Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.29786

A lab in the streambed: development of in-situ column experiments to study clogging dynamics.

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Globally, extensive river restoration efforts are undertaken for ecological enhancement and flood prevention. These activities can significantly modify surface water - groundwater interactions, especially if riverbed clogging was restricting recharge. Restoration works typically reduce the clogging and thus increase infiltration rates, affecting groundwater quality and quantity. However, over time, a new isolating clogging layer can develop, yet these dynamics are difficult to predict and remain poorly understood.

Riverbed clogging is commonly studied using lab column experiments, in which the settling of suspended particles gradually reduces pore space and hydraulic conductivity. However, the scaling up of these results to real-world dimensions remains uncertain.

To assess clogging under natural conditions, we developed a new approach by inserting sediment columns directly into the riverbed. These inserted columns can be equipped with sensors that provide continuous, near real-time monitoring of parameters linked to the clogging dynamics. Furthermore, the columns enable sampling at various depths and regular infiltration tests to evaluate hydraulic conductivity. The columns can be deployed in the riverbed for extended periods and later replaced or removed for further analysis in the laboratory.

We installed two columns filled with homogeneous sand (0.3 - 0.8 mm) in a river showing variable discharge and fluctuating suspended sediment load. This setup is representative of a simplified freshly restored riverbed exposed to frequent floods and clogging. Additionally, we performed repeated salt tracer-pulse tests to monitor the travel time of the infiltrating river water in combination with regular infiltration tests. For comparison, we conducted laboratory experiments using identical columns, sensors, and sediment fillings, and also performed repeated salt tracer-pulse tests.

This contribution will showcase the potential of this novel setup to analyse clogging at the relevant environmental scale.