LETTER OF ACTION

The communication strategy for the release of the first European Seismic Risk Model and the updated European Seismic Hazard Model

Dear Mathilde Sørensen,

We would like to thank you and the two reviewers for the careful consideration and meaningful suggestions to improve our manuscript. We are pleased to resubmit our paper entitled "The communication strategy for the release of the first European Seismic Risk Model and the updated European Seismic Hazard Model".

In our revision, we followed all comments of the reviewers, which strongly improved the clarity of the findings and the relevance of our research. The reviewers recommended the following major amendments: First, we broadened the discussion concerning the applicability and adaptability of our recommended communication strategy and transdisciplinary approach by illustrating specific examples on both national and international levels. Second, we provided additional details about the design choices, drawing from the insights of our user testing. Furthermore, we also addressed all minor and specific suggestions.

As the reviewers mentioned, our manuscript presents a communication strategy to support the public release of models and their outputs to both the scientific community and societal stakeholders and provides specific insights into how to best use a transdisciplinary approach in such endeavors. Thus, we hope for a full consideration of our revised manuscript in order to encourage other researchers to conduct future studies in this research field.

Kind regards,

the authors

COMMENTS REVIEWERS

Thank you for responding to the comments from the reviewers. As you have seen, both reviewers suggest minor revisions before publication of your manuscript. Please submit your revised manuscript considering the comments raised by the reviewers.

Based on the reviewers' comments, we have revised our manuscript. In the following, we listed and explained all the amendments taken in the manuscript in detail.

Acknowledgements

The authors would like to thank the EFEHR ambassadors (Josip Atalić, Philippe Gueguen, Gottfried Grünthal, Kyriazis Pitilakis, Vassilis Karastathis, Benedikt Halldórsson, Sevgi Ozcebe, Radmila Salic Makreska, Mathilde B. Sørensen, Radu Vacareanu, and Constantin Ionescu) for supporting the outreach of the communication products and release of the models. Further, we thank all participants for filling in the survey on the interactive web viewer or the risk poster. The authors also thank the two reviewers for their valuable comments, which strongly improved the clarity of our article.

Reviewer #1

Scope and other applications. The authors clearly identify the possibility of their proposal could support the development of future products on the same topics, however one general comment is the missing discussion about the comparison of these design criteria to other hazard and risk maps adopted out of Europe.

We agree that the scope of our comparison to other hazard and risk maps was limited. We have broadened the discussion, considering the scarcity of studies that have thoroughly analyzed and evaluated the design of such products. With our paper we thus also want to encourage other research groups to share their experiences in developing and evaluating societally relevant assets.

With a clear strategy, an interdisciplinary team, and the involvement of the target audiences, communication products can be designed that are valuable and useful to support decision taking. Thereby, it is important that not only the technical data, but also all outreach materials are openly available and easily accessible, which we for example ensured via the EFEHR website for the European seismic hazard and risk models. We are convinced that the chosen approach is not only useful in this context, but could be applied to any domain, where complex scientific findings should be made accessible to diverse target audiences.

The effectiveness of the approach's transferability is, for instance, demonstrated through its successful application in developing Switzerland's first publicly available earthquake risk model (Dallo et al., 2023; Marti et al., 2023) or in redesigning the seismic hazard map for Germany (Schneider et al., 2022). A transdisciplinary approach is currently also used by the United States Geological Survey (USGS) to design products for aftershock forecasts in various countries (Schneider et al., 2023). They have already used user testing for the evaluation of the rapid impact assessment they release after significant earthquakes (Karjack et al., 2022). This approach is also partially utilized and under consideration for the future development of socially relevant assets within the framework of the European Plate Observing system (EPOS; Marti et al., 2022).

The results. The use of tables and figures appears to be well balanced. Although the article is intended to illustrate the communication strategy, it could benefit from presenting some details of the final product. For example, some points in Table 3, which describes the "Practical implications for designing comprehensive, useful and well-perceived risk maps and posters", deserve further investigation. In particular, the points regarding "the difference between the risk index of the risk map and the components of the overall risk model" and "the house next door" should be explored in greater detail. How did you solve the problem of communicating such complex points? (Images in Table S8 do not provide a clear answer due to resolution. Consider the possibility to insert a more detailed figure). The final choice of color scales "based on the correct interpretation and perception of the risk of the map" also deserves clarification.

Thank you for this suggestion. We have incorporated an additional paragraph to delve into the pertinent design-related aspects in more detail. Additionally, we have replaced the images in Table S8 with higher resolution pictures to ensure improved visibility of the details (the new supplement file is uploaded on the ETH Research Collection).

> Regarding the design, we here discuss the aspects relevant for the final choice of the colour scale and risk index. First, our decision is ground in choosing a colour scale that ensures that people correctly interpret the map (Table S14 in the Supplement). Second, with the selected colour scale, people better understood that although the house next door might be located in a differently coloured area, this does not indicate a lower seismic risk per se (e.g., influence of building type). An effective visual technique for conveying this information involved incorporating a gradient or fading of colours. Third, we explicitly state on the poster and other products that the map illustrates a risk index, representing the average annual economic loss and the average annual loss of life. In the case of the Swiss earthquake risk map, we went one step further by clearly indicating the risk index and its two underlying components in the legend too, a measure proven to improve public comprehension of the map (Dallo et al., 2023).

Technical comments

- *Line 95 and 97: please, consider the possibility to substitute the verbs "elaborated" with "illustrated" or "shown".*
- *Line 147: The sentence is not clear, please specify whether "well educated and trained people" stand for "non-technical audiences"*
- *Figure 5: specify the parameter plotted in the seismic hazard map (Fig. 5b), in legend too*
- *Table 1, page 11, fourth central box: "The video last about 5 minutes" (not 3)*
- *Figure 7: on the map, the Pavia locality must be replaced with the more well-known reference locality Milan*
- *Line 250: Add "in Supplement" when Fig. S1 is cited*
- *Line 260-261: the information is given also in line 274, please choose one*

- *Line 267: In general Table 2 is too hermetic. Please consider if the manuscript could benefit from less detailed tables, referring to a more extensive and in-depth version in the Supplement. In particular:*
    - *Table 2, pag 15: some symbols need to be clarified.*
    - *Line 8, 9 and 17: what is the meaning of symbol ">"?*
    - *Symbol "/" can be changed with "and" (4 times)*
    - *Please, specify that "NUTS19" is administrative unit*
- *Line 273: please, specify the "participants' characteristics" (shown in line 284)*
- *Line 304: Table 3 is too specific. It is suggested to present a more concise table in the paper, after having extrapolated some important concepts to be explored in greater depth (see above).*

Thank you for these specific comments. We changed the manuscript accordingly (see track changes in the resubmitted manuscript). Regarding the comment about replacing Pavia with Milano, we informed the people responsible and they will consider changing it, which will take some time. Pavia was originally chosen as that is the location of Eucentre that hosts the European Seismic Risk Services.

In response to your suggestion to relocate the tables to the Supplement, we opted to retain them in the main text. This decision stems from our belief that the tables offer valuable insights crucial for designing maps, interactive tools, etc. In the supplement, we provide detailed information and evidence for those insights. Additionally, we argue that some readers appreciate to gain a comprehensive overview of the results by looking at the tables and others who are less interested in the numbers may simply skip the tables. If the editor deems it more appropriate, we could list the tables as an Appendix at the end of the manuscript.

Reviewer #2

The paper presents the communication strategy, for supporting the public release of the European seismic hazard and risk models, which was co-defined and implemented by the communication experts and the model developers. The models are shortly introduced and the framework of the adapted strategy consisting of the preparation phase, the public release and the re-work processes are illustrated. For each component, the methods used, the inputs and outputs are explained in detail. The authors suggest that the chosen approach and the developed strategy could be applicable in any domain in order to make complex scientific findings accessible to different target audiences. This point deserves some more discussion where comparisons with the available similar work in Europe and around the world are first provided and then in what regards the presented strategy might contribute to/improve them are illustrated.

Thank you for this summary and the suggestion to discuss the transferability in more detail. We addressed this suggestion by including a paragraph in the discussion section that highlights examples from various countries and regions.

With a clear strategy, an interdisciplinary team, and the involvement of the target audiences, communication products can be designed that are valuable and useful to support decision taking. Thereby, it is important that not only the technical data, but also all outreach materials are openly available and easily accessible, which we for example ensured via the EFEHR website for the European seismic hazard and risk models. We are convinced that the chosen approach is not only useful in this context, but could be applied to any domain, where complex scientific findings should be made accessible to diverse target audiences.

The effectiveness of the approach's transferability is, for instance, demonstrated through its successful application in developing Switzerland's first publicly available earthquake risk model (Dallo et al., 2023; Marti et al., 2023) or in redesigning the seismic hazard map for Germany (Schneider et al., 2022). A transdisciplinary approach is currently also used by the United States Geological Survey (USGS) to design products for aftershock forecasts in various countries (Schneider et al., 2023). They have already used user testing for the evaluation of the rapid impact assessment they release after significant earthquakes (Karjack et al., 2022). This approach is also partially utilized and under consideration for the future development of socially relevant assets within the framework of the European Plate Observing system (EPOS; Marti et al., 2022).

Lines 41-44: The authors start by posing a question and say that 'the long answer is this paper'. Does it imply that there is no other answer/example available?

Thank you for raising this question. We agree that it was not clearly written that the example/answer pertains to our communication strategy developed through a transdisciplinary approach. We made it clearer in the text.

How should we render scientifically-developed models relevant and useful for society? The short answer is that model developers, communication experts, and societal stakeholders must collaborate on and co-design the products (Pohl et al., 2021). The comprehensive answer is presented in this paper, offering an illustrative example of ~~The long answer is this paper, which provides an overview of~~ the communication strategy ~~that was~~ developed and implemented ~~based~~ throughon a transdisciplinary approach to support the launch of the European seismic hazard and risk models. This strategy consisted of the preparation phase (communication concept, end-user testing, expert feedback rounds, outreach specialist network), the public release (information materials and model data, events, distribution channels), and the rework processes (requests, follow-ups).

Figure 5: (a) It would be useful to provide the definition of the mapped risk metric. (b) Please specify the ground motion parameter with its unit and explain what the map presents (i.e. the hazard level).

This was also a comment by reviewer 1. We added corresponding explanations in the Figure captions.

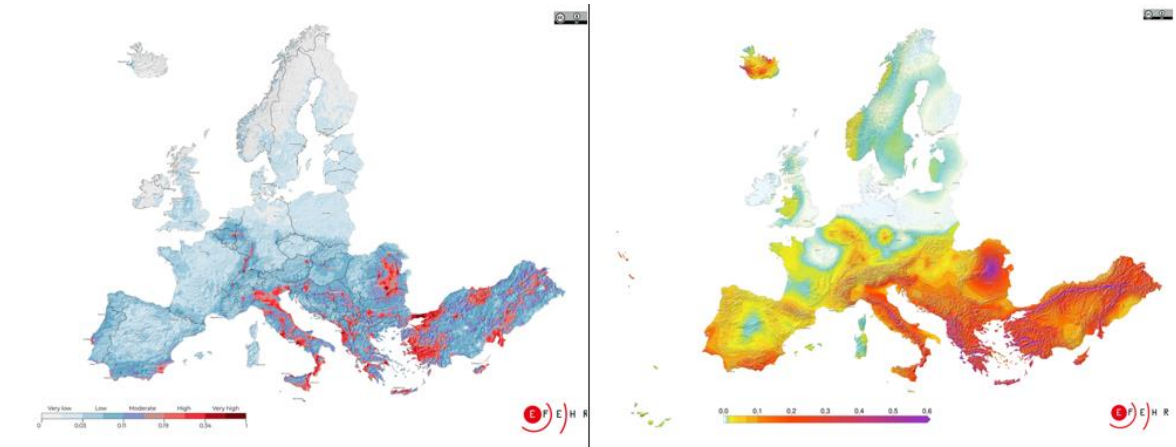

Fig 5a: Seismic risk map showing the risk index which combines the average annual economic loss and the average annual loss of life.

Fig 5b: Seismic hazard map showing the expected level of ground shaking [Peak Ground Acceleration]

Figure 5: The European seismic risk and hazard map [www.efehr.org/explore/Downloads-information-material/]

Table 1: In description section, specific URLs might be provided for the following products: EFEHR website, Detailed (technical) report, Fact sheets, Interactive map viewers for professionals and for the general public.

That is a great idea. We added the hyperlinks to Table 1 so that readers can directly access the products.

Figure 7: It would be more consistent to have all the city names in English and to illustrate only capital cities.

Thank you for this suggestion. We informed the people responsible and they will internally discuss to change it, though this decision is beyond our direct responsibility.