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Title: Regional-scale analysis of high-mountain multi-hazard and risk in the Pamir (Tajikistan) with GRASS GIS

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REVIEW

General Comments:

The reviewed discussion paper addresses a relevant topic in relation to natural hazard assessment, that is the combination of individual hazards/risks in a multihazard –risk assessment. This is a fundamental issue that has to be addressed in the field of geohazards. This goal is particularly relevant and challenging for high mountain areas in developing countries, which have proved to be particularly prone and vulnerable to slope instability, especially in the context of climate change, and where there's a general lack of good quality base data.

The overall presentation is well structured and clear, the method and the assumptions are very well outlined, even if the proposed methodology is quite complex, and suppose a certain familiarity with the considered processes: a wide selection of references allows anyway to fill eventual knowledge gaps of the reader. The title and the abstract are appropriate to the content of the paper.

Even if the final results are not so satisfactory, as pointed out and discussed by the authors, the proposed methodology is scientifically rigorous, takes into account all the available knowledge on the studied processes gained by the scientific community in the last decades in different parts of the worlds, is based on a well sound knowledge of the area by the authors, and of the GIS tools which are used. That is to say that is the most rigorous approach which could be applied to the problem. The authors give proper credit to previous and related works, and indicate clearly their own contribution.

The proposed methodology is mainly based on a combination of previously developed GIS routines, but its novelty is represented by the way this GIS modules have been combined and adapted to obtain a multi-hazard –risk assessment procedure.

The main remark that I'd like to make to the authors is that the figures are numerous and very dense (both the ones accounting for the logical framework of the different models, and the ones illustrating the outcomes). I understand that there's a lot of information that the authors would like to give to the reader to illustrate methods and outcomes of their work: nevertheless, I think that the figures contain too much information in comparison to their size. The authors probably need to make a choice among the figures, and enlarge the chosen ones.

Technical corrections:

1693-1 Figure 2 shouldn't be cited before Fig. 1: either cite it later, or exchange numbering with Fig. 1.

1693-9: “7495 m” change to “7495 m a.s.l.”

1693-18: Is the Fedchenko Glacier in northern Pamir? Please specify

1693-20: “Intense tectonic uplift in combination with glacial and fluviatile erosion (Mahmood et al., 2008) has resulted in a particularly pronounced relief” change to “Intense tectonic uplift, in combination with glacial and fluviatile erosion (Mahmood et al., 2008), has resulted in a particularly pronounced relief”

1693-25: “the 1911 Sarez rock slide” in the figure’s caption the date indicated is 2011

1694-10: “Consequently, many glaciers are retreating”: present glacier retreat cannot be related to future scenarios, to which the previous sentence was pointing. Please adjust the sentence.

1695-1: please specify why did you resample this datum.

1695-23: “Fig. 3c” change to “Fog. 3d”: the content of fig. 3d is different from what explained in the text, pay attention

1695-26: “Fig. 3c” change to “Fog. 3d”: the content of fig. 3d is different from what explained in the text, pay attention

1695-28: “The exposure of the communities in the study areas to high-mountain hazards (see Fig. 3d)”: it doesn’t seem to me that this is the content of figure 3d, please check to which figure did you mean to refer.

1696-2: in table 2 you also introduce the IH index, that you don’t account for in the text and neither in the table’s caption

1697-1: you should decide if to introduce table 2 here or in the previous section (see the previous comment)

1700-24: the symbol “R” has been already used for “Risk”: a different symbol should rather be used for “runup”

1703-9: “< 800 m³propagating” change to “< 800 m³ propagating”

1705-15: “The outburst volume is set to the entire lake volume, lake area Al multiplied with lake depth Dl)” change to “The outburst volume is set to the entire lake volume (lake area Al multiplied with lake depth Dl)”

1708-10: “lakes” change to “lake”

1709-3: “> 800×106 m3” isn’t this value too big? Is it realistic?

1709-12: “debris flows with travel distances > 15 km and floods > 80 km” change to “debris flows with travel distances > 15 km and floods with travel distances > 80 km”

1714-17: “differs” change to “differences”

Table 2: you should explain in the table's caption or in the text what IH is, as you introduce this topic only later in text

Figure 1: please specify in the caption what the yellow circles and square refer to

Figure 2: the red rectangle should become more evident

Figure 3b: the difference in color of the 3 classes is not so clear, given the small size of the figure

Figure 4: please check the upper part of the figure, the format doesn't look right

Figure 7: the regression and envelop curves cannot be distinguished in the figure