Geophysical Research Abstracts
Vol. 18, EGU2016-18245-1, 2016
EGU General Assembly 2016

Time lapse imaging of water content with geoelectrical methods: on the interest of working with absolute water content data

Gaël Dumont (1), Tamara Pilawski (1), Tanguy Robert (2), Thomas Hermans (3), Sarah Garré (4), and Frederic Nguyen (1)

(1) University of Liege, Applied geophysics, Liege, Belgium, (2) Aquale S.P.R.L., Ecofox Développement, Novilles les Bois, Belgium, (3) Stanford University, Stanford, USA, (4) University of Liege, Agro-Bio Tech, Gembloux, Belgium

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.

In the literature, the relative change of resistivity ($\Delta\rho/\rho$) is generally computed. For saline or heat tracer tests in the saturated zone, the $\Delta\rho/\rho$ can be easily translated into pore water conductivity or underground temperature changes (provided that the initial salinity or temperature condition is homogeneous over the ERT panel extension).

For water content changes in the vadose zone resulting of an infiltration event or injection experiment, many authors also work with the $\Delta\rho/\rho$ or relative changes of water content $\Delta\theta/\theta$ (linked to the change of resistivity through one single parameter: the Archie's law exponent "m"). This parameter is not influenced by the underground temperature and pore fluid conductivity (ρ¬w) condition but is influenced by the initial water content distribution. Therefore, you never know if the loss of $\Delta\theta/\theta$ signal is representative of the limit of the infiltration front or more humid initial condition.

Another approach for the understanding of the infiltration process is the assessment of the absolute change of water content ($\Delta\theta$). This requires the direct computation of the water content of the waste from the resistivity data. For that purpose, we used petrophysical laws calibrated with laboratory experiments and our knowledge of the in situ temperature and pore fluid conductivity parameters. Then, we investigated water content changes in the waste material after a rainfall event ($\Delta\theta = \Delta\theta/\theta * \theta$). This new observation is really representatives of the quantity of water infiltrated in the waste material. However, the uncertainty in the pore fluid conductivity value may influence the computed water changes ($\Delta\theta$=k*m$\sqrt{}$(ρ_w) ; where "m" is the Archie's law exponent).

Using these two complementary approaches, we analyzed the effect a major rainfall (20-30 mm in 2 hours) that 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 the $\Delta\theta/\theta$ distribution is the initial water content distribution in the ground. Water addition in dry zones resulting in large relative changes. The computation of the $\Delta\theta$ is necessary to demonstrate preferential infiltration through the capping in a restricted zone of the vegetalized area.