

## ***Interactive comment on “Estimating the volume of Alpine glacial lakes” by S. J. Cook and D. J. Quincey***

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The study on the empirical relationship of lake volume  $V$  to lake surface area  $A$  is of importance for hazard assessments of potential outburst floods from naturally dammed lakes.

On a first point of view, there might be numerous problems involved as lake bathymetry (hence the lake's volume) is not systematically related to its shape resp. surface area. One might add from a mathematical point of view, that the statistics are over-simplified as e.g. data distributions and other correlations than the form of  $V = xA^y$  are not considered and analysed systematically. For sure, that would be a comment of only theoretical importance as the natural variability hinders the application of very sophisticated statistical methods in most parts of earth sciences. On the other hand, hazard assess-

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ments require data on lake volumes which are typically hard to survey at all. That is sufficiently explained in the manuscript already. Those who mainly see problems and have significant doubts about the reliability (cf. the remarkable good correlations well presented by the authors!) might avoid its application in own studies, but for sure, numerous investigations will benefit from the results presented here.

While principally, the publication of the findings is welcome and seriously supported, some details might be useful to improve:

1) The approach is well established in the countries of the previous Soviet Union, where not all hazardous naturally dammed lakes could not be surveyed for different reasons. These experiences are not considered in previous publications as systematically as they might be so far and unfortunately, the manuscript presented for discussion here does not improve the situation. So by a closure look, the amount of new data is relatively poor which might be seen as limitation of the novelty of the manuscript. For sure, the access to those publications (e.g. Nikitin, A.M.: Lakes of Central Asia. Hydrometeorological Regime of Lakes and Reservoirs of USSR. Leningrad, Gidrometeoizdat, 1987. – 106 p. (In Russian). — Tsarev, B.K.: On the assessment of possibility of remote sensing monitoring of the areas and levels of mountainous lakes and water reservoirs in Central Asia. Proceedings of Central Asian Hydrometeorological Research Institute, 2003, Iss. 162 (243), 55-73. (In Russian).) is challenging and the ability of reading texts in Russian language is not wide spread in the western scientific community, but for sure, it is worth to be considered. To access those and other studies on the topic carried out in northern and Central Asia, it might be recommended to contact the Department of Glaciology of the Russian Academy of Science (e.g. Vladimir Konovalov <http://glac.igras.ru/index.php?r=109&id=1351> ). The consideration of the these previous studies in literature published in English language is pretty rare for the reasons mentioned above, while a few exceptions exist (but are very hard to find to be true):  $V = 6.31A^{0.092}$  (with  $V$  in  $1000 \text{ m}^3$  and  $A$  in  $1000 \text{ m}^2$ ) based on data from the sources mentioned above and published by Glazirin, G. et al. (2013): Inventory of

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glacial lakes in the territory surrounding Uzbekistan. In: Borodavko, P., G. Glazirin, J. Herget & I. Severskiy (eds.): Hazard assessment and outburst flood estimation of naturally dammed lakes in Central Asia. Aachen (Shaker), p. 54-74. Anyway, it will never be possible to consider all studies in detail for such correlation but as the gap is systematic and the approach well established but not sufficiently considered the manuscript might benefit significantly from a unfortunately time-consuming improvement as suggested here.

2) On page 914 resp. 916 it is mentioned that data pairs from the same lake but different values were left out for statistical reasons. Personally, I think considering the newest data only is a poor argument as with contradictory data you cannot be sure which one is right. On the other hand, it is well known that Alpine glacial lakes vary significantly by size / volume throughout the year and from year to year. So from the statistical point of view, your selection might be right, but the natural variability (including the natural decrease of lakes by silting up) is a significant characteristic and cannot be ignored. It is recommended to discuss this aspect.

3) A minor formal aspect is to ask for the addition of the range of values of A for surface area in tables 1 and 2 to get an impression about the data ranges, the different regression equations are valid for. Consequently, not all equations can be applied for the lakes listed in table 3? Probably an additional figure illustrating the individual range of the equation and their different levels respectively gradients could be useful in this context.

In the full review and interactive discussion, the referees and other interested members of the scientific community are asked to take into account all of the following aspects: 1. Does the paper address relevant scientific questions within the scope of ESurf? YES 2. Does the paper present novel concepts, ideas, tools, or data? Partly - cf. details above (#1) and their self-critical discussion. 3. Are substantial conclusions reached? YES 4. Are the scientific methods and assumptions valid and clearly outlined? Mostly - cf. details (#2+3) above. 5. Are the results sufficient to support the interpretations

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and conclusions? YES 6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? - Mostly, cf. details (#2) above 7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Partly - cf. details above (#1) and their self-critical discussion. 8. Does the title clearly reflect the contents of the paper? YES 9. Does the abstract provide a concise and complete summary? YES 10. Is the overall presentation well structured and clear? YES 11. Is the language fluent and precise? YES 12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? YES 13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? YES, as mentioned above. 14. Are the number and quality of references appropriate? Unfortunately not, but cf. the self-critical discussion above. 15. Is the amount and quality of supplementary material appropriate? Mostly, cf. details (#3) above.

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Interactive comment on Earth Surf. Dynam. Discuss., 3, 909, 2015.

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