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HIGH-RESOLUTION TEMPERATURE PROFILING OF PERMAFROST AT TESHEKPUK LAKE

CASE STUDY

United States Geological Survey

Alaska, USA

Teshekpuk Lake, the largest lake in the Alaskan Arctic, holds immense ecological significance, serving as a habitat for native wildlife. This delicate ecosystem faces potential disruptions due to factors such as sea-level rise, coastline erosion, and oil and gas development. Recognizing the need for a deeper understanding of these changes, the Teshekpuk Lake Observatory (TLO) was established. The presence of permafrost in northern Alaska adds a layer of complexity to environmental forecasting, given its influence on hydrologic and thermal fluxes.

Application

The northern Alaskan environs are characterized by permafrost, permanently frozen soils with a complex array of ice features influencing hydrologic and thermal fluxes. This unique boundary condition is pivotal for forecasting environmental change in the region. However, due to the high spatial variability and vastness of Alaska's North Slope, there is a scarcity of continuous, long-term measurements characterizing the temperature regime of the upper active layer and shallow permafrost depths.

beadedstream Solution

In response to the challenges posed by the unique permafrost conditions, the US Geological Survey (USGS) initiated a long-term monitoring project near Teshekpuk Lake. The focus was on collecting quality data, conducting sound science, and facilitating public outreach. The study incorporated the use of a **beaded**stream Digital Temperature Cable, equipped with 19 sensors spaced over a 5m instrumented length. These sensors were strategically placed at 0.1m intervals in the top 1m and at 0.5m intervals below, allowing for high-resolution temperature profiling of the permafrost active layer.

*Installation of **beaded**stream Digital Temperature Cable at Teshekpuk Lake.*

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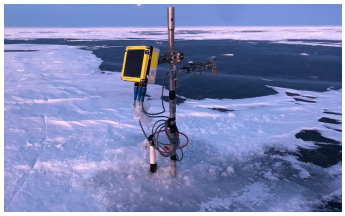
Additional parameters, including corresponding snow depths and air temperatures, were also measured. Real-time data transmission, occurring at 12-hour intervals, was facilitated by a **beaded**stream D405 Data Logger to the cloud for viewing within the **beaded**cloud data platform.



***beaded**stream D405 Data Logger deployed in the frozen Teshekpuk Lake, connected to four temperature cables for real-time data collection.*

beadedstream Solution Benefits

The **beaded**stream Digital Temperature Cable, designed for high-resolution temperature profiling, provided accurate insights into the permafrost active layer's temperature dynamics, essential for understanding environmental changes. In addition to temperature profiling, the system monitored corresponding snow depths and air temperatures. This holistic approach offered comprehensive insights into the interconnected environmental variables influencing permafrost conditions.

By leveraging the **beaded**stream D405 Data Logger and the **beaded**cloud data platform, the project achieved efficient real-time data transmission and accessibility. Researchers and scientists were able to monitor and analyze data promptly. The robustness of this solution makes it reliable for long-term monitoring in challenging environmental conditions, fostering trust in the durability and accuracy of the equipment for sustained data collection over extended periods. This underscores the pivotal role of such solutions in advancing scientific understanding in complex ecosystems, providing invaluable insights into permafrost dynamics, and contributing to the broader field of environmental monitoring in the Arctic.

A view of the project data on **beaded**cloud from the year 2015, which shows the seasonal variations in the active layer temperature, can be viewed below: