



Calculation of former ELA depressions in the Himalaya – a comparative analysis

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For the reconstruction of former Equilibrium Line Altitudes (ELA) and ELA depressions in the Himalaya, the group of the Toe-to-Summit-Altitude-Methods (TSAM) is most suited. In this investigation the Kuhle (1986) method that is particularly tailored to the extreme high mountain relief, as well as the widely used Höfer (1879) method and Louis (1954/55) method, have been applied. Applying the relief specific correction factor FSD (Factor for snowline deviation) in the Kuhle method, it is thereby possible to simulate the shifting position of the ELA within the vertical extension of the glacier in dependence on the relief characteristics and glacial type. The results of this work, carried out along the Kali Gandaki in central Nepal, illustrate that as a rule, the Louis method results in the highest ELAs and the lowest ELA depressions, while the Höfer method yields the lowest ELAs and the highest ELA depressions.

In affirmation of the literature, the Louis method tends to overestimate the ELA, since using the maximum peak height, especially for large glaciers in mountain ranges with high relief energy, leads to an overly high position of the glacier upper limit. With respect to the Höfer method, the suspicion already voiced by Höfer (1879) himself, that with the use of his method, the for the Himalaya typically high elevated, and with marginal gradient toward the valley moving ridge progressions, would lead to a too low ELA, can be affirmed. Clearly to be disputed, however, is the statement of Gross et al. (1976) that the Höfer method leads to an overestimation of the ELA. The reason for this can be found in a wrong computation of the mean ridge height above the ELA and consequently of the ELA itself within the Höfer method, based on the erroneous assumption that otherwise the ELA could not be calculated due to a circular conclusion (Gross et al. 1976). As is evidenced by this study, the Kuhle method mediates between the empiric overly high values of the Louis method and the overly low values of the Höfer method, because of a mediating definition of the accumulation zone upper limit. Additionally, over the FSD, Kuhle allows for a high degree of adaptation to the extreme Himalaya relief, and within limitations from the change of the relief constellation, which stems from transverse valley's characteristics of the Kali Gandaki. Therefore, the results of the Kuhle method must be affirmed as reflecting the greatest conformity with the actual values of the ELA and the ELA depression.

References:

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