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Evaluation of two algorithms for the construction of master recession curves of karst springs

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The recession of spring hydrographs is frequently used to infer information about the hydraulic properties of karst aquifers (e.g., Birk and Hergarten, EGU2012-9777). For this purpose, it is convenient to overlap the recession segments of the individual discharge events and create master recession curves (MRCs) that are assumed to represent the average recession behaviour of the aquifer. An automated procedure for the construction of MRCs based on an adapted matching strip method was implemented in an Excel spreadsheet by Posavec et al. (Ground Water, Vol. 44, No. 5, 2006). While this algorithm used linear, power, exponential, logarithmic, or second-order polynomial regression models to adjust individual recession segments to their proper positions in the MRC, a more recently developed spreadsheet employs trigonometry laws for this purpose (Posavec et al., Groundwater, Vol. 55, No. 6, 2017). Initial comparisons of the two methods show that in some cases the trigonometry-based approach creates narrower spreads of the overlapped recession segments and thus MRCs with a higher coefficient of determination, while in other cases the approach based on regression models appears superior. This work attempts a closer evaluation and comparison of the two methods focussing on two karst springs, namely the Gallusquelle (Germany) and the Hammerbach spring (Austria), for which long time series are available. Previous research has shown that the early stage of the recession is expected to vary between different events (e.g., Birk and Hergarten, EGU2017-14927); for the Hammerbach spring, it was further demonstrated that there is at least one time period extending over several years that shows a discharge behaviour different from other times, presumably because of sediment redistributions within the karst conduit system (e.g., Birk and Wagner, EGU2013-11365). Splitting the available time series into shorter parts allows investigating the effect of the selected time period and its length on the MRC and thus assessing the predictability or predictive capability of the MRCs created with the two different approaches.