



## **Modeling the retreat of Unteraargletscher until 2050**

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Future retreat of Unteraargletscher, the fourth largest valley-glacier in Switzerland, is assessed by using a coupled ice-flow mass-balance model for the period 2005-2050. Detailed measurements of surface velocity in the last decade allow us to relate ice flux directly to glacier thickness and width, and hence, simplify ice flow modeling. Mass balance is calculated using a distributed temperature-index model, calibrated with ice thickness changes derived from photogrammetrical analysis of aerial photographs. The model was tested for the period 1961-2005 and showed good agreement between simulated and observed evolution of surface geometry.

In order to investigate the response of Unteraargletscher to future climate, regional climate scenarios for temperature and precipitation change with seasonal resolution were used. Three scenarios were defined, corresponding to 2.5 %, 50 % and 97.5 % quantiles of a statistical analysis of 16 different climate model ensembles. We present a forecast of the future extent of Unteraargletscher in the next decades and analyze relevant parameters with respect to the past. The model predicts a retreat of the glacier terminus of 1250 m to 2300 m until 2050. The ice flux into the glacier tongue currently accounts for 50 % of its ablational mass loss. The flux-ablation ratio is supposed to drop to 10 % by 2050. We show that, nevertheless, ice flux is not negligible in glacier retreat studies. Model results indicate that the debris coverage of Unteraargletscher delays the glacier retreat by a factor of three.