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Microtomographic Analysis of Small Scale Pore Space Characteristics using Synchrotron Radiation

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Developments in computer microtomography using synchrotron radiation have opened up new possibilities to analyse pore space properties on the micro/aggregate scale. Soil aggregates are well known as sequestration sites for soil organic carbon depending on their internal geometry. The non-disturbing determination of pore space distributions and connectivity/continuity of potential flow channels within soil aggregates will greatly enhance the investigation and interpretation of soil organic carbon storage within soil aggregates. Due to a lack of suitable algorithms, however, quantitative studies of pore space properties have been rare which makes investigations on the role of soil management for SOC sequestration difficult. Recent developments of algorithms to quantitatively describe porous media from reconstructed 3D images will greatly facilitate the link of soil pore space properties with soil biological processes. This in turn contributes to understanding the mechanism involved in carbon sequestration within soil intra-aggregate pore space. To provide a statistical analysis of pore geometrical properties pore throat size, channel length and connectivity as well as pore size distributions within aggregates may be useful. Lindquist and Venkatarangan (2000) have developed a suite of algorithms assembled into a software package referred to as 3DMA to extract such geometric property distributions from 3D data sets. The authors investigated the accuracy of their algorithms using a simulated image of packed hexagonal spheres. Relative errors between theoretical and numerically computed values were in general smaller than 5%. Also the analysis of microtomographic images of Fontainebleau sandstone produced good results (Lindquist and Venkatarangan 2000). To test the applicability of above mentioned al-

gorithms for soil aggregates we have analysed a set of soil aggregates approximately 5 mm across at the synchrotron radiation source in Hamburg/Germany (DESY). From the reconstructed 3D images we extracted brick shaped subvolumes which we analysed for pore statistical properties. Potential applications and drawbacks of the applied algorithms will be discussed.