List of changes in the revised paper:

This document explains the changes made in the revised manuscript while adressing the comments raised by the reviewer. Reviewers' comments are marked in **black**; authors' response is shown in **blue;** while the changes in the revised manuscript are marked in **red.**

Response to Reviewers Reviewer #2

General comment: While the paper is generally well-written, there could be improvements in organizing the content to enhance readability and flow, particularly in presenting the methodology and results sections.

Response: We thank the reviewer for helpful and detailed comments and suggestions. They contributed to further improving our manuscript. The methodology section has been significantly restructured to avoid duplication and improve readability.

Specific comment 1: It would be beneficial to include a more detailed discussion on the validation process and uncertainty analysis of the models to ensure the robustness and reliability of the findings.

Response: The validation is embedded in our susceptibility model (but does not account for the exposure aspect). There are several sources of uncertainty, including models and exposure data. Future research might modify and enhance the exposure and susceptibility groups.

Specific comment 2: It is not entirely clear from the paper how the multiple hazards (floods and wildfires) are integrated into the multi-hazard exposure estimation. The methodology section should provide a more detailed explanation of the approach used to combine and assess the compound risk arising from different hazards. Clarifying this aspect would help readers better understand the synergistic effects of multiple hazards and how they contribute to overall risk.

Response: Thanks for your comment. We clarify that the hazard susceptibility maps were produced separately for flood and wildfires, and then combined in a multi-hazard susceptibility maps that consider only the spatial co-occurrence of these hazards, without considering dynamic interactions. We explained the approach used to combine and assess the compound risk arising from different hazards in Section 3.1 Methodology flowchart, as follows:

3.1 Methodology flowchart

The implementation process comprises seven main stages, as follows: (1) Factors potentially influencing the spatial distribution of floods and wildfire were collected, including topography, geology, hydrology, climate (temperature, wetness, wind), and land use based on their relevance and data availability (Luu et al. 2018; Pham et al. 2021), (2) Inventory maps of each hazard were created based on historical data collection, (3) The influencing factors of each hazard were tested for multicollinearity to enhance the reliability and stability of the model's predictions, (4) CART and RF models were developed on the GEE cloud computing platform to construct susceptibility maps of floods and wildfires separately, (5) The Area Under the ROC Curve (hereafter, AUC) was utilised to assess the predictive performance of the susceptibility map to choose the best model for each hazard and validate it, (6) The flood susceptibility map and the wildfire susceptibility map were combined to build a multi-hazard susceptibility map, and (7) this multi-hazard susceptibility map was overlaid with the building data to create a multi-hazard exposure map for the study area (**Figure 2**).

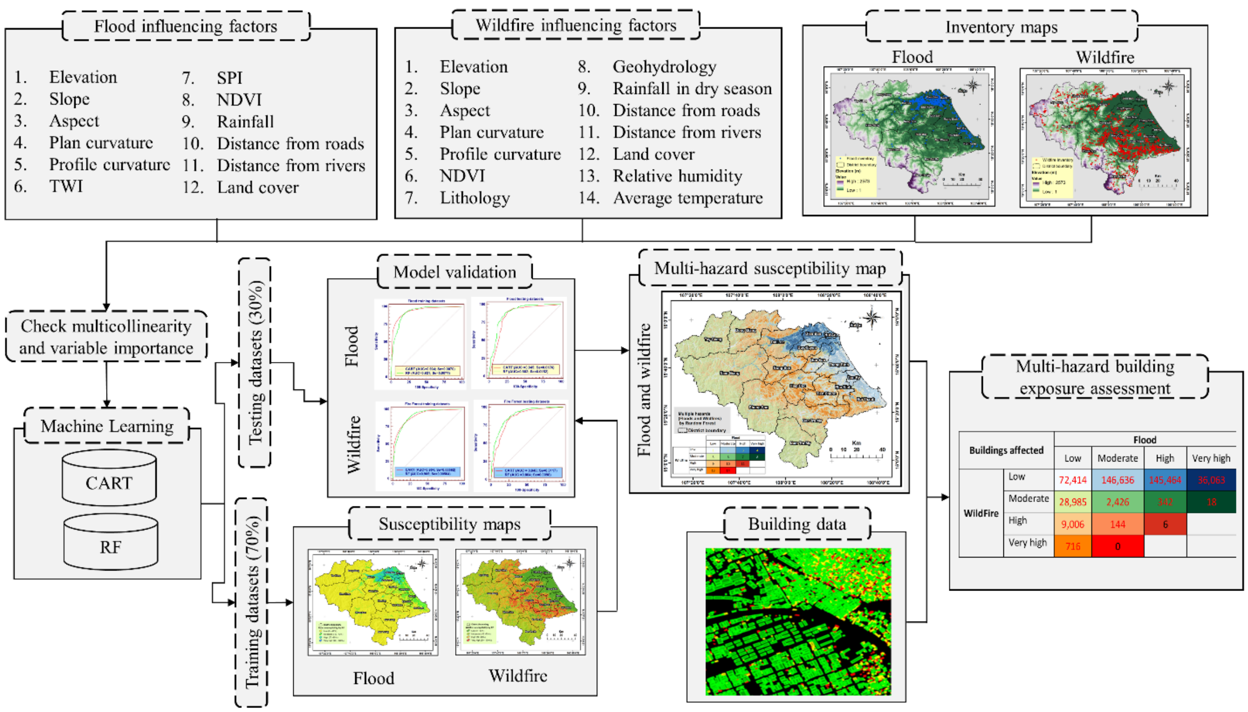

Figure 1. Methodology flowchart for multi-hazard exposure assessing and mapping in this study.

Specific comment 3: My previous comment is of special relevance when the two hazards analyzed are common to happen in different hydrological seasons. Exploring the interactions, dependencies, and cumulative effects of floods and wildfires would provide valuable insights into the complex nature of multi-hazard scenarios. A comparative analysis of the combined risk versus individual hazards would further highlight the significance of considering multiple hazards in risk assessment and management.

Response: We agree with you. To highlight the significance of considering multiple hazards in risk assessment and management, we explained the dynamic interplay between flood probability in wet seasons and wildfire likelihood in dry seasons in Section 1. Introduction. We acknowledge that your assessment is limited to spatial co-occurrence without considering temporal links or dynamic interactions, so we added the limitations into Section 5. Discussion: "In this study, we have only considered spatially co-occurring multi-hazard events and neglected the dynamic interaction of these hazard events. The obtained exposure maps also need further analysis into the impacts of multi-hazard events to provide more useful information for risk assessment and effectively implement disaster risk management within the study area. A more significant limitation of this research lies in the absence of consideration for stakeholder engagement and feedback while developing and applying the multi-hazard exposure estimation model. Interaction with stakeholders in charge of risk management would help to identify further the challenges posed by exposure to multi-hazard, validate the modelling approach proposed in this research and specify how the result of such model can best contribute to strengthening the effectiveness of risk management strategies.”.

Specific comment 4: Consideration of stakeholder engagement and feedback in the development and application of the multi-hazard exposure estimation model could enhance the relevance and applicability of the research to real-world scenarios.

Response: We agree that consultation with the stakeholders is very important. We will consider stakeholder engagement and feedback in the next stage of our GeoSciRe project. At this stage, we only present some potential results and approaches in this paper. We added this limitation to the Discussion section as follows:

“In this study, we have only considered spatially co-occurring multi-hazard events and neglected the dynamic interaction of these hazard events. The obtained exposure maps also need further analysis into the impacts of multi-hazard events to provide more useful information for risk assessment and effectively implement disaster risk management within the study area. A more significant limitation of this research lies in the absence of consideration for stakeholder engagement and feedback while developing and applying the multi-hazard exposure estimation model. Interaction with stakeholders in charge of risk management would help to identify further the challenges posed by exposure to multi-hazard, validate the modelling approach proposed in this research and specify how the result of such model can best contribute to strengthening the effectiveness of risk management strategies.”

References

Luu, C., Von Meding, J., and Kanjanabootra, S.: Assessing flood hazard using flood marks and analytic hierarchy process approach: a case study for the 2013 flood event in Quang Nam, Vietnam, Natural Hazards, 90, 1031-1050, https://doi.org/10.1007/s11069-017-3083-0, 2018.

Pham, B. T., Luu, C., Phong, T. V., Nguyen, H. D., Le, H. V., Tran, T. Q., Ta, H. T., and Prakash, I.: Flood risk assessment using hybrid artificial intelligence models integrated with multi-criteria decision analysis in Quang Nam Province, Vietnam, Journal of Hydrology, 592, https://doi.org/10.1016/j.jhydrol.2020.125815, 2021.