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Earth Surface Dynamics Discussions

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

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This is an interesting and useful study on volumes of alpine glacial lakes. The discussion of variability, uncertainty and outliers in terms of lake forming processes is especially appreciated. Further investigation of depth conditions in lakes of various origins and dynamics is indeed an urgent need.

Depth-area (D-A) regression shows the main problem: lake area is not a good general predictor of lake depth. Corresponding correlation coefficients and scatter plots illustrate the large uncertainty involved. The transformation of D-A regression into volume-area (V-A) (self-) regression is popular but problematic. This transformation compares lake volumes (V = D times A) with the lake areas (A) from which they had been calculated. The corresponding use of area in both variables of V-A regression for lakes (and

similarly for landslides and glaciers) creates a misleading impression about the quality of the used data and their interrelationship: The high correlation coefficients and the nice looking scatter plots are artifacts which only seemingly reduce the uncertainty of the relation. Resulting predictive equations (equations 1, 3 and 4 on page 912, for instance) essentially predict area from itself.

V-A regression also tends to hide the source of the statistical database (quantitative information on area and depth). Volumes of lakes cannot be "measured": there is no technique which would allow for measuring lake volumes directly, i.e. independently of lake area. All volumes (unit m3) of lakes from field measurements are – without any exception – calculated from quantitative information about water depth (unit m) inter-/extrapolated, averaged or integrated over defined lake areas (unit m2). How would it otherwise be possible to know where to measure and to get the units straight? Dividing lake volumes reported in the literature through lake areas which go with them does, therefore, not mean to "derive" lake depth but to reconstruct the original depth information from which the lake volume had been calculated. The remark about autocorrelation on page 914 and the related data processing may need some further reflection.

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