Geophysical Research Abstracts
Vol. 20, EGU2018-6391-1, 2018
EGU General Assembly 2018

The greenhouse gas balance of Sphagnum farming on former peat extraction sites

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Drainage of peatlands for agriculture, forestry and peat extraction turned these landscapes into hotspots of greenhouse gas emissions. Climate protection now fosters rewetting projects to restore the natural peatland function as a sink of atmospheric carbon. One possible way to combine ecological and economical goals is Sphagnum farming, i.e. the cultivation of peat mosses as high-quality substrates for horticulture. Here, we evaluate the attempt of commercial Sphagnum farming on former peat extraction sites in north-western Germany, which are, in contrast to previous Sphagnum farming experiments, characterized by strongly decomposed peat. In order to estimate the greenhouse gas balance of Sphagnum farming sites in comparison to near-natural peat bog sites, the exchange of carbon dioxide (CO_2), methane (CH4) and nitrous oxide (N2O) of the whole peatland-based production chain comprising a near-natural donor mire, a propagation area, an irrigation polder and a commercial cultivation site are determined for two years using transparent and opaque manual chambers. We also investigate the effect of potential future climate change conditions as simulated by Open Top Chambers (OTC) at selected sites.

We will present the results of the first year, i.e. the establishment phase of the experimental sites. Due to differences in groundwater level and pre-conditions before the start of the experiment (peat extraction vs. ten years of shallow polders following peat extraction), the establishment of Sphagnum differed strongly between different sites and irrigation systems. CH4 emissions were highest at the near-natural site – and surprisingly even higher than at the irrigation polder –, probably due to the largest vegetation cover and highest groundwater level. N2O emissions were mostly low with the exception of some large peaks after dry periods at sites with a low vegetation cover. OTCs tended to increase both, CH4 and N2O emissions. CO_2 fluxes were strongly correlated with vegetation cover. Our results emphasize the importance of elaborate water management when attempting to grow Sphagnum on strongly decomposed peat.