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# Soil microaggregates: How to analyze their 3D structure.

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All biogeochemical processes are regulated or modulated by soil structure, which can be studied at different scales. On a very small scale soil microaggregates (SMAs) with a size smaller than 250 $\mu$m are considered to play an important role in soil functioning. Understanding their structure and composition is therefore crucial for the appreciation of many soil processes and functions, such as the storage and cycling of water, nutrients and organic matter. The formation of SMAs and the mechanisms leading to the spatial organization of their building units (primary minerals, phyllosilicates, organic matter, oxides and hydroxides of Al and Fe) is still poorly understood and little is known on the microscale internal architecture of SMAs.

The best method for a non-invasive structure analysis is computed microtomography ($\mu$CT), as this technique can provide detailed 3D (or even 4D) information on soil microstructure at a high-resolution. In this talk we will introduce possibilities to study and quantify the 3D-architecture of SMAs and how it is influenced by clay content. Morphological parameters that can be related to soil functions associated with SMAs are shown and the possible feedback mechanisms on SMA formation and stabilization are discussed.

Naturally, a positive correlation exists between acquisition time for each scan and the image quality that is achievable. Since time and money are limited resources in any research project, it is important to determine the best compromise between a quick scanning process and high image quality. In order to find a solution to this problem and elucidate the possibilities of structure analysis with $\mu$CT, we scanned two SMAs from a toposequence in Scheyern, Bavaria, with contrasting clay contents at six different acquisition times and used the longest scan (with highest image quality) as a reference. We show first results of various structural parameters, such as total porosity, pore size distribution, surface area and connectivity of the pore skeleton. Next, we evaluated which of these parameters was sensitive to scanning time/image quality and to what extent a lower image quality could be compensated by image processing tools prior to segmentation (i. e. different filters).

A clear improvement of image quality was visible at scanning times of 80 min and above. While both SMAs showed similar mean pore diameters, the sample with higher clay content exhibited a lower total porosity, but a more connective pore network. Most parameters were not sensitive to scanning time (with the exception of the fastest scan that showed an over- or underestimation of many parameters) and lower image quality could be partially compensated by image processing methods.