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Scales of water retention dynamics observed in eroded Luvisols

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Soil pore structure is known to change dynamically due to swelling and shrinkage, wetting and drying or tillage operations. For erosion-affected soils with truncated profiles and due to soil management changes, the water retention dynamics could be even more complex. The objective was to separate shorter-term hysteretic from longer-term seasonal dynamics in field-measured water retention data of eroded Luvisols. Tensiometers and TDR sensors were installed in 10, 30, and 50 cm depths of six lysimeter soil monoliths from two field sites. The water content and suction data of three years (2012-2014) allowed identifying drying and wetting periods for which separate parameters of the van Genuchten (VG) retention function were fitted. The water retention curves of the initial or main drying in spring were generally steeper than those obtained in the lab. During intra-seasonal wet/dry cycles, steepness increased and the saturated VG parameter successively decreased; these data indicated a limitation in re-wetting with dry/wet cycles. The water retention of an annual maximum drying curve increased in the three years with the pH-values due to changes in the soil management. When dealing with soils of cultivated arable landscapes, water flow modelling should consider management-induced gradual changes in hydraulic properties in addition to hysteresis and seasonal dynamics. The disentangling of dry/wet cycles from highly-resolved time series' may help identifying processes responsible for retention dynamics.