Geophysical Research Abstracts
Vol. 15, EGU2013-5780, 2013
EGU General Assembly 2013


# Thermal state of permafrost in the Northern Yakutia: modern dynamics and spatial variability.

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Permafrost exerts a significant influence on northern socioeconomic and biological systems. The thermal state of permafrost has recently become the focus of rapt attention around the world. Permafrost temperature is an integrated parameter and depends not only on the air temperature, but also on the heat transfer conditions at the ground surface and on the thermal properties of deposits; any permafrost regional forecasts and models must take these factors into consideration.

Current research concerns to study of regional permafrost feedbacks associated with climate change in the Northern Yakutia. The investigated region covers the most ancient permafrost area in the Northern Hemisphere; it is characterized by varied climate zones, from a maritime to a continental. There are 3 main landscape types here including boreal forest, tundra and river or streams valleys.

The research was based on making geothermal observations in an already-established network of boreholes. Recently this network includes 12 boreholes. Temperature measurements were supplemented with investigations of landscape conditions and determination of relevant soil physical properties at the key observational sites. We will achieve the goals of this project by comparing modern measurements with historical data and meteorological observations in combination with investigating heat transfer parameters at the monitoring sites.

Geothermal measurements show that in the boreal forest natural zones recent permafrost temperature varies from -2.6 to -6.4°C, at the Kolyma-Panteleiha floodplain from -4.7 to -5.5°C and in tundra natural zone -9 to -10.4°C. Most of observed boreholes shows sustainable permafrost temperature rising. Within the tundra zone rate of mean annual ground temperature (MAGT) increasing consists of 0.073 to 0.109°C per year, within the boreal forest – from 0.035 to 0.063°C per year and in the floodplain 0.019°C per year.

Such variations in both MAGT values and its modern changes rates can be explained by the different surface heat transfer conditions in the various ecosystems.

Due to lower thermal conductivity (0.6 – 0.8 W/(m*°K)) organic rich soils of active layer prevent propagation of summer heat into permafrost, while the sites with active layer mostly composed of mineral soil (thermal conductivity 1.2 – 1.5 W/(m*°K)) are characterized by higher permafrost temperature and higher temperature increasing rates.

Thus conclusion about the higher resilience of permafrost within the ecosystems with high bioproductivity can be done. Following this conclusion we can assume, that climate induced increasing of bioproductivity can reduce the atmosphere warming impact on permafrost.

Results of the observations are available for the broader scientific community and for the public at the Cooperative Arctic Data and Information Service (CADIS) data portal: www.aoncadis.ucar.edu and Geophysical Institute Permafrost Laboratory web site www.permafrostwatch.org.

Current research was supported by the NSF (ARC-0520578, ARC-0632400 and ARC- 0856864) and collaborative RFFI-CRDF program (RUG1-2986-PU-10).