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Soil porosity correlation and its influence in percolation dynamics

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The prediction of percolation in natural soils is relevant for modeling root growth and optimizing infiltration of water and nutrients. Also, it would improve our understanding on how pollutants as pesticides, and virus and bacteria (Darnault et al., 2003) reach significant depths without being filtered out by the soil matrix (Beven and Germann, 2013).

Random walk algorithms have been used successfully to date to characterize the dynamical characteristics of disordered media. This approach has been used here to describe how soil at different bulk densities and with different threshold values applied to the 3D gray images influences the structure of the pore network and their implications on particle flow and distribution (Ruiz-Ramos et al., 2009).

In order to do so first we applied several threshold values to each image analyzed and characterized them through Hurst exponents, then we computed random walks algorithms to calculate distances reached by the particles and speed of those particles. At the same time, 3D structures with a Hurst exponent of ca 0.5 and with different porosities were constructed and the same random walks simulations were replicated over these generated structures. We have found a relationship between Hurst exponents and the speed distribution of the particles reaching percolation of the total soil depth.

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