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Hydrological characteristics of a glacier forefield

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The proglacial discharge regime is characterised by snow melt in spring and followed by glacier melt in summer, both showing a distinct diurnal pattern. In autumn, the runoff is precipitation-driven and during the winter the water flows are low. A complex surface / subsurface topography, heterogeneous soil and changing contributions of water from snow melt, glacier melt, and precipitation on glacier forefields result in highly variable patterns of the flow regime. Moreover, in such an environment the role of water storage is still poorly understood. In this study, we examine the hydrological response of a proglacial field to the driving meteorology at the study site in central Switzerland (46˚38.1´N, 8˚27.6´E).

The daily and seasonal dynamics of hydrographs sampled at five locations within the braided river system on the forefield are analysed in the context of a) meteorological conditions on the forefield and at two locations in the vicinity of the watershed, b) measurements of the ground water table near the streams, c) soil moisture measurements on transects close to the streams, and d) estimates of snow ablation patterns from photographs taken by an automatic camera.

The results show that the hydrographs of the individual streams on the glacier forefield differ significantly and vary with season and individual weather events. The ground water table is connected to the surface water fluctuations, and both display almost equally high variations. However, the surface soil moisture near the streams is less affected by these variations but rather governed by rain events. The watershed discharge is mainly driven by the meteorological conditions, with a quick response to changing weather. Especially, snow falls in summer increases the albedo of the glacier surface. This reduces the discharge rates in a transitional phase until the ice cover is free from snow.