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Scale dependence relationship between soil physical properties

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Spatial variability and scaling of soil and soil water properties are traditionally studied by means of geostatistics and spectral analysis. These techniques are very powerful in many conditions except when dealing with nonstationary and highly variable data. Many of them are based on averaging over spatial locations and hence information on localized areas is lost. Deeper understanding of spatial variability of soil properties and their relationship among them to scale up measured soil properties that can be used to improve the predictive capacity of several functions applied in soil. The objective of this study was to characterize scaling properties and persistency of several soil physical properties through Multifractal Analysis (MFA).

Volumetric water content (v.w.c.), porosity, N2O and pH were determined on 256 soil cores from a 1024-m transect across arable fields at Silsoe in Bedfordshire, east-central England, this has previously been described by Lark et al (2004). The first sample point on the transect was at UK Ordnance Survey (OS) co-ordinates 508570, 235605, and the soil was sampled at 256 locations at 4-m intervals on a line running on a bearing of 188 degrees relative to UK OS grid north.

The MFA for each measure was applied showing that only N2O had a multi-affine structure. From this type of analysis the relative entropy (E) was defined and applied to seek for more scaling information. Finally, based in the concepts of Joint MFA a joint correlation was established and use as a preliminary technique to characterize localized variability and scaling in soil physical properties in an easiest way.

Reference

Lark, R.M, A.E. Milne, T.M. Addiscott, K.W.T. Goulding, C.P. Webster and S. O'Flaherty. 2004. Scale- and location-dependent correlation of nitrous oxide emissions with soil properties: an analysis using wavelets. Eur. J. Soil Sci., 55, 611-627.