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What can we learn about low flow storage properties from flow duration curves?

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Flow duration curves are widely used for quantifying recurrence magnitude of streamflow and are of major importance for predicting low flows (Q95) in gauged catchments. But which physical hillslope properties describe the course of duration curves? And how can we derive duration curves for ungauged catchments?

We show the influence of dominant runoff processes – the storage and drainage capacity of soils - and short term storage of the upper layer on flow duration curves. Catchments inhabiting large storage have different duration curves than catchments with small storage. But dominant runoff process maps cannot fully capture the influence of those storage features. For low flow prediction, other mechanisms are prevalent. We found two main gradients in duration curves from numerous catchments in the Swiss midlands and Alps: a steeper part from Q1 to approximately Q65 and a flatter part from Q65 to Q100. We propose that duration curves can be reconstructed by comparing the storage settings of gauged reference areas to ungauged catchments. The steeper part until Q65 can be reconstructed by gathered knowledge on dominant runoff processes, gradient of the flatter part by two discharge measurements at a defined time between Q65 to Q100. This simple approach can help improving low flow estimations in ungauged areas, based on physical assumptions on storage properties in reference areas.