Geophysical Research Abstracts
Vol. 16, EGU2014-10748, 2014
EGU General Assembly 2014

Carbon sequestration in deep ploughed Luvisols and Podzols of Northern Germany

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Research on carbon sequestration in arable soils up to now has mainly focused on reduced and no-tillage systems even though the effects on soil carbon stocks are marginal. This study addresses the long-term effects of deep ploughing. We are sampling five Luvisols and five Podzols under agriculture as well as five Podzols under forest in Northern Germany, which were deep ploughed (50 to 90 cm depth) in the 1960s. Adjacent equally managed, but conventionally ploughed (approx. 30 cm depth) subplots are used as a reference respectively. At each site two subplots of 20 by 40 meters, we collect samples from different depths of a soil profile (down to 1.5 meter depth) after digging a pit. Additionally, five composite core samples down to 1 meter depth randomly distributed over the field subplot are collected. Soil bulk density, gravel fraction as well as organic and inorganic carbon content will be determined to calculate organic C stocks. First results from an arable loess soil (Haplic Luvisol) near Salzgitter, which was ploughed to 90 cm depth in 1966, show a mean C stock of 82,5 Mg ha^{-1} in the deep ploughed subplot compared to 65,9 Mg ha^{-1} in the reference subplot. This is equal to a long-term increase of 30% in soil organic carbon due to deep ploughing, which is several times higher than the effects of reduced ploughing or no-tillage. Moreover, we will conduct incubation experiments to determine soil respiration and microbial biomass via substrate induced respiration in order to elucidate the stability of the buried carbon. Further analysis will address the stabilization mechanisms of the buried soil organic matter including pH measurements, soil texture analysis, atomic absorption spectroscopy to quantify pedogenic iron and aluminum oxides, cation-exchange capacity, C density fractionation and radiocarbon dating. We will present data from the first sampling campaigns and discuss their implications for our view on subsoil carbon stability.