Geophysical Research Abstracts
Vol. 15, EGU2013-12846, 2013
EGU General Assembly 2013

Refining regional SOC estimates: Accounting for erosion induced within field variability of the vertical distribution of SOC.

Jeroen Meersmans and Tim Quine
University of Exeter, College of Life and Environmental Sciences, Rennes Drive, Exeter EX4 4RJ, United Kingdom

Recently, soil organic carbon (SOC) is considered as a dynamic soil property largely influencing soil quality and global C-cycling. Consequently, accurate mapping of SOC at the regional or national scale becomes an important issue in order to help policymakers in developing an appropriate soil and climate change management strategy. So far, in these studies, only factors determining the spatial and temporal distribution of SOC at the landscape scale, such as soil type, land use (change), climate and agro-management, were considered. Despite the fact that a few recent studies incorporated as well the distribution of SOC with depth, resulting in an improved representation of the 3D distribution of SOC, most studies only considers topsoil and/or are characterized by simple sampling by site at rather coarse resolution. Consequently, they omit quantification of stable subsoil carbon buried in depositional areas and does not allow to clearly identify significant differences of SOC and erosion at the within field scale. Hence, the variability of SOC at smaller scales in complex terrain driven by lateral soil transport processes (such as soil erosion), is still rather understudied and is not (well) presented in existing regional SOC estimates. Nevertheless, incorporating this smaller level of spatial detail will most probably have a major influence on SOC mapping and regional SOC stock dynamics' calculations. Consequently, there exists an urgent need in conducting an appropriate soil sampling strategy considering deeper layers and enabling us to detect significant patterns at detailed spatial levels.

In this study we aim to unravel the variation of SOC depth distributions along typical hillslope transects under cropland (Devon, UK) and link these to soil redistribution rates and variations in C input, i.e. below and above ground biomass productivity. The radionuclide isotope Caesium-137 (137Cs) was used as proxy for erosion. Furthermore, a soil sampling strategy was conducted in order to capture the within site variability, allowing us to detect significant within field differences in SOC in function of water and tillage erosion. In this context five replicate cores until 1 meter depth were taken by site (i.e. at crucial slope positions). The results show that the lowest SOC values were identified at places characterized by the highest erosion rates (i.e. most convex and/or steepest slope positions). Sites characterized by depositions due to tillage erosion (i.e. most concave position) have moderated SOC surface values (ca. 1%) that stay constant until a depth of 50 cm (which can be considered as an extended tillage layer), while the sites characterized by depositions due to water erosion (i.e. foot slope) have much higher SOC values near the surface, but show a faster decline with depth. Hence, this study underlines the importance of subsoil sampling and considering within site variability by applying replicated sampling techniques in order to obtain more complete spatial C and erosion estimates, including large quantities of stable buried subsoil C, and detect significant differences within the field. This output can be considered as a first step to refine 3D mapping of SOC at regional or national scales.