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3D Soil Images Structure Quantification using Relative Entropy

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Soil voids manifest the cumulative effect of local pedogenic processes and ultimately influence soil behavior - especially as it pertains to aeration and hydrophysical properties. Because of the relatively weak attenuation of X-rays by air, compared with liquids or solids, non-disruptive CT scanning has become a very attractive tool for generating three-dimensional imagery of soil voids. One of the main steps involved in this analysis is the thresholding required to transform the original (greyscale) images into the type of binary representation (e.g., pores in white, solids in black) needed for fractal analysis or simulation with Lattice–Boltzmann models (Baveye et al., 2010).

The objective of the current work is to apply an innovative approach to quantifying soil voids and pore networks in original X-ray CT imagery using Relative Entropy (Bird et al., 2006; Tarquis et al., 2008). These will be illustrated using typical imagery representing contrasting soil structures. Particular attention will be given to the need to consider the full 3D context of the CT imagery, as well as scaling issues, in the application and interpretation of this index.

References

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