

Investigating groundwater-surface water processes in a Chalk catchment in South East England using fluorescence properties of dissolved organic matter

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Understanding the hydrochemical functioning of lowland permeable catchments in the UK is important for effective environmental management of river and wetland ecosystems. Anthropogenic tracers such as CFCs and SF₆ have been useful tools in providing a framework for understanding groundwater flow and mixing processes within a part of the Lambourn Chalk catchment at Boxford, South East England. The fluorescence properties of groundwater and surface water samples from the site were examined to investigate the use of dissolved organic matter (DOM) as a natural tracer to better understand groundwater-surface water processes. Fluorescence centres were observed in fulvic acid-like, aromatic protein and microbial by-product like regions of the emission-excitation matrix in both groundwater and surface water samples. A decrease in the fluorescence intensities of the fulvic acid-like material was observed with depth (down to 25m) in the Chalk interfluvium and adjacent to the river highlighting the role of the soil zone as an important source of DOM. Groundwater from chalk beneath the gravels show fluorescence signatures similar, although less intense, to that of the river indicating a degree of mixing between water bodies. Fluorescence centres from groundwater in the gravels adjacent to the river show less of a river signature and are therefore perhaps partially isolated with the river system. These findings corroborate the conceptual model of groundwater movement and demonstrate the potential of intrinsic fluorescence as a natural tracer for investigating groundwater-surface water interactions.