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Infiltration front monitoring using 3D Electrical Resistivity Tomography

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The electrical resistivity tomography (ERT) geophysical method is commonly used to identify the spatial distribution of electrical resisitivity in the soil at the field scale. Recent progress in commercial acquisition systems allows repeating fast acquisitions (10 min) in order to monitor a 3D dynamic phenomenon. Since the ERT method is sensitive to moisture content variations, it can thus be used to delineate the infiltration shape during water infiltration. In heterogeneous conditions, the 3D infiltration shape is a crucial information because it could differ significantly from the homogeneous behavior.
In a first step, the ERT method is validated at small scale (<1m) studying a suction infiltrometer test. The experiment is carried out in a pit filled with a homogenous silty-sandy soil. It is instrumented by 17 resistivity probes and 3 commercial capacitive moisture content probes to provide local measurements of the moisture content variation. The Multiple Inversion and Clustering Strategy (MICS) (Audebert et al 2014) is used to delineate the infiltration patern. A satisfying agreement between infiltration delineation and sensor measurements is obtained with a few centimeter accuracy on the moisture front location.
In a second step, the same methodology is applied at a larger scale (> 10m). Two examples of leachate injection monitoring in municipal solid waste landfills are used to put forward benefits and limitations of the ERT-MICS method. Effective infiltration porosities in a range between 3% and 8% support the assumption of a flow in heterogeneous media.

Audebert, M., R. Clément, N. Touze-Foltz, T. Günther, S. Moreau, and C. Duquennoi (2014), Time-lapse ERT interpretation methodology for leachate injection monitoring based on multiple inversions and a clustering strategy (MICS), Journal of Applied Geophysics, 111, 320-333.
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