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The relative importance of fertilization and soil erosion on C-dynamics in agricultural landscapes of NE Germany

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The hummocky ground moraine landscape of north-east Germany is characterized by distinct small-scale soil heterogeneity on the one hand, and intensive energy crop cultivation on the other. Both factors are assumed to significantly influence gaseous C exchange, and thus driving the dynamics of soil organic carbon stocks in terrestrial, agricultural ecosystems. However, it is not yet clear to which extent fertilization and soil erosional status influence soil C dynamics and whether one of these factors is more relevant than the other.
We present seasonal and dynamic soil C balances of biogas maize for the growing season 2011, recorded at different sites located within the CarboZALF experimental area. The sites differ regarding soils (non-eroded Albic Luvisols (Cutanic), extremely eroded Calcaric Regosol and depositional Endogleyic Colluvic Regosol,) and applied fertilizer (100% mineral N fertilizer, 50% mineral and 50% N organic fertilizer, 100% organic N fertilizer). Fertilization treatments were established on the Albic Luvisol (Cutanic).
Net-CO_2-exchange (NEE) and ecosystem respiration (Reco) were measured every four weeks using a dynamic flow-through non-steady-state closed manual chamber system. Gap filling was performed based on empirical temperature and PAR dependency functions to derive daily NEE values. At the same time, daily above-ground biomass production (NPP) was estimated based on biomass samples and final harvest, using a sigmoidal growth function. In a next step, dynamic soil C balances were generated as the balance of daily NEE and NPP considering the initial C input due to N fertilizers.
The resulted seasonal soil C balances varied from strong C losses at the Endogleyic Colluvic Regosol (602 g C m-2) to C gains at the Calcaric Regosol (-132 g C m-2). In general, soils exerted a stronger impact on seasonal and dynamic C balances compared to differences in applied N fertilizer. There are indications that inter-annual variations in climate conditions and interactions between soil and fertilization types also seem to affect C-dynamics. Hence, long-term measurements of different fertilization treatments at characteristic soil landscape elements are needed.