Between global risk reduction goals, scientific-technical capabilities and local realities: a novel modular approach for multi-risk assessment

This manuscript presents a framework for implementing multi-risk assessments in practice. The approach is demonstrated for Lima, Peru, in the case of a tsunami following an earthquake. The authors also provide a helpful overview of the motivation for shifting practical disaster risk reduction to a multi-risk framing, in the introductory section. The content is timely and would be of interest to readers of the journal. However, there are several comments provided below that I think the authors should address before the manuscript can be deemed publishable in my opinion.

Main comments:

1. Novelty: The authors claim to present a new conceptual approach to multi-risk assessment. But (despite what is implied by line 156), all the tools used for conducting the fundamental risk calculations have been developed in previous studies. Furthermore, the end-to-end calculations conducted in this study do not represent an advancement over the numerous frameworks for multi-risk assessment that have already been proposed in the literature (and that are referred to in the manuscript itself, for example around line 90). I think the authors should frame the novelty of the approach more accurately in terms of its practical relevance.
2. Scope: Related to the previous comment, the approach has only been demonstrated in the context of a very narrow definition of multi-risk assessment (i.e., one set of interacting hazards where one hazard triggers the other and for which there are well established models that capture the underlying interactions at the hazard and impact levels). Section 2.2.3 seems to suggest that, despite the decentralised architecture of the system, its design is inherently dependent on the multi-risk story selected. Point vi of the conclusions seems to confirm my doubts about the generalisability of this approach to other contexts. (Furthermore, is the approach limited to hazards that interact through triggering?) I think the authors need to provide a more honest description of the limited scope of this study near the start of the manuscript. This is merely a first (straightforward and somewhat simplified) demonstration of a practical approach for facilitating user-centred multi-risk assessment. Furthermore, I believe the manuscript could benefit from a discussion about the challenges associated with expanding or enhancing this type of system for more complex contexts, e.g., involving more than two hazards and/or where there is less well-established means of capturing their interactions.
3. User input: The user-oriented design of the approach is a welcome feature. However, despite its numerous advantages, there are some "dangers" associated with allowing user input in this type of system. For instance, stakeholders may not be sufficiently educated to appropriate hazard stories, particularly in the context of climate change. A comment on the potential downsides or caveats associated with user involvement should be added to the manuscript, in my opinion.
4. Case Study: This could benefit from a few more details.
    a. It seems that the multi-risk story was pre-defined in the case study (i.e., taken from INDECI, 2017), which is not compatible with the user-centered workflow presented in Section 2.2.3.
    b. How is the size of the tsunami related to the magnitude of the earthquake selected and how is the uncertainty in this size accounted for?
    c. What are the outputs (risk metrics) shown? Are all metrics disaggregated per hazard event? Do they account for cascading impacts (as described in the last two paragraphs of Section 2.2.2)? Was there consultation with the end users on the types of risk metrics to be shown in the system? The conclusion mentions that the platform can be used to compare the results of different stories, but the ability to do this (i.e., show multiple sets of results side by side) is not made clear in the case study description.
    d. I think the manuscript could benefit from more figures of the system, particularly the GUI.

e. The spatial extent of the case study needs to be described, particularly in the context of cascading impacts (see comment 4d).

5. Introduction: Despite its strengths, I think the introduction section is a bit disorganised. I think that some of Section 1.3 should be moved forward to Section 1.1, such that all content that provides a general motivation for risk management is contained within one section.
6. Questionnaire and user feedback: The link between the results shown in Section 3.4 and the questions in the questionnaire needs to be clearer (I cannot find any of the questions mentioned in Figure 7 in the questionnaire questions provided in the supplementary material). The supplementary material should provide all questions, and the results for all questions should be provided in the main text (at least in summary form).

Minor comments:

1. Line 180: end users are mentioned here as a stakeholder category but it is not yet clear why they would be considered a separate category in themselves - any of the other stakeholder categories listed here could also be a potential end user of this type of system. I see that the end users are described in more detail in line 281; this explanation should be moved forward to line 180 for clarity. However, the situation is further confused in the conclusions section (point viii) and Figure 2, where stakeholder groups are described as "user groups".
2. Figure 5: A reader may look at this figure and question why an EQ catalogue is an input if we are dealing with a specific earthquake scenario. I think it should be more clearly described in the flowchart that the EQ catalogue is used to choose an earthquake scenario for which the ground motion is simulated (the earthquake scenario itself is currently missing from the diagram).
3. Line 475: I do not believe that a value of 55% could be described as an "overwhelming majority"
4. Line 485: it seems that the practical usability of the tool actually decreases over time – e.g., 14% said they are totally likely to use the tool in year 3 versus 18% in year 1. Furthermore, Figure 7d does match with the description of these results provided in the text; it is mentioned that 64% rated the possibility of using the tool as highly likely in year 1, but there is no highly likely colour marked on the bottom bar of fig 7d.