Geophysical Research Abstracts
Vol. 18, EGU2016-8310, 2016
EGU General Assembly 2016

Is there still ice in the lateral moraines? Hydrochemical analyses of episodic springs from lateral moraines and their implications for the interpretation of geomorphological process studies

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The Gepatschferner glacier in the Upper Kaunertal valley in western Austria is recently one of the fastest melting glaciers in the region of the Eastern Alps. With a retreat rate of around 100m/year in the last years unconsolidated sediments of steep lateral moraines have been exposed to erosion. The earth surface changes in the proglacial area are often quantified and monitored using high resolution change detection methods, such as ALS, TLS or SFM and assume erosion to be the dominant factor of volume change. The existence of episodic springs dwelling from the lateral moraines fostered the hypothesis that a potential significant morphological change may result from the melt out of ice lenses and the leaching of the water from the moraines, and is so far not considered in contemporary measurement campaigns. The present study aims to identify the spring water's origin and displays first attempts of quantifying the leached volume.

In a one year monitoring campaign in 2015 around 40 samples were monthly derived from the glacier, various springs, and a precipitation collector. In order to differentiate the spring water's origin between infiltrated rain and/or ice the samples were analyzed for temperature, EC, and the stable isotope compositions of O18 and deuterium. Additional monthly precipitation averages of 30 years continuous isotopic measurements in similar altitude from the Global Network for Isotopes were used as comparison. Results support the hypothesis that certain springs derive from melting ice of similar isotopic signature as the glacier.

In a second step, chosen samples were examined for the long-lived anthropogenic radionuclide 129I. Since the 1950s this radioactive isotope has been significantly increased in the atmosphere mainly due to releases by reprocessing plants. Its abundance hints surface contact of the waters in the last 65 years. Springs of ice origin show little to no 129I content and thus are believed to derive of dead ice by the glacier.

Further ice retreat, discharge and sediment load measurements allowed to give first rough estimates of the discharge and erosion volume caused by the melt out of the dead ice lenses.