EGU2020-10165
https://doi.org/10.5194/egusphere-egu2020-10165
EGU General Assembly 2020

What happens when the ice is gone? A hydrological journey into the glacier forefield subsurface

Tom Müller[1], Bettina Schaefli[2], and Stuart N. Lane[1]
[1]Institute of Earth Surface Dynamics, University of Lausanne, Lausanne, Switzerland
[2]Institute of Geography, University of Bern, Bern, Switzerland

Rapid glacier recession related to recent climate change in Alpine regions is exposing large areas of previously ice-covered till and bedrock. These newly created proglacial areas are composed of poorly sorted sediments and debris of mixed subglacial (till), englacial and supraglacial origin. They are subject to rapid geomorphological and ecological modifications. They also constitute potential new groundwater reservoirs for rain, snowmelt and ice melt. The hydrology of such glaciated catchments is therefore evolving, but the connectivity between glacier meltwater and other paraglacial structures such as talus slopes, outwash plains or small lakes to these areas remains unclear. We propose a conceptual model of water connectivity and storage based on the Otemma glacier, one of the largest Swiss glaciers, which summarizes the key geomorphological structures and their hydrological functions. In particular, we combine multiple field data such as water table fluctuations, river discharge, isotopic analysis and geophysical studies from the proglacial area of the Otemma glacier to show the growing importance of the outwash plain for storing water and maintaining baseflow in these headwater catchments. We show that the accumulation of reworked subglacial till and exported sediments from the glacier create new reservoirs for the storage and release of water which may become larger in regions where the subglacial bedrock has a low slope and where ice is rapidly retreating. These fluvioglacial aquifers are mainly recharged by ice-melt at present but could store more snowmelt and precipitation in the future. The processes influencing sediment export and aggradation combined with future snow and ice melt dynamics are therefore key to understanding the future hydrological functioning of these catchments. River and groundwater dynamics will eventually shape the biodiversity and vegetation succession of these areas that are hotspots for many endemic species and where soil stabilization and development will create a clear feedback on the future sediment and water budget of high Alpine environments.