Geophysical Research Abstracts,
Vol. 11, EGU2009-6753, 2009
EGU General Assembly 2009

Effective hydraulic properties on a highly heterogeneous soil horizon

A. Samouëlian, I. Cousin, A. Frison, and G. Richard

Centre de Recherche INRA d'Orléans, Unité de Science du Sol, 2163 Av. de la Pomme de Pin, CS 40001 ARDON, 45075 ORLEANS Cedex 2, France (anatja.samouelian@orleans.inra.fr)

Knowing the soil hydraulic functioning for agricultural practices is more and more important in the context of global change. In that context, soil horizons represent the reference soil volume in term of soil functioning. Nevertheless they can be heterogeneous as for example, stony horizons, cultivated horizons, or also specific weathering horizons like those in Albeluvisol. The determination of effective hydraulic properties in these heterogeneous horizons can not be done by classical laboratory experiments like Multi-Step-Outflow or evaporative Wind experiment. So it remains a real challenge to get the effective hydraulic properties. The aim of this paper is to propose a methodology for the determination of effective hydraulic properties of heterogeneous soil horizons based on the knowledge of the: on one hand the 3D soil structure and on the other hand the local hydraulic properties.

The studied soil is an Albeluvisol that exhibits some horizons composed by the juxtaposition of two Elementary Pedological Volumes (EPVs); they can be visually distinguished by their colours (ochre and white) and they have differential hydraulic functioning: the clayey ochre ones conduct less water than the loamy white ones. Local hydraulic properties were determined on each type of volumes. The 3D structure of the heterogeneous horizon was obtained by electrical resistivity measurements. Several two-dimensional cuts with different structures were extracted from this 3D block so that we can simulate on them the hydraulic functioning of the horizon by the Hydrus2D software. The equivalent water retention curve was obtained thanks to the additive properties of the water retention curves at the local scale. The equivalent unsaturated hydraulic conductivity of the horizon was determined on each 2D cut, which requires the knowledge of the structure. The calculations were done by two methods, a numerical one that simulated the water flow for a constant hydraulic potential, a analytical one that used the Wiener, the Cardwell & Parsons, and the Matheron bounds. The first method provides accuracy results but it is quite time consuming, the second method was much more rapid to do but provided only bounds of the unsaturated hydraulic conductivity.

Based on laboratory data related to a real field application, we finally discussed the methods to estimate the equivalent unsaturated hydraulic conductivity. Water flow simulations using the different effective hydraulic conductivity were then compared.