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TITLE: Percolation in soils at Different Bulk Densities: Porosity, Connectivity and Grey Threshold.
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SESSION TITLE: H51H. Quantifying and Evaluating Spatial Heterogeneity in Porous Media I Posters

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ABSTRACT BODY: To improve percolation modelling on soils the geometrical properties of the pore space must be understood; this includes porosity, particle and pore size distribution and connectivity of the pores. A study was conducted with a soil at different bulk densities based on 3D grey images acquired by X-ray computed tomography. The objective was to analyze the effect in percolation of aspects of pore network geometry and discuss the influence of the grey threshold applied to the images. A model based on random walk algorithms was applied to the images, combining five bulk densities with up to six threshold values per density. This allowed for a dynamical perspective of soil structure in relation to water transport through the inclusion of percolation speed in the analyses. To evaluate separately connectivity and isolate the effect of the grey threshold, a critical value of 35% of porosity was selected for every density. This value was the smallest at which total-percolation walks appeared for the all images of the same porosity and may represent a situation of percolation comparable among bulks densities. This criterion avoided an arbitrary decision in grey thresholds. Besides, a random matrix simulation at 35% of porosity with real images was used to test the existence of pore connectivity as a consequence of a non-random soil structure. The results showed that porosity distribution with depth had the greatest oscillations for the smallest density, while random matrix presented a scattered distribution around the 35% mean due to the lack of structure. Random matrix presented a normal distribution of percolation speed. In general, percolation speed for real images diminished with bulk density for total percolation walks (Fig. 1). The simulated percolation speed for these images were not distributed according to a Gaussian curve, so it was not possible to assume the Darcy's Law to explain percolation in these soils.

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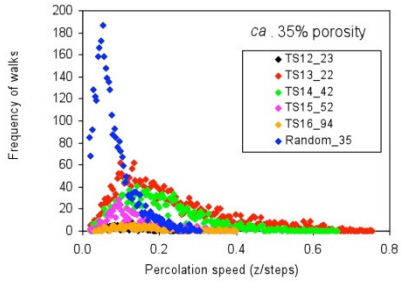

Fig. 1. Frequency of percolation speed reached by total percolation walks for five soils at bulk densities 1.2, 1.3, 1.4, 1.5 and 1.6 at their grey levels corresponding at ca. 35% of porosity, and for a random matrix generated with 35% of porosity.

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