
Evidence-based conceptual requirements of regional groundwater processes for hydrological simulations

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- Conceptual rainfall-runoff models often struggle to simulate contributions from groundwaters, resulting in poor model calibration. Improving predictions of river flows in these catchments critical for water resources planning and management, particularly in the UK where groundwater contributes 30% of public water supply in England.
- With the ultimate aim of improving model predictions in groundwater-dominated catchments, we conduct a detailed analysis of available observational data to better understand groundwater-surface water interactions and processes on a regional (aquifer) and local (river reach) scale, over geologically variable areas.
- National meteorological, hydrological, hydrogeological, geological and artificial influence (characterising abstractions and return flows) datasets are used to develop a conceptualisation of the groundwater processes occurring in 80 subcatchments of the River Thames in the UK.
- We use these data to characterise the **water balance, intercatchment groundwater flows, gaining/losing river reaches** and **hydrological dynamics** of these subcatchments, and investigate how dominant groundwater processes vary spatially and temporally.

A sample of our initial results are presented on the next slide. If you are further interested in the details of this study, please feel free to email me at Louisa.Oldham@bristol.ac.uk.

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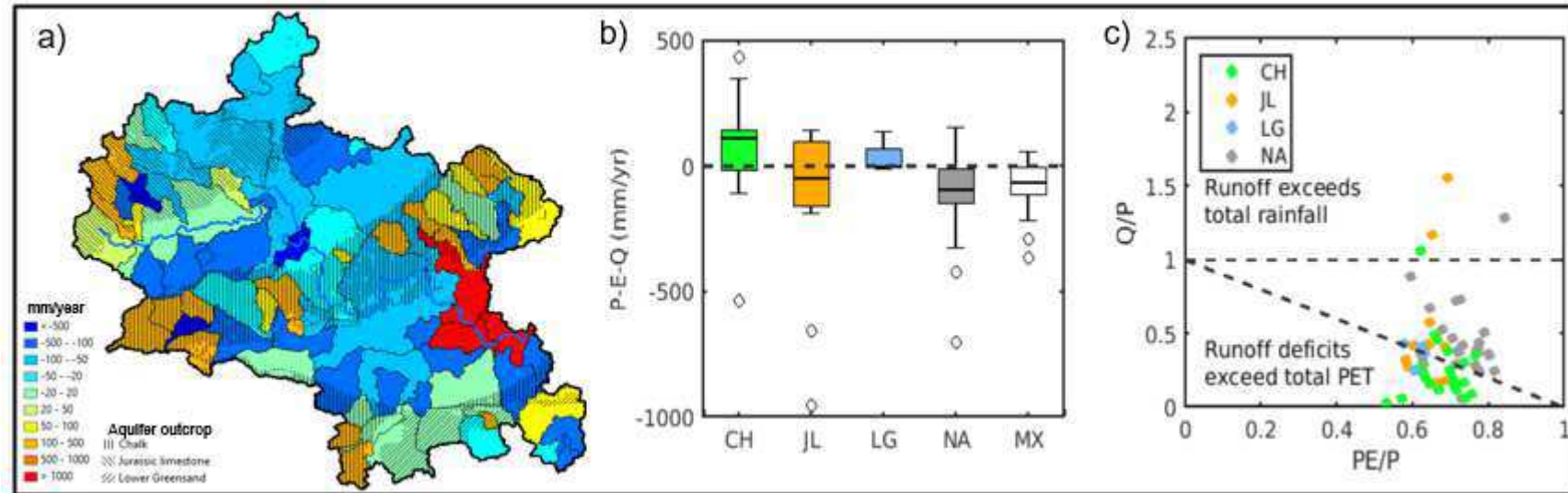


Figure 1: Annual reach water balance metrics for the Thames at Kingston reaches from 1994-2014 inclusive, showing a) Unaccounted for annual water volume from precipitation after subtraction of evaporation and recorded river flow ($P-E-Q$), in relation to location of aquifer outcrops areas, b) as per a) but in chart format, and c) dimensionless reach runoff (river flow/precipitation) and dryness index (potential evapotranspiration/precipitation) in relation to the “water limit”, “energy limit” and aquifer outcrop areas.

Initial analysis has shown that:

- The spatial and temporal variability of surface water-groundwater processes varies greatly for different geologies across the Thames basin.
- We see evidence of intercatchment groundwater flows needed to ‘close’ the water balance in many catchments located on aquifer outcrops, however this is complicated by human influences (this will be explored in future work).
- We can see a pattern of losing then gaining reaches along tributaries when headwaters are located on Chalk aquifer outcrops areas.