



Joint multifractal analysis of soil general properties measured along a transect

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This work is an extension of a previous multifractal analysis of the spatial variability on basic soil properties. Seventy-nine soil samples were collected on a 2370 m long plot at 30 m intervals in Campinas, SP, Brazil. Site, sampling strategy, climate and soil type have been described before (Vidal Vázquez et al., 2010). In this previous work we reported that general physico-chemical soil properties (sand, silt and clay content, pH, organic matter content, exchangeable bases, exchangeable aluminium + hydrogen and cation exchange capacity) had a multiple scale behaviour that was characterized by multifractal functions. There is little information on multiple scale relationships between two interacting and multifractally distributed soil properties, and to our knowledge this research topic had not been before carried out in tropical soils. The objective of this study was to analyze the scale dependence between pairs of basic soil properties by joint multifractal analysis. The moment method was employed to obtain the partition function, the local scaling indices, $\alpha(q,t)$ and $\beta(q,t)$, for each pair of variables and the spectra of the joint dimensions, $f(\alpha,\beta)$, for the corresponding joint distributions. This allows assessment of the strength of the association between the scaling indices of two variables. We showed that relationships between some of the study soil properties were a function of the observation scale. Advantages of multiple scale analysis upon single scale analysis using multifractal and joint multifractal analysis were discussed based on the relationship between the spatial distribution of soil texture parameters (sand and clay) and basic chemical properties. It was concluded that multiple scale analysis significantly improved characterization of spatial variability in soil properties.

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References

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