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SOIL CRYOLOGY LAB

International Conference

Solving the puzzles from Cryosphere

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PYRN Permafrost Young Researchers Network Russia

Институт Криосферы Земли

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

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	short-term freezing-thawing of the surface soil layer	
18	About the organization of a unified program for monitoring cryogenic processes	**Tolmanov V**
19	Geocryological conditions for the passage of the railway Obskaya – Bovanenkovo - Karskaya	**Tretyakov I et al.**
20	Advanced stochastic modelling of thermokarst hazard for linear objects in uniform geological conditions	**Victorov A et al.**
21	Analyzing tundra vegetation characteristics for enhancing terrestrial LiDAR surveys of permafrost thaw subsidence on yedoma uplands	**Veremeeva A**
22	The Geoecological Situations Assessment and Mapping on Regional and Local level in the Russia Permafrost Zone	**Zotova L & Dedjusova S**

18.04.2019	**Thursday**	
	PERMAFROST AFFECTED SOILS **Chairs: Alexey Lupachev, Andrey Dolgikh**	
9:00-9:15	Problems of Permafrost-Affected Soils Classification and Their Places in Different Taxonomic Systems	**Goryachkin S et al**
9:15-9:30	The response of West Siberia tundra ecosystems to experimental warming: results of short and long-term experiments	**Matyshak G et al**
9:30-9:45	Temperature Field and the "Mirror Image" of the Thawing and Freezing processes of the Cryoarid Catenae Soils in Central Buryatia	**Badmaev N & Bazarov A**
9:45-10:00	Carbon and nitrogen distribution patterns in the soils of the Barents sea coastal area	**Shamrikova E et al**
10:00-10:15	Pedodiversity of the Cryolithozone in the Siberian middle taiga	**Golovleva Yu & Krasilnikov P**
10:15-10:30	Pumping-Effect in Soils of Permafrost	**Lapina L & Zyryanov V**
10:30-11:00	**Coffee**	
11:00-11:15	The Soil-Forming Environmental Characteristics of the North-East Arctic Coastal Areas of Russia	**Gubin S**

sands of alluvial and ancient alluvial origin. The areas have permafrost: insular in case of Western Siberia and continuous in case of Eastern Siberia.

The studied soils in Weatern Siberia have brownish colors, specific caviar structure in the B horizons, clay coatings and strongly acid environment. Micromorphological study of soil thin sections in transmitted and reflected light showed the presence of numerous rounded aggregates with and without Fe-Mn nodules in their centers. Mercury porosimetry showed the presence of a large number of pores of different configurations, predominantly of small and medium size. The mineralogical composition of clays is characterized by the presence smectite. Soils in Eastern Siberia are pale with cryogenic platy structure in lower horizons that is typical for permafrost-affected soils and neutral-alkaline. There are several types of coatings in voids and on soil aggregates: clay, humus-clay and carbonate. The mineralogical composition of clays is characterized by the presence of chlorite-vermiculite and kaolinite. The vertical distribution of organic carbon concentration is accumulative in both regions.

The pedogenetic processes in the studies soils in Western Siberia include intense leaching, clay dissolution in acidic environments in surficial horizons, poorly clay illuviation, aluminum penetration in the crystalline lattice of layered silicates, structure forming and gleying. Solodization, carbonate illuviation, iron hydroxide formation process, humus accumulation, structure forming and cryoturbationare were suggested as active pedogenetic processes in the soils of Eastern Siberia. Soils were identified as Cambisols and Alisols in Western Siberia, Cryosols and Planosols in Eastern Siberia according to the WRB.

Differentiated vs. poorly differentiated soils form due to local hydrothermal, topographical and lithological conditions. Cold environments with seasonal and perennial frost action are the major factor, which influence pedogenesis and appearance of the soils. We hypothesized that initially similar substrated transformed into different soils due to divergent evolution. The texturally differentiated loamy soils could form in warmer areas with earlier seasonal thawing, and have percolative water regime practically throughout the growing season. In recent decades, global climatic changes could impact current pedogenesis, and may lead to increased textural differentiation in soils.

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Pumping-effect in soils of permafrost

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The one-dimensional equation is considered

$\partial T/\partial t=\partial/\partial z\ (K(T)\partial T/\partial z)$,

Where T - soil temperature, K(T) – function of heat diffusivity of the soil, axis z is directed upright down (z=0 – the surface of the soil). Boundary conditions:

$T(z=0) = f(t),\ z \to \infty\ \ T < C < \infty,$

where f(t) is periodic function with the period τ .

In this work function of thermal diffusivity K(T) of a look is considered

$K(T) = \alpha T^2 + \beta T + C + \gamma T^{-2/3}.$

It is known that solution at $z \to \infty\ T \to T^{(\infty)}$, where

$T^{(\infty)} = \Psi^{-1}[\langle \Psi(f(t)) \rangle],\ \ \Psi(T) = \int K(T)dt,\ \Psi^{-1}(\mathrm{T}) - inverse\ function.$

Pumping-effect for permafrost soils has the negative value, i.e. increase in a oscillation amplitude at the surfaces of the soil leads to cooling of the soil at larger depths and, on the contrary, decrease of a oscillation amplitude leads to temperature increase of the soil. For example, for conditions of Yakutsk a pumping-effect is estimated at minus 2 degrees.

The Soil-Forming Environmental Characteristics of the North-East Arctic Coastal Areas of Russia

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Coastal environments and the soils on the shores of the Laptev, East-Siberian and Chukchi seas in the North-East part of the Russian Arctic are very poorly studied. They provide very important ecological function being the buffer geochemical zone between the marine and terrestrial environments, especially keeping in mind the possibility of dangerous anthropogenic impacts.

Regional peculiarities of pedogenesis in these areas are determined by the features of the sea coasts–their relatively young age, processes of thermoerosion and thermoabrasion, shallow depths of the sea shelf, wide areas of the upsurge, low degree of the sea water salinity, dominance of the Ice Complex material enriched with organic carbon in the marine and terrestrial deposits etc. The important feature of the local pedogenesis is the active input and deposition of the organic material in the synlithogenic soil profiles. This material comes from the uppermost organogenic horizons of the Late Pleistocene and Holocene watersheds and slopes' soils. The activeness of this process and the volume of the allochtonous material are determined by activeness of the thermoabrasion and the lithological structure (e.g. ice content) of the coastal deposits. During the evolution of the coastal areas, the alas depressions turn to the shallow lagoons and the hydrothermal regime and physico-chemical properties of the soils here completely change.