



Small spatial but large sporadic variability in methane emission measured from a patterned boreal bog

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The variation of methane emissions in different plant community types of a patterned boreal bog was studied in Siikaneva in southern Finland (61°50'N, 24°12'E) where methane fluxes were measured in three subsequent growing seasons 2012 – 2014 using the static chamber method. Six plant community types characteristic to the site and included in the study were high hummock (HHU), hummock (HU), high lawn (HL), lawn (L), hollow (HO) and bare peat surfaces (BP). The hypothesis was that the plant community types differ in their methane flux. Mixed-effects models were used to analyse the variation in methane flux and in the measured environmental variables between plant community types and years, as well as their relation. As a result, there were no significant differences in methane emissions between the six plant community types in the three measured growing seasons, except higher fluxes from hummocks than from other community types in 2013. Excluding the highest 2.5 % of all fluxes, methane fluxes varied from -309 to 556 mg m⁻² d⁻¹. They increased with increasing peat temperature, total leaf area (LAI_{TOT}) and leaf area of aerenchymatous plant species (LAI_{AER}) but had no correlation with water table. Chamber fluxes upscaled to ecosystem level for July and August were of the same magnitude as the fluxes measured with the eddy covariance (EC) technique. There was a good agreement between the two methods in 2012 and in August 2014, whereas in 2013 and in July 2014 the chamber fluxes were higher than the EC fluxes. Net methane oxidation was detected every year and on all plant community types. These fluxes from the atmosphere to soil ranged from 4 to 309 mg m⁻² d⁻¹. Sporadic events of exceptionally high fluxes, up to 17 000 mg m⁻² d⁻¹ were recorded in 2013 and 2014. This was most pronounced in 2013 that was the warmest year. The high fluxes were not detected in EC measurements. Generally, the methane fluxes were higher in the middle of the growing season but the unusually high fluxes did not follow this pattern.