EGU22-9540, updated on 31 Mar 2023
https://doi.org/10.5194/egusphere-egu22-9540
EGU General Assembly 2022

What role do glaciers play in smoothing streamflow during summer rainfall events? A case study from the Swiss Alps.

Bettina Schaefli[1,2], Ladina Binkert[1], Luca Benelli[1], Natalie Ceperley[1,2], Peter Leiser[1], Jan Baumgartner[3], Benjamin Berger[3], and Kevin Wyss[3]

[1]Institute of Geography, GIUB, University of Bern, 3012 Bern, Switzerland
[2]Oeschger Center of Climate Change Research, OCCR, University of Bern, 3012 Bern, Switzerland
[3]Kraftwerke Oberhasli AG, 3862 Innertkirchen, Switzerland

The retreat of glaciers, particularly in catchments where they were extensive, has important consequences for future water management and in particular for hydropower production. Glaciers store water in liquid or solid form on short- to long-term time scales and thereby affect the precipitation-runoff behavior of heavily glacier-covered catchments from interannual and seasonal to sub-daily time scales. While today reliable predictions can be made about the change in quantity and timing of glacier melt runoff, the consequences of glacier retreat for summer rainfall events remain unclear. By intensively monitoring streamflow during the summer months in an area with a high degree of glacier cover, we can fill this research gap. Our key research question is hereby how strongly the glacier smooths out the observed rainfall peaks and how the smoothing effect evolves over the course of the glacier melt season. The answer to this question is crucial to anticipate potential water and sediment management challenges under intense summer rainfall events in catchments with strongly reduced glacier-cover.

In this presentation, we share results from the Oberaargletscher catchment (10 km^2, elevation 2310 - 3630 m a.s.l.) located in the Swiss Alps that was intensively monitored from July to October 2021. The monitored variables include precipitation, streamflow, electric conductivity, stable isotopes of water, water and air temperature. Based on the high resolution streamflow data, we analyze the influence of summer rainfall events on the runoff response, and in particular on the runoff lag time and the hydrograph shape. The obtained results are related to potential driving variables including the extent of snow cover and of the glacial drainage system, the precipitation intensity and air temperature.

We will furthermore discuss to what extent the rainfall fraction in the streamflow can be quantified based on streamflow observations alone, which will give valuable insights for future measurement campaigns at comparable sites.