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Using the Optical Imaging Profiler (OIP) for the detection of fluorescent tracers in groundwater

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Determination of preferential flow is crucial for the understanding of contaminant spreading. It allows more exact targeting of pollutants during remediation and provides a more accurate basis for groundwater protection activities. The typical ways for assessing this are laboratory analysis of sediment cores, tracer tests between wells and/or various geophysical methods with limited vertical resolution. Here we have investigated the capability of the Optical Imaging Profiler, a new in-situ and direct-push imaging probe for detection of fluorescent molecules. The performance of three different Optical Imaging Profiler (proto)types was compared in the laboratory using fluorescein, Eosin Y, Rhodamine WT and Sulforhodamine B. When only solutions were used in the tests, one type of Optical Image Profiler allowed detection limits from ∼0.005 to ∼0.05 mg/l, depending on the type of tracer. The two other types were less sensitive. Mixing of the tracer solutions with coarse to fine quartz sand resulted always in deterioration of the detection limit. Moreover, the measured fluorescence decreased with the grain size of the quartz. In a field trial, an injected 3.75 mg/l Eosin solution could be very clearly detected directly after the injection within a radius of 0.5 m around the injection point. The trial shows that the Optical Imaging Profiler can be used for in-situ detection of fluorescent tracers on centimeter scale with the advantage of the flexible placement of direct push-probes and without the expensive installation of observation wells.