

Accepted Manuscript

Research papers

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PII: S0022-1694(18)30514-6

DOI: <https://doi.org/10.1016/j.jhydrol.2018.07.009>

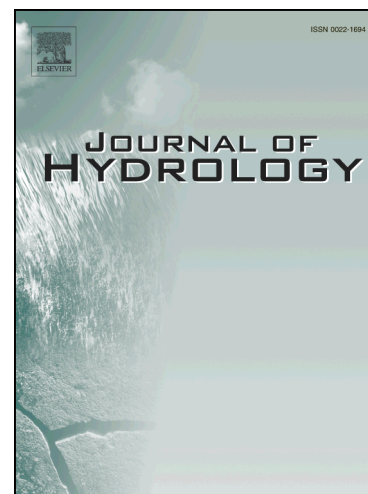
Reference: HYDROL 22941

To appear in: *Journal of Hydrology*

Received Date: 2 November 2017

Revised Date: 28 June 2018

Accepted Date: 5 July 2018



Please cite this article as: Marchant, B.P., Bloomfield, J.P., Spatio-temporal modelling of the status of groundwater droughts, *Journal of Hydrology* (2018), doi: <https://doi.org/10.1016/j.jhydrol.2018.07.009>

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Spatio-temporal modelling of the status of groundwater droughts

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Highlights

- Groundwater drought status in the UK Chalk aquifer is reconstructed from 1960-2013
- Variation is heterogeneous in space and time and observations are sporadic
- Spatially-varying impulse response functions represent temporal variation
- Time series of drought status are interpolated in space
- Spatial clusters corresponding to differing geology and meteorology are evident

Abstract

An empirical (geo)statistical modelling scheme is developed to address the challenges of modelling the severity and distribution of groundwater droughts given their spatially and temporally heterogeneous nature and given typically highly irregular groundwater level observations in space and time. The scheme is tested using GWL measurements from 948 observation boreholes across the Chalk aquifer (UK) to estimate monthly groundwater drought status from 1960 to 2013. For each borehole, monthly GWLs are simulated using empirical mixed models where the fixed effects are based on applying an impulse response function to the local monthly precipitation. Modelled GWLs are standardised using the Standardised Groundwater Index (SGI) and the monthly SGI values interpolated across the aquifer to produce spatially distributed monthly maps of SGI drought status for 54 years for the Chalk. The mixed models include fewer parameters than comparable lumped

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