Geophysical Research Abstracts
Vol. 19, EGU2017-12412, 2017
EGU General Assembly 2017

Tree CH_4 fluxes in forestry drained peatland in southern Finland

Iikka Haikarainen, Anuliina Putkinen, Petteri Pyykkö, Elisa Halmeenmäki, and Mari Pihlatie

Division of Atmospheric Sciences, Department of Physics, University of Helsinki, Helsinki, Finland (iikka.haikarainen@helsinki.fi)

Methane (CH_4) is among the most important greenhouse gases and its atmospheric concentration is increasing. Boreal forests are commonly considered a net sink of atmospheric CH_4 due to CH_4 consuming bacteria in aerated soil layers. Recent studies have, however, demonstrated that trees are capable of emitting CH_4 from their stems and shoots by transporting anaerobically produced CH_4 from deeper soil layers to the atmosphere. Furthermore, trees may act as independent sources of CH_4.

We have measured tree stem CH_4 exchange of boreal tree species at Lettosuo, a nutrient rich peatland forest in Tammela, southern Finland (60˚38' N, 23˚57' E), using the static chamber technique. Three species, downy birch (*Betula pubescens*), Norway spruce (*Picea abies*) and Scots pine (*Pinus sylvestris*), were selected under investigation as they represent common boreal tree species. Fluxes of CH_4 were measured during 7.6.2016 – 17.10.2016 from in total 25 sample trees growing on two different plots: a treatment plot where all the pines were removed to raise the water table level (WTL) and a control plot. Three birches from the treatment plot were selected to measure CH_4 flux variation within vertical profile of the trees. Characterization of microbial communities, quantification of methanogenic and methanotrophic functional genes, and measurements of potential CH_4 production and consumption from peat profile and forest floor moss samples were also carried out to obtain insight to the CH_4 flux dynamics at the studied sites.

The pine removal treatment did not markedly change the average WTL, but it made the WTL more variable with frequently 10–15 cm closer to soil surface compared to the WTL on the control plot. We found small and variable CH_4 emissions from the stems of trees on both of the plots, while occasional consumption of CH_4 was also present. Generally the CH_4 emissions were higher and more dominant at the treatment plot compared to the control plot, and the fluxes were significantly different between the plots ($p < 0.001$). The CH_4 emission rates from the birches at the treatment plot decreased exponentially in the stem vertical profile. Clear seasonal flux dynamics or significant differences in the CH_4 flux between the species were not found at either of the plots. Microbial experiments showed that anaerobic CH_4 production, CH_4 oxidation potential (under 1000 ppm CH_4) and the amount of methanogens were higher in the peat of the treatment site.

The difference in the CH_4 flux rates between the plots indicates that the WTL is a major regulator of tree CH_4 emissions on forestry drained peatlands, supporting our hypothesis that the stem emitted CH_4 originates from anaerobic soil conditions. This hypothesis is further supported by the results of the microbial analysis and by the observation that more CH_4 is emitting from the lower parts of the stems compared to the upper stem.