REVIEWERS' COMMENTS TO THE AUTHOR:

Reviewer 2:

General comments

1. **The manuscript "Quantifying the potential benefits of risk-mitigation strategies on future flood losses in Kathmandu Valley, Nepal" addresses flood risk under four scenarios of urbanization and climate change (Scenarios A-D) with a focus on a multi-hazard prone area by computing the associated mean absolute financial losses and mean loss ratios. I believe the manuscript could represent a substantial contribution to the understanding of flood events and especially their consequences and therefore fits perfectly the special issue "Estimating and predicting natural hazards and vulnerabilities in the Himalayan region". Nevertheless, before the manuscript is considered for publication, the authors need to address some concerns.**

Many thanks for your overall positive assessment of our manuscript and your insightful comments, which are addressed in detail below.

2. **The introduction provides valuable information about the relevance of flood events and risk assessment in the region of study. However, I believe the authors need to provide some additional details about the selected methodology (LL 96-98)). Why has this specific methodology been chosen? I recommend the authors to justify this selection. Is it based on previous works? Please add the associated references.**

The methodology used in this study represents a conventional approach to flood risk assessment involving the modeling of hazard, exposure, and vulnerability components. Further details of each step of the methodology are provided in section "2. Material and methods" and in Figure 1.

We have replaced the term "integrates" with "is" in the sentence in question (L95) to avoid misinterpretation:

*"The methodology **is** a scenario-based flood loss estimation approach, using 100-year and 1000-year mean return period flood occurrence maps and four potential present (2021) and future (2031) exposure and vulnerability scenarios, focusing only on residential buildings."*

3. **I believe a figure showing the framework of the work with a step-by-step diagram will be very useful for the readers to better understand the methods implemented and highlight the scope of the work**

Thank you for this suggestion. We have incorporated it by adding Figure 1, which provides an overview of the flood risk modeling approach used in this study.

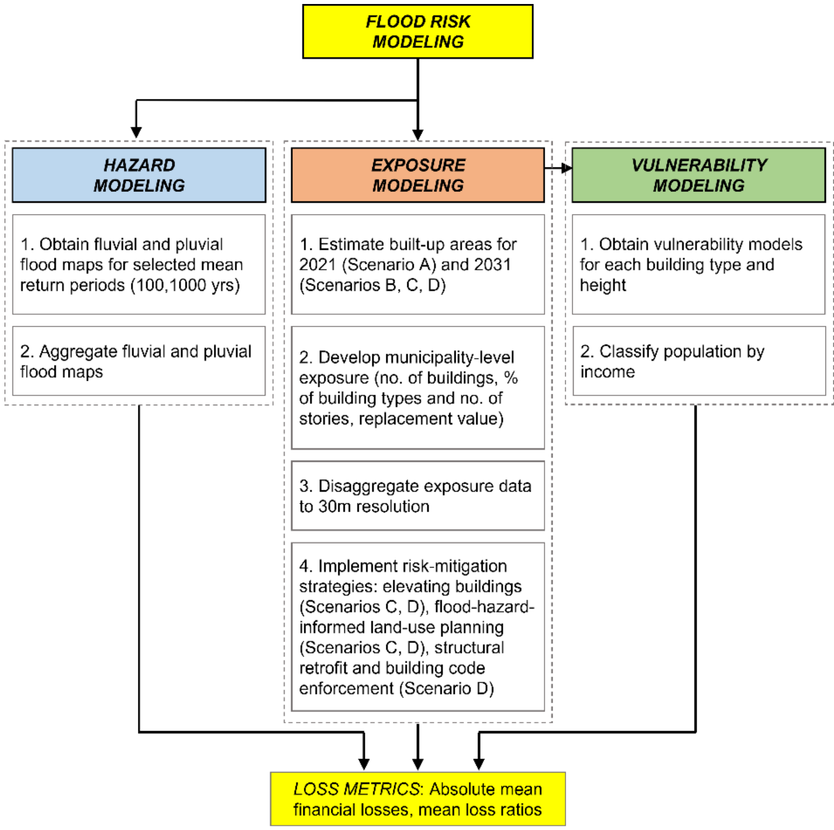

Figure 1. Overview of the flood risk modeling approach used in this study

4. **Regarding the information provided in Table 2, I recommend the authors to include a graph with the "expected number of buildings exposed to flooding" (Y axis) for the different scenarios (represented with colors for example) and the different flood depth (X axis), instead of the overwhelming Table 2. The authors could keep the information about the percentage in Table 2.**

Thank you for this suggestion, which we have incorporated. We have added Figure 6, which contains plots of the expected number of buildings in the floodplain. We have kept the information about the expected proportions of buildings within various depth ranges of the floodplains in Table 2.

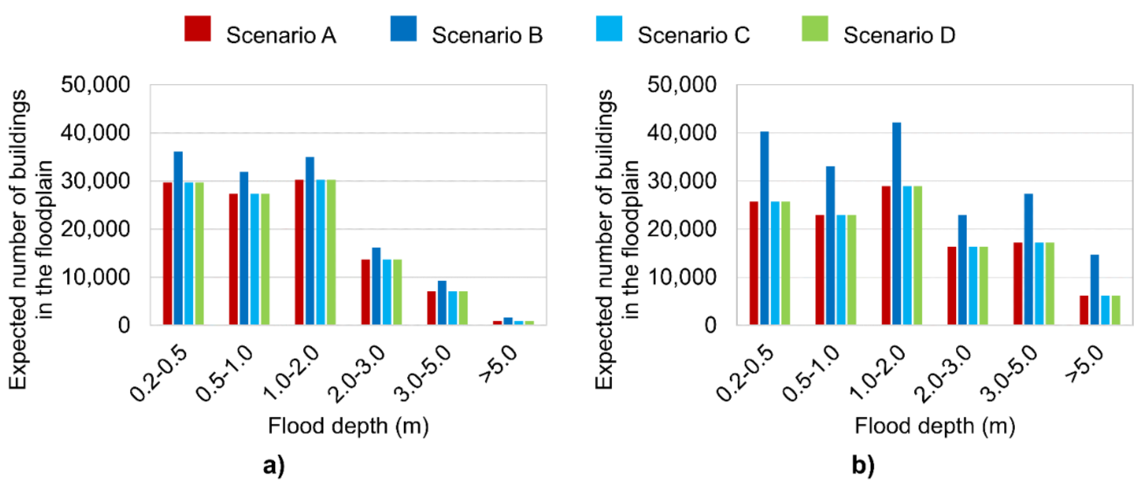

Figure 6. Exposure to flooding: the expected number of buildings within a given range of flood depth, per flooding occurrence and exposure scenario

Table 2. Exposure to flooding: proportions of the total building stock within a given range of flood depth, per flooding occurrence and exposure scenario.

Flooding occurrence	Scenario	0.2-0.5 m	0.5-1.0 m	1.0-2.0 m	2.0-3.0 m	3.0-5.0 m	>5-0 m
100-year	A	3.8%	3.5%	3.8%	1.7%	0.9%	0.1%
	B	3.8%	3.4%	3.7%	1.7%	1.0%	0.2%
	C, D	3.1%	2.9%	3.2%	1.5%	0.8%	0.1%
1000-year	A	3.3%	2.9%	3.7%	2.1%	2.2%	0.8%
	B	4.3%	3.5%	4.5%	2.4%	2.9%	1.6%
	C, D	2.7%	2.4%	3.1%	1.7%	1.8%	0.7%

5. **It is unfortunate that in Figure 4 and Figure 5 the regions with 1% or 10% buildings in the floodplain are represented by a very small pie chart. This makes very difficult the interpretation. Is there any way that the authors could rescale these charts?**

Thanks for this comment. We have rescaled the pie charts to a uniform size to improve their interpretation. However, we have moved these maps (Figures S1 and S2) to the Supplementary Material, since the accompanying text in the last paragraphs of section "3.1 Distribution of building in the floodplain" (L340-L355) is more focused on the percentage of buildings in the floodplain than the prevalence of different flood depths at municipality level.

In addition, as suggested by another reviewer, we have replaced Figures 4 and 5 with Figures 7 and 8, which contain plots of the expected number of buildings in the floodplain and the percentage of buildings in the floodplain.

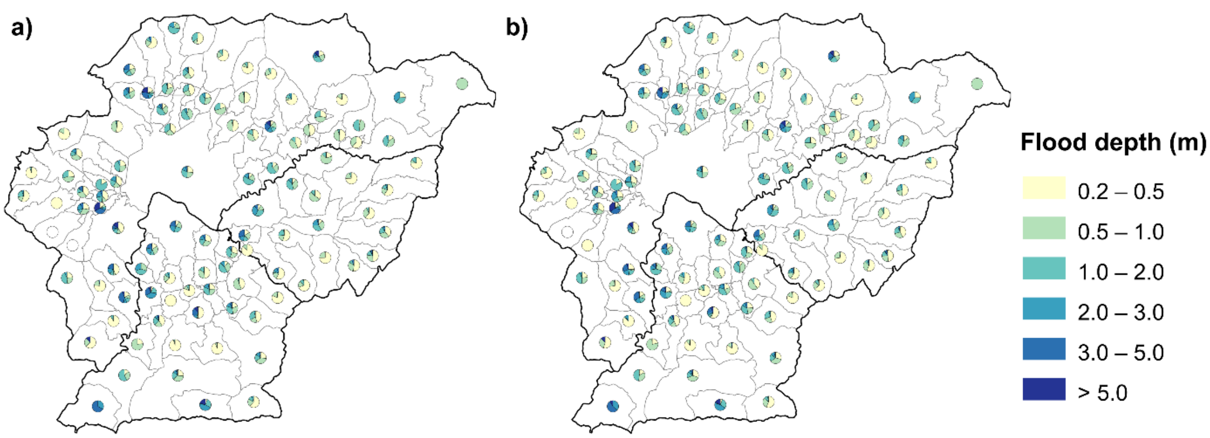

Figure S1. Expected proportions of buildings within various depth ranges of the 100-year floodplain for a) Scenarios A, C, D, and b) Scenario B.

Scenarios A, C, and D yield identical results, since the flood-hazard-informed land-use planning imposed as part of Scenarios C and D means that the expected number of buildings within the floodplain in 2031 (Scenarios C, D) remains limited to 2021 levels (Scenario A).

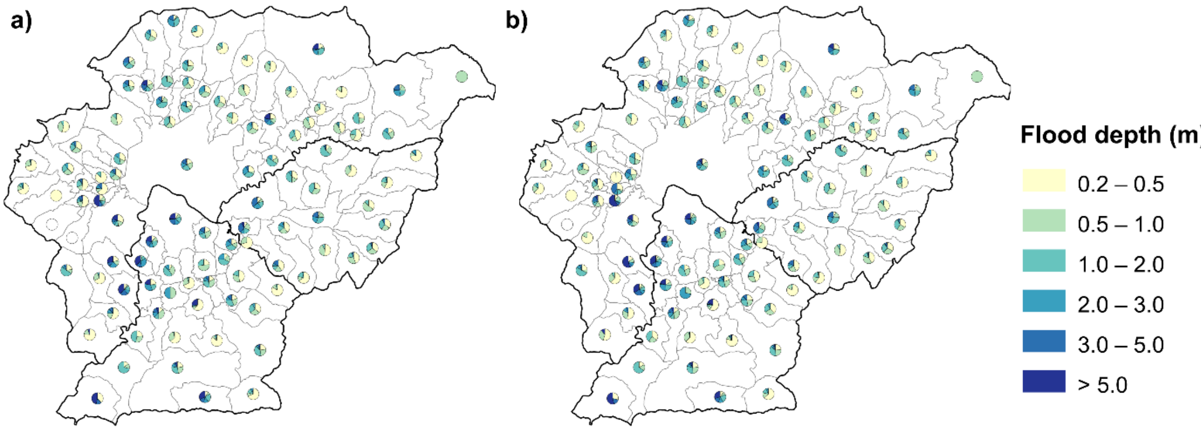

Figure S2. Expected proportions of buildings within various depth ranges of the 1000-year floodplain for a) Scenarios A, C, D, and b) Scenario B.

Scenarios A, C, and D yield identical results, since the flood-hazard-informed land-use planning imposed as part of Scenarios C and D means that the expected number of buildings within the floodplain in 2031 (Scenarios C, D) remains limited to 2021 levels (Scenario A).

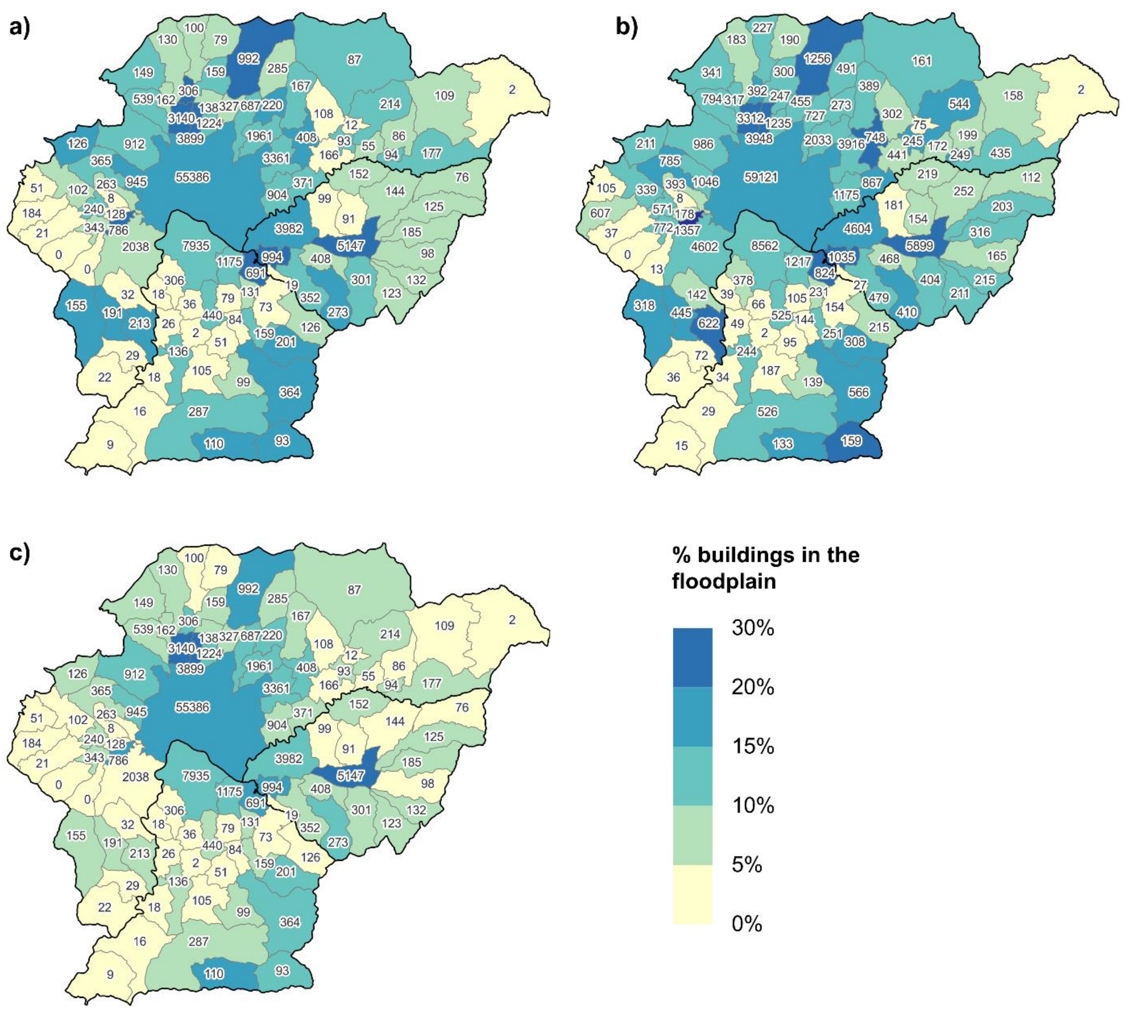

Figure 7. Spatial distribution of buildings in the 100-year floodplain for a) Scenario A, b) Scenario B, and c) Scenarios C and D. The numbers plotted inside each municipality correspond to the expected number of buildings in the floodplain.

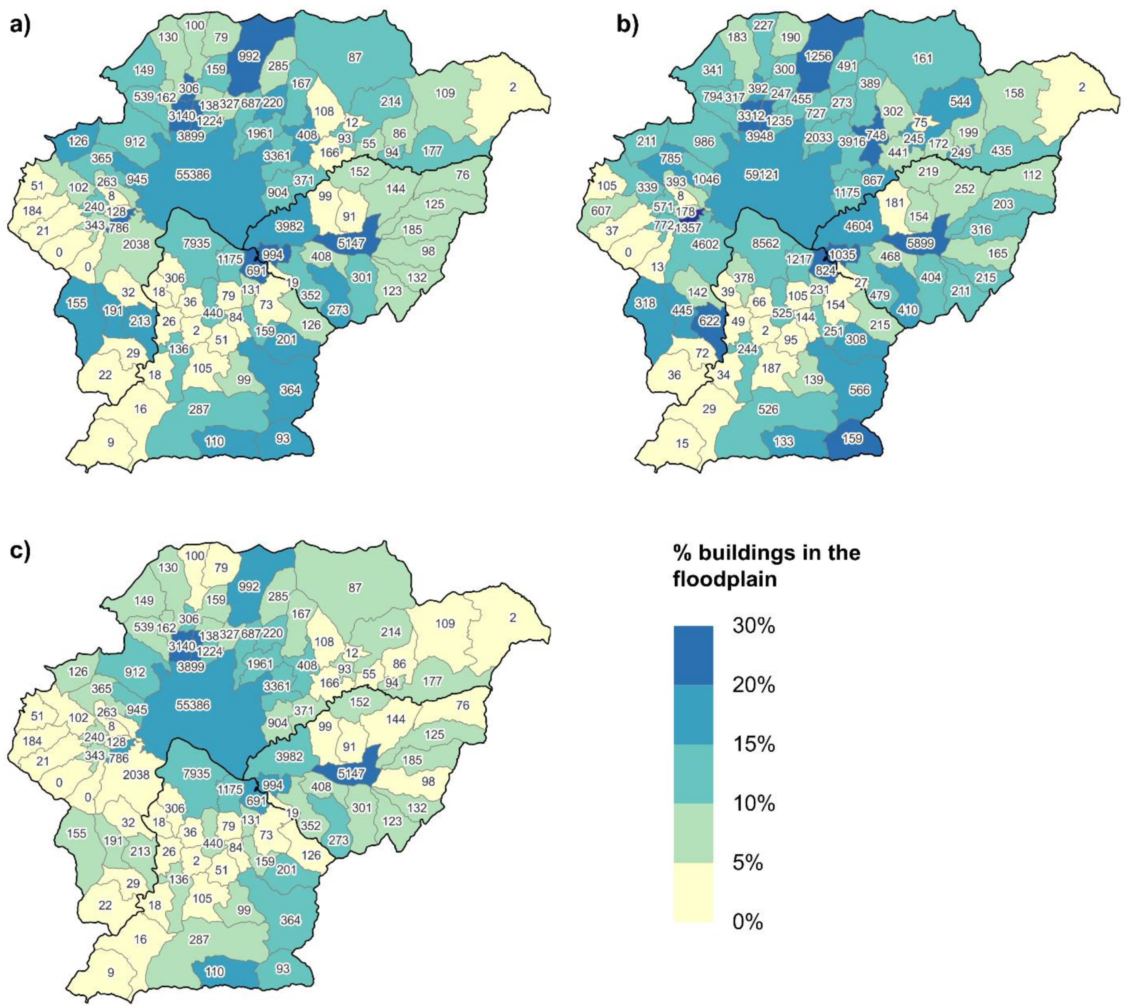

Figure 8. Spatial distribution of buildings in the 1000-year floodplain for a) Scenario A, b) Scenario B, and c) Scenarios C and D. The numbers plotted inside each municipality correspond to the expected number of buildings in the floodplain.

6. Table 3 shows relevant information. However, the authors have a very detailed amount of data that could be used to have a more complete table. Could the authors include the absolute values for the different districts? And income levels per district for example?

Thank you for pointing this out. We attempted to incorporate the absolute results disaggregated by districts and income into Table 3, as suggested. The results of this attempt are provided in the following table, which we believe contains too much information for one table. Most importantly, the purpose of Table 3 is to provide a general overview of the changes in flood risk for the entire Kathmandu Valley, which is in line with how we discuss the results in the main text (L406-L442). Therefore, we have decided to keep Table 3 in its current format.

However, we have added new Tables S2 and S3 to the Supplementary Material, where we provide the changes in mean absolute financial losses and mean loss ratios disaggregated by district and income level, respectively.

Table 3. Mean loss metrics for Scenario A, and absolute changes to these metrics in Scenario B, C, and D. The mean absolute financial losses are disaggregated by district and income level. **(this table is not included in the manuscript)**

Flooding occurrence	Metric	District/ income level	Scenario A	Scenario B	Scenario C	Scenario D
100-year	Mean absolute financial losses (€)	**Total**	**472,932,965**	**+ 74,654,044**	**-63,283,799**	**+ 52,691,045**
		Bhaktapur	62,253,439	+8,617,871	-6,306,202	+9,605,264
		Kathmandu	345,346,326	+57,348,232	-51,220,080	+32,270,581
		Lalitpur	65,333,200	+8,687,941	-5,757,517	+10,815,200
		Low income	38,592,710	+18,097,384	-6,774,800	+2,259,014
		Middle income	103,189,196	+23,146,134	-11,400,874	+14,191,417
		High income	331,151,059	+33,410,526	-45,108,125	+36,240,614
	Mean loss ratio	**Total**	**2.8%**	**-0.06%**	**-0.75%**	**-0.77%**
1000-year	Mean absolute financial losses (€)	**Total**	**774,793,163**	**+ 107,901,808**	**-66,393,767**	**+ 130,500,162**
		Bhaktapur	89,654,403	+12,377,766	-5,258,360	+18,393,467
		Kathmandu	576,162,142	+83,341,425	-56,444,738	+88,865,127
		Lalitpur	108,976,618	+12,182,617	-4,690,669	+23,241,568
		Low income	60,564,250	+25,800,358	-7,288,996	+7,639,070
		Middle income	162,179,628	+35,446,740	-11,381,018	+29,947,118
		High income	552,049,285	+46,654,710	-47,723,753	+92,913,974
	Mean loss ratio	**Total**	**4.5%**	**-0.17%**	**-1.0%**	**-1.1%**

Table S2. Mean loss metrics for Scenario A, and absolute changes to these metrics in Scenarios B, C, and D, disaggregated by district

Flooding occurrence	Metric	District	Scenario A	Scenario B	Scenario C	Scenario D
100-year	Mean absolute financial losses (€)	Bhaktapur	62,253,439	+8,617,871	-6,306,202	+9,605,264
		Kathmandu	345,346,326	+57,348,232	-51,220,080	+32,270,581
		Lalitpur	65,333,200	+8,687,941	-5,757,517	+10,815,200
	Mean loss ratio	Bhaktapur	3.5%	-0.09%	-0.81%	-0.84%
		Kathmandu	2.7%	-0.07%	-0.80%	-0.82%
		Lalitpur	2.4%	-0.02%	-0.49%	-0.52%
1000-year	Mean absolute financial losses (€)	Bhaktapur	89,654,403	+12,377,766	-5,258,360	+18,393,467
		Kathmandu	576,162,142	+83,341,425	-56,444,738	+88,865,127
		Lalitpur	108,976,618	+12,182,617	-4,690,669	+23,241,568
	Mean loss ratio	Bhaktapur	5.0%	-0.13%	-1.0%	-1.0%
		Kathmandu	4.6%	-0.20%	-1.1%	-1.2%
		Lalitpur	4.0%	-0.11%	-0.66%	-0.74%

Table S3. Mean loss metrics for Scenario A, and absolute changes to these metrics in Scenarios B, C, and D, disaggregated by income level

Flooding occurrence	Metric	Income level	Scenario A	Scenario B	Scenario C	Scenario D
100-year	Mean absolute financial losses (€)	Low	38,592,710	+18,097,384	-6,774,800	+2,259,014
		Middle	103,189,196	+23,146,134	-11,400,874	+14,191,417
		High	331,151,059	+33,410,526	-45,108,125	+36,240,614
	Mean loss ratio	Low	2.1%	+0.10%	-0.88%	-0.90%
		Middle	2.4%	-0.08%	-0.71%	-0.73%
		High	3.0%	-0.04%	-0.69%	-0.72%
1000-year	Mean absolute financial losses (€)	Low	60,564,250	+25,800,358	-7,288,996	+7,639,070
		Middle	162,179,628	+35,446,740	-11,381,018	+29,947,118
		High	552,049,285	+46,654,710	-47,723,753	+92,913,974
	Mean loss ratio	Low	3.3%	+0.06%	-1.3%	-1.3%
		Middle	3.7%	-0.14%	-1.0%	-1.0%
		High	5.0%	-0.15%	-0.94%	-1.0%

7. **Section 3 is in my opinion much more oriented to describing the results rather than a discussion of the obtained results. I believe the authors could benefit from adding a specific discussion section to go one step further and try to find the reasoning behind the obtained results. Furthermore, the authors could answer critical questions such as: what is the impact or correlation of the flood depth on the losses? Are there any thresholds that could be established based on the present results in terms of flood depth leading to specific losses? Why are high income levels suffering the highest losses? How are the flooding risk areas differing from other hazards such as earthquakes? Are there any solutions that would be beneficial to prevent simultaneously both hazards? Additionally, from figures 7 and 8 the authors could integrate an interesting discussion about measures planning, prioritizing high risk areas and highlight the benefits of taking action.**

Some of these questions were already addressed in various sections of the manuscript. For instance, in both the Results and Conclusions, we discuss the relationship between loss and income (L375-L381; L537-L539), the benefits of taking action (L420-L430), and the varying effects that risk-mitigation measures have for flood and earthquake hazards (L541-L550). Solutions that simultaneously prevent losses from floods and earthquakes are those that we propose in Scenario D (L218-L222). Moreover, it is the vulnerability functions themselves that correlate flood depth and loss, and provide information on threshold depths that lead to certain losses. We attempted to make broad municipality-level associations between mean water depth and mean loss ratios (or absolute losses); however, as the proportion of flooded buildings and building typologies vary per municipality, we could not find any interesting general trend.

L375-381: "From Figure 9 (panel b), we identify some variability in the mean loss ratios by income level. All scenarios produce the highest mean loss ratios for the high-income population, which reflects their disproportionate share of buildings in inundated areas (there are also minor differences in the prevalence of building typologies between income groups, but the three income groups are dominated by brick and concrete typologies). For instance, in Scenario A, the proportion of buildings in the floodplain is 15% in high-income municipalities, 11% in middle-income municipalities, and 12% in low-income municipalities. Proportions of buildings that experience flood depths below and above 2.0 m, respectively, are 81%-19% for high-income municipalities, 75%-25% for middle-income municipalities, and 84%-16% for low-income municipalities."

L537-L539: "Second, this study reveals that high-income populations are exposed to the highest mean loss ratios across both flooding-occurrence cases due to having the largest proportions of buildings in the floodplain."

L420-L430: "In contrast, the relative decrease in mean absolute financial losses for Scenario C shows that, despite a growing population, elevating existing buildings and implementing flood-hazard-informed land-use planning could significantly reduce flood losses in the future. However, it should be noted that risk-mitigation actions implemented in Scenario C would still leave the building stock highly vulnerable to earthquakes and thus do not completely address multi-hazard risk in the valley, which is left to Scenario D. The relative increase in mean absolute financial losses in Scenario D is associated with the larger replacement value of its building stock (due to the structural retrofitting and building code enforcement measures implemented), highlighting a tension between short-term (pre-hazard occurrence) costs and long-term benefits (i.e., after the occurrence of hazard events) associated with holistic DRR measures. In summary, Scenario D demonstrates that, despite a growing population, adequate DRR measures that aim to improve the building stock's quality (for better sustaining both flood and earthquake damage) as well as incentivize urbanization away from flood-sensitive areas can limit (but not reduce) flood losses in the future."

L541-550: "This discrepancy illustrates that risk-mitigation measures can have varying effects for different hazards; therefore, DRR plans should be appropriately tailored for a specific region or sub-region and account for multiple hazards. Kathmandu Valley's building stock is highly vulnerable to earthquakes due to the prevalence of URM buildings (particularly in low-income municipalities), such as adobe and brick/stone masonry. However, this feature of the building stock does not make it particularly susceptible to flood damage (except in the case of adobe houses, which are made of mud), which is why a multi-hazard approach to DRR that also considers earthquake vulnerability strengthening measures has little effect on the mean loss ratios (and even results in increased mean absolute financial losses) in this study. Instead, the flood risk is mainly controlled by the extent to which populations are located in the floodplain. Considering that hazard intensities vary spatially and that flooding and earthquake-induced ground shaking can affect different proportions of buildings in a given municipality, combinations of individual DRR measures should be investigated to find the optimal DRR solution for a given municipality."

L218-L222: "Scenario D incorporates DRR measures that account for the multi-hazard-prone nature of Kathmandu Valley and can reduce both flood and seismic risk effectively. This means that it still includes the Scenario D structural retrofitting policies and building code enforcement seismic risk-mitigation interventions introduced in Mesta et al. (2022a) (i.e., A, BSM, BSC building typologies are replaced by RM; the RC-CCP typology is converted to RC-WDS), in addition to the flood-related DRR measures proposed in Scenario C."

8. **I strongly recommend adding in the discussion a section about the limitations of the study. Along the manuscript many limitations and simplifications have been mentioned (e.g.: maps resolution, neglection of urbanization effects on flood hazards, basement consideration, random association of number of stories, component-level vulnerability information not available), please discuss the implications of all these aspects and the associated uncertainties for the findings of this study. What are the most impactful simplifications? The authors suggest addressing specific limitations in the future in the conclusions, but these statements need a previous proper discussion about the impact of these limitations on the accuracy and uncertainty of the results of the present work.**

We have addressed this comment by adding a new section "Discussion", where we comment on the main limitations of this study. This new section (L483-L527) reads as follows:

*"**4 Discussion***

The main results of this study provide a clear description of the current and potential near-future flood risk in Kathmandu Valley, suggesting that decision-makers of today have a unique opportunity to positively influence the risk of tomorrow, through their choices on implementing policies that control future risk drivers (e.g., Cremen et al., 2022b). However, we acknowledge that different sources of uncertainty and limitations of the data and methods used can influence the accuracy of the results obtained, which is now discussed.

In this study, we characterize the flood hazard using global maps with a coarse resolution (i.e., 90 m), which may not capture the highly localized nature of flood hazard (e.g., associated with small streams). While finer-resolution hazard maps (e.g., 10 m or lower) are generally preferred for conducting urban flood risk assessments, the spatial resolution of the hazard model must also be consistent with the resolution of the exposure model used. We characterize exposure in the valley using urban maps with a spatial resolution of 30 m; therefore, our analyses would not benefit from hazard maps with finer resolutions. In addition, some authors (e.g., Fatdillah et al., 2022; Zhang, 2020) report that using finer-resolution digital elevation models (DEM), which would be needed to produce finer-resolution flood hazard maps, can result in larger simulated flooded areas and losses compared to coarser-resolution DEM; however, other authors (e.g., McClean et al., 2020) suggest the opposite, indicating that flood risk *may be exaggerated using flood maps based on global coarse DEM. These ambivalent findings suggest that the advantages of using finer-resolution flood maps for regional flood risk assessments in fact require careful evaluation for each specific context. Another limitation of the flood maps employed in this study is that they do not capture the effects of urbanization on flood hazard (i.e., the replacement of natural ground with impermeable surfaces, changes to drainage or irrigation systems, and deforestation can increase runoff during precipitation events). The use of physic-based flood simulations that include future urban footprints would address this issue (e.g., Jenkins et al., 2022), but may entail a high computational cost.*

Uncertainties and limitations associated with the exposure and vulnerability models also affect the loss outputs. Due to the absence of a reliable database for Kathmandu Valley containing exact building footprints (and relevant attributes such as building typology and height), we construct our exposure model by downscaling data collected from census and surveys (mainly at the municipality level) into the built-up areas of the valley (i.e., dasymetric mapping). While exposure disaggregation techniques are widely used in regional risk assessments (e.g., Geiß et al., 2022; Dabbeek et al., 2020), it is recommended to use original exposure models that are refined from the outset, since the accuracy of damage and loss estimates are highly sensitive to that of the exposure. The accuracy of the exposure model may be of heightened importance for flood loss assessments, given the potentially significant localized variability of flood hazard (i.e., flood depths can abruptly change even between closely-spaced locations). Moreover, the loss accuracy strongly depends on the quality of the vulnerability curves. In this study, we modify existing continental-based vulnerability curves to include relevant characteristics of the local building stock in Kathmandu Valley (e.g., building typology and height). However, it is difficult to ascertain how much (if any) uncertainty and/or accuracy is effectively improved with these modifications.

The design and implementation of risk-mitigation strategies also face several challenges. For instance, policies that restrict future urbanization within floodplains rely on the accuracy of spatial designations made within flood maps. While flood maps provide a good basis for floodplain management, regulation, and mitigation- e.g., in the USA, 100-year flood maps are used to identify Special Flood Hazard Areas where the National Flood Insurance Program's floodplain management regulations must be enforced (Ludy and Kondolf, 2012; Federal Emergency Management Agency (FEMA), 2010)- it is essential to acknowledge that different sources of uncertainty (e.g., climate change impacts, uncertainty in the hydrological/hydraulic models, etc.) can affect floodplain delineation (Zahmatkesh et al., 2021). Consequently, populations outside the designated floodplains may still be at risk of flooding and should be made aware of this.

A comprehensive sensitivity analysis could be conducted to investigate the impact of the aforementioned limitations on the results (e.g., Bernhofen et al., 2022). However, since the main focus of this study is to investigate relative risk changes across different sets of actions, for instance, for prioritizing DRR investments under a limited budget, the exact values of absolute losses are not of particular interest or relevance."

References:

1. *Bernhofen, M.; Cooper, S.; Trigg, M.; Mdee, A.; Carr, A.; Bhave, A.; Solano-Correa, Y.; Pencue-Fierro, E.; Teferi, E.; Haile, A.; Yusop, Z.; Alias, N.; Sa'adi, Z.; Bin Ramzan, M.; Dhanya, C.; Shukla, P. The Role of Global Data Sets for Riverine Flood Risk Management at National Scales. Water Resources Research, 2022.*
2. *Cremen, G., Galasso, C., and McCloskey, J.: Modelling and Quantifying Tomorrow's Risks from Natural Hazards, Sci. Total Environ., 2022b.*
3. *Dabbeek, J., Silva, V., Galasso, C., and Smith, A.: Probabilistic earthquake and flood loss assessment in the Middle East, Int. J. Disaster Risk Reduct., 49, 101662, 2020.*

4. *Fatdillah, E., Rehan, B., Rameshwaran, P., Bell, V., Zulkafli, Z., Yusuf, B., Sayers, P. Estimates of Flood Damage and Risk Are Influenced by the Underpinning DEM Resolution: A Case Study in Kuala Lumpur, Malaysia. Water, 14, 2208, 2022.*
5. *Federal Emergency Management Agency (FEMA): Special Flood Hazard Area (SFHA). Available at https://www.fema.gov/glossary/special-flood-hazard-area-sfha, last access: 27 November 2022.*
6. *Geiß, C., Priesmeier, P., Aravena Pelizari, P., Soto Calderon, A. R., Schoepfer, E., Riedlinger, T., Villar Vega, M., Santa María, H., Gómez Zapata, J. C., Pittore, M., So, E., Fekete, A., and Taubenböck, H.: Benefits of global earth observation missions for disaggregation of exposure data and earthquake loss modeling: evidence from Santiago de Chile, Nat. Hazards, 2022.*
7. *Jenkins, L; Creed, M., Tarbali, K., Muthusamy, M.; Šakić, R.; Phillips, J.; Watson, S.; Sinclair, H.; Galasso, C.; McCloskey, J. Physics-based simulations of multiple natural hazards for risk-sensitive planning and decision making in expanding urban regions. International Journal of Disaster Risk Reduction, 103338, 2022.*
8. *Ludy, K, Kondolf, G.M.: Flood risk perception in lands "protected" by 100-year levees. Nat. Hazards 61, 829–842, 2012.*
9. *McClean, F., Dawson, R., & Kilsby, C. Implications of using global digital elevation models for flood risk analysis in cities. Water Resources Research, 56, e2020WR028241, 2020.*
10. *Zahmatkesh Z., Han, S., Coulibaly, P.: Understanding Uncertainty in Probabilistic Floodplain Mapping in the Time of Climate Change. Water 13, 1248, 2021.*
11. *Zhang, Y. Using LiDAR-DEM based rapid flood inundation modelling framework to map floodplain inundation extent and depth. Journal of Geographical Sciences, 30, 1649-1663, 2021.*

Minor comments

9. Figure 1. Please include the river network.

We have updated Figure 2 by adding the river network and an inset overview map.

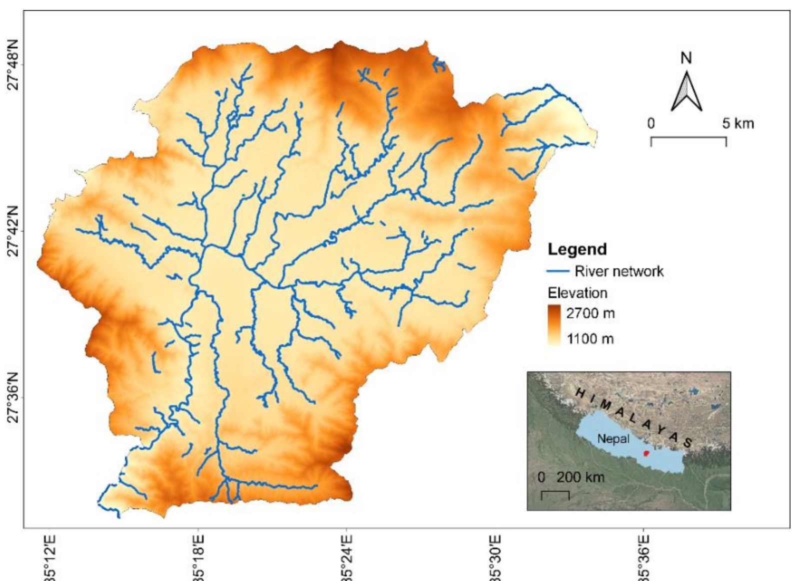

Figure 2. Physical map of Kathmandu Valley

10. LL 123-124: I believe LL 120-123 (till "van de Lindt, 2021") are connected to the justification of the scope of the work (LL124-127 from "However, the primary purpose"). Thus, I would recommend the authors to move the sentence in between about urbanization effects on flood hazard to the end of this paragraph. Please also clarify the concept of "urbanization effects on flood hazard".

Thank you for pointing this out. We place the sentence "However, the primary purpose of this study is to test different exposure/vulnerability scenarios using a common flood hazard input that is open and easily accessible; developing bespoke fine-resolution flood hazard models for the study area is not within the scope of this work." at the end of the paragraph because the two previous sentences describe two different limitations of our hazard model. Therefore, we have kept the sentence in question in its current position (L136-L139).

*Note that the effects of urbanization on flood hazard are described in the Introduction (L44-L48). We have made modifications (marked in **bold**) to the sentence in question (L134-L136) to also clarify it there:*

*L134-L136: "In addition, urbanization effects on flood hazard **(i.e., the replacement of natural ground with impermeable surfaces, changes to drainage or irrigation systems, and deforestation can increase runoff during precipitation events)** are not explicitly accounted for by the Fathom-Global model and are therefore neglected in our analyses."*

L44-L48: "Specifically, rapid urbanization – which is expected to mainly feature across cities in Asia and Africa over the next few decades (United Nations, 2019a) – could increase flood exposure and vulnerability (e.g., Hemmati et al., 2020) and intensify flood hazard (by increasing runoff during precipitation events, due to the replacement of natural ground with impermeable surfaces, changes to drainage or irrigation systems, and deforestation, for instance), if not correctly managed."

11. L130: Please add a reference for the sentence in brackets.

We have added references to the sentence in question (L142-L143):

"Decision makers frequently use this type of map (e.g., to identify flood risk zones in the United States) (Ludy and Kondolf, 2012; Federal Emergency Management Agency (FEMA), 2010)."

References:

1. *Ludy, K, Kondolf, G.M.: Flood risk perception in lands "protected" by 100-year levees. Nat. Hazards 61, 829–842, 2012.*
2. *Federal Emergency Management Agency (FEMA): Special Flood Hazard Area (SFHA). Available at https://www.fema.gov/glossary/special-flood-hazard-area-sfha, last access: 27 November 2022.*

12. L133 Please specify what the neighbor method and add some references.

We have added the term "nearest" next to "neighbor method" since we had omitted it by mistake. We have also added a reference, as requested (L145):

*"The flood maps are resampled to 30 m using the **nearest** neighbor method to match the spatial resolution of the exposure maps (Díaz-Pacheco et al., 2018)."*

References:

1. *Díaz-Pacheco, J., van Delden, H., and Hewitt, R.: The Importance of Scale in Land Use Models: Experiments in Data Conversion, Data Resampling, Resolution and Neighborhood Extent, in: Geomatic Approaches for Modeling Land Change Scenarios, edited by: Camacho Olmedo, M. T., Paegelow, M., Mas, J.-F., and Escobar, F., Springer International Publishing, 163–186, 2018.*

13. L135 I suggest to provide some information about the method of Tate et al. (2021).

*Thank you for your suggestion, which we have implemented. We have made modifications (marked in **bold**) to the sentence in question (L147-L148) :*

*"We combine individual flood maps into aggregated hazard maps that represent fluvial-pluvial flooding for each mean return period by taking their maximum depths in line with the method of **Tate et al. (2021), who mosaiced fluvial and pluvial flood grids to generate an aggregated flood hazard map for the United States.**"*

References:

1. *Tate, E., Rahman, M. A., Emrich, C. T., and Sampson, C. C.: Flood exposure and social vulnerability in the United States, Nat. Hazards, 106, 435–457, 2021.*

***14.* Figure 2. Are these maps computed by the authors or were they directly obtained from any other sources? If they were obtained from Fathom-Global please add the url and references**

The authors obtained the individual pluvial and fluvial flood maps through a direct request to Fathom-Global. However, the flood hazard maps are available online from the METEOR project (available at https://maps.meteor-project.org/map/flood-npl/, last accessed December 2022). We have added the requested URL to the caption of Figure 2, as well as in sections "2.2 Hazard modeling" (L150) and "Data availability" (L574).

15. LL255-257: The authors try to give some context to the selection of the 2 m threshold. Please clarify this in advance (in the introduction or methods) and give some references that justify this selection.

We decided to use the 2 m threshold simply because this flood depth produces critical mean loss ratios of around 50% (between 43% and 72%) for buildings with 1 or 2 stories, which together comprise the majority (51%) of buildings in Kathmandu Valley. However, note that more detailed related information that considers six ranges of flood depth is provided in Figure 6 and Table 2.

The sentence in question (L314-L316) reads as follows:

"To provide some context, a 2.0 m flood depth produces mean loss ratios between 43% and 72% for non-elevated buildings with one or two stories and between 17% and 29% for non-elevated buildings with three, four, and five stories. (…)"

16. L264 Please remove the specific rows in brackets, this information is not needed since we do not have any numbering for the rows.

We have removed the rows in brackets.

17. Page 15 and in general: Some abbreviations seem very repetitive (e.g.: VDC). I suggest the authors make an effort to merge ideas and avoid the use of overwhelming abbreviations.

To address this comment, we have replaced the term "VDC" with "municipality" across the manuscript.

As suggested by another reviewer, we have also added Table S1 to the Supplementary Material, which contains a list of the acronyms used in the study.

18. Figures 2,4,5,7,8 could benefit from including a short title describing each of the plots. For example in Figure 2, a) 100-year mean return period, b) 1000-year mean return period.

For the figures in question, it is important to note that the captions already provide a short contextual description at the start that refers to both subplots. For instance, in the caption "Figure 4. Fluvial-pluvial flood maps for a) 100-year mean return period; and b) 1000-year mean return period flooding occurrences", the description "Fluvial-pluvial flood maps for" applies to both subplots a) and b). Thus, we do not believe that additional descriptions are necessary.