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Multifractal Characterization of Soil Pore Shapes

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Two dimensional (2-D) images representing pores and solids are used for direct quantification of soil structure using tools that are sensitive to the spatial arrangement of pores or by grouping pores by morphological properties such as shape and size. Pore shapes and sizes are related and have been used to interpret soil processes. Fractal and multifractal methods of pore characterization have been applied separately to spatial arrangement of soil pores and to pore size distributions derived from 2-D images. The objective of this work was to estimate fractal dimensions of spatial arrangement of soil pores of predetermined shapes. Images covering a range of soil structures were analyzed. Pore shape was classified using a shape factor S that quantifies the circularity of pores (S=1 for circular pores). Images containing only pores with S values smaller than 0.1, between 0.1 and 0.2, 0.2 and 0.5, 0.5 and 0.7 and greater than 0.7 were derived from the initial images and analyzed with a multifractal algorithm. The findings of this work will be discussed in relation to models of soil hydraulic properties.