



Hydrogeophysical monitoring of water infiltration processes

Ivan Bevilacqua (1), Giorgio Cassiani (2), Rita Deiana (2), Davide Canone (1), and Maurizio Previati (1)

(1) Università di Torino, DEIAFA - Sez. Idraulica Agraria, Grugliasco, Italy (ivan.bevilacqua@unito.it), (2) Università di Padova Dipartimento di Geoscienze

Non-invasive subsurface monitoring is growing in the last years. Techniques like ground-penetrating radar (GPR) and electrical resistivity tomography (ERT) can be useful in soil water content monitoring (e.g., Vereecken et al., 2006). Some problems remain (e.g. spatial resolution), but the scale is consistent with many applications and hydrological models. The research has to provide even more quantitative tools, without remaining in the qualitative realm. This is a very crucial step in the way to provide data useful for hydrological modeling.

In this work a controlled field infiltration experiment has been done in August 2009 in the experimental site of Grugliasco, close to the Agricultural Faculty of the University of Torino, Italy. The infiltration has been monitored in time lapse by ERT, GPR, and TDR (Time Domain Reflectometry).

The sandy soil characteristics of the site has been already described in another experiment [Cassiani et al. 2009a]. The ERT was performed in dipole-dipole configuration, while the GPR had 100 MHz and 500 MHz antennas in WARR configuration. The TDR gages had different lengths. The amount of water which was sprinkled was also monitored in time. Irrigation intensity has been always smaller than infiltration capacity, in order not to have any surface ponding.

Spectral induced polarization has been used to infer constitutive parameters from soil samples [Cassiani et al. 2009b]. 2D Richards equation model (Manzini and Ferraris, 2004) has been then calibrated with the measurements.

References.

Cassiani, G., S. Ferraris, M. Giustiniani, R. Deiana and C. Strobbia, 2009a, Time-lapse surface-to-surface GPR measurements to monitor a controlled infiltration experiment, in press, Bollettino di Geofisica Teorica ed Applicata, Vol. 50, 2 Marzo 2009, pp. 209-226.

Cassiani, G., A. Kemna, A. Villa, and E. Zimmermann, 2009b, Spectral induced polarization for the characterization of free-phase hydrocarbon contamination in sediments with low clay content, Near Surface Geophysics, special issue on Hydrogeophysics, p. 547-562.

Manzini G., and Ferraris S. 2004. Mass-conservative finite-volume methods on 2-D unstructured grids for the Richards equation, 'Advances in Water Resources' 27(12):1199–1215, 2004.

content with ground penetrating radar: A review. Vadose Zone Journal 2, 476–491.

Vereecken H., Binley A., Cassiani G., Kharkhordin I., Revil A. and Titov K. 2006. Applied Hydrogeophysics. Springer-Verlag.