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Geometrical attributes of soil pore space to characterize soil management and depth

Fernando San José Martínez, Luisa Martín Horcajo, and Javier Caniego Monreal
Dpt. Applied Mathematics, Universidad Politécnica de Madrid, Madrid, Spain (fernando.sanjose@upm.es)

Hydraulic properties and transport of solutes in the unsaturated zone of the soil depend on the geometrical structure of pore space. Tunnels and cavities are two types of pores that appear on media such as natural soil. They have a different behavioral response in physical processes such as water flow, water accessibility or solute transport. In this work we analyze pore tunnels observed in 3D images of soil columns obtained by computed tomography. We use geometrical and topological properties of the pores quantified by theirs Minkowski functionals: four measures that are directly related to volume, area, accumulated mean curvature and Euler number/connectivity of soil voids. We study if these measures show statistically significant differences for samples from the same soil that has been subjected to two different agricultural treatments, at two different depths. Our work is framed in the need to evaluate the pertinence of geometrical indicators such as those previously mentioned to discern between porous structures whose dissimilarity is known in advance. Our results suggest the relevance of Minkowski functionals as geometric indicators of soil management and depth.