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Geomorphic Signatures on Brutsaert Base Flow Recession Analysis

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This paper addresses the signatures of catchment geomorphology on base flow recession curves. Its relevance relates to the implied predictability of base flow features, which are central to catchment-scale transport phenomena and to ecohydrological function. Moving from the classical recession curve analysis method, originally applied to the Finger Lakes Region, a large set of recession curves has been analyzed from Swiss streamflow data relatively unaffected by snowmelt. For these catchments, digital terrain models have been accurately analyzed. Recent results aimed at the geomorphic origins of recession curves have been then applied to the Swiss dataset. The method links river network morphology, epitomized by time-varying geometry of saturated channel sites, with the classic parametrization of recession events, in particular by assimilating two scaling exponents, β and b_G (i.e. $|dQ/dt| \propto Q^\beta$ where Q is at-a-station gauged flow rate; $N(l) \propto G(l)^{b_G}$ where l is the downstream distance from the channel heads receding in time, $N(l)$ is the number of draining channel reaches located at distance l from their heads, and $G(l)$ is the total drainage network length at a distance greater or equal to l, the active drainage network). Here, we confirm that the method provides good results, yet only in catchments where drainage density can be regarded as spatially constant. A correction to the method is proposed, which accounts for arbitrary local drainage densities affecting the local drainage inflow per unit channel length. Such corrections properly vanish should drainage density become spatially constant. A comparative analysis on the Swiss streamflow and Digital Elevation Model data shows that the proposed correction proves indeed statistically significant. Overall, definite geomorphic signatures are recognized for recession curves, with notable theoretical and practical implications.