Geophysical Research Abstracts
Vol. 21, EGU2019-1477, 2019
EGU General Assembly 2019

A small, low-cost, robust and reliable new electrical conductivity sensor for the improved quantification of hyporheic travel times and exchange processes

Nicolai Brekenfeld (1), Nick Kettridge (1), Theresa Blume (2), Adam Ward (3), Hjalmar Laudon (4), Kevin Bishop (5), David Hannah (1), and Stefan Krause (1)

(1) University of Birmingham, Birmingham, United Kingdom (nxb634@bham.ac.uk), (2) German Research Center for Geosciences, GFZ, Potsdam, Germany, (3) Indiana University Bloomington, Bloomington, IN, USA, (4) Swedish Agricultural University, Umea, Sweden, (5) Swedish Agricultural University, Uppsala, Sweden

The interactions between streamwater and hyporheic or riparian porewater are tightly linked to the biogeochemical and ecological processes within fluvial ecosystems. The analyses of hyporheic biogeochemical cycles often involves manual sampling, which either limits the number of sampling locations or the sampling frequency – or both. Estimating the travel time and the flow paths of hyporheic porewater as well as metabolic transformation rates is therefore sometimes connected to high uncertainties. Here we present a newly developed, small (<0.5cm), inexpensive (< 5 Euro), robust and reliable electrical conductivity sensor, based on the principle of a voltage divider. Connected to dataloggers, these sensors can be installed into the stream sediments and measure continuously the breakthrough curves of salt injections through bedforms, side bars, riparian zones and others. Once installed, these sensors hardly require any maintenance and induce low hydraulic disturbances due to their small size. We tested and installed ca. 100 of these sensors in-situ in a first-order boreal stream, along with multi-level piezometers and temperature sensors. The results indicate the suitability of these sensors for the estimation of hyporheic flow paths and residence times. Combining the low-cost, high spatial and temporal resolution of the electrical conductivity measurements with traditional porewater sampling can lead to a more accurate understanding and quantification of hyporheic exchange processes in future.