



Space-time modeling of catchment specific drought characteristics

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Drought affects all components of the water cycle as it develops from its origin as a meteorological drought through a deficit in soil moisture, reduced groundwater recharge and levels, and finally shows up as a low streamflow or dried-up river. Its impact is not limited to the river network, and regional drought characteristics like the area covered by the drought and the total deficit over an area are thus important measures of the severity of a drought event. In this study emphasis is on the catchment scale and how the spatial aspect of a meteorological drought (deficit in rainfall) is propagated in the hydrological cycle to appear as a drought in groundwater recharge, hydraulic head and groundwater discharge. Accordingly, one might talk about catchment specific, rather than regional drought characteristics. The analysis is done using data from a groundwater fed catchment, the Pang in UK. Catchment specific drought characteristics are derived based on a set of gridded time series obtained from an earlier study. The series include spatially interpolated rainfall and simulated groundwater recharge, head and discharge derived from physically-based soil water and groundwater models. The model area comprises cells with a size of 500 x 500 m, and the total model area exceeds that of the Pang catchment (170 km²) to allow proper conditions at the boundary of the catchment. In total there are about 1900 cells of which approx. 1100 constitute the Pang catchment. Drought events are derived separately for each grid cell and variable using the threshold level method and combined to yield catchment specific drought characteristics. A critical minimum area is introduced as a second threshold to define a drought event, i.e. a drought exists only if a certain percentage of the catchment area is experiencing a deficit. Special attention is given to the characterisation (definition and standardisation) of drought events to allow vari-

ables of different units and properties to be compared. The study reveals rather large differences in the spatial and temporal characteristics of drought as it propagates in the hydrological system. Meteorological droughts frequently cover the whole catchment and last for a short time, whereas droughts in recharge and hydraulic head typically cover a smaller area and last longer. Hydraulic head and groundwater discharge exhibit similar drought characteristics, which can be expected in a groundwater fed catchment.