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# Mass fractal dimension and spectral dimension to characterize different horizons in La Herreria (Sierra de Guadarrama, Spain)

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Knowledge on three dimensional soil pore architecture is important to improve our understanding of the factors that control a number of critical soil processes as it controls biological, chemical and physical processes at various scales. Computed Tomography (CT) images provide increasingly reliable information about the geometry of pores and solids in soils at very small scale with the benefit that is a non-invasive technique. Fractal formalism has revealed as a useful tool in these cases where highly complex and heterogeneous meda are studied. One of these quantifications is mass dimension (Dm) and spectral dimension (d) applied to describe the water and gas diffusion coefficients in soils (Tarquis et al., 2012).

In this work, intact soil samples were collected from the first three horizons of La Herreria soil. This station is located in the lowland mountain area of Sierra de Guadarrama (Santolaria et al., 2015) and it represents a highly degraded type of site as a result of the livestock keeping. The 3D images, of 45.1 micro-m resolution (256x256x256 voxels), were obtained and then binarized following the singularity-CA method (Martín-Sotoca et al. 2016). Based on these images Dm and d were estimated.

The results showed an statistical difference in porosity, Dm and d for each horizon. This fact has a direct implication in diffusion parameters for a pore network modeling based on both fractal dimensions. These soil parameters will constitute a basis for site characterization for further studies regarding soil degradation; determining the interaction between soil, plant and atmosphere with respect to human induced activities as well as the basis for several nitrogen and carbon cycles modeling.

References

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