Geophysical Research Abstracts
Vol. 19, EGU2017-5088, 2017
EGU General Assembly 2017

Investigating the role of the hyporheic zone in the transformation and fate of nitrogen within an agriculturally impacted catchment

Nicholas Garrard (1), Kevin Hiscock (2), Alina Marca (3), and Tim Jickells (4)

(1) University of East Anglia, United Kingdom (n.garrard@uea.ac.uk), (2) University of East Anglia, United Kingdom (k.hiscock@uea.ac.uk), (3) University of East Anglia, United Kingdom (a.marca@uea.ac.uk), (4) University of East Anglia, United Kingdom (t.jickells@uea.ac.uk)

The role of the hyporheic zone (HZ) in the attenuation of nitrogen in a catchment impacted by intensive arable agriculture is investigated after mass balance calculations showed a 31% discrepancy between input of nitrogen through fertiliser applications and the flux of nitrate in stream water downstream at the catchment outlet (Wexler, 2012). Measurement of the dual stable isotopes of nitrate together with major ion analysis has been carried out on field drain, stream water and nested in-stream piezometers (at depths of 0.5, 1.0 and 1.5 m below the stream bed). Sampling occurred at five sites along a 1.6 km reach in the Wensum Demonstration Test Catchment (DTC) in eastern England between October 2014 and March 2017. While Wexler (2012) highlighted the potential importance of the HZ in nitrate removal, stable isotope and nitrate concentration data in the present study reveal strong evidence for microbially-mediated denitrification in the soil profile as demonstrated in the field drain samples, while piezometer samples do not follow this same trend. Sampling of end-members (groundwater and stream water samples) reveals enriched $\delta 18ONO_3$ values in the piezometer samples (+2 to +35‰ relative to groundwater boreholes (+19.65‰ at 15.5 m depth and +18.53‰ at 12 m) and the stream water (+2.0 to +8.5‰, with similar $\delta 15NNO_3$ values across all sampling locations (+3 to +20‰. A slightly narrower range in $\delta 15NNO_3$ values is observed in the piezometer samples (+5 to +15‰. The large variability in piezometer samples suggests a sporadic input of high $\delta 18ONO_3$ material to the HZ, with $\delta 18ONO_3$ falling in the range of wet and dry deposition of atmospheric nitrate and nitrogen fertiliser. This input could potentially be masking any denitrification signal in the piezometer samples, given the very low concentrations of nitrate ($\sim$0.1 – 5 mg NO_3- L) present.