

Review to the manuscript

„New method for assessing the potential hazardousness of glacial lakes in the Cordillera Blanca, Peru“

submitted by A. Emmer and V. Vilímek

Reviewer: Martin Mergili

The authors present an interesting new method for identifying potentially hazardous glacial lakes in the Cordillera Blanca. The research presented is certainly relevant for the audience of the journal and for glacial lake hazard assessment. However, the authors should make a number of improvements before the manuscript can be published. I recommend a **moderate revision**, my comments and suggestions are provided in detail below.

General comments

My major concern consists in the fact that the method is called “objective”. I have to emphasize that I like the approach with the indices between 0 and 1 for different possible triggers of GLOFs. However, I would be careful in calling it “objective”. The equations, even though leading to continuous results on a numeric scale, are driven by the experience of the authors and do not directly employ deterministic or statistical relationships – since the method uses quantifiable parameters, it can be characterized as “reproducible”, but it is not objective in a strict sense.

I recommend to introduce abbreviations for each of the five trigger mechanisms at the very beginning – this would make the further text better readable and avoid frequently repeating the very lengthy names of the trigger mechanisms.

Further, the use of terms such as “potential hazard”, “potential hazardousness” etc. is not necessary since a hazard is a potential. Therefore just use the terms “hazard” or maybe even better “susceptibility” or “hazard indicator” (the method does not yield a hazard in the strict sense).

The text is well-structured and the tables and figures are informative and well-designed. Even though most of the manuscript is well understandable, English grammar and style require some improvement. I have addressed the most important issues (but not everything) in the specific comments.

Specific comments

2392, 10: “have yet to be used before”: I do not understand – have they be used before or not?

2393, 6ff: GLOFs are introduced as fluvial processes – even though this is certainly not wrong, at least a few words should be dedicated to the possibility of entrainment of sediment and the possible conversion of floods to powerful mud or debris flows.

2395, 24: “We have the following reasons for this study”: Better write something like: “The objectives of the present study are: “

2395, 24: Please cite some of your work in the Cordillera Blanca.

2396, 14: “which were consider”: Please correct the grammar.

2396, 26: “allows”.

2397, 13f: “point-based methods”. Further, please shortly explain the main characteristics of the methods listed.

2397, 24: “dynamic slope movements”: do also static slope movements exist?

2399, 22: “strong earthquake”.

2401, 7: “If the lake”

2401, Eqs. 2 and 3: Why do you use the sinus of the slopes? From a geotechnical viewpoint, the tangent would be more appropriate as – at least for cohesionless materials – the safety factor is $\tan \phi / \tan \text{slope}$.

2403, 14: Better: “lakes at high elevation”.

2403, 16: “large lakes” would be better instead of “great lakes”.

2404, 27: “In these cases”.

2405, Eq. 8: This is not objective (see also general comment above)!

2406, 2: “digital terrain model”.

2406, Eq. 10: Also here, the tangent might be more “objective” than the sinus.

2406, 23ff: The maximum slope often depends very much on the raster cell size used, so please be careful in applying it.

2407, 3: “into account”.

2407, 5ff: An additional criterion would be the retention capacity between the upstream and the downstream lake (e.g., a floodplain where a flood wave could be alleviated) – please justify why you did not take this aspect into account.

2408, 5: Better: “seismically most active regions”.

2408, 20f: “strong earthquake”.

2409, Eqs. 14 and 15: Doubling gamma and applying the square of rDH, respectively, are far away from “objective” approaches, even though they are reproducible (see general comment above).

2410, 10: “It is always highly important”.

2410, 17: “lakes which have yet to produce GLOFs”: please avoid this phrase here and in all other places where it is used. A lake does not have to produce a GLOF. Better just write “lakes which have not yet produced GLOFs”.

2411, 10: I suppose that “Autoridad” would be correct Spanish instead of “Authoridad”.

2411, 25: I suppose the potential is always “higher or equal” instead of “higher”?

2412, 23: “produced a GLOF in 1941”.

2413, 10f: I am not so familiar with the details of the Laguna 513 Event, but as far as I know, it occurred in 2010 and there was certainly awareness of the hazard as the lake level had been lowered artificially – please check with the literature.

2414, 14: Better: “has to be considered” instead of “is unfortunately taken into consideration”.

2415, 1-3: Please reformulate this sentence, it is not understandable.

2415, 11: “which were recorded in the study region”.

2416, 2f: “including the presented one, and represents a potential source ...”.

2416, 8: “and uniform input data, if possible”.

2416, 9: Better write “Advantages and disadvantages” or “Potentials and limitations”.

2416, 13f: This is reproducibility, but not “objectivity”.

2416, 20: Not understandable, please reformulate.

2417, 2: Better remove “fluvial” – in some cases, GLOFs may be transitional between fluvial and gravitational.

2417, 6: What is a spatial-effective mitigation tool?

2417, 15: “for identifying the most hazardous lake(s)”.

Table 1: Again the term “objective”: I would not describe my own schemes as fully “objective”, rather as “reproducible”.

Captions of Figures 7-11: “The results for particular lakes”.

The authors shall feel free to contact me at martin.mergili@boku.ac.at in case they disagree with my comments or wish to discuss the one or the other issue.

With best regards

Martin Mergili