Application of X-ray tomography for quantification of the soil pore structure and visualization of soil organic matter

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Protection of Soil Organic Matter

Soil organic matter (SOM) determines soil fertility and soil quality and plays an important role in the global carbon cycle. Hypotheses to explain the protection of SOM against microbial degradation include chemical recalcitrance and physical protection of OM. Recent advances have stressed the importance of soil structure as a factor in SOM dynamics. Many studies have attempted to tackle the complex interaction between SOM and the soil matrix by using measurements of soil aggregates as surrogates of the soil structure. But in reality, the undisturbed soil profile exists as a continuous convoluted pore, bounded by solids and not as a bed of aggregates [1].

X-ray Computed Tompography

The application of X-ray computed tomography (CT), a technique that generates cross-sectional images of an object by computer software from multiple X-ray scans, enables the visualization of the soil pore space in three dimensions. The very few studies applying CT scanning in soil science have attained spatial resolutions of several µm [2]. The UGent centre for X-ray Tomography (UGCT) has developed a CT scanner which is capable of providing the highest spatial resolutions in CT scans attainable at the present, i.e. about 0,4 µm. Application of this equipment for visualization of the soil structure will provide unique data on the 3D soil pore distribution which could enable us to relate the soil structure to SOM dynamics. The objective of this research is to investigate the potential of X-ray CT for the visualization of the pore space and ultimately the automated visualization of SOM.

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[2] Taina *et a*l. (2007) *Can. J. Soil Sci.* **88**, 1-20.

Chemical composition of aerosols and cloud condensation nuclei in the Eastern Mediterranean: Results from long-term studies.

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Observational Data Set

Long-term measurements of cloud condensation nuclei (CCN) number concentrations, aerosol size distribution and chemical composition were performed at a remote site in the Eastern Mediterranean, during two field campaigns (FAME07, FAME08) covering a six-month period (June to October 2007 and May to June 2008). The aim was to study the role of chemical composition, with emphasis on the organic fraction, on cloud condensation nuclei formation and droplet growth kinetics. The measurements of CCN were performed between 0.2 and 1.0% supersaturation.

Results and Discussion

Application of 'simple' Köhler theory, using measurements of chemical composition and size distribution resulted in satisfactory CCN closure, with slight under prediction, especially at lower supersaturations.

As for the droplet growth kinetics, the role of the aged organics is found not to delay droplet growth kinetics, as ambient aerosol grows with the same rate as pure sodium chloride.

Possible explanations for these observations will be presented and thoroughly discussed during the presentation.