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Continuous measurements of CO_2 emission from cultivated peat soil - effect of tillage intensity

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Peatlands process and transfer significant quantities of greenhouse gases (GHG) such as CO_2, CH_4 and N_2O. Most natural water-saturated peatlands sequester large amounts of CO_2 from the atmosphere and emit CH_4. Drainage and cultivation of peat soils increase soil aeration and reverse the carbon flux into net CO_2 emissions, while CH_4 emissions decrease and cultivated peat soils may even act as sinks for CH_4. Fertile peat soils are potential sources of N_2O when drained.

In this investigation we used automatic dark chambers (ADC BioScientific Ltd) to measure CO_2 emissions from plots with different soil tillage intensities. The field trial is located on the island Gotland east of the Swedish main land (57.584825N 18.47691E) and the soil is a peat soil with high pH (7.5) and organic content of 46.4 % (loss on ignition).

The set-up was 4 treatments repeated in 4 blocks. Each plot was 18 by 25 meters and the following treatments were tested:

A. Ploughing every year
B. Ploughing 1 out of 4 years
C. Only stubble cultivation
D. Permanent ley

One chamber was put in each plot and connected to a master control unit to create a network with 16 chambers. Measurements were made every hour during most of 2012 (17/4- 6/11 with some gaps) and every second hour during 2013 (22/4-27/6). Higher emissions could be observed just after cultivation and that effect lasted for about one day. The average emission was highest from treatment D during 2012 (4.53 μmol m^{-2} s^{-1}) and treatment C and D during 2013 (3.85 μmol m^{-2} s^{-1}).