Comment	Category / paper section	Author's reply	Response / action taken
the multi-hazard analysis is performed using a frequentist approach based on the results of “single hazards” procedure. This may affect the results and it should be declared at the very beginning, outlining very clearly which is the procedure that will be followed. For instance, the workflow depicted at the beginning does not represent the entire procedure, so the reader cannot understand the aim of the list of each single hazard.	Introduction; Methodology, p. 4/5	Yes, good point.	We inserted a paragraph at the end of the Introduction chapter and added an additional explanation at the beginning of Chapter 3 describing Figure 2.
Results should be presented in a consistent manner, and for instance showing close up of the areas most affected by a specific hazard.	Figure 7 and Results, p. 26	We improved the result chapter and revised Figure 7 adding zoomed-in insert maps showing floodprone areas with settlements.	The Results section has been revised to improve consistency in the presentation of results across hazards, using comparable metrics and layouts. In addition, the areas most affected by each hazard are highlighted and discussed to improve the interpretability of the spatial patterns.
The Authors assess the risk associated with each hazard and then write about the socio-economic vulnerability. The risk is estimated using the vulnerability of the population and the buildings to each hazard. Therefore, it seems a bit out of context to talk again about vulnerability. Maybe the Authors refer to the fact that those socio-economic vulnerabilities exacerbate the impact of those hazards. I’d kindly suggest rephrasing and to re-think about the way in which results are presented.	General	Yes, we corrected this clearly differentiating between physical and social vulnerability .	We updated the headings in each single-hazard risk analysis section for clarity. The term 'Vulnerability' is used when addressing both physical and socio-economic factors. When discussed individually, they are labeled as 'Physical Vulnerability' or 'Socio-Economic Vulnerability.
The number of figures presented is too high and some of them are not crucial, I’d suggest replacing them with sentences.	General	We removed three figures.	We removed three figures as suggested by the reviewer.
I’d kindly suggest to provide the readers information on the broad perspective of the paper and its final aim for scholars but also for stakeholders.	Abstract, Introduction	We added a paragraphs in	Abstract and Introduction has been revised to better articulate the broader perspective and final aims of the paper, highlighting its relevance both for scholars and for stakeholders involved in disaster risk reduction and planning.
Figure 3: there are many figures in the paper, so I kindly suggest choosing only those that are informative, while the others may be represented by text. In this case, the two figures present two different information, however, the area is very large and the data is jeopardized, I wonder whether it would be better to use only one figure and to synthetize the data in sentences without using the figures.	p. 10	We removed this figure.	Figure 3 was removed as suggested by the reviewer.
In Figure 4 you present the commune-scale building taxonomies distribution maps of Bujumbura Marie and Cibitoke, however, you are interested in a larger scale analysis, so there is a difference in scale between this figure and the actual data you’ll use. I kindly suggest reporting the data in a couple of sentences without using the Figure.	p. 10	We removed this figure.	Removed figure 4 as suggested by the reviewer
p.12, there is a reference reporting an error “(Figure 5Error! Reference source not found.)	p. 12	We corrected this.	Removed the Error (now on page 11)
Figure 6 is of poor quality and layout, I kindly encourage you to provide the law of the equations, without the need of reporting the plots. You have already many figures.	p. 13	We removed this figure.	Removed figure 6 and described the equation with text.
p.14, the “Risk analysis” subsection header is without numbering. It reports information not clearly. Indeed, it is not clear the workflow to assess the risk, and it is not clear how this section is linked to the previous whereby the hazard is estimated	p. 16	We corrected this.	Added a third level of heading in each hazard analysis.

p.15 “Information on 64 flood events that occurred between 2000 and 2020 was collected and analysed, collected from international databases from European Commission, Flood List, Darmouth Flood Observatory, International Committee of Red Cross, Global Flood Modelling and Earth Engine” can you please provide the website whereby you accessed the information and date of access?	p. 14	The information regarding these events were actually obtained from the Floodlist and EM-DAT databases/platforms, providing general data regarding the dates and location of the flood events and impacts recorded, although no details regarding the rainfall, flood height observed or flood layer extent. Thus, within the context of the assessment made, the information only served for identifying approximate floodprone areas along the reported watercourses referred in the historical flood records.	We revised the manuscript accordingly.
Figure 7: from the results it seems that only some areas are flood prone and also they are vulnerable because of the presence of people. I’d kindly suggest making a close up on those areas only and do not show the entire area	Figure 4, p. 15	We inserted a revised figure showing zoomed in insert maps	Figure 7 has been revised to include close-up views of the flood-prone areas, using inset maps that also show the spatial distribution of settlements.
p. 16: “The elaboration of the hydrological precipitation-runoff model was carried out using the Hec-HMS software developed at the Hydrologic Engineering Centre (HEC) of the US Army Corps of Engineers.” Which is the input you used and how did you calibrate the model? Did you prepare one model only for the entire area or did you subdivide the rivers? Please provide more information on this procedure.	p. 15	The hydrological precipitation-runoff model was developed for five local so-called floodprone “hotspot areas”, which had previously been selected for the calculation of the recurrent flood risk focused on building damage and number of population affected in accordance with the calculated recurrent flood footprints. These hotspot flood-areas were distributed across the country, including two located within the Bujumbura urban footprint: Kanyosha District and the Gasenyi River Area, and three provincial capital/rural areas: Rugombo City (Cibitoke), Giheta City (Gitega) and Bukemba City (Rutana). The assessment was done on individual catchment scale. The selection of the hotspot areas was based both on the reported urban flood-prone areas, and the indication of Government representatives in the cases of rural areas. The climate model expert (Meteosim) calculated IDF curves (Intensity-Duration-Frequency) curves for the five targeted catchments based on the 3 km resolution national precipitation map produced as a result of the comprehensive climate downscaling process completed as part of the hazard assessment process. Climate change projection precipitation maps were also developed for additional CC scenarios. Peak discharges at the flood model entrance points were estimated based on these IDF curves in combination with other parameters required for hydrological water basin runoff modelling through HEC-RAS, in particular: catchment definition, concentration time, projected runoff across the catchments and curve number. The peak discharges were projected for T2, T10, T50, T100 and T500 return periods. These peak discharges were subsequently used to calculate the projected flood footprints across the river stretches downgradient of the indicated flood area entrance points. Given the limited data context of Burundi, the actual calibration of the models was hard to verify. It was roughly done by comparison with the compiled historic flood reference previously gathered, and, particularly within the Bujumbura hotspots, by validation from the local experts who could confirm the rough agreement of the lowest return-period flood events along the two low catchment areas modelled through IBER.	We inserted a short paragraph in the manuscript.
p.17: “The hydrological model was employed to estimate the recurrent precipitation for five selected catchment basins, for which IDF curves for each considered return period were developed” can you please provide more details on the data used to estimate the IDFs?	p. 16	The Intensity-Duration-Frequency (IDF) curves were generated from the developed 3 km resolution nationwide scale precipitation rate projections (current and projected CC scenarios). The analysis of frequency and intensity of torrential rains has been assessed through the calculation of Intensity-Duration-Frequency (IDF) curves, which relates the recurrency of a certain type of event (frequency), defined by a certain intensity and duration. The selection of extreme events intensity has been implemented using Peak-Over-Threshold (POT) method which considers all measurements above a chosen threshold. The 99th percentile of the data series has been selected as threshold in this case. The selected exceedances over the selected threshold are fit to a Generalized Pareto distribution (GPD). Results provided using this approach were for three return periods (2, 10 and 50 years) and for durations of 10 minutes and 3 hours both at province and livelihood area level. In order to develop the specific IDC curves for each selected hotspot catchment area, the following process was followed: •The average of the cells that fell within the defined area (Catchment area) were considered, and •When the area was so small that it didn't encompass any grid points, the nearest one was used. Regarding the origin of the data collected for precipitation, there are two main sources: 1.Observation data, for the historical period (IGEBU) and International databases like IMERG database (NASA) 2.Climate downscaled data (WRF simulation forced with GCM's) for the future projections.	We inserted two sentences in the manuscript shortly describing how the IDF curves were generated.

p.17: the procedure explained here refer to the assessment of the hazard related to the flood events and not to the risk that is estimated by multiplying the hazard by the exposure by the vulnerability.	p.17	The actual risk assessment, as addressed here starts by overlapping the flood footprint (for each return period) with the exposure maps, buildings and population, and combining with the vulnerability curves, for buildings, or probabilistic impact relationships for population.	We inserted a sentence describing the risk analysis in the manuscript.
p.18: “by (Nibigira et al., 2013) including a subset of landslide information published by (Broeckx et al., 2018)” please note that in case of citation in the text, you should write “by Nibigira et al. (2013)…. by Broeckx et al. (2018)”	p.17	We corrected this.	Corrected.
p.19: “Figure 9Error! Reference source not found.” Please check the reference source	p.18	We corrected this.	We removed the error.
p.19: can you provide a reference source for the Poisson process model used? Please consider adding more information on the data and the uncertainty	p. 19	Yes.	We added three references supporting the use of Poisson process models for landslide occurrence. In addition, we have expanded the methodological description to provide further information on the data used to define the landslide occurrence rate and to explicitly discuss the main sources of uncertainty associated with the modelling assumptions and the stochastic event generation process.
p.20: “Furthermore, it was necessary to characterise the distribution of event intensity, which in the case of shallow landslides can be …. The determination of the appropriate scaling law would require a more consistent dataset. However, it was deemed that a fixed 425 power exponent of -2.3 was a plausible estimate. This is for instance the mean value (std dev:0.56) of a set of 27 global inventories including events triggered by rainfall, snowmelt and earthquakes described by (Van Den Eeckhaut et al., 2007) (see also Tebbens, 2020). A minimum event size of 100 m² has been chosen to exclude small events within the roll-over of the distribution.” Can you please provide more information on the law you are using and the suitability to the case study analysed and how did you estimate the parameters?	p. 19	Yes.	We expanded Section 6.3 (Landslides) to explicitly define the landslide size–frequency law (including the equation), clarify why a power-law form is used, and justify the parameter choices for Burundi. We added supporting references (e.g., Malamud et al., 2004; Stark & Hovius, 2001; Van Den Eeckhaut et al., 2007) and explained the rationale for adopting $\alpha = -2.3$ as a pragmatic central estimate under data scarcity, as well as the use of a minimum area threshold (100 m²) to avoid the rollover region. We also explicitly note this as a simplifying assumption and a source of epistemic uncertainty. We added relevant literature references.
Figure 11: despite this information is interesting, it would be helpful to have it for the areas whereby the analysis has been performed, since some hazards are analysed at the local scale. As it is, the information on the social vulnerability is not linked to the rest of the analyses. See also comment at the beginning of the review.	p. 32	We added an explanation.	Included the following text in the limitations section of the discussion: *The DTM-DRR survey, which provided the underlying data for the colline-resolution analysis, was conducted before the initiation of the presented study and collected data based on over 100 questions relating for the 532 randomly-selected collines. Therefore, the collines analysed in the SEVA do not align with the hotspots in this study, a reason for which the SEVA is not integrated into the overall risk analysis.*
Pag. 29: “multi-hazard map”, can you please clarify whether you are talking about hazard or risk? It may be confusing, since in the following sentence you write “This representation indicates several potential risk hotspots”, thus talking about risk and not hazard	Page 29	Good point. We corrected this.	We clarified terminology in Section 8.1 and the Discussion to consistently distinguish hazard from risk. Specifically, we refer to Fig. 12 as a multi-hazard hazard-overlap (intensity/susceptibility) map and replaced ‘risk hotspots’ with ‘hazard hotspots’. We added an explicit sentence noting that Fig. 12 is based on hazard intensity/susceptibility exceedance only and does not include exposure/vulnerability or frequency–magnitude relationships; AAL-based results (e.g., Fig. 13) are used to describe risk. In Section 6.2 we clarified that ‘hotspots’ refers to selected flood modelling study areas and replaced ‘risk hotspots’ with ‘hotspot study areas/case studies’ to avoid confusion with the hazard-overlap map and AAL-based risk hotspots elsewhere.