Responses to Referee #1

We thank the anonymous referee for their careful reading of the manuscript and their constructive and insightful comments. Below, we address each comment in detail and explain how these points will be implemented in the revised version of the manuscript.

RC1-1 The introduction is very well written and no changes are suggested regarding writing quality. However, indeed the target study area is Italy, however recent earthquakes such as the 2023 Türkiye–Syria earthquake sequence represent a highly relevant example of multi-fault rupture behavior. Including this event and related studies in the references particularly in the context of multi-fault rupture scenarios discussed in the introduction would strengthen the relevance of the manuscript. Several studies addressing such rupture complexity should now be available.

Author's response (AR): We agree that the 2023 Türkiye–Syria earthquake sequence represents a highly relevant and recent example of complex multi-fault rupture behaviour. We will include this event and the related recent literature in the Introduction to further strengthen the motivation for considering multi-fault rupture scenarios in fault-based PSHA.

RC1-2 The introduction provides a solid overview of fault-based PSHA approaches; however, the scope would benefit from a clearer conceptual distinction between traditional (area-source-based) PSHA and fault-based PSHA. For example, are there specific uncertainties that are better addressed by one approach compared to the other? It would be useful to include quantitative examples or clearly stated metrics (e.g. rates) illustrating the benefits and limitations of fault-based PSHA relative to traditional approaches.

AR: We agree that a more quantitative distinction between traditional area-source-based PSHA and fault-based PSHA would strengthen the Introduction. In the revised manuscript, we will support this discussion by referring to published studies showing quantitative differences between the two approaches, for example in terms of long-term ground-motion estimates and spatial variability of hazard (e.g., Williams et al., 2023).

RC1-3 Typos and minor issues: Line 115: Its probably meant to be "coseismic"; Table 3: In the title: should be "background" (check spelling); Figures 7–12: Figure resolution is poor. The resolution limits readability even with a bit of zooming into the document.

AR: All typographical errors have been corrected, the table title has been revised, and the resolution of Figures 7–12 has been improved in the revised manuscript to enhance readability.

REFERENCES:

Williams, J. N., Werner, M. J., Goda, K., Wedmore, L. N., De Risi, R., Biggs, J., ... & Chindandali, P. (2023). Fault-based probabilistic seismic hazard analysis in regions with low strain rates and a thick seismogenic layer: a case study from Malawi. Geophysical Journal International, 233(3), 2172-2207.