

## **Review of the manuscript 'Moraine-dammed lake failures in Patagonia and assessment of outburst susceptibility in the Baker Basin'**

submitted to "Natural Hazards and Earth System Sciences" by P. Iribarren Anaconda, K.P. Norton and A. Mackintosh

Reviewer: Martin Mergili

The authors present an interesting study on the characteristics of failed lakes in Patagonia and, on this basis, on the susceptibility of glacial lakes in the Baker Basin, to GLOFs. Most of the manuscript is concise, well-written and well-structured. I can recommend the work for publication after the authors have included some **minor-moderate revisions** specified in detail below.

The authors are welcome to contact me at [martin.mergili@boku.ac.at](mailto:martin.mergili@boku.ac.at) in case they disagree with my comments or if they wish to further discuss the one or the other issue.

### **General comments**

1. The quality of the figures is generally very good. It might be useful for the reader to have an overview map of the Baker Basin presented early in the paper (a map of the basin is only shown in Fig. 12 where the results are presented). In contrast, Fig. 8 could be omitted – in my opinion, it does not carry a lot of additional information.
2. Grammar and style need some final polishing, I have addressed some (but probably not all) issues in the specific comments below.

### **Specific comments**

4767, 6 and 4772, 21: "Schuster" would be correct instead of "Shuster".

4769, 1: Remove "are"

4769, 4: Better: "... in the southernmost part ..."

4770, 25ff: Were the angles of reach measured in a straight line or along the flow path?

4771, 16: On data from how many lakes is the equation based, and could you provide a measure of error/uncertainty?

4772, 10: "... conditioning factors ..."

4772, 23: Better: "... larger amounts of water ..."

4773, 12: You talk about growing and stable lakes – are there also shrinking lakes observed?

4775, 18f: "... including very large moraine-dammed lakes ..."

4776, 11f: "... that of rock avalanches ..."

4776, 20: Probably better: "Lake outlet slope measurement" or "Dam slope measurement"

4776, 23: "... maximum flow accumulation in the lake ..."

4777, 4: "... steepest descent ..."

4777, 7ff: In my opinion, this procedure needs to be explained more clearly: (i) It should be explained what is the purpose of the pairwise comparison (Table 3) as this is hard to understand for anyone not familiar with this method. (ii) It should be mentioned in the text that in Table 4, the sum of the weights of all factors – i.e., the highest possible score – is 100.

4777, 9: "We chose this method ..."

4777, 10 and 17: "... judgements ..."

4779, 2: "... with higher peak discharges ..."

4779, 15: ... "outburst floods in Patagonia ..."

4780, 8: In contrast to ice, rock fall material cannot "cover" the lake's surface – please reformulate.

4780, 13: I am not sure whether the term "overtopped" is suitable here.

4781, 10: Please refer to Fig. 5 here.

4781, 22f: Please make clearer that the peak discharge you refer to is a computed (and therefore hypothetical) and not a measured one.

4782, 15f: Unless they have completely drained, those 16 lakes "are" located ...

4783, 12: "... lake level ..."

4784, 5: Better: "... show quick responses ..."

4784, 12: In the case of General Carrera Lake, was it really the LIA when it was formed, or was it the ice age?

4784, 21: "analyses"

4786, 2: "... glacier and lake changes ..."

4786, 8f: "... faced by Patagonian settlements ..."

4786, 12: "... stable lakes ..."

4786, 22: "Our analysis shows ..."

4786, 24: "... on the lake outburst susceptibility ..."

4787, 2: Remove "one"

4787, 16: "... which has to include data ..."

4791, 21ff: This paper is not cited in the text (at least, I did not find it).

Table 4: Glacier steepness above lake is classified into *Yes* and *No* – why not into classes of slope angles?

Fig. 1: In the legends of A and B, the class thresholds are not clear – e.g., an elevation of 250 m is assigned to two classes at the same time - better write:  $\leq 250$  m,  $>250 - 500$  m,  $>500 - 1000$  m, etc. Further, please replace “Altitude” by “Elevation”.

Fig. 2: Replace “glacier angle of terminus” with “slope of glacier terminus”; “Verification of outburst factors into the lakes”: “into” seems not the correct word here; “Classification of lake outburst susceptibility”.

Fig. 3, line 5 of caption: “... fewer data are available.”. Further, the green line appears strange to me: if it is derived from the black points, it should be much higher up in the right part of the diagram – please clarify.

Fig. 6, line 2 of caption: “... (where debris flows often occur) ...”

Fig. 7, caption, first line: “Types of moraine dams ...”

Suggested further literature:

Gruber, F.E., Mergili, M. (2013): Regional-scale analysis of high-mountain multi-hazard and risk indicators in the Pamir (Tajikistan) with GRASS GIS. *Natural Hazards and Earth System Sciences* 13: 2779-2796. doi:10.5194/nhess-13-2779-2013

Mergili, M., Müller, J.P., Schneider, J.F. (2013): Spatio-temporal development of high-mountain lakes in the headwaters of the Amu Darya river (Central Asia). *Global and Planetary Change* 107: 13-24. doi:10.1016/j.gloplacha.2013.04.001