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Towards a method to characterize temporary groundwater dynamics during droughts

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In order to improve our understanding of the complex mechanisms involved in the development, propagation and termination of drought events, a major challenge is to grasp the role of groundwater systems. Research on how groundwater responds to meteorological drought events (i.e. short-term climate anomalies) is still limited. Part of the problem is that there is as yet no generic method to characterize the response of different groundwater systems to extreme climate anomalies. In order to explore possibilities for such a methodology, we evaluate two statistical approaches to characterize groundwater dynamics on short time scales by applying them on observed groundwater head data from different pre- and peri-mountainous groundwater systems in humid central Europe (Germany). The first method is based on the coefficient of variation in moving windows of various lengths, the second method is based on streamflow recession characteristics applied on groundwater data. With these methods, the gauges behavior during low head events and its response to precipitation was explored. Findings regarding the behavior of the gauges make it possible to distinguish between gauges with a dominance of cyclic patterns, and gauges with a dominance of patterns on seasonal or event scale (commonly referred to as slow/fast responding gauges, respectively). While some clues on what factors that might control these patterns are present, the specific controls are general unclear for the gauges in this study. However as the key conclusion stands the question if the variety of manifestations of groundwater dynamics, as they occur in real systems, is subsumable with one unique method. Further studies on the topic are in progress.