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

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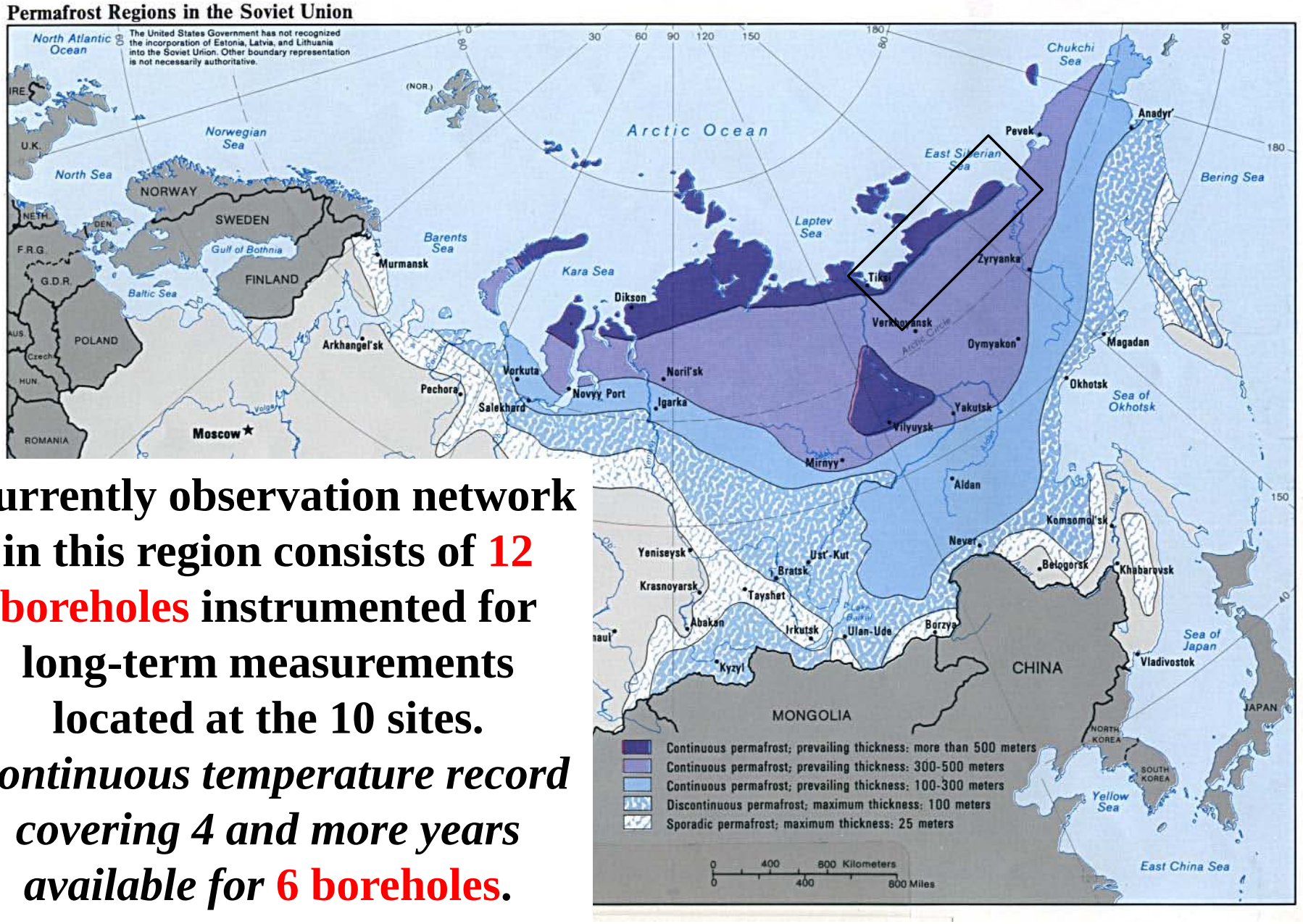
REGIONAL PERMAFROST CONDITIONS (YAKUTIA)

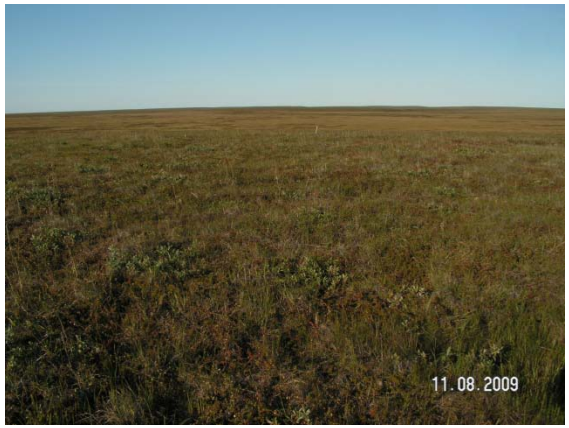


Currently observation network in this region consists of 12 boreholes instrumented for long-term measurements located at the 10 sites.

Continuous temperature record covering 4 and more years available for 6 boreholes.

VEGETATION AND LANDSCAPE TYPES

TUNDRA



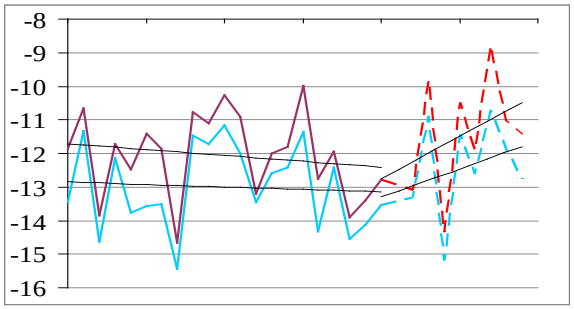
BOREAL FOREST

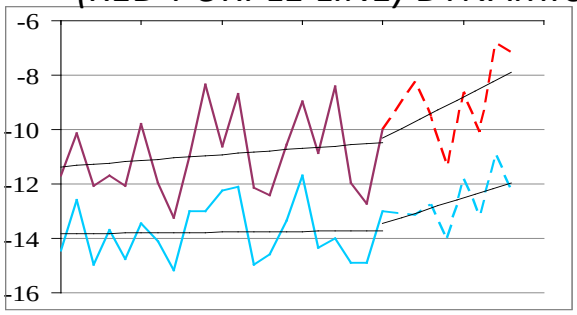
FLOODPLAIN

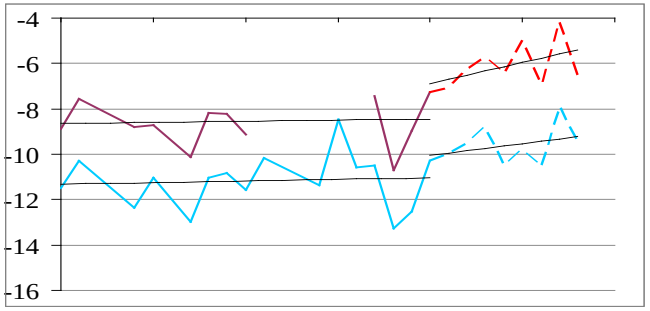
AN ANNUAL AIR TEMPERATURE DYNAMICS AND ESTIMATION OF THE SNOW INFLUENCE ON THE GROUND TEMPERATURE.

TIKSI CHOKURDAH CHERSKY

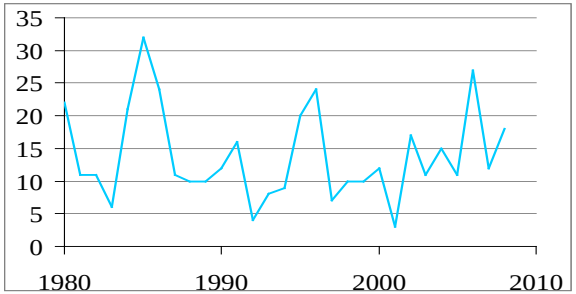
MEAN ANNUAL AIR TEMPERATURE (BLUE LINE) AND TEMPERATURE WITH SNOW INFLUENCE CORRECTION (RED-PURPLE LINE) DYNAMICS

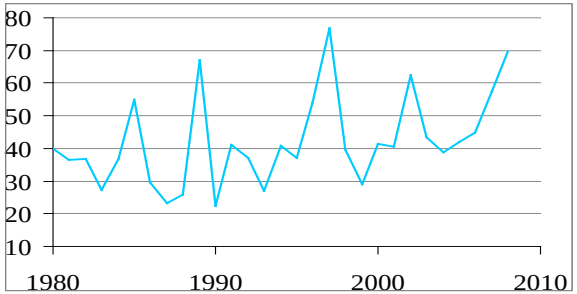


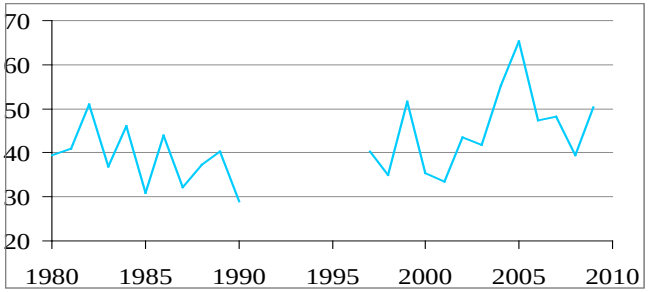




MAXIMAL SNOW THICKNESS DYNAMICS





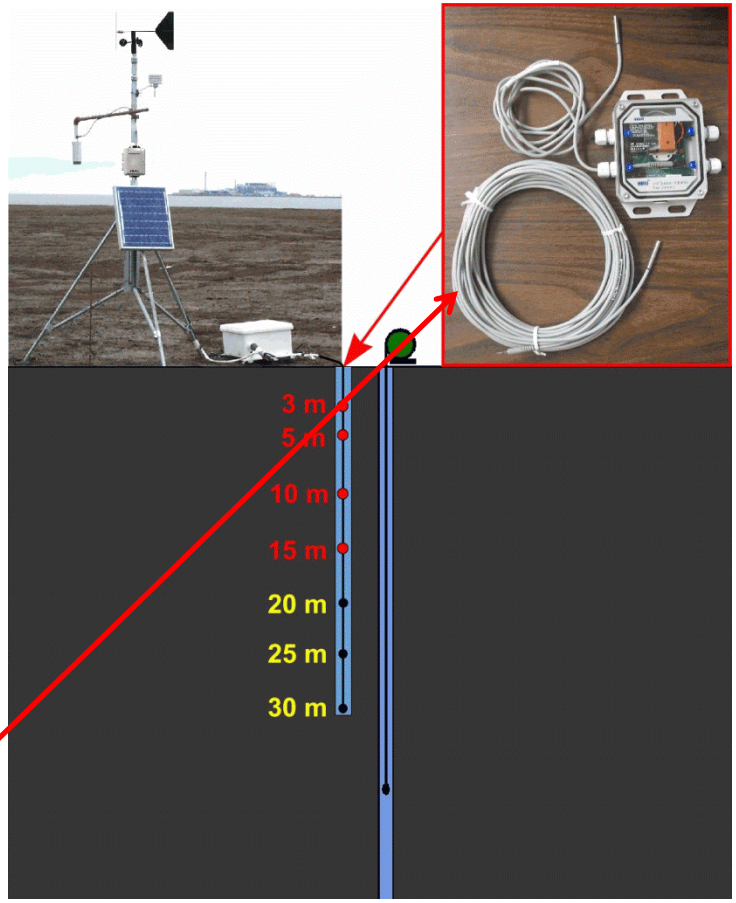


Snow warming influence was estimated using Kudryavtcev approach, taking into consideration snow thickness, density and amplitude of air temperature seasonal oscillation.

METHODS - MEASUREMENTS STRATEGY

Before 2006

Occasional or periodical measurements

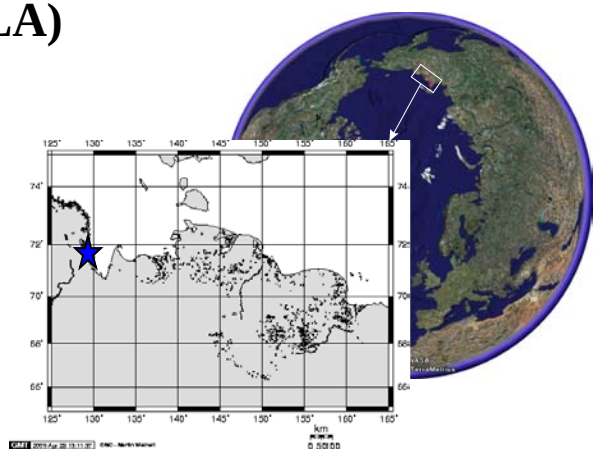


After 2006

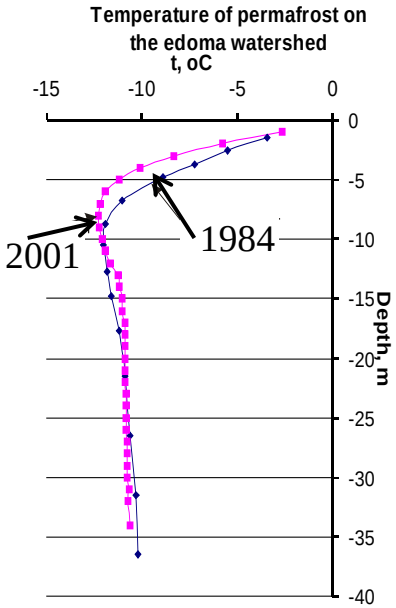
Long-term high-frequency (hourly to daily) continuous observations

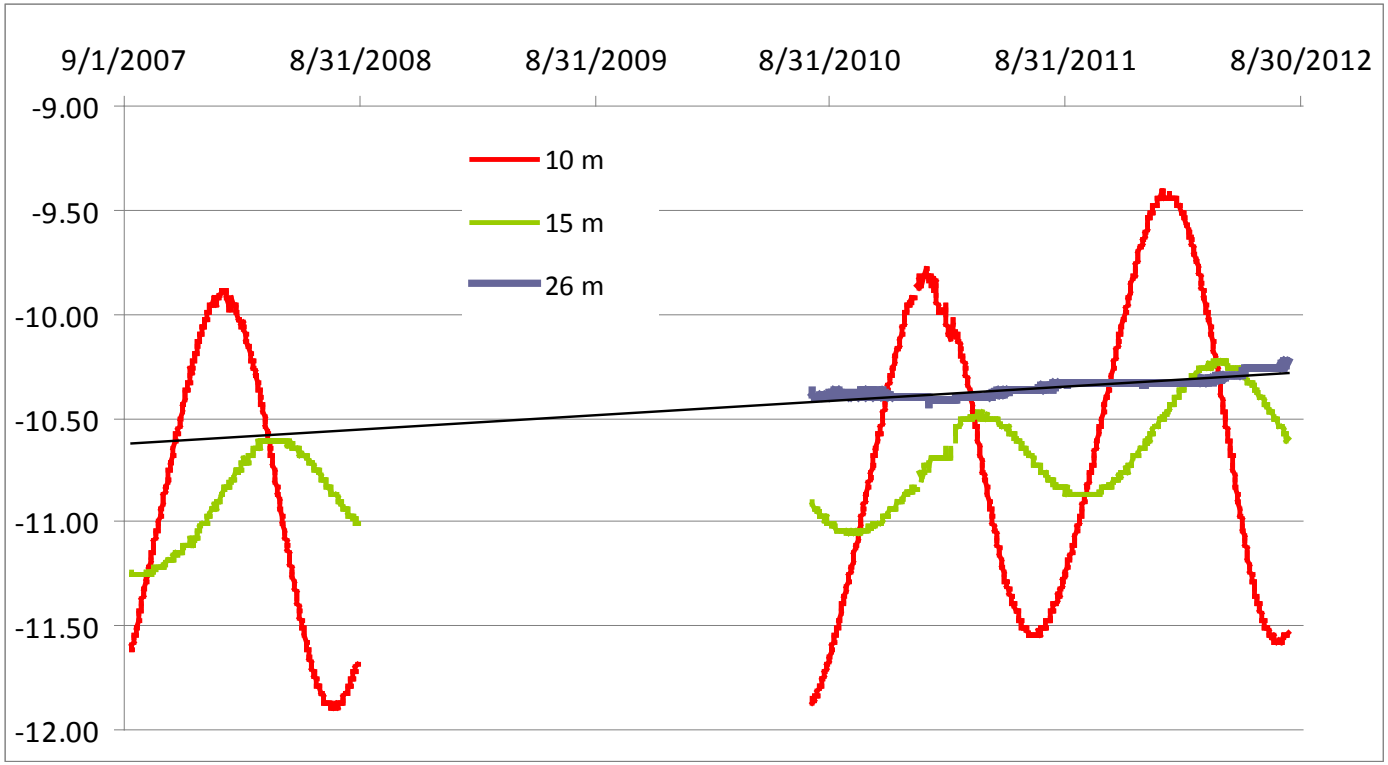
Data logger HOBO U-12 with termistors TMC-HD. It allows to do measurements with resolution 0.004ºC and accuracy 0.02ºC

TUNDRA (BYKOVSKY PENINSULA)

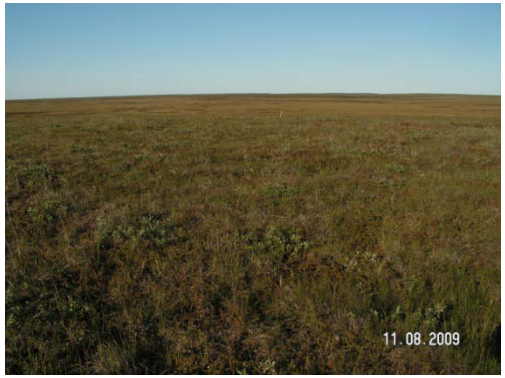


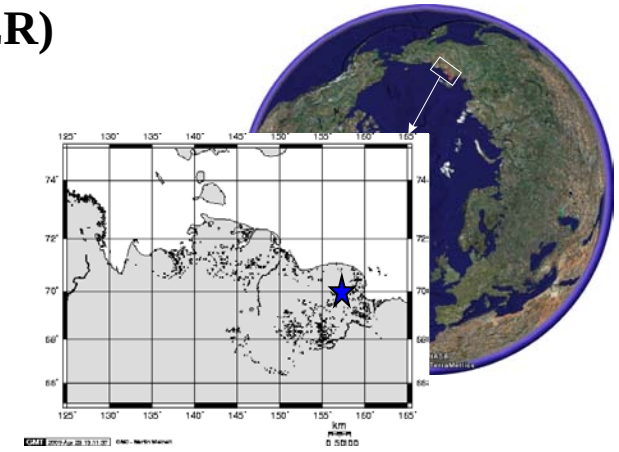
MAGT at the 26 m depth (2012) -10.3°C Positive trend, °C/year 0.073



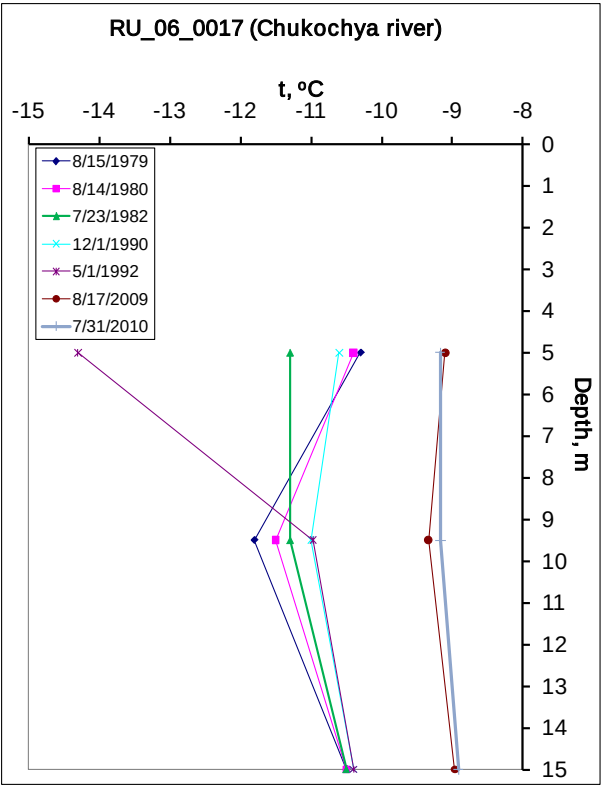


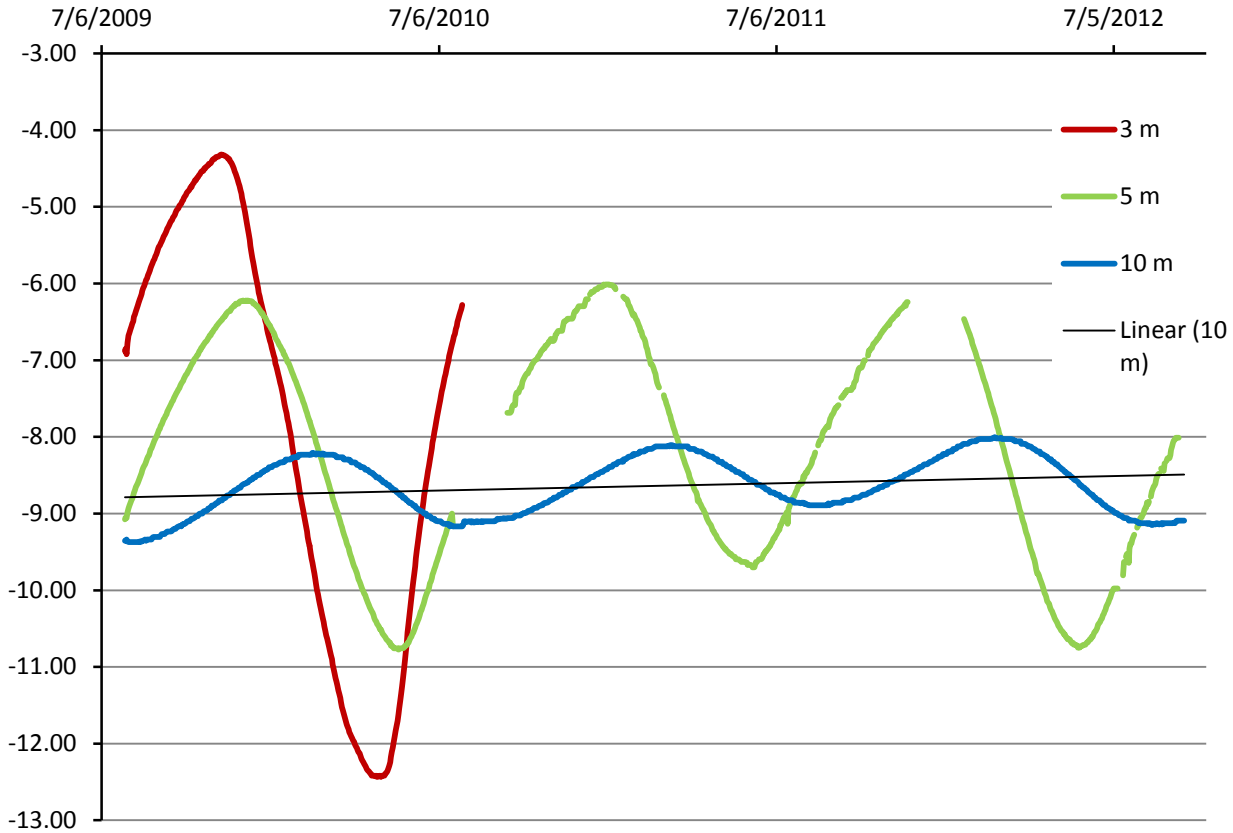
TUNDRA (CHUKOCHYA RIVER)



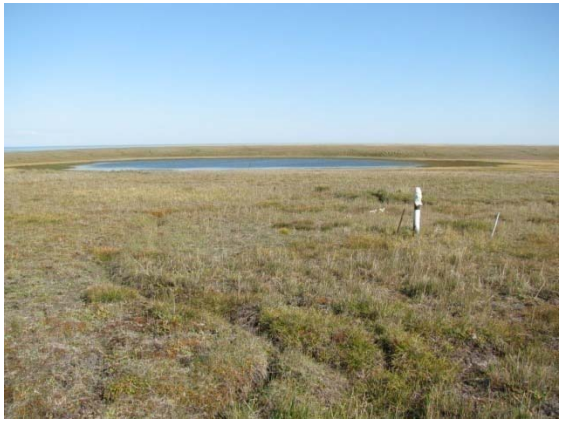


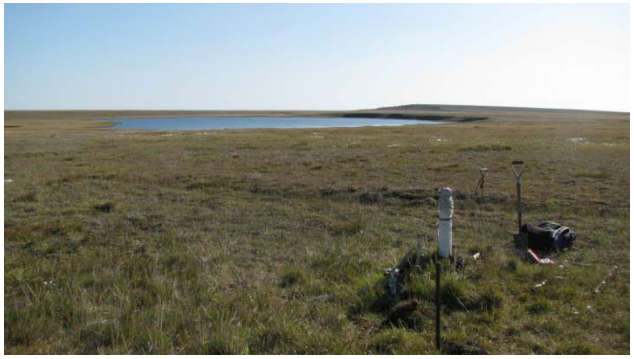
MAGT at the 10 m depth (2012) **-8.6°C** Positive trend, °C/year **0.109**

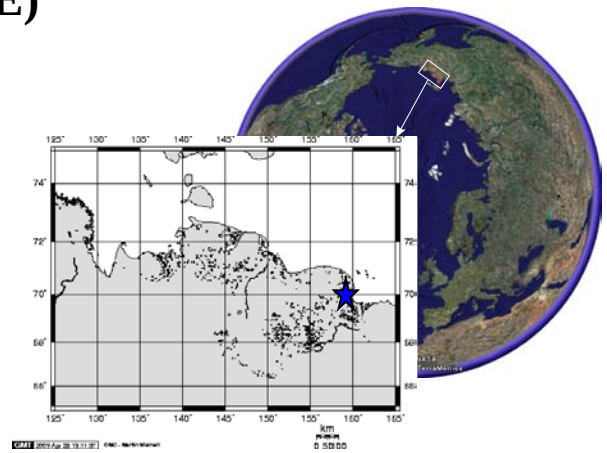




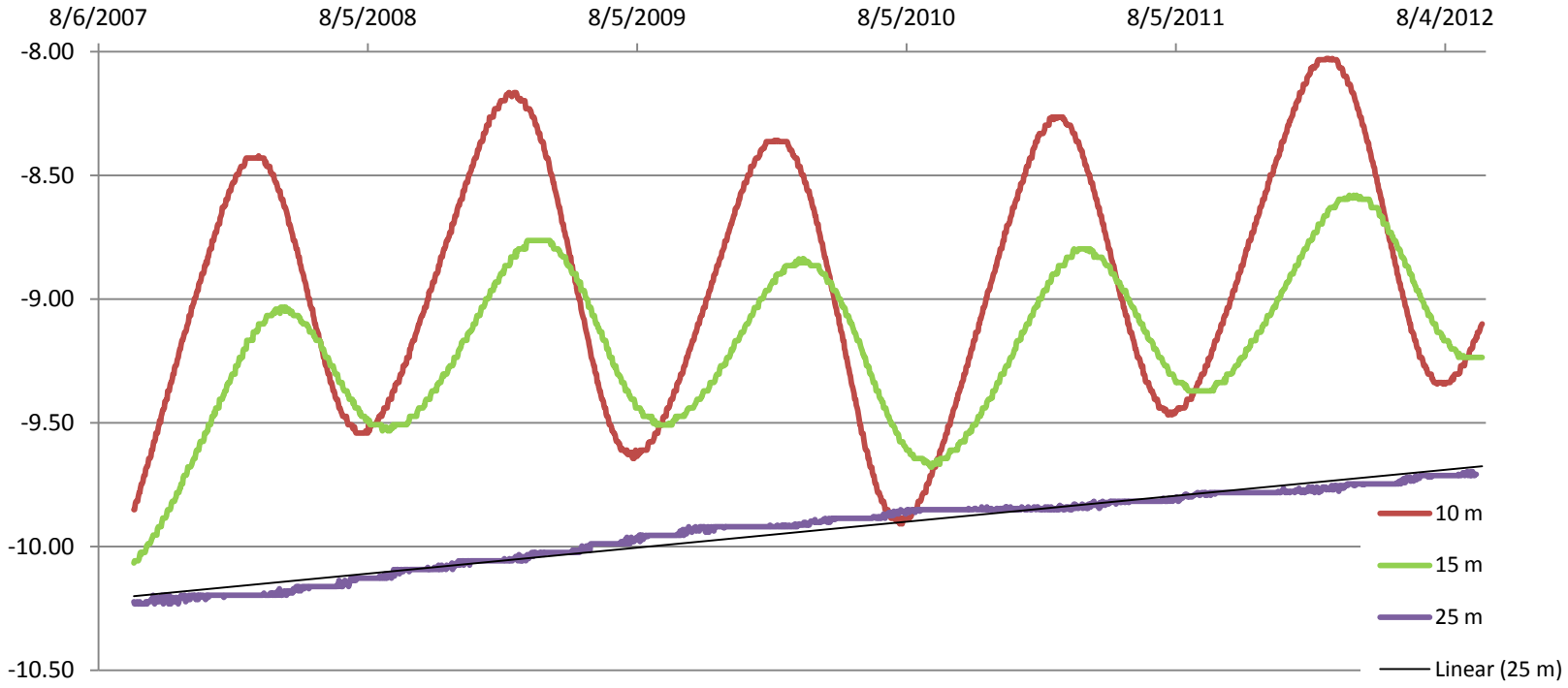
TUNDRA (CHUKOCHIYA CAPE)



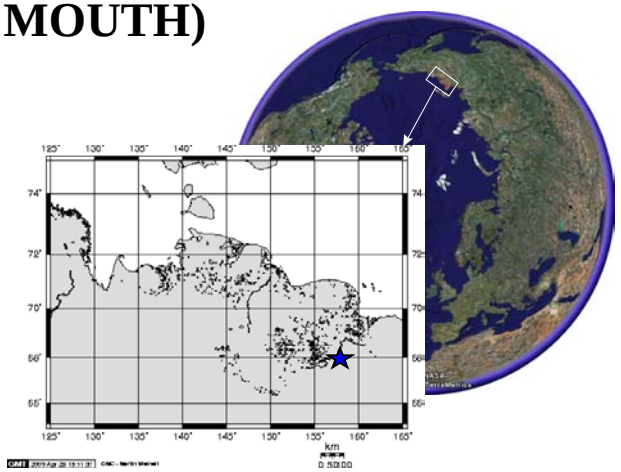




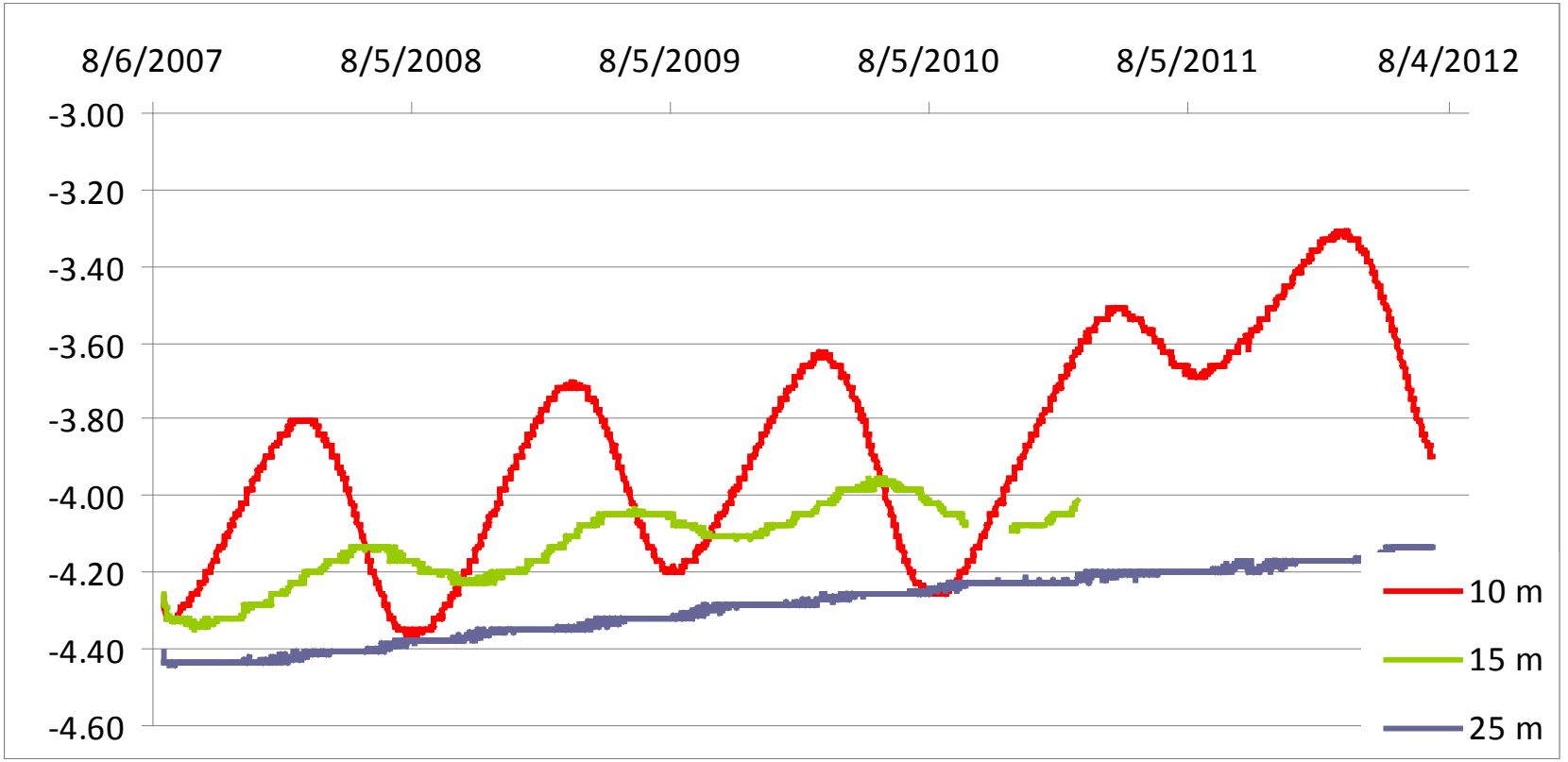
MAGT at the 25 m depth (2012) **-9.8°C** Positive trend, °C/year **0.109**



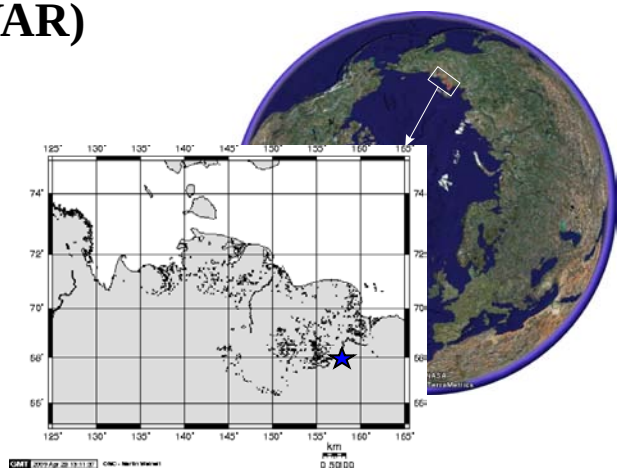
BOREAL FOREST (OMOLON RIVER MOUTH)



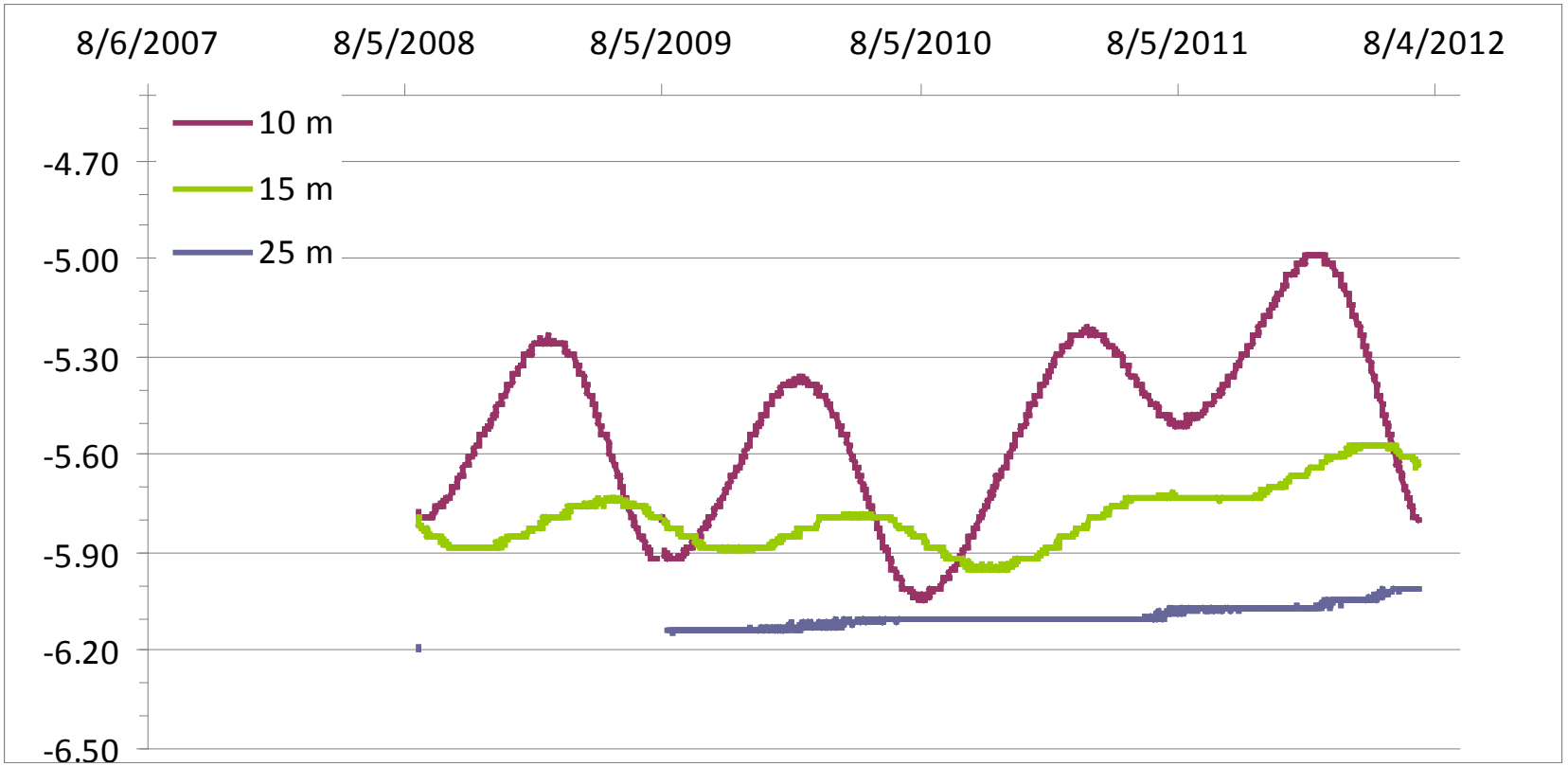
MAGT at the 25 m depth (2012) **-4.2°C** Positive trend, °C/year **0.063**



BOREAL FOREST (DUVANNY YAR)



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



FLOODPLAIN (AMBOLIHA)

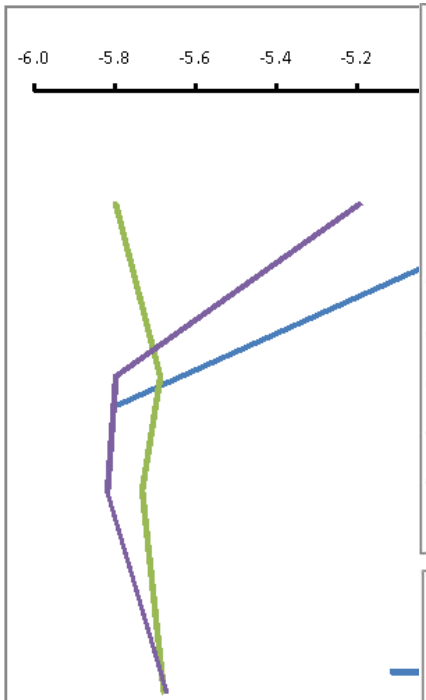
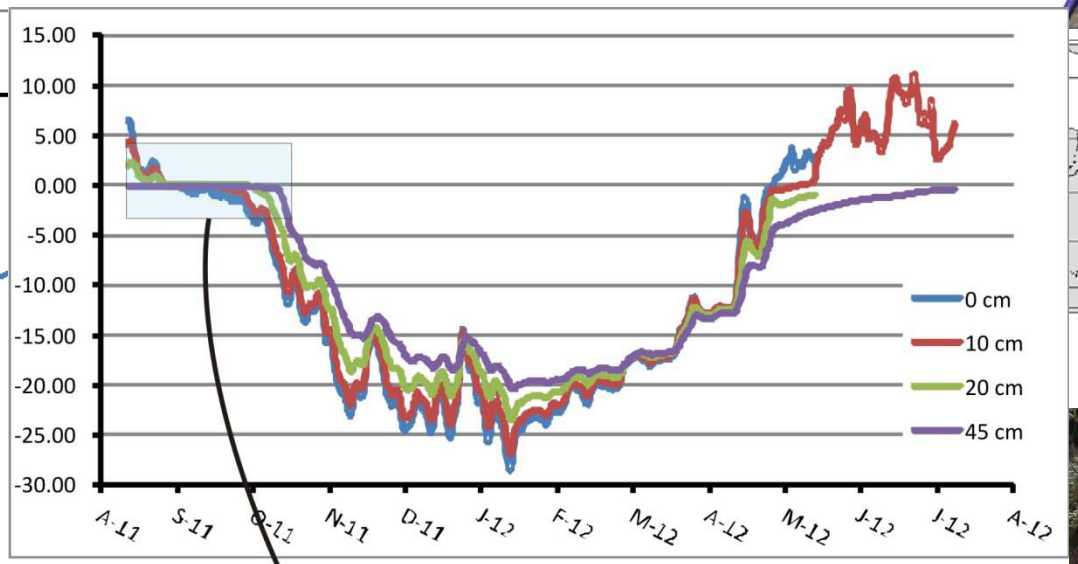
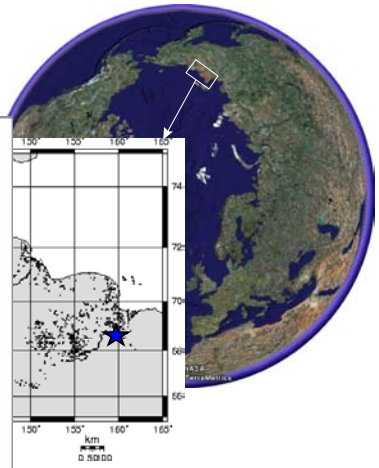
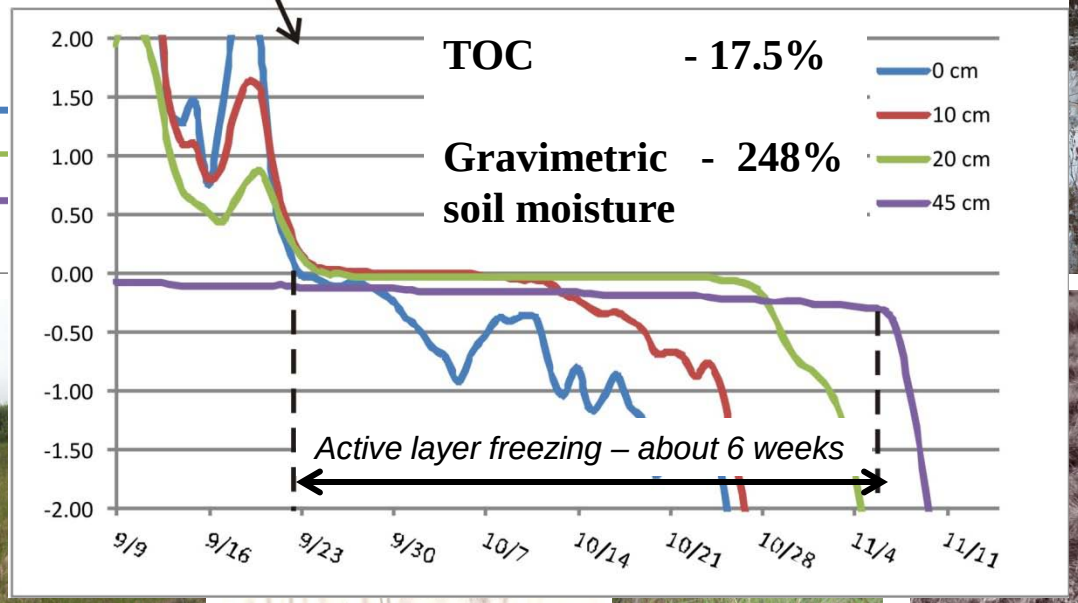
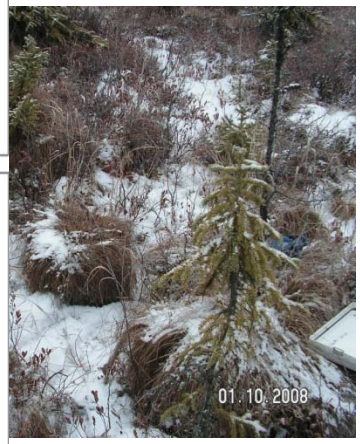


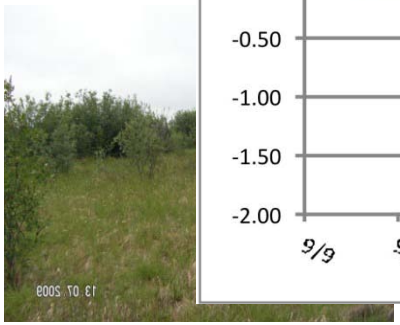
Fig. 10. Mean annual temperature in the borehole at Amboliha site at 1981; 2008 and 2009.

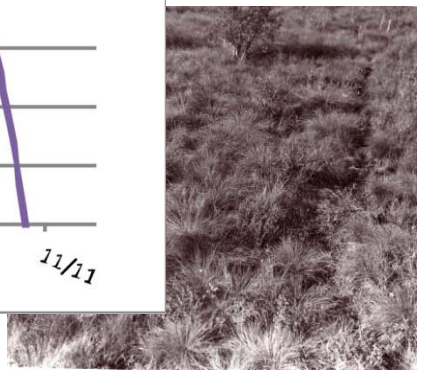






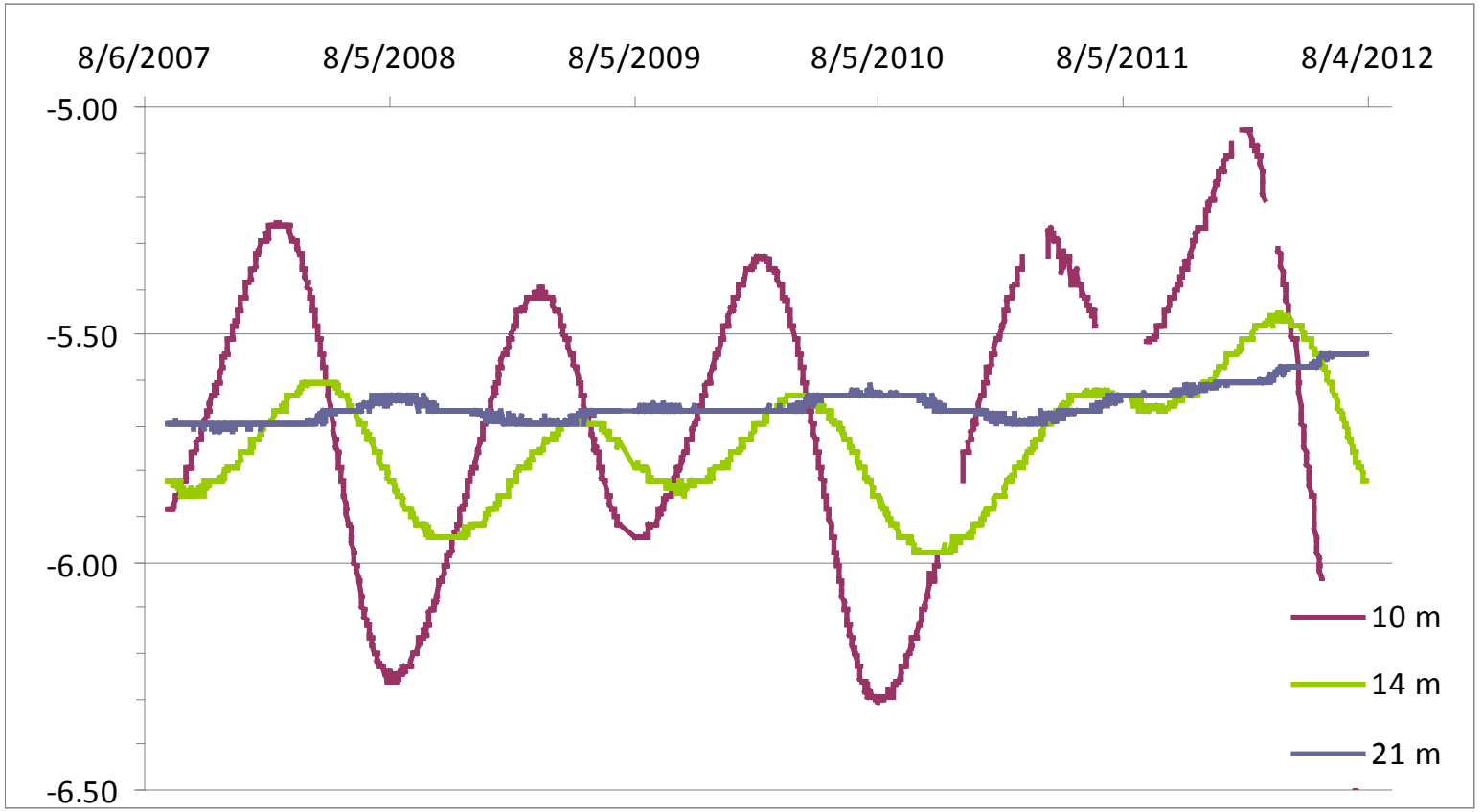




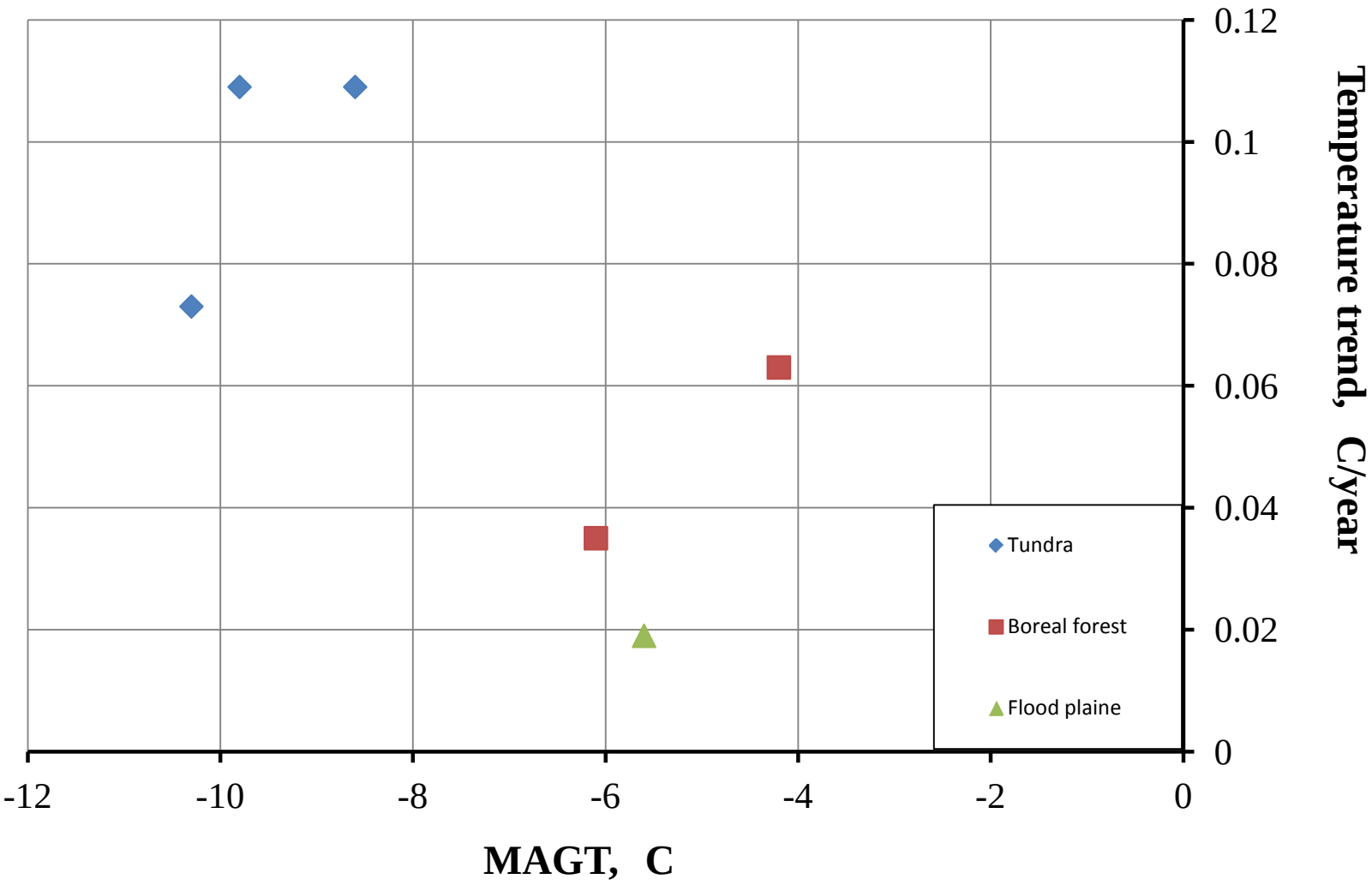


FLOODPLAIN (AMBOLIHA)

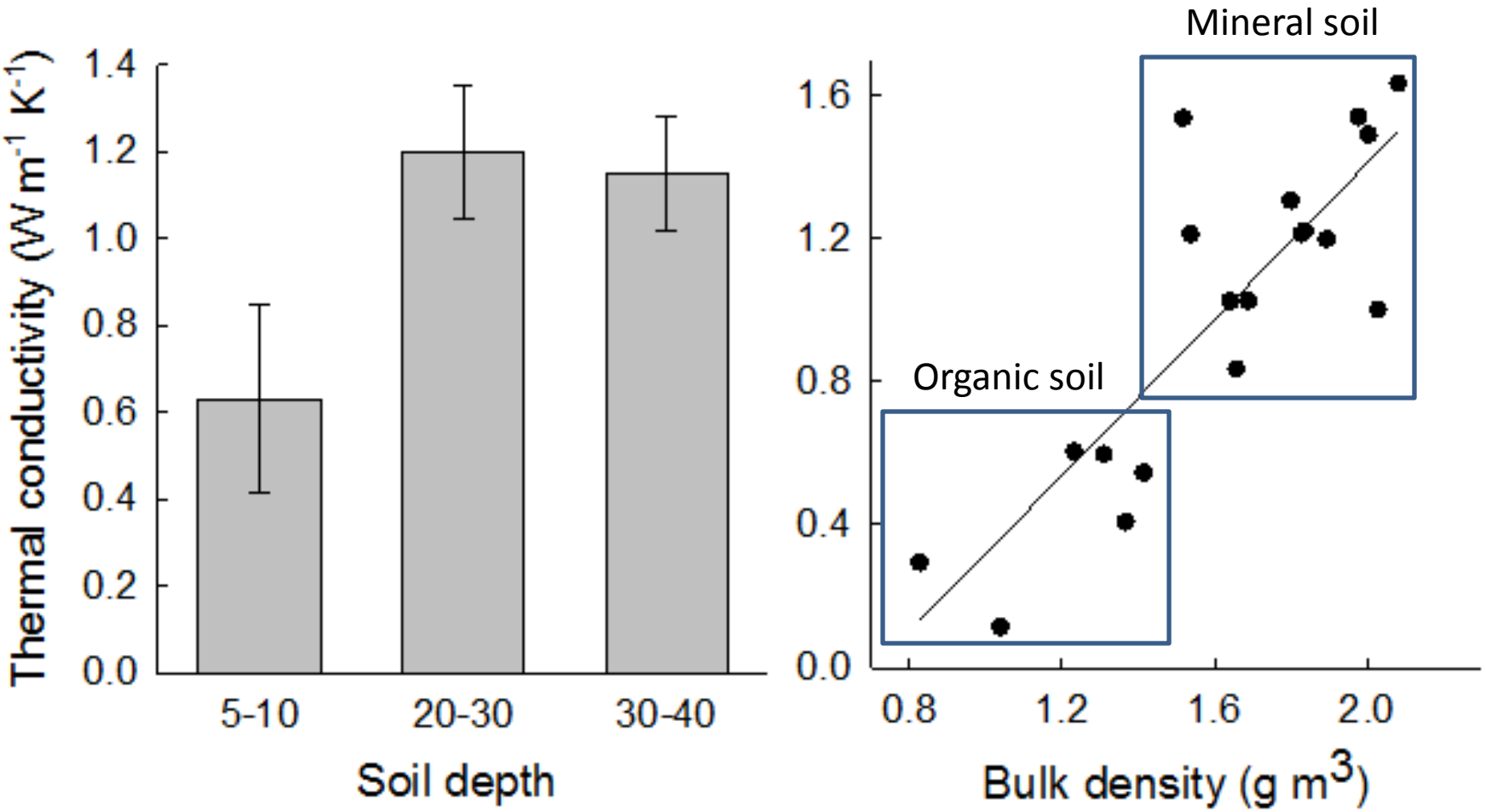
MAGT at the 21 m depth (2012) **-5.6°C** Positive trend, °C/year **0.019**



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

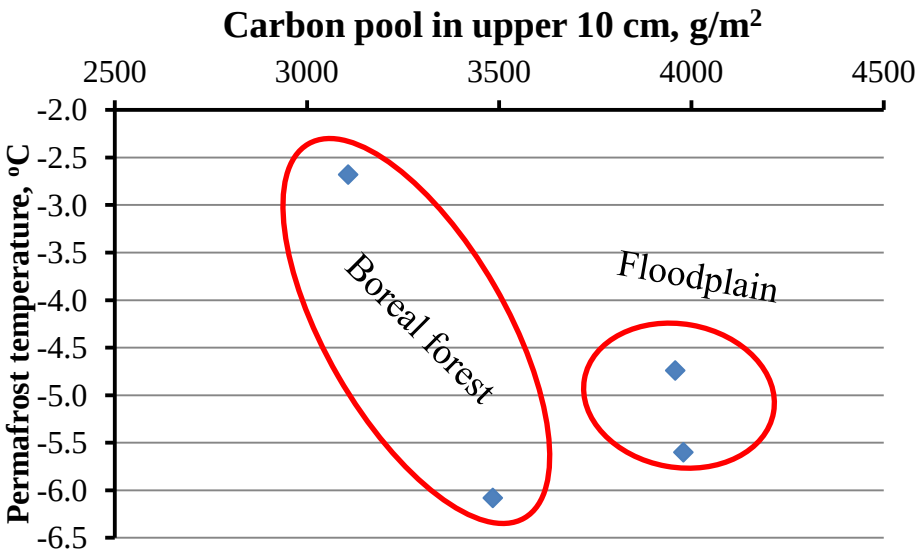


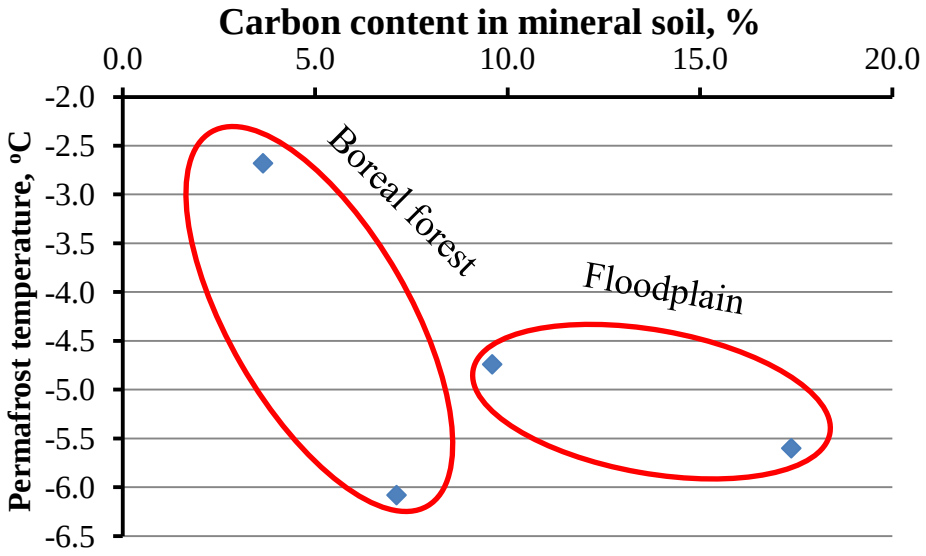
RMAL CONDUCTIVITY OF ACTIVE LAYER SOIL IN THE INVESTIGATED AREA



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.

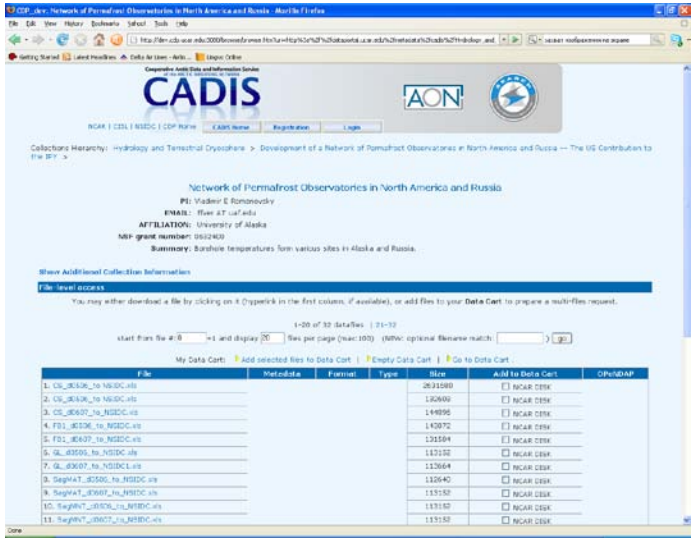
Ecosystems with ***higher bioproductivity*** are characterized by ***lower rate of permafrost warming***

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

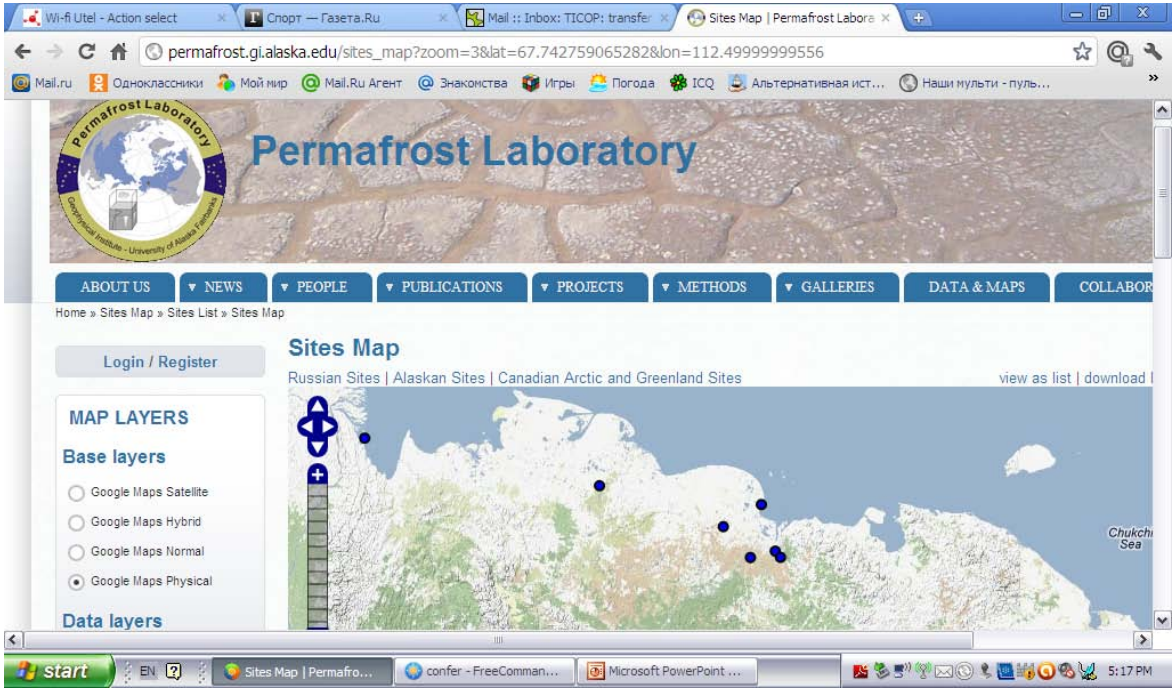
Results of measurements are available via Internet on the web site of the Cooperative Arctic Data and Information Service (CADIS)

WWW.AONCADIS.UCAR.EDU



Geophysical Institute UAF,
Permafrost laboratory web site

WWW.PERMAFROSTWATCH.ORG
http://permafrost.gi.alaska.edu/sites_map



AKNOWLEDGEMENTS

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National Science Foundation
WHERE DISCOVERIES BEGIN

and

RFBR and CRDF (RUG1-2986-PU-10)

РФФИ

CRDF GLOBAL