GEOPHYSICAL INVESTIGATION OF PERMAFROST CONDITIONS IN THERMOKARST-PRONE AREAS FAIRBANKS, ALASKA

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The degradation of permafrost poses a severe environmental threat to communities in cold regions. As near-surface permafrost warms, extensive topographic variability is prevalent in the Arctic and Sub-Arctic communities. Geologic hazards such as thermokarst are formed due to varying rates of permafrost thawing, resulting in ground subsidence. This gradual subsidence or abrupt collapse of the earth possess a danger to existing infrastructure and the economic activities of communities located in cold regions.

Understanding the dynamics of permafrost is a difficult task. It requires the characterization of surface and subsurface controls over a large spatial area with minimal disturbance to the natural state of the ground. Therefore, to improve our understanding of frozen ground and its land-related features and hazards like thermokarst, we utilized the Electrical Resistivity Method to characterize the active layer, and permafrost variability, and to monitor variations associated with the freeze and thaw process over a specific period.

A subsurface 2D Electrical Resistivity Tomography survey was conducted to characterize permafrost conditions in a discontinuous permafrost region on the campus of the University of Alaska Fairbanks (UAF), Alaska. Analysis of time-lapse data from the study showed temporal and spatial changes in permafrost conditions from the winter to the summer. Anomalies which may represent talik (a layer of unfrozen ground that occurs in permafrost) were generally present in some locations of the study area and were characterized by lower than 40 Ωm resistivity values. Resistivity profiles across sites prone to thermokarst depression showed clear variation in permafrost conditions as very low resistivity anomalies were present across all the transects

The results from this study showed the effectiveness of ERT to characterize permafrost conditions at the study sites. The information from this study can be used to provide a better understanding of permafrost required for engineering purposes and the stability of engineering structures.