

## **CROSS BOREHOLE 3-D ELECTRICAL RESISTIVITY TOMOGRAPHY AS A SOURCE OF AUXILIARY INFORMATION FOR UNSATURATED FLOW MODELS**

R. MIDDLETON, A.M. BINLEY, G. CASSIANI, AND P. WINSHIP  
Dept. of Environmental Science, Lancaster University, UK

The development of saturated and unsaturated groundwater flow models traditionally relies on borehole hydrological information. However, geophysical data are increasingly utilized as auxiliary information to constrain the model calibration process. Among the advantages of geophysical data are: (i) they are non-invasive; (ii) they can map quantities of interest in their spatial variability. In modelling unsaturated flow processes electrical resistivity tomography (ERT) provides precious data on water content as a function of space and time, given a well established relationship between pore fluid water content and bulk resistivity. In particular, cross borehole ERT may be used to constrain vadose zone models. A combined geophysical-hydrological study of a controlled water tracer injection in a sandstone aquifer is reported. Changes in pore fluid saturation tomograms over time resulting from application of 3-dimensional cross borehole ERT show migration of the tracer through the vadose zone. These tomograms are compared with those predicted by an appropriate vadose zone model with a-priori knowledge of the site. The combined hydro-geophysical programme permits the value of the geophysical data in constraining the hydrological model to be assessed.