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Multi-year methane ebullition measurements from water and bare peat surfaces of a patterned boreal bog

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We measured methane ebullition from a patterned boreal bog situated in the Siikaneva wetland complex in southern Finland. Measurements were conducted on water (W) and bare peat surfaces (BP) in three growing seasons (2014–2016) using floating gas traps. The volume of the trapped gas was measured weekly, and methane and carbon dioxide (CO_2) concentrations of bubbles were analysed from fresh bubble samples that were collected separately. We applied a mixed-effects model to quantify the effect of the environmental controlling factors on the ebullition.

Ebullition was higher from W than from BP, and more bubbles were released from open water (OW) than from the water's edge (EW). On average, ebullition rate was the highest in the wettest year (2016) and ranged between 0 and 253 mg $m^{-2}d^{-1}$ with a median of 2 mg $m^{-2}d^{-1}$, 0 and 147 mg $m^{-2}d^{-1}$ with a median of 3 mg $m^{-2}d^{-1}$, and 0 and 186 mg $m^{-2}d^{-1}$ with a median of 28 mg $m^{-2}d^{-1}$ in 2014, 2015 and 2016, respectively. Ebullition increased together with increasing peat temperature, weekly air temperature sum and atmospheric pressure, and decreasing water table (WT). Methane concentration in the bubbles released from W was 15–20 times higher than the CO_2 concentration, and from BP it was 10 times higher. The proportion of ebullition fluxes upscaled to ecosystem level for the peak season was 2–8 % and 2–5 % of the total flux measured with eddy covariance technique and with chambers and gas traps, respectively. Thus, the contribution of methane ebullition from wet non-vegetated surfaces of the bog to the total ecosystem-scale methane emission appeared to be small.