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Multifractal analysis of 2D gray soil images

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Soil structure, understood as the spatial arrangement of soil pores, is one of the key factors in soil modelling processes. Geometric properties of individual and interpretation of the morphological parameters of pores can be estimated from thin sections or 3D Computed Tomography images (Tarquis et al., 2003), but there is no satisfactory method to binarized these images and quantify the complexity of their spatial arrangement (Tarquis et al., 2008, Tarquis et al., 2009; Baveye et al., 2010). The objective of this work was to apply a multifractal technique, their singularities (α) and f(α) spectra, to quantify it without applying any threshold (Gónzalez-Torres, 2014).

Intact soil samples were collected from four horizons of an Argisol, formed on the Tertiary Barreiras group of formations in Pernambuco state, Brazil (Itapirema Experimental Station). The natural vegetation of the region is tropical, coastal rainforest. From each horizon, showing different porosities and spatial arrangements, three adjacent samples were taken having a set of twelve samples. The intact soil samples were imaged using an EVS (now GE Medical. London, Canada) MS-8 MicroCT scanner with 45 μm pixel-1 resolution (256x256 pixels). Though some samples required paring to fit the 64 mm diameter imaging tubes, field orientation was maintained.

References

Baveye, P.C., M. Laba, W. Otten, L. Bouckaert, P. Dello, R.R. Goswami, D. Grinev, A. Houston, Yaoping Hu, Jianli Liu, S. Mooney, R. Pajor, S. Sleutel, A. Tarquis, Wei Wang, Qiao Wei, Mehmet Sezgin. Observer-dependent variability of the thresholding step in the quantitative analysis of soil images and X-ray microtomography data. Geoderma, 157, 51-63, 2010.

González-Torres, Iván. Theory and application of multifractal analysis methods in images for the study of soil structure. Master thesis, UPM, 2014.

Tarquis, A.M., R.J. Heck, J.B. Grau; J. Fabregat, M.E. Sanchez and J.M. Antón. Influence of Thresholding in Mass and Entropy Dimension of 3-D Soil Images. Nonlinear Process in Geophysics, 15, 881-891, 2008.

Tarquis, A.M., R.J. Heck, D. Andina, A. Alvarez and J.M. Antón. Multifractal analysis and thresholding of 3D soil images. Ecological Complexity, 6, 230-239, 2009.

Tarquis, A.M.; D. Giménez, A. Saa, M.C. Díaz. and J.M. Gascó. Scaling and Multiscaling of Soil Pore Systems Determined by Image Analysis. Scaling Methods in Soil Systems. Pachepsky, Radcliffe and Selim Eds., 19-33, 2003. CRC Press, Boca Ratón, Florida.

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