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Passive hyporheic flux meter - measuring nitrate flux to the reactive sites in the river bed

Julia Vanessa Kunz (1), Dietrich Borchardt (1), Michael Rode (1), and Michael Annable (2)

(1) Helmholtz Centre for Environmental Research UFZ, Magdeburg, Germany (vanessa.kunz@ufz.de), (2) Dep. of Environmental Engineering Sciences, University of Florida, Gainsville, Florida, USA (annable@ufl.edu)

Most European lowland rivers are afflicted by high nitrate loads, modified morphology and discharge regulations, resulting in restricted capacity to retain nitrate. In those nutrient saturated rivers, sediment bound denitrification is the only process by which nitrate is removed from the system. Despite the importance of the hyporheic zone in nutrient reduction we are lacking detailed information on the transport to and retention at those reactive sites.

Passive flux meters have successfully been used to measure contaminant transport to aquifers (eg Cho and Annable 2007).
Here we present how a modification of those samplers can be used to quantify nitrate flux to and intermediate storage patterns in the interstices of an agriculturally impacted river. Installed in the river bed sediments, water flux and nutrient quantities passing through the device are recorded. While the amount of water flux serves as an index for connectivity of the hyporheic zone (exchange surface-subsurface water) the nitrate flux through the device can be seen as the portion of nitrate subjected to denitrification.

The generated data on solute behavior in hyporheic zones are the missing puzzle to in-stream nitrate dynamics. Complementing flume and tracer experiments our approach depicts how discharge, morphology and sediment characteristics control the denitrification rate via the connectivity of the hyporheic zone. Passive hyporheic flux meter are a novel method to directly asses the quantity of removed nitrate by an in situ experiment.