Geophysical Research Abstracts
Vol. 13, EGU2011-7079, 2011
EGU General Assembly 2011

Soil organic carbon pool composition in eroding landscapes and the link to topography

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Recent findings indicate that soil redistribution processes have a major influence on the distribution of soil organic carbon (SOC) in eroding agricultural landscapes. Unclear is, however, the influence of these processes on SOC characteristics and consequently stability of SOC at different slope positions within the landscape. Large amounts of carbon are stored in colluvial sediments at footslopes under virtually stable conditions. Climatic changes and changing erosion patterns might re-mobilize these SOC reservoirs and bring them back to surface with unknown consequences in terms of their mineralization potential.

Here, our research focuses on the identification of functionally important SOC pools and their distribution with depth at different slope positions as well as their stability under surface conditions. We conducted a series of chemical and physical fractionations samples from agricultural sites in Central Europe in order to identify functionally important SOC pools and their distribution with depth at different slope positions. We accompanied this work with a 50 day incubation to assess differences in CO2 and N20 emission potentials within the landscape and as a base for future risk assessments.

Our data shows that size and composition of SOC pools depend largely on slope position and that the carbon pool composition between eroded and depositional sites differs significantly. The preferential erosion of soil colloids during the transportation downhill led to a high amount of carbon protected in microaggregates in the subsoils of depositional sites, whereas eroded sites are dominated by silt & clay associated carbon fractions. In contrast, the observed respiration rates were similar at all positions despite the composition and age of certain carbon sources. This leads to the conclusion that older deep soil carbon from colluvial sites decomposes under surface conditions at a similar rate to topsoil carbon resources and that these might lead to large fluxes of greenhouse gases from soil to atmosphere if no measures are taken to prevent the re-mobilization of colluvial sediments.