Geophysical Research Abstracts
Vol. 17, EGU2015-15313, 2015
EGU General Assembly 2015

3D Structure of Tillage Soils

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Soil structure may be defined as the spatial arrangement of soil particles, aggregates and pores. The geometry of each one of these elements, as well as their spatial arrangement, has a great influence on the transport of fluids and solutes through the soil. Fractal/Multifractal methods have been increasingly applied to quantify soil structure thanks to the advances in computer technology (Tarquis et al., 2003).

There is no doubt that computed tomography (CT) has provided an alternative for observing intact soil structure. These CT techniques reduce the physical impact to sampling, providing three-dimensional (3D) information and allowing rapid scanning to study sample dynamics in near real-time (Houston et al., 2013a). However, several authors have dedicated attention to the appropriate pore-solid CT threshold (Elliot and Heck, 2007; Houston et al., 2013b) and the better method to estimate the multifractal parameters (Grau et al., 2006; Tarquis et al., 2009).

The aim of the present study is to evaluate the effect of the algorithm applied in the multifractal method (box counting and box gliding) and the cube size on the calculation of generalized fractal dimensions (D_q) in grey images without applying any threshold. To this end, soil samples were extracted from different areas plowed with three tools (moldboard, chissel and plow). Soil samples for each of the tillage treatment were packed into polypropylene cylinders of 8 cm diameter and 10 cm high. These were imaged using an mSIMCT at 155keV and 25 mA. An aluminium filter (0.25 mm) was applied to reduce beam hardening and later several corrections where applied during reconstruction.

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Acknowledgements

First author acknowledges the financial support obtained from Soil Imaging Laboratory (University of Gueplh, Canada) in 2014.