Collocation of Time Lapse 2.5D ERT, Temperature, snow depth, and active layer thickness measurements for ground temperature forecasting

*Sergei Rybakov, University of Alaska Fairbanks, Fairbanks, AK, USA*

*Dmitry Nicolsky, University of Alaska Fairbanks, Fairbanks, AK, USA*

*Vladimir Romanovsky, University of Alaska Fairbanks, Fairbanks, AK, USA*

*Alexander Kholodov, University of Alaska Fairbanks, Fairbanks, AK, USA*

*Abdallah Basiru, University of Alaska Fairbanks, Fairbanks, AK, USA*

The warming climate has significantly enhanced the degradation of discontinuous permafrost, leading to formation of sub-aerial taliks, and thermokarst development. When considering warm discontinuous permafrost, thaw can propagate in the vertical direction and laterally. In the context of discontinuous permafrost zones in the interior of Alaska, the lateral change in permafrost temperatures and the presence of ice wedges is complex. As a result, forecasting future temperature dynamics may not be accurate enough. Geophysical methods are widely used to investigate these processes to determine permafrost's spatial distribution. To obtain more accurate information for further calibration of temperature data for different landscape units, a semi-automatic system for observing changes in resistivity in the study area using timelapse 2.5D ERT methodology, temperature sensors to depths of 1.2-1.6 meters, as well as measurements of the height of snow cover are used. Our study represents the results of measurements of electrical resistivity for different depths, temperatures, and snow depth during winter at two sites in warm permafrost conditions in Fairbanks. Two polygons differ in the degree of development of taliks and are characterized by different vegetation, soil condition, etc. The first area characterizes by tall black spruce trees and active layer thicknesses of more than 1 m. The second area characterizes by small black spruce, shallow active layer thickness, and tussocks presence. This approach allows obtaining the necessary information for further forecasting without violating the integrity of the vegetation cover. Moreover, the purpose of the study is to assess the possibility of using resistivity/temperature relations for correlation and using these ratios to obtain geological information and assess water saturation and ice content for the selected observation area based on their comparison with laboratory measurements. The subsurface inversions obtained with this set of geophysical methods can be helpful for temperature modeling and provide predictive power to understand future thawing development in permafrost more accurately.