EGU22-10419
https://doi.org/10.5194/egusphere-egu22-10419
EGU General Assembly 2022

A hotspot of CH_4 emission in a Danish agricultural soil: A soft spot in our knowledge?

Andreas Brændholt[1], Azeem Tariq[1,2], Line Vinther Hansen[1], Lars Stoumann Jensen[1], Klaus Steenberg Larsen[3], and Sander Bruun[1]
[1]Department of Plant and Environmental Sciences, University of Copenhagen, Frederiksberg, Denmark (abraendholt@plen.ku.dk)
[2]School of Environmental Sciences, University of Guelph, Guelph, Canada
[3]Department of Geosciences and Natural Resource Management, University of Copenhagen, Frederiksberg, Denmark

Danish agricultural ecosystems are one of the main contributors to the total anthropogenic emissions of greenhouse gases in Denmark. The main research focus on greenhouse gas emissions from mineral agricultural soils has been on N_2O, and on how the N_2O emissions respond to fertilizer addition and different agricultural practices. Studies on CH_4 fluxes are scarce and mostly show a small uptake of CH_4, indicating that oxidation of CH_4 is dominant in agricultural soils.

As part of the NATEF (National emission factors for nitrous oxide from nitrogen fertilizers and crop rotations) project, we have established a field experiment in Taastrup, Denmark. The experiment has been running since early 2019, and consists of 12 plots (4 rotation treatments × 3 blocks) that each are managed following a common Danish crop rotation (main crops: spring barley, winter wheat and oilseed rape) in addition to cover crops (oat, phacelia, oilseed radish) following winter wheat. The field experiment is one of four identical field experiments located across Denmark, thereby capturing the variation in climate and soil types seen in Denmark. The main aim of the project is to determine emission factors for nitrous oxide for Danish cropping systems. This is achieved by regular manual measurements of N_2O, CH_4 and CO_2 fluxes by the discrete closed chamber method in all plots. Furthermore, we have deployed an automated flux chamber system (ECO_2 FluX, Prenart Equipment) connected to a greenhouse gas analyzer (G2508, Picarro) to provide high-frequency measurements of the fluxes of N_2O, CH_4 and CO_2. In each growing season, two plots were selected and three automated chambers were placed in each plot, totaling six automated chambers in the study. The automated measurements allowed us to examine the high-frequency temporal dynamics in the fluxes, e.g. periods following rain events, freeze-thaw, fertilization or tilling.

As expected, we generally observed emissions of N_2O across all plots with different crops. CH_4 fluxes were slightly negative (i.e. uptake) or close to zero during most periods, indicating that oxidation was the dominant process. However, during the autumn of 2019, we captured CH_4 emission by the automated chambers in the plot with oilseed radish, while at the same time, the

automated chambers in a plot with winter wheat showed no CH_4 emissions. However, spatial variation in emissions were very large indicating that edaphic and topological factors played a major role. Our results show evidence that hotspots of CH_4 emissions can occur in Danish agricultural ecosystems that otherwise mostly act as a sink for CH_4. We expect that similar hotspots for CH_4 emissions could exist in other similar agricultural systems.