

THERMAL STATE OF PERMAFROST IN THE NORTHERN YAKUTIA: MODERN DYNAMICS AND SPATIAL VARIABILITY.

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REGIONAL PERMAFROST CONDITIONS (YAKUTIA)

Permafrost Regions in the Soviet Union

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MONGOLIA

Sporadic permafrost: maximum thickness: 25 meters

Continuous permafrost; prevailing thickness: more than 500 meters

BOO Miles

Continuous permafrost; prevailing thickness: 300-500 meters Continuous permafrost; prevailing thickness: 100-300 meters Discontinuous permafrost; maximum thickness: 100 meters KORE

East China Sea

located at the 10 sites. Continuous temperature record covering 4 and more years available for 6 boreholes.



VEGETATION AND LANDSCAPE TYPES

TUNDRA

BOREAL FOREST

FLOODPLAIN













O AN ANNUAL AIR TEMPERATURE DYNAMICS AND ESTIMATION OF THE SNOW INFLUENCE ON THE GROUND TEMPERATURE.

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CHOKURDAH

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MEAN ANNUAL AIR TEMPERATURE (BLUE LINE) AND TEMPERATURE WITH SNOW INFLUENCE CORRECTION (RED-PURPLE LINE) DYNAMICS







MAXIMAL SNOW THICKNESS DYNAMICS



Snow warming influence was estimated using Kudryavtcev approach, taking into consideration snow thickness, density and amplitude of air temperature seasonal oscillation.



METHODS - MEASUREMENTS STRATEGY

Before 2006

Occasional or periodical measurements



After 2006

Long-term highfrequency (hourly to daily) continuous observations

Data logger HOBO U-12 with termistors TMC-HD. It allows to do measurements with resolution 0.004°C and accuracy 0.02°C





TUNDRA (BYKOVSKY PENINSULA)







MAGT at the 26 m depth (2012) -10.3°C Positive trend, °C/year 0.073





TUNDRA (CHUKOCHYA RIVER)



11.08.2009









TUNDRA (CHUKOCHIYA CAPE)



MAGT at the 25 m depth (2012) -9.8°C Positive trend, °C/year 0.109





BOREAL FOREST (OMOLON RIVER MOUTH)





MAGT at the 25 m depth (2012) -4.2°C Positive trend, °C/year 0.063





BOREAL FOREST (DUVANNY YAR)



MAGT at the 25 m depth (2012) -6.1°C Positive trend, °C/year 0.035





FLOODPLAIN (AMBOLIHA)





FLOODPLAIN (AMBOLIHA)





MAGT at the 21 m depth (2012) -5.6°C Positive trend, °C/year 0.019



O ESULTS: CORREALATION OF GROUND TEMPERATURE VALUES AND DYNAMICS WITHIN THE DIFFERENT LANDSCAPE TYPES

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RMAL CONDUCTIVITY OF ACTIVE LAYER SOIL IN THE INVESTIGATED

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Left panel: Conductivity of organic (5-10 cm) soil was lower than mineral (20-40 cm). Right panel: The positive relationship between bulk density (low in organic soil) and thermal conductivity



CORRELATION OF PERMAFROST TEMPERATURE AND SOIL CARBON CONTENT







CONCLUSIONS

Mean annual permafrost temperature rising was recorded at the most of observation sites in the region.

Rate of rising changes from **0.03 C/year** within boreal forest natural zone to **0.1 C/year** in tundra. Within each of ecosystem types rate of permafrost warming strongly depends on local surface conditions.

Cooling natural factors such as higher *organic content in active layer* or *snow redistribution due to micro topography* reduce permafrost temperature and climate impact on its dynamics.

Ecosystems with *higher bioproductivity* are characterized by *lower rate of permafrost warming*

Based on the current research we would **strongly recommend to take into consideration climate induced ecosystem changes** (i.e. vegetation structure, microtopography dynamics, increasing of bioproductivity and soil organic carbon accumulation) when doing long-term permafrost dynamics modeling and forecasts.



DATA ACCESS

Results of measurements are available via Internet on the web site of the Cooperative Arctic Data and Information Service (CADIS)

WWW.AONCADIS.UCAR.EDU

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Geophysical Institute UAF, Permafrost laboratory web site

WWW.PERMAFROSTWATCH.ORG





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