International Conference

Solving the puzzles from Cryosphere

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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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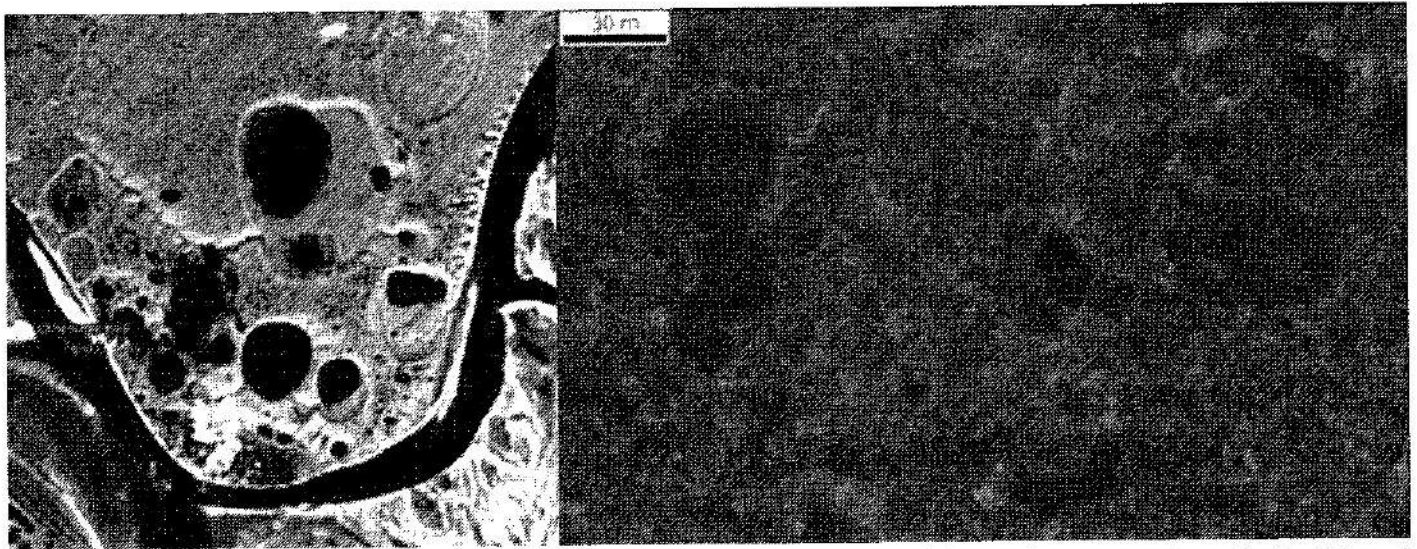
Figure 1. Southern part of Kurungnakh Island (left) and example of digitized water bodies (right)

Approximation the soil temperature of piecewise continuous function

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Data analysis of temperature condition was carried out for the mineral and peat soils located on section in a subband of the typical tundra (the basin of the Kolva River, the European Northeast of Russia). The soils given measurements were divided into two periods: winter (from October 15, 2014 to May 14, 2015) and summer (all others). In spite of the fact that observations were carried out incomplete year (about 11 months) nevertheless it was succeeded to recover the missed data proceeding from the function constructed according to measurements. For assessment of approximation error used mean value of the soil temperature for the period both calculated, and calculated on observations.

On every period approximation in the form of function of a look is looked for:

where ω – the frequency of annual fluctuations, A – amplitude (^{0}C). For the winter period of t changes from 0 to $7/6\pi$, for the summer period of t from 0 to $5/6\pi$. Time is measured in hours.

	Winter					Summer				
	A	B	φ	Sred obs	Sred calc	A	B	φ	Sred obs	Sred calc
0	5,06	-1,9	2,75	-4,54	-4,54	13,37	-3,84	0,38	5,03	5,81
2	5,24	-1,66	2,71	-4,4	-4,38	12,15	-3,9	0,34	4,2	5,04
5	5,22	-1,5	2,67	-4,2	-4,19	10,32	-3,41	0,29	3,49	4,2
10	5,21	-1,22	2,64	-3,9	-3,89	9,59	-3,19	0,26	3,22	3,89
40	4,56	-0,99	2,46	-3,2	-3,18	4,89	-2,01	0,06	1,2	1,52

Mean value of function is calculated analytically and has an appearance: for the winter period and for the summer period

Amplitudes significantly differ during the winter and summer periods. Results show that such division into the winter and summer period will justified and well be coordinated with data of observations. The calculated mean value for the summer period is more calculated on observations, as there was no month of summer measurements.

Cryogenesis features of the Kolyma Southern Highlands

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Main reserves of mineral resources are highly concentrated in the northeast of Russia - Kolyma Highlands area is a highly representative example of such circumstances. Moreover, the natural conditions of the cryolithozone there are very diverse, which affects the noticeable differentiation of the permafrost conditions in this territory. Due to the industrial development the changes may occur within the frozen sediments, leading to the activation of hazardous exogenous processes, which may pose the main danger to engineering structures.

Key site within the Omchak river valley was chosen as typical one for this region - its permafrost-geological conditions are common for southern part of the Kolyma Highlands. The author performed Engineering and permafrost studies in 2013-14 including drilling of geotechnical wells with sampling with subsequent laboratory processing of the physical and mechanical properties of soils, description of landscape conditions, as well as geophysical studies.

Kolyma river headwaters are located within the midlands and can be characterized by continental climate with harsh snowy winter and short cool summer. The average annual long-term air temperature is −11.7°C.

In the permafrost-hydrogeological terms, the research area is located in the area of continuous distribution of permafrost, but through and above permafrost taliks may be present. Permafrost thickness varies from 60 m in the river valleys (Omchak river) to 300-400 m on the watersheds. Stable taliks have a limited distribution: in the Omchak river floodplain and in the mouth of its inflows. The upper boundary of permafrost mainly repeats terrestrial landforms and depends on the exposure of the slopes, lithology, thickness and water permeability of unconsolidated sediments, the presence of vegetation and proximity of surface waters. Temperature of sediments ranges from −0.1 to −5.4 ° C. Field investigations have shown that at a depth of 10.0 m, the temperature was −0.7 ÷−3.2 ° C, with an average of −2.4 °C. In some drills lenses and interlayers of ice