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New Potentiometric Wireless Chloride Sensors Provide High Resolution Information on Chemical Transport Processes in Streams

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Quantifying the travel times, pathways and dispersion of solutes moving through stream environments is critical for understanding the biogeochemical cycling processes that control ecosystem functioning. Validation of stream solute transport and exchange process models requires data obtained from in-stream measurement of chemical concentration changes through time. This can be expensive and time consuming, leading to a need for cheap distributed sensor arrays that respond instantly and record chemical transport at points of interest on timescales of seconds. To meet this need we apply new, low-cost (in the order of a euro per sensor) potentiometric chloride sensors used in a distributed array to obtain data with high spatial and temporal resolution. The application here is to monitoring in-stream hydrodynamic transport and dispersive mixing of an injected chemical, in this case NaCl. We present data obtained from the distributed sensor array under baseflow conditions for three stream reaches in Luxembourg. Sensor results are comparable to data obtained from more expensive electrical conductivity meters and allow spatial resolution of hydrodynamic mixing processes and identification of chemical ‘dead zones’ in the study reaches.