



## QUANTIFYING FLOW PATHS IN CLAY SOILS USING MULTIFRACTAL DIMENSION AND WAVELET-BASED LOCAL SINGULARITY

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**ABSTRACT**—Most soil parameters as the spatial variability of preferential pathways for water and chemical transport in field soils show complex variations at different scales that cannot accurately described with stationary assumptions. This is why multifractal formalism or the wavelet transform reveals as useful tools for classifying and quantifying the spatial variability of these preferential pathways, as visualized through dye infiltration experiments.

The high-resolution images resulting from these experiments are analyzed using both box-counting methods and wavelet transform analysis (WTA). The box-counting methods reveals global scaling patterns while the WTA focuses on local distribution of singularities. So, in the context of multiscaling structure analysis the wavelet methods can complement box-counting analysis which could be useful for statistically describing preferential flow path geometry and flow processes.

The methodology is illustrated using well-known fractal structures as multifractal Sierpinsky carpets and results are illustrated with images of horizontal planes of the subsoil, acquired after dye infiltration into a 4m<sup>2</sup> plot located on a Vertisol soil near College Station, Texas.

**Key Words:** wavelet transform, singularities, multifractal, generalized dimensions, multifractal spectrum, Sierpinsky carpets, hydrology.