5th European Conference on Permafrost, Book of Abstract

Philip Deline, Xavier Bodin, Ludovic Ravanel

Book of Abstracts

5th European Conference on Permafrost
June 23 – July 1, 2018, Chamonix, France

Book of abstracts

5th European Conference on Permafrost

Edited by Philip Deline, Xavier Bodin and Ludovic Ravanel

Co-editors: Chloé Barboux, Reynald Delaloye, Christophe Lambiel, Florence Magnin, Paolo Pogliotti, Philippe Schoeneich

Laboratoire EDYTEM, CNRS, Université Savoie Mont-Blanc

June 2018

Recommended citation

Deline P., Bodin X. and Ravanel L. (Eds.) (2018): 5th European Conference On Permafrost – Book of Abstracts, 23 June - 1 July 2018, Chamonix, France. <hal-01816115>

Disclaimer and Copyright

Publisher

Laboratoire EDYTEM - UMR5204
Université Savoie Mont Blanc
Bâtiment « Pôle Montagne »
5 bd de la mer Caspienne
F-73376 Le Bourget du Lac cedex

Editors

Philip Deline
Xavier Bodin
Ludovic Ravanel

Estimation of methane formation and emission in dominant landscapes of typical tundra of Western Yamal

Alexander Vasiliev[1,2],
Gleb Oblogov[1,2],
Irina Streletskaya[3]
[1] *Earth Cryosphere Institute of Tyumen Scientific Center (ECI TSC) SB RAS, Tyumen, Russia, email: al.a.vasiliev@gmail.ru*
[2] *Tyumen State University (TSU), Tyumen, Russia*
[3] *Moscow State University, Faculty of Geography (MSU), Moscow, Russia*

Abstract

In this presentation, we report the main results of our estimation of methane formation and emission in dominant landscapes of typical tundra. The study area is located in Western Yamal. The landscape structure of the representative area of typical tundra was studied, and landscape map was compiled. Soils of the active layer and upper permafrost were sampled within all dominant landscapes. Methane concentration was measured for every sample, and total methane content in the active layer and upper permafrost was evaluated. The highest methane content was observed in mires and ravines. Peatlands, well-drained tundra, wet tundra, and sand fields were characterized by the lowest methane content. Thus, mires and ravines are the main sources of methane emission in typical tundra. Daily methane flux in these landscapes reaches 10 to 20 mg/m^2.

Keywords: methane, active layer dominant landscapes.

Introduction

Permafrost plays an important role in global climate change and affects biological, hydrological, and human activities in the Arctic. In this study, we estimate methane content and its emission to atmosphere in dominant landscapes of typical tundra of Western Yamal based on the field investigations.

Methodology

Prior to measurements of methane emissions, we had developed a landscape map of the representative area 1 x 1 km based on satellite imagery and field observations, and determined its landscape structure (Fig. 1).

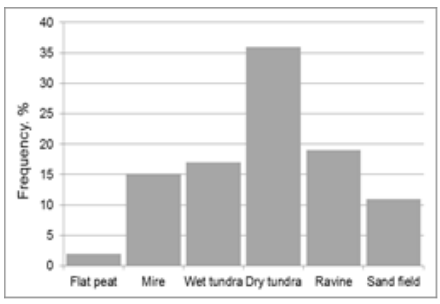

Figure 1. Landscape structure of typical tundra of Western Yamal.

It is known that emissions of methane generally peak between July and early August, with smaller emissions observed during late spring, early summer, and fall (Euskirchen et al., 2017).

Table 1. Soil conditions of the dominant landscapes

	Mire	Wet tundra	Dray tundra	Ravine	Sand field
Soil	loam	clay	clay	loam	sand
Vol. moisture content (%)	42,8	38,4	30,3	47,2	25,6
Surf. Temp. (late July) (°C)	7…8	7…9	4…7	6…8	9…11
Tot organic carbon in active layer (%)	0,68	1,26	0,45	4,50	0,34
Avg. methane content in soil (ppm)	2200	328	121	1590	86
Air methane concentration on landscape surface (ppm)	4,0	2,2	2,1	3,5	<2,0

Samples for evaluation of methane concentration were obtained from cores of boreholes drilled in late July 2016 within every dominant landscape with the exception of peatlands. In parallel, the soil conditions of

active layer, including soil composition, density, volumetric moisture content, total organic carbon, were studied (Tab. 1).

Soil samples were degassed, and the gas was collected using a "head space" method. Methane content was measured using a gas chromatograph XPM.4 with plasma ionization detector in the Institute of Physical, Chemical, and Biological Problems in Soil Science RAS.

Results

High methane concentrations were detected only within the two landscapes – mires and ravines – while there is almost no methane in the active layer of all other landscapes.

Methane fluxes were measured in 200-mm-diameter plastic pipes installed within each dominant landscape. Gas samples were collected every hour during three to four hours. Field measurements showed that the highest methane emissions to the atmosphere were typical of the same two landscapes. Surface temperatures during the field experiment varied from 4 to 11 ^{o}C.

Daily methane flux in these landscapes reached 10 to 20 mg/m^2 (late July 2017), while in all other landscapes it did not exceed 2 to 5 mg/m^2.

Conclusions

Based on our studies, the highest methane emission occurs only within the two landscapes: mires and ravines, which occupy approximately 30% of typical tundra. During the peak emission, daily methane flux in these landscapes can reach 10 to 20 mg/m^2

Acknowledgments

This work was supported by RSF, grant №16-17-00102, the soil conditions were studied in the framework of the Russian Foundation for Basic Research, project no.16-05-00612.

References

Euskirchen, E.S. M.S. Bret-Harte, G.R. Shaver, C.W. Edgar, V.E. Romanovsky. 2017. Long-term release of carbon dioxide from arctic tundra ecosystems in northern Alaska. *Ecosystems*. 20: 960-974