



GIS-based modelling of (all) glacier beds in Switzerland

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Due to the ongoing and expected future increase in global mean temperature, the Alpine environment will continue to get further away from equilibrium. Glaciers are a part of the high-mountain cryosphere, and their changes are considered to be the best natural indicators of climatic changes. The calculation and visualization of future glacier development is thus an important task of communicating climate change effects to a wider public.

One of the most challenging topics in the assessment of climate change impacts on future glacier development is the unknown glacier bed and the related uncertainties in glacier volume estimations (Driedger and Kennard, 1986). In this respect, an estimated topography of the glacier bed would facilitate the calculation of glacier volume, the detection of local depressions, and the visualization of future ice-free grounds.

We here present a simple but robust GIS-tool which allows to calculate an approximate bed topography for a large sample of glaciers. The only input used is a DEM, glacier outlines, and a set of flow lines. The method is based on the calculation of the ice thickness along selected points of the flow lines from the shallow ice approximation and subsequent spatial interpolation using topogrid and is independent of glacier size, type or climatic setting.

The generated ice thickness distribution is in good agreement with direct measurements (GPR profiles) and results from more sophisticated methods that include assumptions on glacier flow. However, local derivations exist due to the very sensitive dependence on surface slope.