Comments on the manuscript

Contribution of Rock Glacier Discharge to Late-Summer and Fall Streamflow in the Uinta Mountains, Utah, USA

by Jeffey S. Munroe and Alexander L. Handwerger

The authors analyzed water released from two active rock glaciers in the Uinta Mountains of Utha (USA) which they compare with water released from a spring that is not related ro rock glaciers, and with water of the master stream of the catchment area.

Water samples ware taken by automtaic water samplers from the beginning of July until mid October in 2021 for analyizing stable isotopes and hyrochemistry (ICP-MS). Additional samples were taken from the snowpack and also rainwater was collected.

The authors conclude that water released from the rock glaciers is derived from snowmelt in late summer shifting to seasonal ice and melting of perennial ice in fall.

The manuscript is an important contribution to the understanding of the hydrological/hydrogeological system of intact (active) rock glaciers, mainly based on the study of stable isotpes and hydrochemistry.

Some general comments

A great disadvantage of the study is the short sampling period which started at the beginning of July and therefore did not cover the beginning and peak of the snowmelt period which would be important for understanding the hydrological and hydrochemical processes. Another disadvantage is the lack of continuous records of the water height (discharge) and electrical conductivity. It is well known that discharge of intact rock glaciers is characterized by distinct seasonal and diurnal variations, particularly during the snowmelt period.

To see the influence of individual rainfall events on isotope values and hydrochemistry a much shorter sampling interval (one hour) is needed.

Therefore I suggest to continue the hydrological studies on these rock glaciers and to extend the sampling/measuring period to include the beginning of the melt season and also to install a

gaging station that records water height and electrical conductivity. This will support the interpretation of isotope and hydrochemical data.
An average discharge of 15 L/min seems to be extremely low, too low, even when the annual precipitation rate is lower than in the Alps. So may be that a major portion of the discharge is released as groundwater stream and not as surface stream?
Tracer tests (e.g. dye tracer test) will provide useful information on the residence time (flow velocity) of the quickflow component (includes water derived from snowmelt, rainfall events and partly also from melting of ice) which for rock glaciers of medium-size is in the order of a few hours.
The presence of a massive ice core indicates that below the frozen core a layer of unfrozen, fine-grained sediment may occur which acts as a reservoir for groundwater that is supplied by snowmelt, rainfall and icemelt, and slowly flows through the reservoir and is characterized by high electrical conductivity.
Geophysical investigations would provide information on the internal structure of the rock glacier (thickness of the active layer, thickness and composition of the frozen core, presence of an unfrozen sediment layer between the bedrock and the frozen core).

The title clearly reflects the contents of the manuscript

The abstract provides a brief and informative summary

The overall presentation is well structured and clear

The aim of this study is clearly pointed out, the manuscript addresses relevant scientific questions and the authors present new ideas and data concerning the hydrology of intact rock glaciers

Study area is precisely described, the scientific methods are valid and clearly outlined

The results are sufficient to support the interpretation and conclusions (see comments). The results are well presented, the text is supported by a number of instructive figures

Conclusions

The authors conclude that in early summer discharge is mainly composed of water derived from snowmelt.

Additionally, rainfall events also contribute to the discharge (indicated by rainfall events shown in Fig. 8). The proportion of rainwater is low in early summer and icreases towards fall (untill refreezing), this is not considered in the conclusions. The proportion of icemelt will also be very low in early summer and increase towards fall as concluded by the authors. There will also be a small amount of groundwater that is not mentioned in the conclusions. The proportion of groundwater will be low in early summer and increase towards fall. There is probably also groundwater released during the winter months.

Figures and Tables are clear and instructive

The number and quality of the references is appropriate. The authors give proper credit to realted work and clearly indicate their own contributions. The reference list is complete

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