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Modelling Seasonal Carbon Dynamics on Fen Peatlands

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In Germany more than 99 % of fens have lost their carbon and nutrient sink function due to heavy drainage and agricultural land use especially during the last decades and thus resulted in compression and heavy peat loss (CHARMAN 2002; JOOSTEN & CLARKE 2002; SUCCOW & JOOSTEN 2001; AUGUSTIN et al. 1996; KUNTZE 1993). Therefore fen peatlands play an important part (4-5 %) in the national anthropogenic trace gas budget.

But only a small part of drained and agricultural used fens in NE Germany can be restored. Knowledge of the influence of land use to trace gas exchange is important for mitigation of the climate impact of the anthropogenic peatland use. We study carbon exchanges between soil and atmosphere on several fen peatland use areas at different sites in NE-Germany. Our research covers peatlands of supposed strongly climate forcing land use (cornfield and intensive pasture) and of probably less forcing, alternative types (meadow and extensive pasture) as well as rewetted (formerly drained) areas and near-natural sites like a low-degraded fen and a wetted alder woodland. We measured trace gas fluxes with manual and automatic chambers in periodic routines since spring 2007. The used chamber technique bases on DROESLER (2005). In total we now do research at 22 sites situated in 5 different locations covering agricultural, varying states of rewetted and near-natural treatments.

We present results of at least 2 years of measurements on our site of varying types of agricultural land use. There we found significant differences in the annual carbon balances depending on the genesis of the observed sites and the seasonal dynamics. Annual balances were constructed by applying single respiration and photosynthesis CO_2 models for each measurement campaign. These models were based on LLOYD-TAYLOR (1994) and Michaelis-Menten-Kinetics respectively. Crosswise comparison of different site treatments combined with the seasonal environmental observations give good hints for the identification of main flux driving parameters. Based on this procedure we developed a specific methane efflux model, mainly driven by the observed groundwater fluctuation and soil temperature. Depending on the observed timescale initial starting points of the model showed up to be remarkably different. We also will present suggestions for an advanced CO_2 modelling as the present approaches are both based on single parameters. Generally our experiences from our field studies show that mono-parameterized models often fail in reproducing measured flux values.

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