Geophysical Research Abstracts
Vol. 13, EGU2011-1267-1, 2011
EGU General Assembly 2011

Direct and indirect measurements of porosity on a real heterogeneous confined aquifer

Carmine Fallico, Aldo Pedro Ferrante, Maria Chiara Vita, and Samuele De Bartolo
University of Calabria, Department of Soil Conservation, Rende, Italy (ferranteap@libero.it, 0984494050)

The porous media can be considered as composed of a pore phase and a solid one. The flux and mass transfer phenomena in these media are strongly affected by the characteristics of the pores inside of which the groundwater flows. Therefore the porosity plays a very important role among the parameters characterizing a porous media. The measurement of this parameter can be performed directly in laboratory, on undisturbed soil samples, or indirectly in field, relating the porosity other with parameters easier to measure, as hydraulic conductivity, electric resistivity, velocity of seismic waves, etc... (Archie, 1942; Biot, 1956; Miura et al., 2001).
In this study direct and indirect porosity measurement, performed on the confined aquifer of the Montalto Uffugo test field (Department of Soil Conservation - Calabria University – Italy), were considered. The indirect measurement of porosity was carried out by hydraulic conductivity measurements. On the test field area it is possible to differentiate a shallow and a lower confined aquifer, separated by a clay layer. The considered confined aquifer, constituted by sand, conglomerates and loam, shows a thickness of about 44 meters, with the bottom to 55 meters depth, where a compact clay layer begins. In this test field there are 5 wells drilled in the shallow aquifer, 6 wells and 2 piezometers drilled in the confined aquifer, of which only one well and the two piezometers are completely penetrating. For each of the drilling columns of the two piezometers, A and B, n. 18 undisturbed soil samples were considered and analyzed in laboratory, determining in direct manner the hydraulic conductivity and the porosity for each soil sample. The hydraulic conductivity measurement was carried out by the flux cells on the saturated soil samples, while the porosity measurements were carried out by the gravimetric method. The indirect measurements of hydraulic conductivity were carried out by slug tests and aquifer tests. The correspondent porosity values were obtained using empirical relations based on the particle size analysis (Odong, J., 2007, Vukovic and Soro, 1992).
The porosity values measured in direct and in indirect manner were compared, putting them on a graph. In this way it was possible to verify a substantial difference between the values measured by the two considered methods, that is at different scales.

Bibliografy

Archie, G.E., 1942. Electrical resistivity log as an aid to determining some reservoir characteristics. Trans. AIME 146, 54-61.
Biot, M.A., 1956. Theory of Propagation of Elastic Waves in a Fluid-Saturated Porous Solid. I. Lower Frequency Range. II. Higer Frequency range. J. Acoust. Soc. Am. 28,168-191.
Miura, K., Yoshida, N., Kim, Y.S., 2001. Frequency Dependent Property of Wavws in Saturated Soil". Soils and Foundations 41, 1-19.
Odong, J., 2007. Evaluation of Empirical Formulae for Determination of Hydraulic Conductivity based on Grain-Size Analysis. Journal of American Science 3, 54-60.
Vukovic, M., Soro, A., 1992. Determination of hydraulic Conductivity of Porous media from Grain-Size Composition. Water Resources Publications, Littleton, Colorado.