



Variability in glacier hydrographs around the world

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Glacierized catchments are essential hydrological systems for water supply in mountainous regions. Glaciers have a pronounced effect on the hydrograph and in these systems act as moderator of streamflow, also known as the glacier compensation effect. However, glacier hydrographs are the result of the interplay between catchment and glacier characteristics and different climate variables. The absolute and relative contributions of melt water can therefore vary within and between different regions in the world. This study focuses specifically on the diversity of the glacier compensation effect. In general, the compensation is caused by a different correlation of streamflow with precipitation in the glacierized (negative correlation) and non-glacierized (positive correlation) parts of the catchment. In this way, glaciers can reduce streamflow variability on various time scales, influencing the hydrograph and its stability through time. In particular, the relationship between year-to-year streamflow variability and catchment glacier cover is often presented in the literature as a curve with a minimum variability for moderate glacier covers. This study aims to test the generality of this relationship with a newly assembled large dataset of glacierized catchments from different regions, including the European Alps (Switzerland, Austria), Norway, North America (Canada, Alaska) and South America. Statistical analysis was performed to get insight into the diversity and similarities of hydrograph properties in and across the different countries. The results show that the multi-scale streamflow variabilities vary between and within regions and do not necessarily follow the previously published generalized curves. Furthermore, catchments with similar glacier cover show a diversity in streamflow variabilities. We also found no generalizable evidence of an increase in variability with glacier retreat over time for several of the available long time series. The results suggest that great care must be taken in assuming that the glacier compensation effect will sustain water resources everywhere around the world in the same manner.