02

ERT monitoring of water infiltration process through a landfill cover layer

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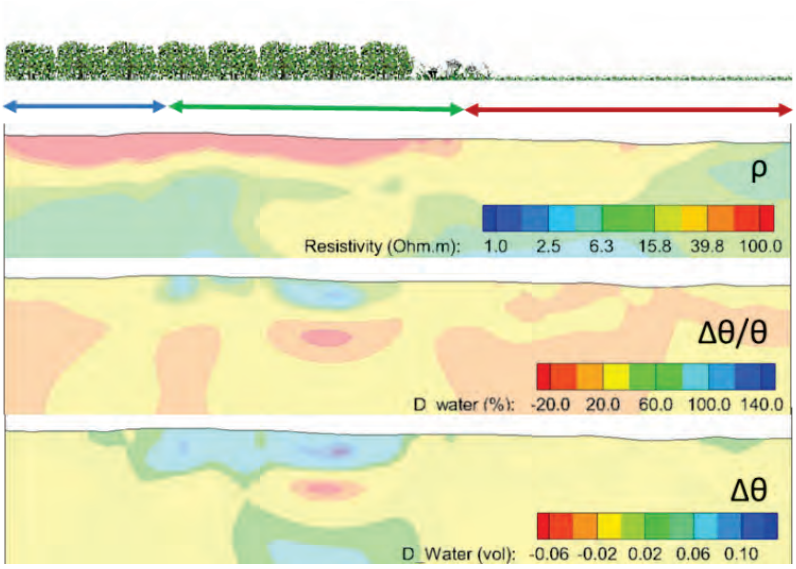
The electrical resistivity tomography is a suitable method to estimate the water content of a waste material and detect changes in water content. Various ERT profiles, both static data and time-lapse, where acquired on a landfill during the Minerve project.

Firstly, we estimated the water content of the waste from the resistivity data. For that purpose, we used petrophysical laws (namely Archie's law and Campbell's law) calibrated with laboratory experiments. The waste temperature was measured in a borehole and the leachate electrical conductivity was measured on waste samples collected during the drilling process.

Secondly, we investigated water content changes in the waste material after a rainfall event in order to better characterize the water infiltration and runoff process. In the literature, the relative change of water content is generally computed. Indeed, this parameter directly is linked to the relative change of resistivity through one single parameter: the Archie's law exponent. Working solely with difference inversion avoid considering the complexity of the initial state (difference in lithology, the initial water content, etc.). However, the absolute change of water content cannot be computed from the relative change of water content only.

During our investigation, a major rainfall (20-30 mm in 2 hours) occurred on the test site, characterized by a vegetalized and relatively dry zone and a devegatelized and humid zone. We intended to prove that most of the information contained in relative change of water content distribution is the initial water content distribution in the ground. Water addition in dry zones resulting in large relative changes. The computation of the absolute change of water content is necessary to demonstrate preferential infiltration through the capping in the vegetalized area.



As further perspectives, the method could be used in less complex areas (e.g. corn field) to analyze in details the water infiltration process (interception storage on the foliage, water retention, infiltration, runoff, etc.) and help in assessing the system water balance.