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Multisite comparison of drivers of methane emissions from wetlands in the European Arctic: influence of vegetation community and water table.

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Arctic and sub arctic wetlands are a major source of atmospheric CH_4 and therefore have the potential to be important in controlling global radiative forcing. Furthermore, the strong links between wetland CH_4 emissions and vegetation community, hydrology and temperature suggest potentially large feedbacks between climate change and future emissions. Quantifying current emissions over large spatial scales and predicting future climatic feedbacks requires a fundamental understanding of the ground based drivers of plot scale emissions.

The MAMM project (Methane in the Arctic: Measurements and Modelling) aims to understand and quantify current CH_4 emissions and future climatic impacts by combining both ground and aircraft measurements across the European Arctic with regional computer modelling. Here we present results from the ground-based MAMM measurement campaigns, analysing chamber-measured CH_4 emissions from two sites in the European Arctic/Sub-Arctic region (Sodankylä, Finland; Stordalen Mire, Sweden) from growing seasons in 2012 and 2013.

A total of 85 wetland static chambers were deployed across the two field sites; 39 at Sodankylä (67˚22'01" N, 26˚3'06" E) in 2012 and 46 at Stordalen Mire (68˚21'20" N, 19˚02'56" E) in 2013. Chamber design, protocol and deployment were the same across both sites. Chambers were located at sites chosen strategically to cover the local range of water table depths and vegetation communities. A total of 18 and 15 repeated measurements were made at each chamber in Sodankylä and Stordalen Mire, respectively, over the snow-free season. Preliminary results show a large range of CH_4 fluxes across both sites ranging from a CH_4 uptake of up to 0.07 and 0.06 mg CH_4-C m^{-2} hr^{-1} to emissions of 17.3 and 44.2 mg CH_4-C m^{-2} hr^{-1} in Sodankylä and Stordalen Mire, respectively.

Empirical models based on vegetation community, water table depth, temperature and soil nutrient availability (Plant Root Simulator Probes, PRS^{TM}) have been constructed with the aim of understanding the drivers of chamber scale fluxes. By combining measurements made at two different sites, >300km apart, using the same experimental setup, we are uniquely able to investigate whether CH_4 emissions are driven by common parameters. Furthermore we are able to determine if plot scale empirical models and parameterisations can be used effectively to upscale emissions to landscape and whole Arctic scale.