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Scales of ground and surface water interaction in the hyporheic zone of a heterogeneous environment

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In relation to the Water Framework Directive, the Catchment Science Centre (Univ. of Sheffield, United Kingdom) develops an integrated study of the pressures on the ecological status of surface and ground waters of the Don catchment (South Yorkshire, United Kingdom). In this frame, the hyporheic zone is of interest, because of its ability to attenuate contaminants and of ecological relations with streams and aquifers. In the West of the catchment, Carboniferous deltaic deposits with contrasting hydraulic permeability are dominated by fracture flow and point discharge to streams. These economically minor aquifers potentially impact stream ecology, especially in terms of pollutant discharge. Porous alluvial deposits also interact with streams at a similar scale (several hundreds meters), with diffuse exchanges and distinct chemistry. At a smaller scale (several dozens meters), river flow and bedforms govern the advection of surface water in the riverbed, bringing dissolved oxygen, nutrients and organic matter to the hyporheic zone, and impacting hyporheic fauna and contaminant attenuation. Finally, at the metric scale, riverbed sedimentology influences the hyporheic fauna in terms of pore size, and govern transit times, connectivity and contaminant retardation capacity. Our aim is to build a conceptual model of the spatial and temporal scales of hydrological interaction of these factors, to better discuss contaminant transfer and ecological risk related issues. We first develop a general assessment of the heterogeneity of the interactions in four reaches of 500m length in a 10km stretch. Physicochemical signatures of hyporheic, stream and aquifer waters allow to quantify ground/surface water mixing in the hyporheic zone in relation to river geomorphology, and identify ground water origin. Hydraulic conductivity of riverbed sediments is

estimated by slug testing, and ground water discharge by temperature measurements.