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Which landscape elements support streamflow during low flow conditions? Lessons from field observations in the Swiss midlands in dry summer 2015

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Low flows can be very heterogeneous even on small scale. It is not well known which areas contribute to low flow during extended dry periods nor can we expect which challenges will arise with changing climate conditions. Therefore we need to improve our understanding of physical properties relevant for water storage and drainage during dry periods.

We present a spatially resolved discharge dataset from the Swiss midlands during the extended dry summer 2015. On very small scales we found major differences in discharge: neighboring nested subcatchments varied by up to a factor of 5. These variations correspond to certain landscape elements. Required storage volumes are quite small, making up only about 1% of annual precipitation, but some features are more likely to support higher streamflow during dry periods due to slow drainage. We found significant evidence for differences in storage and drainage behavior, existence of sections of streambed infiltration and point sources of outstanding contribution along the stream networks of the Swiss midlands and Alps. Major differences can be traced back to different lithology, slope angles and connectivity of storage features to the network. Even though heterogeneity is high on small scale, spatial scale of the research is limited by point source contribution, subsurface flow paths and streambed infiltration and exfiltration.

These findings show the significant extent to which different geological formations with certain physical properties contribute to low flow discharge in midland environments. Understanding the effects of physical landscape properties is a first step to get an insight of water storage capacity and the relevant drainage timescale supporting streamflow during extended dry periods. This helps to find areas that are either sensitive or resistant to changes towards a dryer climate.