

Hydrology II

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4D ERT monitoring for the hydrological characterization of the rocky unsaturated zone

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In recent years geophysics is increasingly used to study the flow and transport processes in the vadose zone.

Particularly, when the vadose zone is constituted of rocks, it is very difficult to install sensors to measure directly hydrological properties of the subsurface. In these cases, Electrical Resistivity Tomography (ERT) could be a useful tool to monitor hydrodynamic of the infiltration and to predict some parameters such as water content and hydraulic conductivity, that affect the mentioned processes.

The study case describes a 4-D ERT monitoring of an infiltrometer test in order to provide a quantitative information about infiltration and redistribution of water in the rocky subsurface. The field activities have been performed in a quarry of sandstone near the town of Canosa, in the South Italy.

Infiltrimeter test has been conducted for many hours at variable head condition using a metallic ring of 0.5 m in diameter, installed directly on the rock, poured with about 8 l of water. The falling of water levels has been measured by means a pressure transducer (PXT – DRUNK ENGLAND) and a metric rod connected to the ring.

Around the ring, 96 steel electrodes, 0.4 m spaced have been installed in a symmetrical position with respect to the center of the infiltrometer ring in order to image a true 3D electrical resistivity distribution of the subsurface. Three days time-lapse ERT monitoring allowed to collect more than 20000 data to obtain reliable geophysical model of the subsurface investigated.

In order to convert images of electrical resistivity in water content a specific calibration function, using four electrodes array, has been obtained in the laboratory on sandstone samples drilled in the same quarry.

The hydro-geophysical results have been supported by means a numerical model.