



**International Conference**  
**Solving the puzzles from**  
**Cryosphere**

**Pushchino, Russia, April 15-18, 2019**



Russian Academy of Science  
Institute of Physicochemical and Biological Problems in Soil Science RAS  
“Okabiolab” Ltd.

International Conference  
“Solving the puzzles from Cryosphere”

## PROGRAM ABSTRACTS

Pushchino, Russia, April 15-18, 2019

The International conference «Solving the puzzles from cryosphere» organized by: Institute of Physicochemical and Biological Problems in Soil Science RAS and “Okabiolab” Ltd.

#### Conference Committees.

Chair of the Organizing Committee: Andrey Alekseev (Corresponding member of RAS, Director of IPCBPSS RAS)

Chairs of the Programm Committee: Vladimir Melnikov (Full member of RAS), Marat Sadurtdinov (Director ECI Tyumen Scientific Centre SB RAS), Mikhail Zhelezniak (Director MPI SB RAS), Elizaveta Rivkina (Head of Soil Cryology Laboratory, IPCBPSS RAS)

Programm Committee: Andrey Abramov, Dmitry Drozdov, Vladimir Tumskoy, Olga Makarieva, Felix Rivkin, Stanislav Kutuzov, Alexey Lupachev

Chair of the local Organizing Committee: Andrey Abramov (Soil Cryology Laboratory, IPCBPSS RAS)

Local Committee: Svetlana Chudinova, Elena Spirina, Victor Sorokovikov, Tatiana Vorobyova

Technical group: Aleksandra Veremeeva, Anastasya Shatilovich, Lyubov Pasnitskaya, Lidia Gulyaeva, Larisa Kondakova, Ekaterina Sokolova, Stanislav Malavin

#### Partners

Earth's Cryosphere Institute, Tyumen Scientific Centre SB RAS (Tyumen)

Melnikov permafrost institute SB RAS (Yakutsk)

PYRN-Russia

relief, etc.) on the formation of the temperature field of rocks in this complex geological and structural area.

### **Permafrost Degradation in the Western Sector of Russian Arctic under Climate Change**

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According to the results of permafrost monitoring in the western sector of Russian Arctic obtained in 1975-2017 by the Tyumen Scientific Center of SB RAS, dramatic changes in permafrost conditions of this region have occurred. Based on observations within the bioclimatic zones of typical tundra, southern tundra, forest tundra, and northern taiga, we detect a new natural phenomenon: widespread degradation of permafrost with formation of the lowered permafrost table at depths from 3 to 10 m and occurrence of thin frozen layers, which may remain frozen for one or several summers. This new phenomenon still needs to be studied because we do not have sufficient information on its geographic boundaries and processes of its formation and evolution. However, we may conclude that the continental permafrost in the study area is not stable anymore as a result of changing thermal conditions and properties of degrading permafrost, including decrease in bearing capacity of frozen soils, migration of boundaries of bioclimatic zones, and changes in conditions of traditional land use.

Similar changes affect submarine permafrost. As a result of climate warming and 0.5 to 2.5°C increase in bottom water temperature during the last decades, rates of the permafrost table lowering in the Kara Sea and south-east part of the Barents Sea have significantly increased, especially in the areas with shallow position of the permafrost table. Degradation of submarine permafrost changes its boundaries, thermal regime, and properties. It also results in changing conditions of land use (first of all, for oil and gas industry).

We present the results of a long-term permafrost monitoring obtained at several locations: Kumzha Island, Cape Bolvanskiy (European North of Russia), Marre-Sale (western Yamal), Northern and Southern Urengoy, and the city of Nadym area. Based on these results, the main features related to permafrost degradation were determined, including lowering of the permafrost table with

time, decrease in depth of zero annual amplitude, formation of zero curtain, and transition of mean annual ground temperatures from negative to positive values.

This study was funded by RFBR according to the research project 18-05-60004.

**Distribution and dynamics of permafrost in the floodplain of the Pechora River. Results of complex geocryological and geophysical monitoring**

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The territory of the Nenets Autonomous Region is about 176000 km<sup>2</sup>, and 93% of this area is located in the cryolithozone. Large river Pechora has a significant warming effect on the permafrost state in the region. The remaining fragments of the low floodplain or alluvial-sea terraces in the Pechora Delta are locally developed, and there the Islands of permafrost are still preserved. These include the island of Kashin in Korovin Bay (the remnant of the II alluvial-sea terrace with elevations of 6-10 m) and the outlier of the I alluvial-sea terrace between the channels of the Pechora with elevations of 4-7 m, on which is located the preserved area of exploration drilling Kumzhinskoe oil&gas field. Below the surface everywhere overlain by sands, sometimes covered with a thin peat.

Monitoring of the geocryological conditions of the floodplain and the remains of the II and I terraces in the Pechora Delta has been carried out since 2009 on two sites - Kashin and Kumzha. Both sites are located in the southern tundra, in the area of sporadic permafrost distribution. In their territory there are two sites for ALT-monitoring (CALM) and 8 operating temperature boreholes up 10 m deep in different cryogenic landscapes. Basic information about the geocryological conditions of this territory was obtained as a result of drilling shallow boreholes (from 3 to 10 m), testing of thawed and frozen grouds, thermometric observations at special sites and boreholes, as well as a complex of geophysical works (georadiolocation and seismic exploration). The results of geocryological and geophysical monitoring at the sites allowed to obtain important conclusions and the state and dynamics of unstable rare-island permafrost in the Pechora delta in the conditions of modern climate warming:

- Seasonal fluctuations in the grounds temperature within the frozen areas are limited to the active layer, their thickness does not exceed 3 m, and below the permafrost temperature is close to 0°C. The permafrost depth ranges from 5 to 30 m according to geophysical methods.