., Nandan, S., Rovida, A., Beauval, C., Bard, P.-Y., Pagani, M., Reyes, C. G., Sesetyan, K., Vilanova, S., Cotton, F., and Wiemer, S.: The 2020 European Seismic Hazard Model: overview and results, *Nat. Hazards Earth Syst. Sci.*, 24, 3049–3073, <https://doi.org/10.5194/nhess-24-3049-2024>.