



Investigating Summer Methane Emissions from Wetlands in Northern Finland and Svalbard

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Arctic wetlands contribute significantly to the global methane budget, but there is a great deal that is still unknown about this vast methane source. Therefore, in August 2008, air sampling campaigns took place to investigate the summer sources of methane in Pallas, northern Finland and Ny-Ålesund, a settlement on the archipelago of Svalbard, Norway.

In northern Finland, wetland sampling at an aapa mire, Lompolojänkkä, occurred between 4th and 7th August 2008. Background sampling, for comparison with the wetland site, was undertaken at Kenttäröva a spruce forest station southeast of the wetland and Sammaltunturi, a hilltop station in the area. All three sites are run by the Finnish Meteorological Institute.

Background methane mixing ratios at Kenttäröva were 1863 ± 3 ppb and the $\delta^{13}\text{C}_{\text{CH}_4}$ was -47.65 ± 0.06 ‰. Samples taken at Lompolojänkkä at a comparable time and height to those at Kenttäröva show methane mixing ratios of 1959 ± 3 ppb and a $\delta^{13}\text{C}_{\text{CH}_4}$ of -48.61 ± 0.07 ‰.

A Keeling plot analysis of the Kenttäröva and Lompolojänkkä data shows a wetland methane source signature of -67 ± 1 ‰.

A diurnal sampling regime carried out at Lompolojänkkä between 5th and 6th August 2008 showed the greatest build up of methane over the site was between 23:15 and 03:15 (local time), with a maximum mixing ratio reached at 03:15 of 2440 ± 5 ppb. During the diurnal, samples were taken simultaneously at 42 cm and 280 cm above the surface of the wetland. There were significant differences in the mixing ratios and $\delta^{13}\text{C}_{\text{CH}_4}$ sampled at the two heights, with the greater differences corresponding to the period of maximum build up.

Keeling plot analysis of samples taken at 42 and 280 cm shows a methane source signature from Lompolojänkkä wetland of -69 ± 1 ‰.

In Ny-Ålesund, chamber studies of methane emissions over a 60-minute time period from four wetland sites in the area were carried out. Two of these wetland sites were situated within a protected bird sanctuary inside the Ny-Ålesund settlement and two were located on the island of Blomstrandhalvøya in the middle of Kongsfjorden.

Background air samples were collected in Ny-Ålesund and from a glacier southeast of the settlement. Daily air samples were collected at the Norwegian Polar Institute's Zeppelin station for comparison with samples collected during the campaign.

At one wetland site within the bird sanctuary, methane mixing ratios were 6739 ± 7 ppb before the chamber was in place and reached $56,068 \pm 200$ ppb within fifteen minutes of the chamber closing. Methane mixing ratios continued to increase within the chamber over the 60 minute observation period. For the two wetland sites on Blomstrandhalvøya, methane mixing ratios increased within the first 15 minutes, but levelled off thereafter.

With the recent warming of the region and the extensive thinning of the summer ice caps, it is anticipated that Arctic wetlands will play an ever more considerable role in the global methane budget. Therefore, further monitoring and research into wetlands in this vulnerable region is critical.