Ground-penetrating radar surveys for the detection of preferential flow into soils

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Preferential flow is more the rule than the exception, in particular during water infiltration experiments. In this study, we demonstrate the potential of GPR monitoring to detect preferential flows during water infiltration. We monitored time-lapse ground penetrating radar (GPR) surveys in the vicinity of single-ring infiltration experiments and created a three-dimensional (3D) representation of infiltrated water below the devices. For that purpose, radargrams were constructed from GPR transects conducted over two grids (1 m × 1 m) before and after the infiltration tests. The obtained signal was represented in 3D and a threshold was chosen to part the domain into wetted and non-wetted zones, allowing the determination of the infiltration bulb. That methodology was used to detect the infiltration below the devices and clearly pointed at nonuniform flows in correspondence with the heterogeneous soil structures. The protocol presented in this study represents a practical and valuable tool for detecting preferential flows at the scale of a single ring infiltration experiment.