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The variation of methane flux rates from boreal tree species at the beginning of the growing season

Iikka Haikarainen (1), Elisa Halmeenmäki (1), Katerina Machacova (2), and Mari Pihlatie (1)

(1) Division of Atmospheric Sciences, Department of Physics, University of Helsinki, Helsinki, Finland (iikka.haikarainen@helsinki.fi), (2) Global Change Research Institute CAS, Brno, Czech Republic

Boreal forests are considered as net sink for atmospheric methane (CH_4) because of the CH_4 oxidizing bacteria in the aerobic soil layer. However, within the last decades it has become more evident that trees play an important role in the global CH_4 budget by offering pathways for anaerobically produced CH_4 from deeper soil layers to the atmosphere. Furthermore, trees may also act as independent sources of CH_4. To confirm magnitude, variability and the origin of the tree mediated CH_4 emissions more research is needed, especially in boreal forests which have been in a minority in such investigation.

We measured tree stem and shoot CH_4 exchange of three boreal tree species at the beginning of the growing season (13.4.–13.6.2015) at SMEAR II station in Hyytiälä, located in southern Finland (61˚51'N, 24˚17'E, 181 asl). The fluxes were measured from silver birch (*Betula pendula*), downy birch (*B. pubescens*) and Norway spruce (*Picea abies*) on two sites with differing soil type and characteristics (paludified and mineral soil), vegetation and forest structure by using the static chamber technique. Scaffold towers were used for measurements at multiple stem heights and shoots. The aim was to study the vertical profile of CH_4 fluxes at stem and shoot level and compare these fluxes among the studied species, and to observe temporal changes in CH_4 flux over the beginning of the growing season.

We found that all the trees emitted CH_4 from their stems and shoots. Overall, the birches showed higher emissions compared to the spruces. The emission rates were considerably larger in the lower parts of the birch stems than upper parts, and these emissions increased during the growing season. The spruces had more variation in the stem CH_4 flux, but the emission rates of the upper parts of the stem exceeded the birch emissions at the same height. The shoot fluxes of all the studied trees indicated variable CH_4 emissions without a clear pattern regarding the vertical profile and progress of the growing season.