EGU21-2714, updated on 17 Oct 2021
https://doi.org/10.5194/egusphere-egu21-2714
EGU General Assembly 2021

Timing and magnitude of runoff in Austrian mountain catchments in a warming climate

Sarah Hanus[1,2], Harry Zekollari[3,4], Gerrit Schoups[1], Roland Kaitna[5], and Markus Hrachowitz[1]
[1]Water Resources Section, Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft, The Netherlands
[2]Department of Geography, University of Zürich, Switzerland (sarah.hanus@geo.uzh.ch)
[3]Department of Geoscience and Remote Sensing, Delft University of Technology, Delft, The Netherlands
[4]Laboratoire de Glaciologie, Université libre de Bruxelles, Brussels, Belgium
[5]Institute of Mountain Risk Engineering. University of Natural Resources and Life Sciences, Vienna, Austria

Hydrological regimes of alpine catchments are expected to be strongly influenced by climate change due to their dependence on snow dynamics. While seasonal changes have been studied extensively, studies on changes in the timing and magnitude of annual extremes remain rare. This study investigates the effects of climate change on runoff patterns in six alpine catchments in Austria by using a topography-driven semi-distributed hydrological model and 14 climate projections for RCP 4.5 and RCP 8.5. The study catchments represent a range of alpine catchments, from pluvial-nival to nivo-glacial, as the study focuses on providing a comprehensive picture of future runoff changes on catchments at different altitudes. Simulations of 1981-2010 are compared to projections of 2071-2100 by examining changes in timing and magnitude of annual maximum and minimum flows as well as monthly discharges.

Our results indicate a substantial shift to earlier occurrences in annual maximum flows by 9 to 31 days on average and an extension of the potential flood season by 1 to 3 months for high elevation catchments. For lower elevation catchments, changes in timing of annual maximum flows are less pronounced. Magnitudes of annual maximum flows are likely to increase, with four catchments exhibiting larger increases under RCP 4.5 compared to RCP 8.5. The timing of minimum annual discharges shifts to earlier in the winter months for high elevation catchments, whereas for lower elevation catchments a shift from winter to autumn is observed. While all catchments show an increase in mean magnitude of minimum flows under RCP 4.5, this is not the case for two low elevation catchments under RCP 8.5.

Our results suggest a relationship between the altitude of catchments and changes in timing of annual maximum and minimum flows and magnitude of low flows, whereas no relationship between altitude and magnitude of annual maximum flows could be distinguished.