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Assessing microrelief decay during simulated rainfall by Multifractal analysis

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Soil surface roughness, a general term to describe the variation in soil microrelief across a field, is now recognized as a key factor in erosion processes. Because of difficulties in characterizing soil surface roughness by single indices, including monofractal ones, the characteristics soil surface roughness remains poorly defined. The main objective of this study has been to use the multifractal analysis (MFA) as a new tool in soil surface roughness assessment. Soil surfaces were prepared using aggregates from the top layer of an agricultural soil in laboratory conditions. Initial surfaces were reconstructed to simulate a natural seedbed so that their random roughness was rather low. The largest aggregates were between 20 and 30 cm. Degraded situations were obtained by simulated rain. Elevations were measured with laser relief meters. Sample spacing, or distance between points on a transect and between transects was 2 mm and vertical resolution was 0.1 mm. The soil surface was scanned periodically, first just after initial microrelief was created, before starting simulated rain, and later on after each of the successive rainfall applications. After trend removal we created raster-based maps (DEMs) from roughness measurements on regular grids. Multiscale nature of soil surface roughness was studied through a MFA of elevation data obtaining a f(a)-singularity spectrum based on a gliding box algorithm. This algorithm has been applied to data sets corresponding to a silt loam soil, measured under different initial conditions and rainfall intensities. From this multifractal spectrum several parameters are selected to assess microrelief decay following consecutive rainfall ap-

plications.