Geophysical Research Abstracts
Vol. 20, EGU2018-14324, 2018
EGU General Assembly 2018

Holocene glacier oscillations in the Silvretta range (AUT/CH) - A synthesis of new 10Be moraine ages, historical documents and instrumental data

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Mountain glaciers respond highly sensitive to climate change on different time scales, ranging from seasonal and annual to centennial and millennial. Deciphering past glacier dynamics enables the reconstruction of climate conditions and has the potential to provide information with respect to underlying climate forcings on a regional and over-regional level. While modern and recent glacier change is documented in instrumental records, the understanding of long-term glacier oscillations relies on the evaluation of geological or biological archives. In the Eastern Alpine realm, there is a wealth of valuable information on minimum and maximum ages constraining glacier fluctuations during the Holocene, derived from a variety of paleorecords, e.g. dendrochronological and radiocarbon chronologies, lake sediments and pollen populations. However, geochronological records which capture the terminal stage of glacier advance are scarce in the Eastern Alps. In order to close this gap, a comprehensive 10Be geochronology study is realized in the Silvretta range, a high-mountainous region at the border of Austria and Switzerland. Surface exposure dating using cosmogenic nuclides has become a key method to assign numerical ages to glacier culminations. The method is based on the build-up of cosmogenic nuclides in blocks deposited along paleo-ice margins and embedded in moraines. Combined with ground-truth geomorphological mapping of moraine deposits and other glacial and periglacial landforms, the magnitude and timing of glacier advances within the Holocene can be resolved.
First preliminary 10Be ages from moraines in the Ochsen valley are presented in the context of complementary archives and are correlated with historical documents and with observational data. This strategy allows linking information on long-term natural glacier oscillations to data on short-term variations influenced by anthropogenic activity. Unravelling the complex spatiotemporal structure of Holocene glacier dynamics in the Silvretta range – with the Ochsen valley as starting point – is a premise for understanding present-day and future development of glaciers and climate in the region, and beyond.