



Geochemical processes in Yamal peninsula lakes under climate variation

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Region of investigation – Yamal peninsula

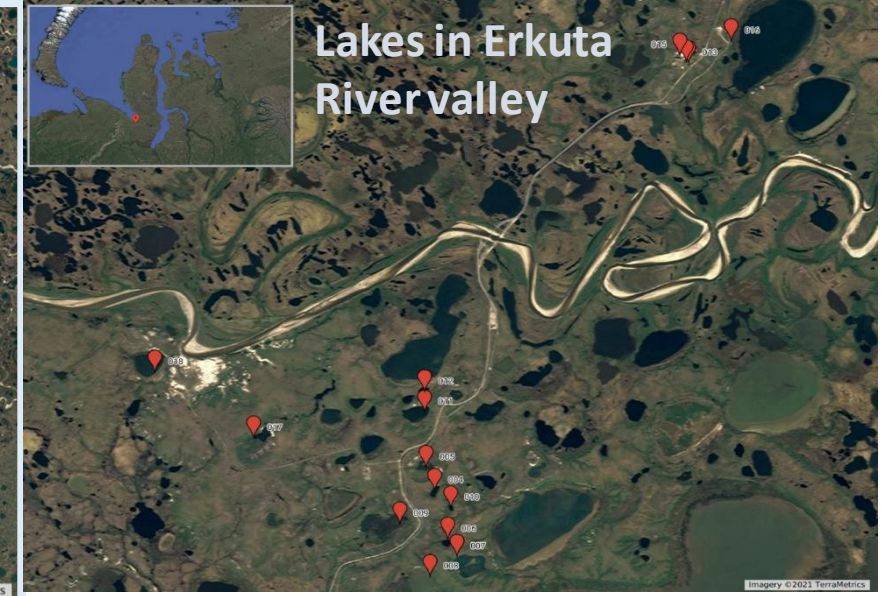
Objects of investigation – lakes of Yamal peninsula (Russian Arctic)



Hydrology
Hydrochemistry
Hydrobiology

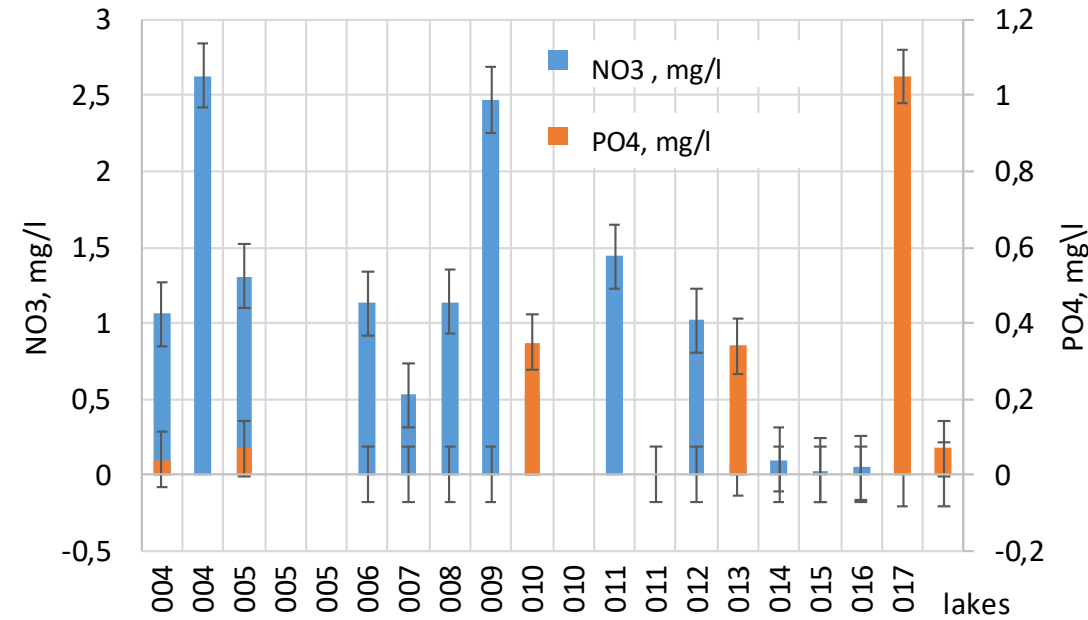


Geophysics
Paleoecology
Paleoclimatology



Geochemistry of sediments
Anthropogenic impact
GHG emission

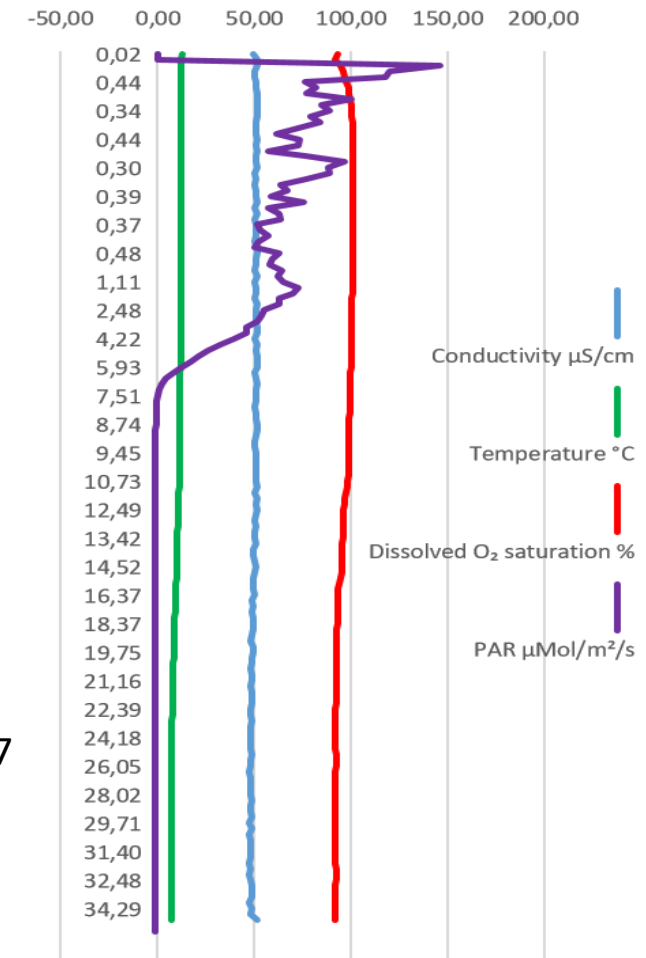
Hydrochemistry



Values of nitrates and phosphates in the lakes of the Erkuta River Valley in July 2021

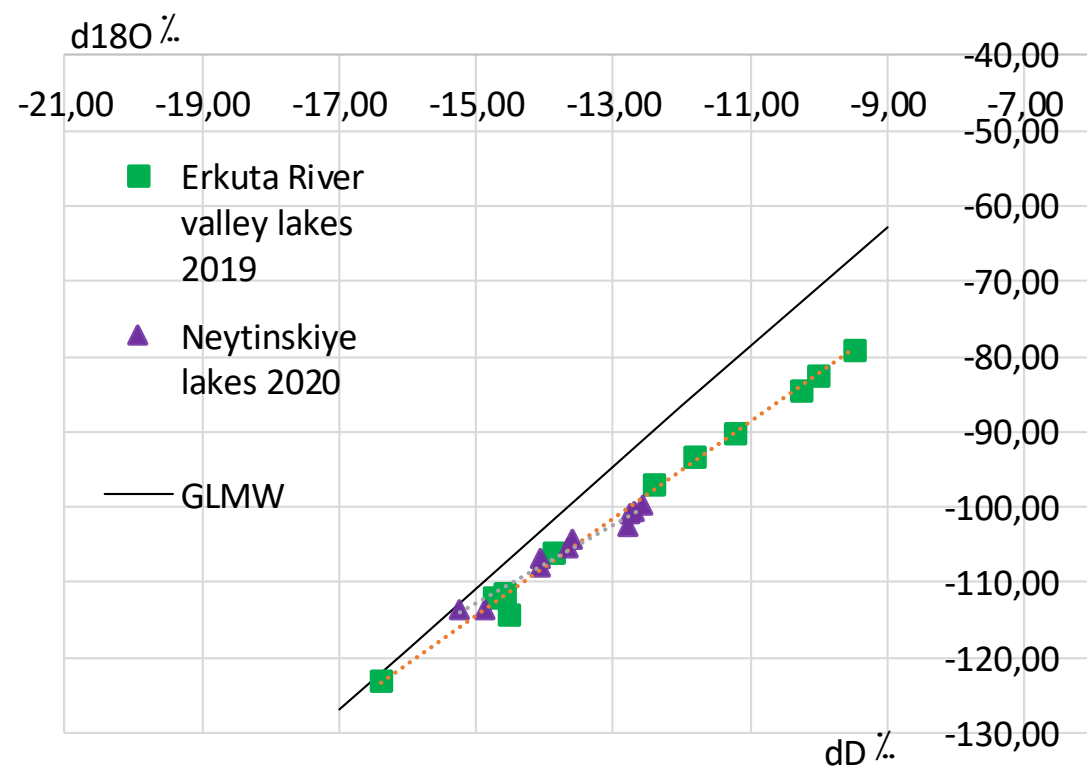
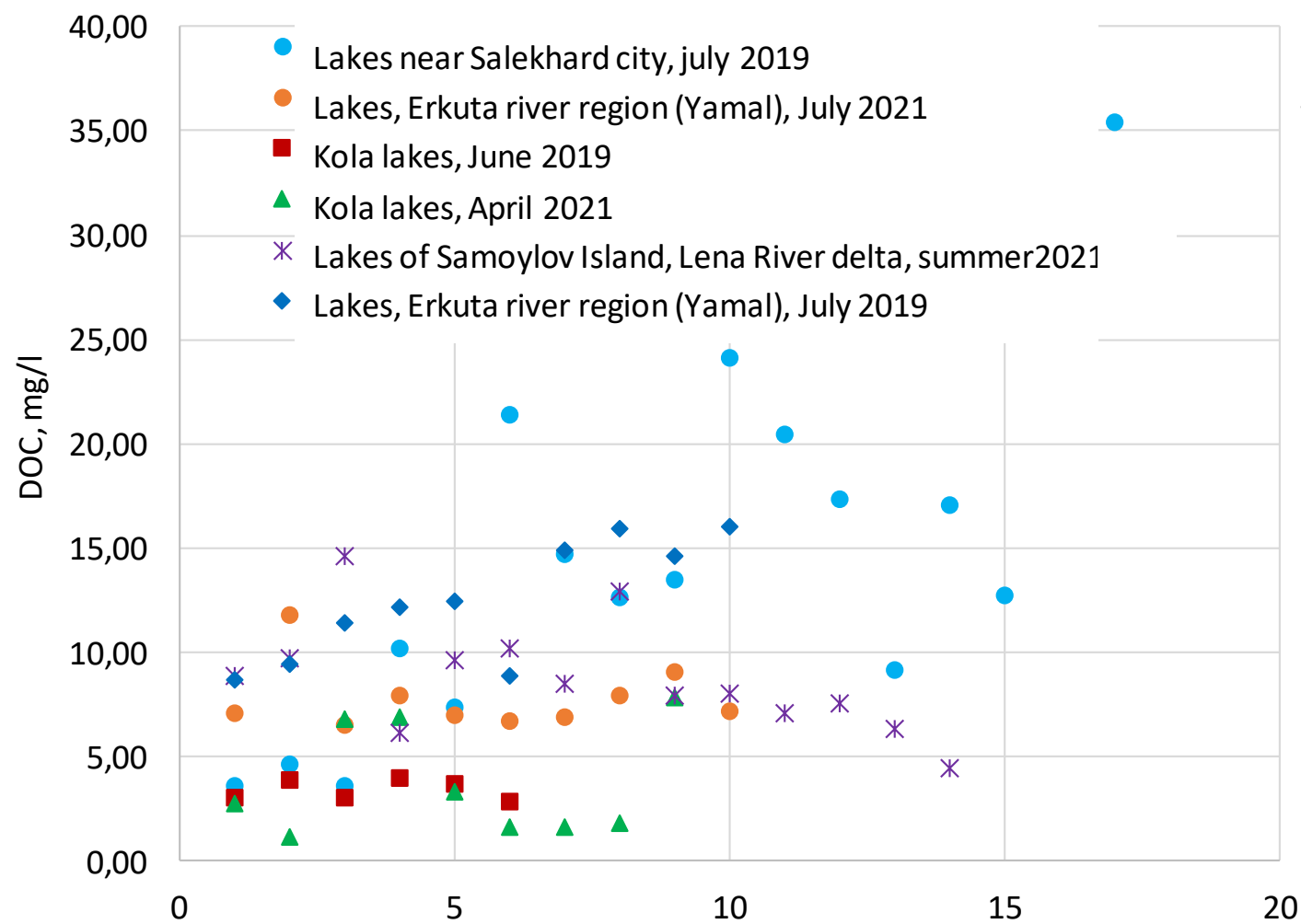
Amplitude of hydrochemical parameters:

- transparency 2-7 m,
- water bottom temperature 6-18°C,
- electrical conductivity 97-465 $\mu\text{S}/\text{cm}$,
- turbidity 6.73-34.3 FTU,
- chromaticity 9.8-46.7°,
- dissolved oxygen 5-10 mg/l ,
- nutrients concentration insignificant
(maximum of $\text{NO}_3=2.63$ mg/L, $\text{NO}_2=0.07$ mg/L, $\text{PO}_4=1.05$ mg/L, and $\text{SiO}_2=3.82$ mg/L, correspondingly),
- pH values 6.1-7.68



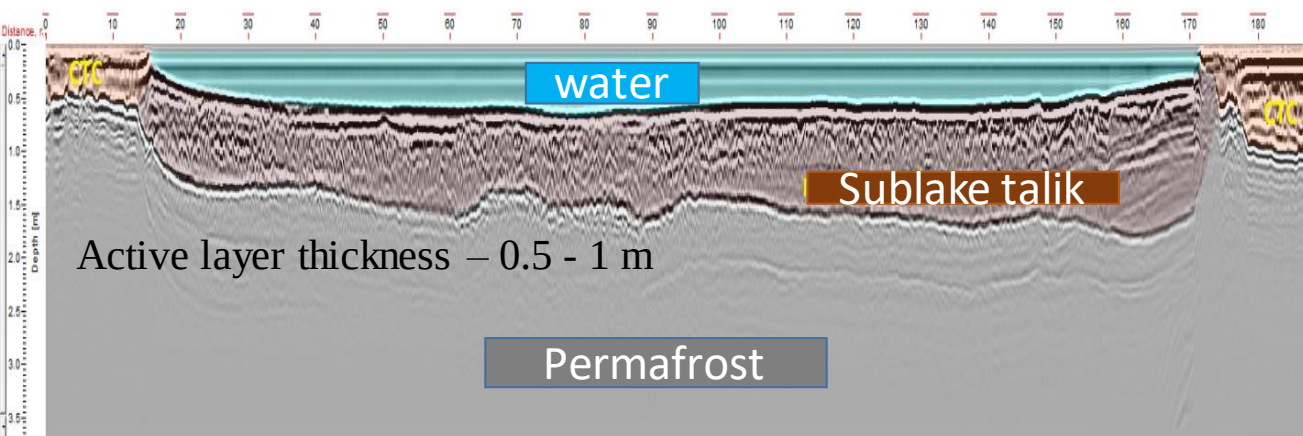
Distribution of Hydrochemical and Hydrophysical Parameters by Depth of Lake Tangabteito (Neytinskiye lakes, Yamal)

DOC, cDOM, Isotopes

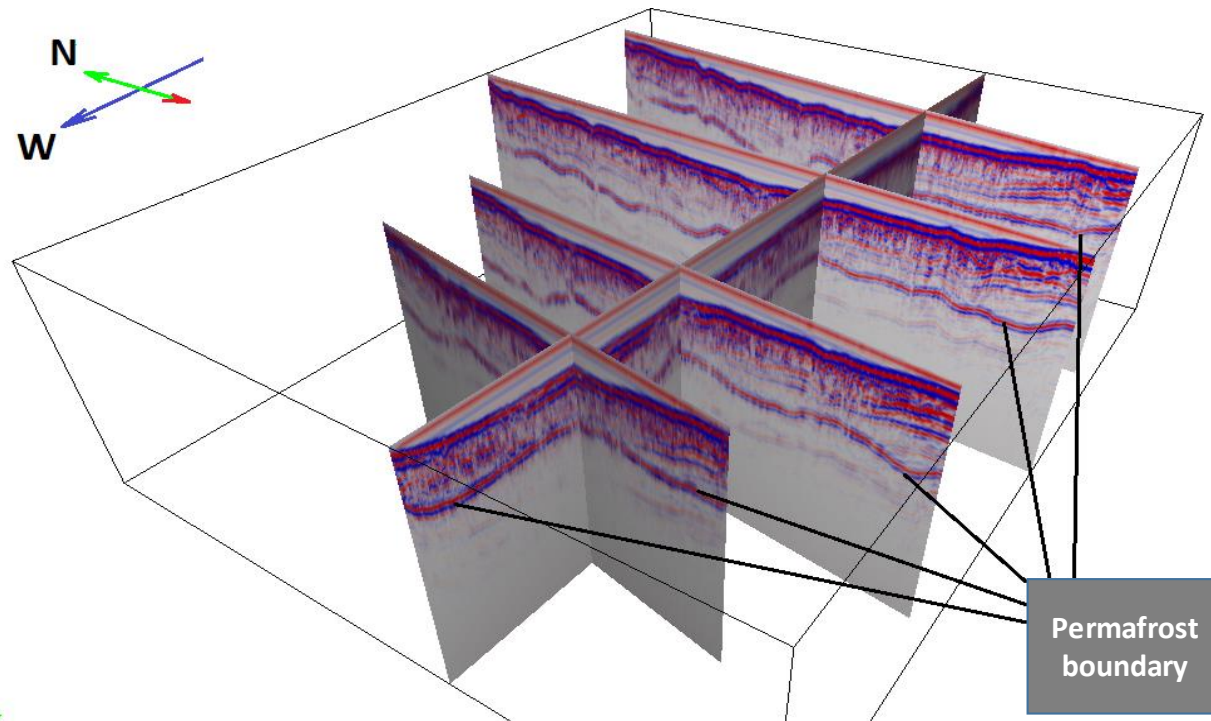


DOC: from 3.6 mg/l to 35.4 mg/l
 α CDOM(440), m-1: 1.25 – 9.05, $S_r < 1.2$
 $\delta^{18}O > -17\text{‰}$, $\delta D > -130\text{‰}$.

Geophysics



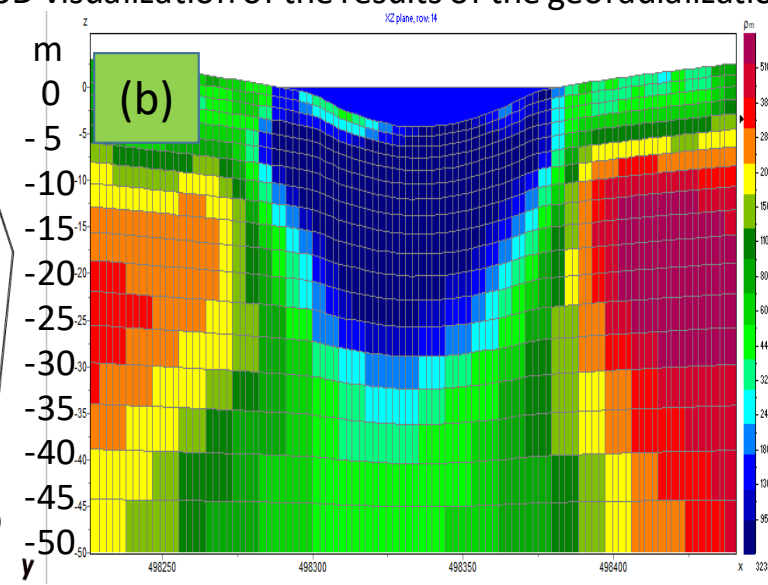
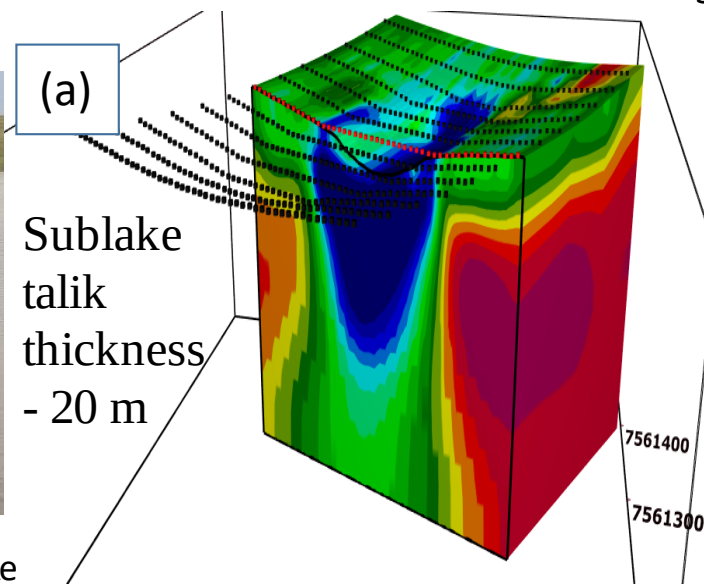
Radarogram by Georadialization Profile (Flooded lake on Seyakha River valley)



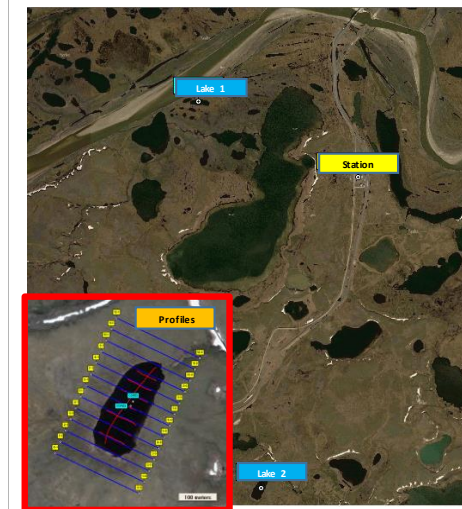
3D visualization of the results of the georadialization survey on the floodplain lake



Geophysics measurements on a lake



Results of 3D inversion of electrotomography data for Lake of Erkuta region:
(a) three-dimensional geoelectric model for the lake; (b) section along the profile

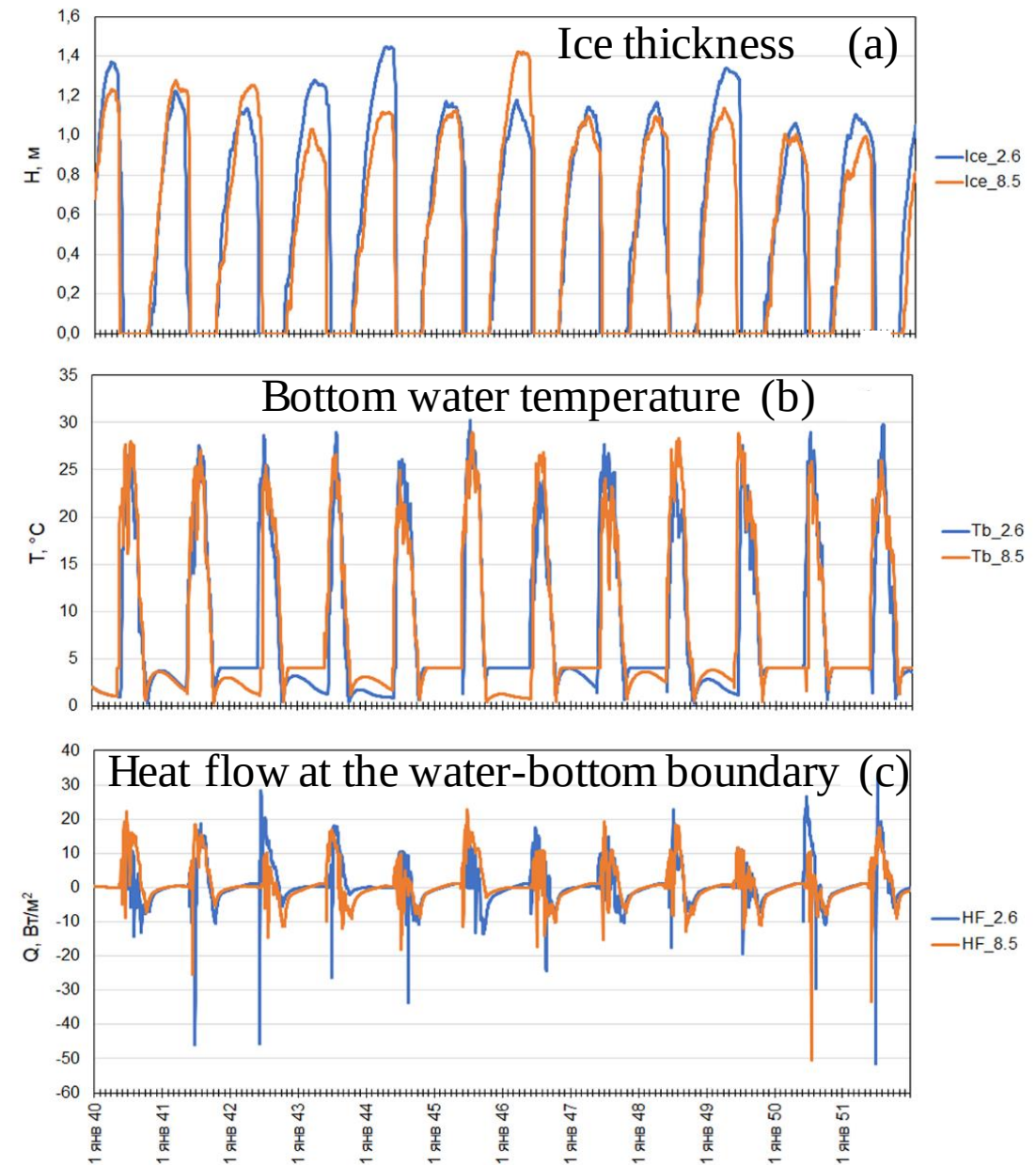


Studied Lakes
of Erkuta river (Yamal) region

Ice thickness and heat flux modeling under climate change

According to Climate scenarios RCP 2.6 and RCP 8.5 following change will be noticed:

- Decrease in ice thickness by 15-20 cm in 2040-2051 relative to the values of 2009-2021;
- The lake bottom water temperature will increase by 1-2°C both during open water and under ice period;
- The thermal balance of the bottom sediments and taliks will be positive;
- Increase of sublake talik volume will be contributed.

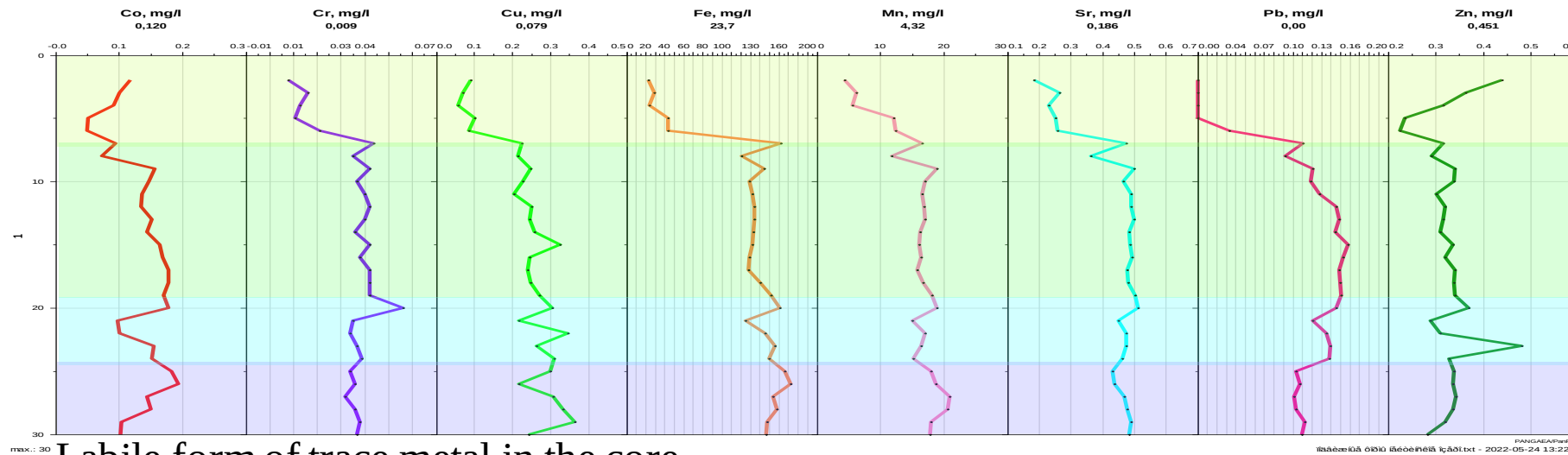


Ice thickness (a), bottom water temperature (b) and heat flow at the water-bottom boundary (c) in Lake on Yamal Peninsula in 2040-2051, according to two climate change scenarios: the scenarios RCP 2.6 and RCP 8.5.

Geochemistry of sediments

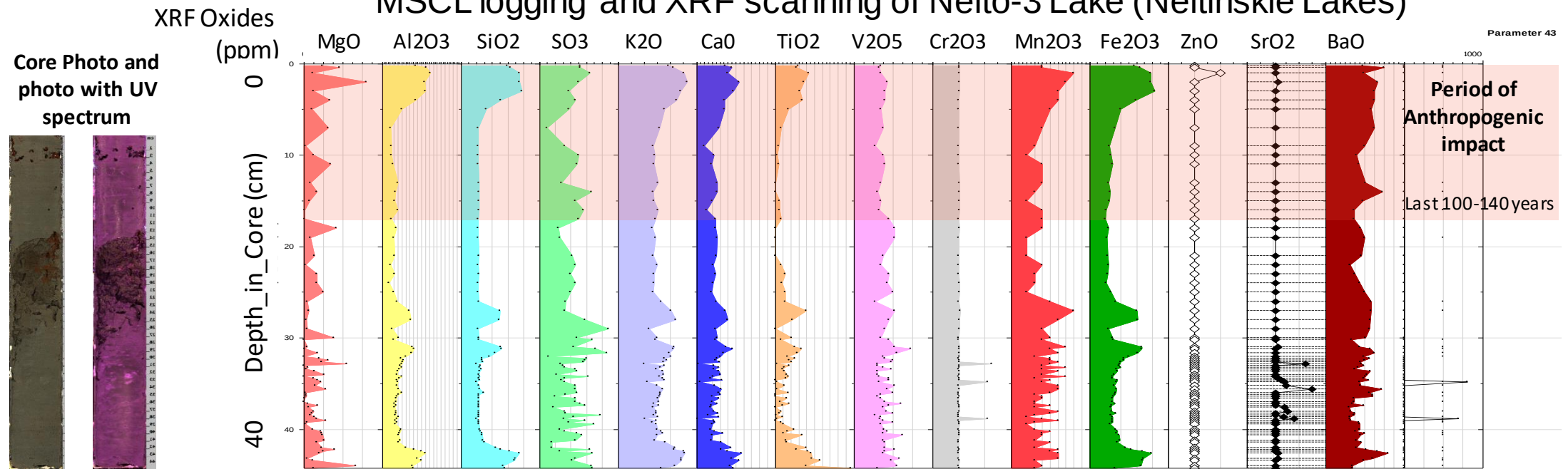
Three paleoclimatic periods of Yamal lakes' sedimentation over the past 500 years were recognized (210Pb method):

- (1) 500-450 years ago - active sedimentation with high values of K, V, Ba;
- (2) 450-100 years - uniform sedimentation with low element's concentrations, cooling and an erosion decrease on the lakes catchment;
- (3) 60-100 years - warm period with waterlogging and increase of Mn and Fe and biogenic elements income from the catchment due to the degradation of permafrost.



Labile form of trace metal in the core

MSCL logging and XRF scanning of Neito-3 Lake (Neitinskie Lakes)



Thank you for your attention!



Thermokarst lake



Ground ice degradation



Hydrological measurements

- Studies supported by RFBR grant 18-05-60291
- MSCL logging and XRF scanning had been done in Shirshov Institute of Oceanology of RAS by Geotek MSCL-XYZ instrument using.
- Geochemical analyses were carried out on the equipment of the SPBU Resource centers "Magnetic Resonance Research Methods" and "Methods for the Analysis of Substance Composition."
- Research on the Yamal lakes will be continued in summer 2022 with the support of the Russian Ministry of Science and Higher Education, agreement No. 075-15-2021-139