



Insight into glacier climate interaction: reconstruction of the mass balance field using ice extent data

Vjeran Visnjevic, Frédéric Herman, and Aleksandar Licul

Institute of Earth Surface Dynamics, Faculté des géosciences et de l'environnement, University of Lausanne, Switzerland

With the end of the Last Glacial Maximum (LGM), about 20 000 years ago, ended the most recent long-lasting cold phase in Earth's history. We recently developed a model that describes large-scale erosion and its response to climate and dynamical changes with the application to the Alps for the LGM period. Here we will present an inverse approach we have recently developed to infer the LGM mass balance from known ice extent data, focusing on a glacier or ice cap. The ice flow model is developed using the shallow ice approximation and the developed codes are accelerated using GPUs capabilities. The mass balance field is the constrained variable defined by the balance rate β and the equilibrium line altitude (ELA), where c is the cutoff value:

$$b = \max(\beta \cdot (S(z) - \text{ELA}), c)$$

We show that such a mass balance can be constrained from the observed past ice extent and ice thickness. We are also investigating several different geostatistical methods to constrain spatially variable mass balance, and derive uncertainties on each of the mass balance parameters.