Geophysical Research Abstracts
Vol. 14, EGU2012-9433, 2012
EGU General Assembly 2012

Impact of energy maize cultivation and erosion on carbon gas exchange and soil organic carbon budgets in young moraine landscapes

M. Pohl (1), U. Hagemann (1), M. Liebe (1), M. Sommer (2), and J. Augustin (1)

(1) Institute for Landscape Biogeochemistry, Leibniz-Centre of Agricultural Landscape Research (ZALF) e.V., Münchberg, Germany (madlen.pohl@zalf.de), (2) Institute for Soil Landscape Research, Leibniz-Centre of Agricultural Landscape Research (ZALF) e.V., Münchberg, Germany

The hilly young moraine landscape of north-eastern Germany is dominated by the cultivation of energy crops like maize. It is suspected that this cultivation can increase erosion effects and lead to the release of soil carbon (C). Therefore, in an interdisciplinary approach, the CarboZALF project investigates the impact of various factors such as erosion on greenhouse gas (GHG) fluxes and C dynamics on the site and the landscape level.
From the CarboZalf-D project site located in the Uckermark, we present measured and modeled GHG fluxes (CO_2 and CH4) and C dynamics of maize on four erosion-related soil types: a) haplic luvisol, b) eroded haplic luvisol, c) haplic regosol (calcaric) and d) endogleyic colluvic regosol. CO_2 flux measurements of ecosystem respiration (Reco) and net ecosystem exchange (NEE) were conducted every four weeks by using a non-flow-through non-steady-state closed chamber system (Livingston and Hutchinson 1995) based on Drösler (2005). Measurement gaps of NEE were filled by modeling the Reco fluxes using the Lloyd-Taylor (Lloyd and Taylor 1994) method and the gross primary production (GPP) fluxes using Michaelis-Menten (Michaelis and Menten 1913) modeling approach. Annual NEE balances were then calculated based on the modeled Reco and GPP fluxes. CH4 fluxes were measured bi-weekly using a static chamber system with interval sampling. The system C budget is the sum of annual NEE, C export and CH4-C values.

The endogleyic colluvic regosol featured the highest uptake of CH4 (< 1 kg C ha-1 yr-1), but the impact of erosion on the cumulative CH4 fluxes was very small. However, erosion and deposition had a significant impact on GPP, NEE and the C export, but with little differences between the resulting annual C balances. All investigated soil types were C sinks, storing 620 – 2600 kg C ha-1 yr-1. We conclude that i) maize cultivation must not be accompanied by soil organic carbon loss; ii) erosion seems to cause spatial variability of GHG fluxes and soil organic carbon budgets at least at the site level. Due to the temporal variability of GHG fluxes, generalized conclusions are only possible after long term investigations. This also applies to the question concerning the degree to which erosion influences C dynamics at the landscape scale.

Drösler, M. 2005. Trace Gas Exchange and climatic relevance of bog ecosystems, Southern Germany, phD-thesis, TU München, München
Livingston, G.P. & Hutchinson, G.L. 1995. Enclosure-based measurement of trace gas exchange: Applications and sources of error. p. 14-51. In P.A. Matson & Harriss, R.C. (ed.) Methods in ecology - Biogenic trace gases: Measuring emissions from soil and water. Blackwell Science, Oxford, England