General Public Abstract

Glaciers are vital indicators of climate change, influencing sea level rise, freshwater availability, and global ecosystems. Understanding how glaciers move and respond to environmental changes is critical for predicting future impacts. This project aims to revolutionize our ability to monitor glaciers using a cutting-edge seismological technology known as Distributed Acoustic Sensing (DAS).

DAS transforms existing fiber-optic cables into thousands of seismic sensors, capable of detecting vibrations in the Earth. These cables can be repurposed to monitor glacier dynamics with unparalleled precision and scale. This innovative approach generates vast amounts of data, but it also poses significant challenges. Detecting and locating seismic events using DAS is far from straightforward. The data is inherently noisy, and interpreting it requires advanced algorithms that can distinguish meaningful signals from background noise. Developing reliable methods to tackle these challenges is a priority for the scientific community, and our project will contribute to these global efforts.

Our research focuses on processing DAS data to enable faster and more accurate analysis. By leveraging advanced computing techniques we aim to track ice and meltwater interactions and understand the processes occurring beneath the ice. This effort is particularly significant because DAS is a relatively new technology in seismology, offering a unique opportunity for domestic development and expertise-building in this emerging field as it may be applied in, for example, the monitoring of anthropogenic seismic activity due to mining.

The dataset we will use is both new and groundbreaking. Collected on Hansbreen glacier in Svalbard, it represents the first DAS-based study of glaciers in this region. Svalbard is an ideal location for such research due to its high sensitivity to climate change, where glaciers are rapidly transforming in response to warming temperatures. Successfully interpreting this dataset will not only overcome significant technical barriers but also provide unprecedented insights into glacier dynamics in a region of critical environmental importance.

Through this project, we aim to reveal new aspects of glacier dynamics and their response to environmental changes. Understanding the mechanisms driving glacier sliding, the interactions between ice and the underlying bedrock, and the dynamics of subglacial processes will shed light on the role of glaciers in the broader climate system. By pioneering DAS data analysis in Svalbard, this research has the potential to transform how dynamic activity of glaciers are monitored. Moreover, it contributes to the global effort to mitigate the impacts of climate change while building domestic expertise in cutting-edge sensing technologies. This combination of innovation and practical application ensures that the outcomes of this project will have lasting scientific impacts.