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# Assessing mercury injection porosimetry curves in two soils with contrasting structural stability by the entropy dimension

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The soil pore space is defined by the relative arrangement of soil particles and aggregates, so that it is complementary to the solid phase. Consequently, both pore space and aggregates may be used for assessment and characterization of soil structure. Parameters are needed to recognize and monitor changes in pore size distributions caused by differences in soil management systems or by degradation of the structural stability. The objective of this work was to evaluate multifractal parameters from Hg injection porosimetry curves on the uppermost surface layer of two soils with contrasting structural stability and organic matter content, before and after simulated rainfall application.

Samples of the studied soils were collected from agricultural fields. The first soil was loamy textured with 36.71 % sand, 37.16 % silt and 26.13 % clay, 4.61 % organic matter content, and high aggregate stability as indicated by a mean weight diameter of 2.136 mm. The second soil was a silty-loam prone to crusring with 28.08 % sand, 57.07 % silt and14.85 % clay, 2.17 % organic matter content, and a mean weight diameter of 0.262 mm, thus a low structural stability. These samples are referredto as low and high structure stability samples, respectively. Depositional crusts were produced by means of successive events of simulated rainfall and drying periods between them. Cumulative rain was 260 mm and 140 mm on the soil with higher and lower structural stability, respectively. Ten replicated samples were taken from each of the initial freshly tilled soil surfaces and also from each of the surfaces disturbed by rainfall,

so that forty individual samples were analyzed. Pore size distributions (PSDs) were determined by mercury intrusion porosimetry. The scaling properties of (PSDs) were charaterized from singularity spectrum and the Rényi espectrum.

Pore volumes in the equivalent pore diameter range from 100 to 0.005 $\mu$m, were significantly higher on the freshly tilled soil surfaces of the two soils than on their respective disturbed counterparts. The most important aggregate volume reduction was in the diameter range from and 10 to 2 $\mu$m.

Soil pore size distributions from Hg intrusion porosimetry could be fitted reasonably well with multifractal models. Multifractal characterization was carried out by means of the scaling of the moments ranging from -10 $<$ q $<$ 10 of the probability distributions of Hg PSDs. Multifractal singularity spectra, f $(\alpha)$ and generalized fractal dimensions or Rényi dimensions, $D_q$, were calculated. Rényi spectra lead to a better definition of multifractal scaling than singularity spectra.

The generalized dimensions, $D_q$, for q = 1 which is known as the information or entropy dimension, $D_1$, discriminates best between PDSs of soils with high and low structural stability. Within each of the two soils the entropy dimension, $D_1$also discriminates between recently prepared and degraded soil surfaces. Mean values of $D_1$ for the soil with the highest aggregate stability were 0.931 and 0.906 before and after simulated rainfall, respectively. In the soil with the lowest aggregate stability mean $D_1$ values before and after simulated rainfall were 0.804 and 0.749, respectively. The smaller the value of $D_1$, the higher the measure is concentrated in a small size domain of the study scale. Consequently soil structure deterioration lead to clustering of PSDs obtained by Hg intrusion porosimetry.

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