Geophysical Research Abstracts
Vol. 16, EGU2014-13506, 2014
EGU General Assembly 2014

Imaging Vis-NIR spectroscopy - mapping SOM quality and quantity in undisturbed soil profiles of semiarid steppe in Inner Mongolia

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Though soil organic matter (SOM) constitutes a small fraction of most topsoils, it plays a decisive role to many soil functions such as nutrient sorption, aggregate stability and water holding capacity. Unfortunately this important factor for soil quality is difficult to investigate due to both the elaborate techniques required and organic matters high variability over small scales. In this study VIS-NIR laboratory imaging spectroscopy is used to measure quality and quantity of SOM with a high spatial resolution in undisturbed soil profiles. Special attention is paid to changes in the amount of particulate organic matter (POM) and its chemical composition.
It is known that grazing has an undisputable negative effect on soil organic carbon stocks. Therefore management of a spacious ecosystem such as semiarid steppes is supposed to be an important factor for carbon sequestration. We sampled two different sites from the semiarid steppe ecosystem in Inner Mongolia, China. One continuously grazed and
the other ungrazed since 1979, both were classified as Calcic Chernozems. We expect longterm grazing to decrease carbon contents and most pronounced POM fractions as sensitive indicators. A stainless steel box (100×100×300 mm3) was used to sample undisturbed soil profiles. Until further investigations the soil boxes were dried at 30C. A hyperspectral camera recorded their visible and near infrared reflectance (400 to 1000 nm in 160 bands) with a spatial resolution of 63×63 μm2 per pixel. This procedure was repeated over three vertical cuts at a lateral distance of 25 mm through the soil boxes. After each image recording the profile was divided into ten equal squares (each 50×50 mm2). Mixed samples were extracted from each square to a depth of 5 mm. Density fractionation was used to separate fractions of POM with different degrees of decomposition. POM quality and quantity was correlated to the most relevant spectral regions. Instead of elaborated laboratory techniques we tested whether imaging spectroscopy might accomplish non-destructive quantification of POM fractions. As a result, Vis-NIR laboratory imaging spectroscopy enables us to distinguish and quantify POM fractions with a high spatial resolution in undisturbed soil profiles.