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# Multifractal and Singularity Maps of soil surface moisture distribution derived from 2D image analysis.

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Soil moisture distribution usually presents extreme variation at multiple spatial scales. Image analysis could be a useful tool for investigating these spatial patterns of apparent soil moisture at multiple resolutions. The objectives of the present work were (i) to describe the local scaling of apparent soil moisture distribution and (ii) to define apparent soil moisture patterns from vertical planes of Vertisol pit images.

Two soil pits (0.70 m long $\times$ 0.60 m width $\times$ 0.30 m depth) were excavated on a bare Mazic Pellic Vertisol. One was excavated in April/2011 and the other pit was established in May/2011 after 3 days of a moderate rainfall event. Digital photographs were taken from each Vertisol pit using a Kodak$^{TM}$ digital camera. The mean image size was 1600 $\times$ 945 pixels with one physical pixel $\approx$373 $\mu$m of the photographed soil pit. For more details see Cumbrera et al. (2012).

Geochemical exploration have found with increasingly interests and benefits of using fractal (power-law) models to characterize geochemical distribution, using the concentration–area (C–A) model (Cheng et al., 1994; Cheng, 2012). This method is based on the singularity maps of a measure that at each point define areas with self-similar properties that are shown in power-law relationships in Concentration-Area plots (C-A method). The C-A method together with the singularity map ("Singularity-CA" method) define thresholds that can be applied to segment the map. We have applied it to each soil image.

The results show that, in spite of some computational and practical limitations, image analysis of apparent soil moisture patterns could be used to study the dynamical change of soil moisture sampling in agreement with previous results (Millán et al., 2016).

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