Geophysical Research Abstracts,
Vol. 11, EGU2009-2258, 2009
EGU General Assembly 2009

Pore network complexity and thresholding of 3D soil images

A.M. Tarquis (1), R.J. Heck (2), D. Andina (3), A. Alvarez (4), and J.M. Anton (5)

(1) CEIGRAM - Universidad Politécnica de Madrid, ETSI Agronomos, Spain (anamaria.tarquis@upm.es), (2) Department of Land Resource Science. Ontario Agricultural College, University of Guelph. NIG 2WI, CANADA (rheck@uoguelph.ca), (3) E.T.S. Ing. Telecomunicaciones, U.P.M. Ciudad Universitaria, s.n. 28040 Madrid. SPAIN (d.andina@upm.es), (4) E.T. Ing. Telecomunicaciones, U.P.M.. Km 7 Ctra de Valencia, 28031 Madrid. SPAIN (aalvarez@ics.upm.es), (5) ETSI Agronomos, Matematica Aplicada, Madrid, U.P.M., Spain (josemanuel.anton@upm.es)

Informative geometric parameters are needed to describe the complex spatial arrangement of pore systems in porous media. Three-dimensional images (45.1 micro m. resolution) of soil samples exhibiting different spatial arrangements and porosities were analyzed to calculate their generalized dimensions (Dq) in the multifractal framework.

Four different threshold criteria were used to transform the CT grey-scale imagery in the binary imagery of pore space and solid phase to study the influence of this choice in Dq values. Thresholds were based on the histograms of the CT units representing voxels. The selection of the threshold affected the value of the apparent porosity inferred from the CT images.

The pore space structure could be described by the multifractal model only for the larger cubes sizes (side lengths ranging from 32 to 256 voxel sides) regardless of the thereshold criteria. Values of Dq were obtained by restricting multifractal analysis (MFA) to these cube sizes.

The difference w between the Dq values for q=-1 to q=5 was also dependent on the threshold criterion selection, and was used to compare the effect of the threshold criteria selection on the multiscaling behaviour. The w values decreased exponentially as the apparent porosity increased. For the same threshold, the largest values of w, indicating the most developed multifractal structure, were found in the surface horizon where interactions with atmosphere and root activity were the most pronounced, and in the relatively deep illuvial horizons where the colloidal material was accumulated that was leached from the upper soil horizons.