



Spatial and temporal characteristics of low flows across Switzerland

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Past studies have reported regional differences in the seasonal and spatial occurrence of low flows, but the underlying drivers of these patterns are often not clear. Understanding those drivers may substantially improve the predictability of low flows. For example, in Switzerland, magnitudes of low flows and the season of occurrence vary regionally. However the dominant drivers of variability of low flow magnitude and seasonality have not been reported yet.

We present how the magnitude and seasonality of low flow discharge varies across 300 catchments located all over Switzerland and use that information to investigate which climatic variables drive these low flows. In a first step, we characterize the seasonality of low flows in all catchments using circular statistics. This allows to delineate the regional patterns of low flow seasonality across Switzerland. In a second step, we compare these seasonality characteristics of low flows to the seasonality characteristics of several climatic drivers that can potentially cause these low flows. This comparison allows understanding which factors drive low flows.

We found distinct regional differences in the seasonality of low flows, and its driving factors. In Alpine regions, low flows are more likely to occur during winter months due to a lack of liquid precipitation, snow and glacier melt. In regions of lower elevation, dry periods occur in late summer influenced by lack of precipitation and higher evapotranspiration. The severity and duration of the dominant climatic events heavily influences the magnitude of low flows. We analyzed different lengths or intensities of dry periods (from 10 days to 2 months), variable threshold amounts of precipitation over certain times, magnitudes of potential evapotranspiration over certain time periods and found large regional differences. The generated national-scale classification of low flow characteristics emphasizes regional differences in driving factors and can support water management strategies during times of water scarcity.