Geophysical Research Abstracts
Vol. 15, EGU2013-6221, 2013
EGU General Assembly 2013


# Revisiting factors controlling methane emissions from high-arctic tundra

Mikhail Mastepanov (1), Charlotte Sigsgaard (2), Torbern Tagesson (1,2), Lena Strom (1), Mikkel Tamstorf (3), Magnus Lund (1,3), Torben Christensen (1,4)

(1) Lund University, Department of Physical Geography and Ecosystems Analysis, Lund, Sweden (mikhail.mastepanov@nateko.lu.se), (2) Institute of Geography and Geology, University of Copenhagen, Denmark, (3) Arctic Research Centre, Bioscience, Aarhus University, Denmark, (4) Greenland Climate Research Centre, Nuuk, Greenland

Among the numerous studies of methane emission from northern wetlands the number of measurements carried on at high latitudes (north of the Arctic Circle) is very limited, and within these there is a bias towards studies of the growing season. Here we present results of five years of automatic chamber measurements at a high-arctic location in Zackenberg, NE Greenland, covering both the growing seasons and two months of the following freeze-in period. The measurements show clear seasonal dynamics in methane emission. In the beginning of the growing season increase in CH4 fluxes was strongly related to the date of snow melt. The greatest variation in fluxes between the study years were observed during the first part of the growing season. Somewhat surprisingly this variability could not be explained by commonly known factors controlling methane emission, i.e. temperature and water table position. Late in the growing season CH4 emissions were found to be very similar between the study years (except the extremely dry 2010) despite large differences in climatic factors (temperature and water table). Late-season bursts of CH4 coinciding with soil freezing in the autumn were observed at least during three out of five years 2006 - 2010. The accumulated emission during the freeze-in CH4 bursts was comparable in size with the growing season emission for the year 2007, and about one third of the growing season emissions for the years 2009 and 2010. In all three cases the CH4 burst was accompanied by a corresponding episodic increase in $CO_2$ emission, which can compose a significant contribution to the annual $CO_2$ flux budget. The most probable mechanism of the late season CH4 and $CO_2$ bursts is physical release of gases, accumulated in the soil during the growing season. In this study we investigate the drivers and links between growing season and late season fluxes. The reported surprising seasonal dynamics of CH4 emissions at this site show that there are important occasions where conventional knowledge on factors controlling methane emissions is overruled by other processes, acting in longer than seasonal time scales. Our findings suggest the importance of multiyear studies with continued focus on shoulder seasons.