Community comment from Luliana Armas

This paper is part of the ongoing efforts to design new operational and conceptual models that more effectively track risk propagation when multiple co-occurring or cascading hazards are involved. As researchers actively engaged in this field, we are glad to see more models emerging, and we are committed to contributing with insights that may help polish models such as Impact Webs.

Authors response: *Thank you for your constructive comments and insights. We are glad to receive them and are also enthusiastic to see new methodologies emerging.*

Accordingly, we commend the authors on their work and highlight several key points to address during this review:

Use of concepts from the existing literature without definition or attribution to original models

Impact Webs include "risks, their underlying hazards, risk drivers, root causes, responses to risks, as well as direct and cascading impacts" (lines 22-23). Although these components are briefly described in section 3.1., they are not clearly defined (e.g., hazard, shock, impacts, risk drivers, root causes). Moreover, the models that introduced these concepts are overlooked – for instance, the root causes that come from the PAR and Access models (Blaikie et al., 1994; Wisner et al., 2004), which are not explicitly mentioned in the paper. Also, the rationale for choosing these specific components for inclusion in Impact Webs and why they do not adhere to more intuitive component names (such as the ones of Impact Chains) are not discussed.

Authors response: *We feel that section 3.1 in the original submission describes well the elements that were selected, including our rationale for them. We can further elaborate on these elements so they are more clearly defined, and will do this in a second submission with a new table. The models that introduce root causes are not overlooked, and are referenced in the manuscript (See lines 243 – 248). We have significantly restructured section 2.1 of the manuscript to further elaborate on what aspects of different models we selected and justified why we have done this. We highlight in the manuscript that we were heavily inspired by Impact Chains, but wanted to overcome one of the critiques in the literature of Impact Chains that they are not well oriented to model complex and systemic risks, thus we drew on other conceptual models that engage with system dynamics to do this.*

Overlooking the use of Impact Chains to analyze multi-risk

The manuscript presents only the preliminary applications of Impact Chains, omitting recent advances and uses. In its current form, the paper fails to bring the reader up to date in terms of the ways Impact Chains (as inspiration for Impact Webs) are currently employed in the literature. Prominent research projects in the field of DRR, such as Paratus, use Impact Chains to assess systemic multi-sectoral and multi-hazard risk using a wide range of scenarios (Cocuccioni et al., 2024; Hurliman et al., 2024).

Failure to address the similarities between Impact Webs and recent conceptual models (i.e., Enhanced Impact Chains)

The authors acknowledge that their literature review on conceptual risk models is incomplete (line 123). Nevertheless, this literature review omits the model with the highest similarity to Impact Webs: the

Enhanced Impact Chains (hereafter EICs) developed by Albulescu and Armaș (2024) and published in this very same Special Issue of NHESS. This shortcoming is understandable, given that this conceptual model was published only a month before this manuscript's submission.

In light of the following arguments, we believe that the authors should 1) include EICs in the literature review on the models used for inspiration and 2) address the novelty of Impact Webs by comparing them to EICs:

1. The models share the purpose of analyzing the interactions between risk elements. The difference is that EICs look at this problem through the lens of vulnerability dynamics, whereas Impact Webs adopt a broader approach. In essence, both serve as co-development tools that account for the complexity of risk assessment, standing out in terms of their capacity to organize a diverse and consistent volume of information, visualize it, and, based on it, evaluate the strengths and weaknesses of disaster risk management across multiple systems, sectors, and at various scales.
2. Both models include similar elements under different terminologies. For example, the vulnerabilities in EICs are the risk drivers and root causes in Impact Webs, the adaptation options in EICs are the responses to risk, while impacts and hazards are the same in both models.
3. Both models zoom in on cause-and-effect relationships while employing feedback loops to illustrate dynamic interactions among risk elements. In this particular case, EICs introduce named and clearly defined connections between the elements (including positive feedback loops), while Impact Webs do not name or describe the types of connections established among the elements. We recommend addressing this ambiguity on the types of connections included in the model.
4. Both models are applied in case studies involving multi-hazards represented by the COVID-19 pandemic and co-occurring natural hazards. The results from the two case studies should be compared in the Discussion section, as these are the only two multi-hazard case studies (including the COVID-19 pandemic) that employ conceptual models focused on the dynamics of risk elements.
5. Both models integrate stakeholder perspectives. In our paper on EICs, the level of stakeholder input is limited, but the model can be fully developed based on these perspectives (as the paper explicitly states).
6. Both models adopt a cross-sectoral approach, demonstrating high flexibility and allowing for the cross-comparison of results across different geographic and socio-cultural settings.

Authors response: *Thank you for highlighting the publication and methodology that was recently developed by yourself and colleagues, including the novelty of impact webs and EIC's. We cannot include EICs in our review of conceptual models for inspiration as this new and recently published methodology was not reviewed by us for inspiration. However, we feel it is important to acknowledge such comparisons of a new methodology and feel the discussion would be the best place in our manuscript to do this in a second submission.*

Ambiguous terminology

"Response to risk" is a term marked by ambiguity. Risks arise as the convergence of hazard, exposure, and vulnerability, and to respond to them would mean addressing all three components. However, disaster risk management typically focuses on mitigating the vulnerability and impacts of the hazard—not the hazard itself. Therefore, we recommend changing the term to one that avoids confusion.

Authors response: *Response risks are referring to the risks arising from responses to risks and impacts (e.g responses not achieving their intended objectives, or having trade-offs). This is not a new term and is well recognized, as it was included in the IPCC AR6 Chapter 1 'Point of departure and key concepts' (see Figure 1.5 part C). To make sure this is clear, we will elaborate on the term to explain it in more detail in the introduction, following the IPCC point of departure and Simpson et al (2021) referencing on line* ***52****, and include reference to AR6 Chapter 1. We will additionally remove the quotation marks on line* ***228*** *to avoid confusion.*