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How to work towards more reliable residual water estimations? State of the art in Switzerland and ideas for using physical based approaches

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Reliable low flow estimations are important for many ecologic and economic reasons. In Switzerland the base for defining residual flow is Q347 (Q95), the discharge exceeded 347 days per year. To improve estimations, we need further knowledge of dominant processes of storage and drainage during low flow periods.

We present new approaches to define Q347 based on physical properties of the contributing slopes and catchment parts. We used dominant runoff process maps, representing storage and drainage capacity of soils, to predict discharge during dry periods. We found that recession depends on these processes but during low flow periods and times of water scarcity different mechanisms sustain discharge and streamflow. During an extended field campaign in dry summer 2015, we surveyed drainage behavior of different landscape elements in the Swiss midlands and found major differences in their contribution to discharge. The contributing storages have small volumes but long residence times mainly influenced by pore volume distribution and flow paths in fractured rocks and bedrock. We found that steep areas formed of sandstones are more likely to support higher flows than flat alluvial valleys or areas with thick moraine deposits, where infiltration takes place more frequently.

The gathered knowledge helps assessing catchment scale low flow issues and supports more reliable estimations of water availability during dry periods. Furthermore the presented approach may help detect areas more or less vulnerable to extended dry periods, important ecologic and economic issues especially during changing climatic conditions.