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# Modelling asymmetries in groundwater drought and flood status across the Chalk aquifer of the UK since 1960

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The Chalk is the major aquifer of the UK, locally supplying more than 75% of potable water and providing baseflow to maintain ecologically important rivers and wetlands across large parts of southern UK. Due to interannual variations in driving climatology, and particularly the consequent variations in winter recharge, in combination with the heterogeneous hydrogeological characteristics of the Chalk, the aquifer is susceptible to both groundwater droughts and episodes of groundwater flooding. However, these two phenomena have quite different spatial and temporal characteristics with groundwater droughts typically having much larger spatial footprints and being longer duration events than episodes of groundwater floods.

Here we present an analysis of a large groundwater level (GWL) dataset for the Chalk of the UK characterising asymmetries in the response of the aquifer in terms of the extent, duration and intensity of extreme events. We use GWL measurements from 948 boreholes to reconstruct groundwater status across the Chalk aquifer from 1960 to 2013. We calibrate a series of empirical mixed models for the GWL measurements from each borehole where the fixed effects are based on applying an impulse response function to the local monthly precipitation. We simulate GWLs on a monthly time-step for each borehole. We then spatially interpolate the monthly values across the aquifer. Following an analysis of the model results, we discuss some of the hydrogeological controls on groundwater drought and flood status, and consider the implications for forecasting of future extreme groundwater events across the aquifer. Lastly, we show how such an approach is being applied to a larger, continental-scale analysis of groundwater extremes as part of the European Groundwater Drought Initiative (GDI).