Geophysical Research Abstracts
Vol. 18, EGU2016-17341, 2016
EGU General Assembly 2016

Monitoring hyporheic exchanges during a dam controlled experiment

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Precise understanding of the hyporheic exchanges response to stream flow fluctuations remains a great challenge for many environmental and hydrological problems. Multiplication of natural stream restoration programs and anthropic structures removal highlight that a better understanding of the hydrodynamic and ecological functioning of hyporheic exchanges is critical . The objective of this field experiment was to monitor the dynamic exchanges within the hyporheic zone due to an artificial stream head variation. Various types of measurements were performed, using natural tracers and electrical resistivity tomography (ERT).
The dam downstream the studied river reach was successively lowered during two days, and raised during three days, implying river heads variations of about 15cm. The studied area was equipped with CTD probes (measuring the head and the conductivity) within the river, 2 multi-depths water sampling tubes inserted up to one meter depth within the riverbed deposits and 3 ERT profiles with various electrode spacing (20 cm, 25 cm, 50 cm). During the 5 days experiment, water sampling and ERT profiles were done regularly. Estimations of the sediments hydraulic conductivity were obtained by several slug tests in plastic tubes at different depths within the streambed.
First results showed that stream fluctuation leads to a rapid hyporheic response according to chloride variations between stream and riverbed sediments. Similar results between geochemical and geophysical tools were found. A decrease in stream head leads to reduce the depth of the mixing zone, as the river gaining conditions intensify. On the contrary, we observed that an increased river head tends to deepen the hyporheic exchange zone.