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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Local land-use change based risk estimation for future glacier lake outburst flood" *by* S. Nussbaumer et al.

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Interactive comment on "Local land-use change based risk estimation for future glacier lake outburst flood" by S. Nussbaumer et al.

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Reviewer: General observations: The authors present an interesting approach to estimate the risk of possible future GLOFs. They demonstrate this methodology using the example of the Aletschgletscher and the community of Naters in Switzerland. In my opinion the manuscript is definitely interesting for the audience of NHESS and therefore worth to be published. The manuscript is well structured, the quality of the figures

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and tables is fine and their number is appropriate. I have one major and a few minor comments to be addressed before the paper can finally be published in NHESS.

My only major concern regards the combination of the different indicators e.g., the losses (page 4359, line 24) or the vulnerabilities (page 4361, line 7). Arithmetic operations such as building the mean are not allowed on ordinal-scale variables. I am aware that examples of such operations are frequently found in the literature but, strictly spoken, they make no sense. I would rather suggest employing a two-dimensional matrix to combine the values or simply to use the maximum. The same problem applies to the risk (page 4361, line 10). Multiplications on ordinal indicator variables are not a valid approach. Here I strongly recommend using a matrix approach (see e.g., Mergili and Schneider 2011, Gruber and Mergili 2013). Mergili, M., Schneider, J.F. (2011): Regional-scale analysis of lake outburst hazards in the southwestern Pamir, Tajikistan, based on remote sensing and GIS. Natural Hazards and Earth System Sciences 11: 1447-1462. Gruber, F.E., Mergili, M. (2013): Regional-scale analysis of high-mountain multi-hazard and risk in the Pamir (Tajikistan) with GRASS GIS. Natural Hazards and Earth System Sciences Discussions 1: 1689-1747.

Author response: We fully agree with this comment and analyzed how it can be best implemented. Our objective was to achieve the highest possible consistency in all dimensions, i.e. vulnerability, loss, damage potential and risk. We eventually come up with four matrices, one for loss (persons and objects), one for vulnerability (physical and social), one for damage potential (loss and vulnerability) and one for risk (damage potential and hazard potential, indicated by intensity). We have four categories in each dimension (axis of the matrix), ranging from low to very high, except for the hazard potential, which we defined according to the two intensity classes medium and high. As with other approaches we face the question how to define the levels in the matrix. For instance, damage potential results from a matrix integrating vulnerability and loss. Like vulnerability and loss, damage potential has four categories from low to very high which need to be defined based on a 4x4 matrix. The definition of the categories,

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or the distribution of the damage potential categories in this 4x4 matrix, is to some degree subjective. We have therefore evaluated different options, considering that the definition has an effect on the results of damage potential and risk map. We also should stress that this definition is not only a matter of science but also one of policy and society. We therefore decided to present two final risk maps, based on two different risk (vulnerability-loss-damage potential) matrices. We think that this approach enhances transparency and is thus an important improvement. We appreciate the reviewer's indication of this important aspect. In the manuscript this revision affects the text in the chapter 3.3, the Fig. 6 and Table 5. We also added a corresponding discussion to the manuscript.

-Further general comment: Grammar and style are fine, but anyway I recommend going through the manuscript carefully once more as there are some minor deficiencies which cannot all be addressed here.

Yes, of course we check the whole document again.

-In particular, I have the feeling that much of the manuscript should be written in present rather than in past tense. However, this may be a personal preference of myself, please only change it if you wish to do so.

We were discussing that issue and prefer to use past tense in the chapter methodology and results, because it is more common practice in scientific writing.

-Further specific comments (page, line): 4350, 10: Better write "hazard" instead of "hazard potential" as the hazard itself is a potential.

To our understanding, "hazard" is a more general definition: "Condition, circumstance or event from which a harm to people, the environment and / or property may occur". Whereas we understand hazard potential as "hazards in the current examination perimeter". Therefore we would like to stay with hazard potential.

-4350, 18: Replace " a time period of 2045" by "the year 2045".

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Ok, we replaced it.

-4351, 20/21: "estimate“, "estimation“: word repetition.

We replaced estimate by evaluate.

-4353, 19: "These data were available : : :“.

Ok, we replaced it.

-4355, 24: Remove "in“.

Ok, we removed it.

-4356, 8/9: "The 24yr step was chosen to allow for an overall rate of change and to avoid further uncertainties“. I do not understand what is meant here, please clarify.

We clarified that sentence.

-4357, 18: You should explain in more detail what a change from “settlements” to “settlements” means.

We explained that shortly.

-4359, 3: Please shortly mention the flood routing model used.

Ok, we added some explanatory text to this section. Basically, we used the Modified Singe Flow Model which is a GIS-based model that distributes flow and mass movements downstream according to geometric and topographic criteria (Huggel et al., 2003). The model allows us to assess areas that are potentially affected by a GLOF event.

-4360, 27: Did you do some weighting for computing the average? 0.7 is not the average from 0.45, 0.95 and 1.

Sorry for that. It’s a typing mistake. It has been replaced by the right numbers.

-4361, 19: Maybe better: "In reference to this information : : :“.

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Ok, we replaced it.

-4362, 10/11: "driving forces“: word repetition.

We changed that.

-4367, 10: "due to more limited relevance of such an approach“. Maybe you could more clearly express what you mean with this.

Ok, we clearified it.

-4367, 15: I’m not sure whether you can "run“ a scenario, rather you can run a model based on a scenario.

This is correct, and we changed the text accordingly.

-4368, 3: "mainly by“ would be better instead of "by mainly“.

Ok, we replaced it.

-4368, 15: "are considered“ would be correct instead of "is considered“.

Ok, we replaced it.

-I hope that my comments will help to further improve the manuscript. If you have any questions, wish further discussion or disagree with one or more of my comments, please do not hesitate to contact me.

We highly appreciate the constructive way of this review of Martin Mergili, and the helpful comments.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 4349, 2013.