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# Experimental and modelling approaches for characterizing stream water-groundwater mixing and dynamic in the hyporheic zone

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The hyporheic zone, which is a near-channel zone of surface water-groundwater mixing, has a major importance in the functioning of ecosystems and reflects the whole ecological state of a river. As a consequence, a good understanding of the processes involved in the hyporheic zone is essential for river restoration.
In the present work, we used both experimental and modelling approaches for characterizing stream water – groundwater mixing and dynamic in the Essonne River (France). The experimental approach was based on geophysical and geochemical tools that give complementary results; water analyses are punctual whereas geophysical surveys give a continuous 2D model of the distribution of some parameters in the subsurface. The river was instrumented with several electrodes lines for electrical resistivity tomography (ERT), and multi-sampling systems to collect pore water from several depths within the streambed sediments. Precise topography of every electrode, piezometer and sampling system was done in order to understand the possible effect of streambed topography on observed measurements. An artificial flood was reproduced during a dam controlled experiment. The dam level downstream the studied area was lowered and raised in order to simulate a flood without any additional contribution from runoff. Another experiment was performed to follow the river water into the streambed sediments. Salt was added into the stream and followed with a high resolution monitoring.
Results from the different experiments showed that is it possible to follow the hyporheic zone dynamic thanks to different varieties of tools. The geophysical surveys indicate a clear change in resistivity of the streambed sediments when the water chemistry of the stream changes, along with the dam experiment. The end of the monitoring highlights a quite rapid return to the stable state despite some hysteresis observed in electric measurements.
In the modelling approach, we used a 3D distributed model, HydroGeoSphere, for simulating the experiments. A sensitivity analysis allowed us to determine the main hydrodynamic parameters. Ongoing simulations will help us to interpret experimental results.