

# Investigating Landslides and Permafrost from Kangerlussuaq to Sisimiut

Steffen Ringsø Nielsen – PhD student

Arctic DTU – DTU Sustain

*Funded by Greenland Research Council*





130 km

Sisimiut

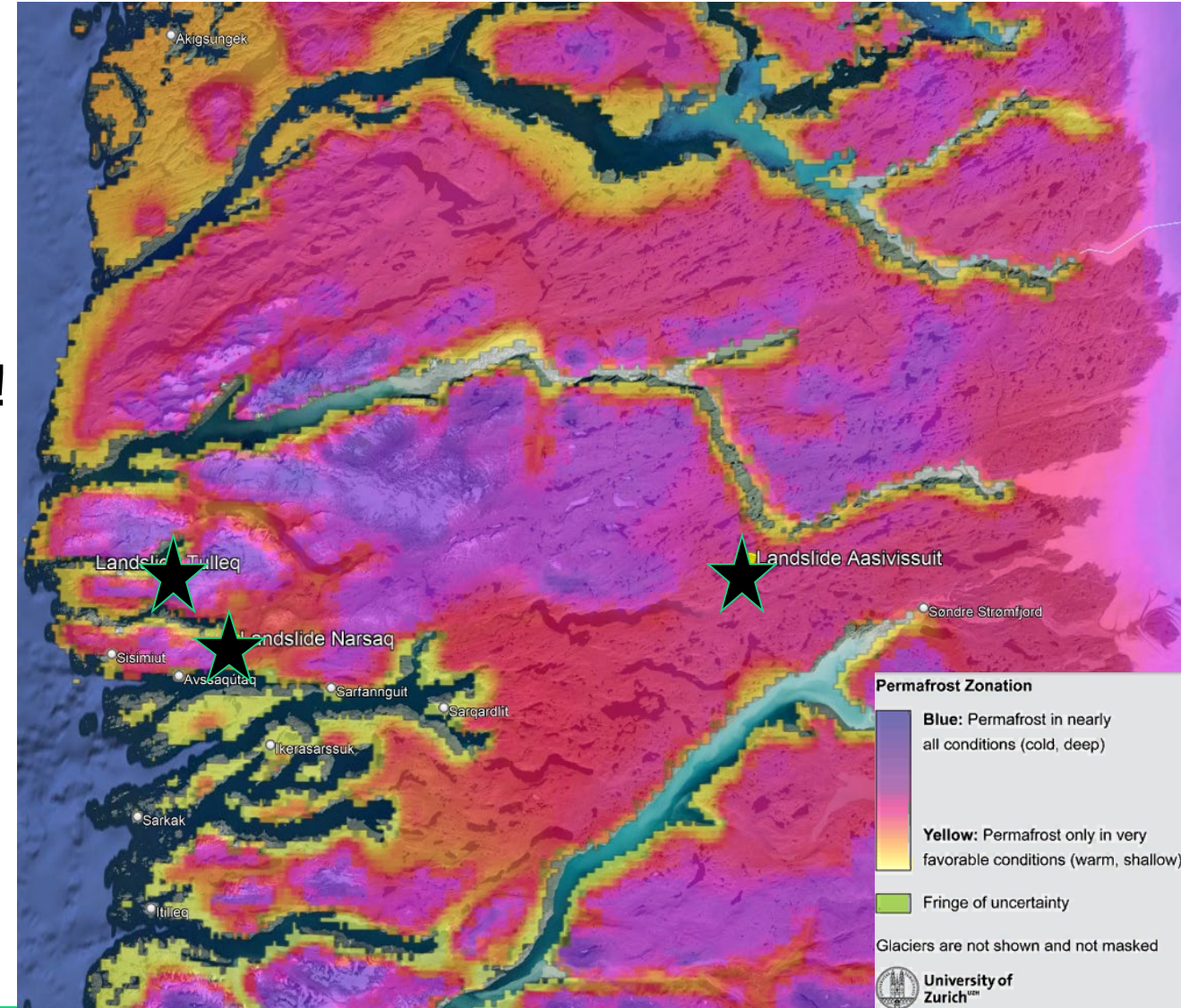
DTU Campus/  
Research Station

Kangerlussuaq

Polar Circle

# Permafrost Extent

- Active layer (depth to permafrost) 0.5 meter to 1.5 meters<sup>1</sup>
- Perma-frozen soil is not rapidly sliding!



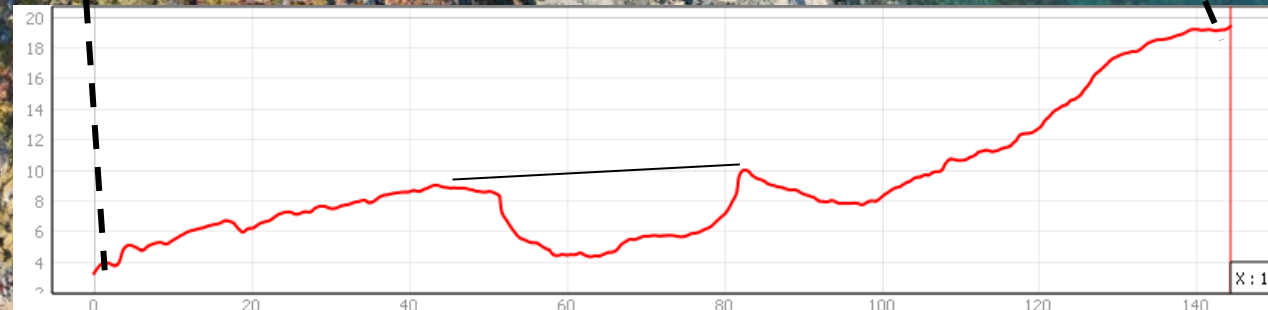
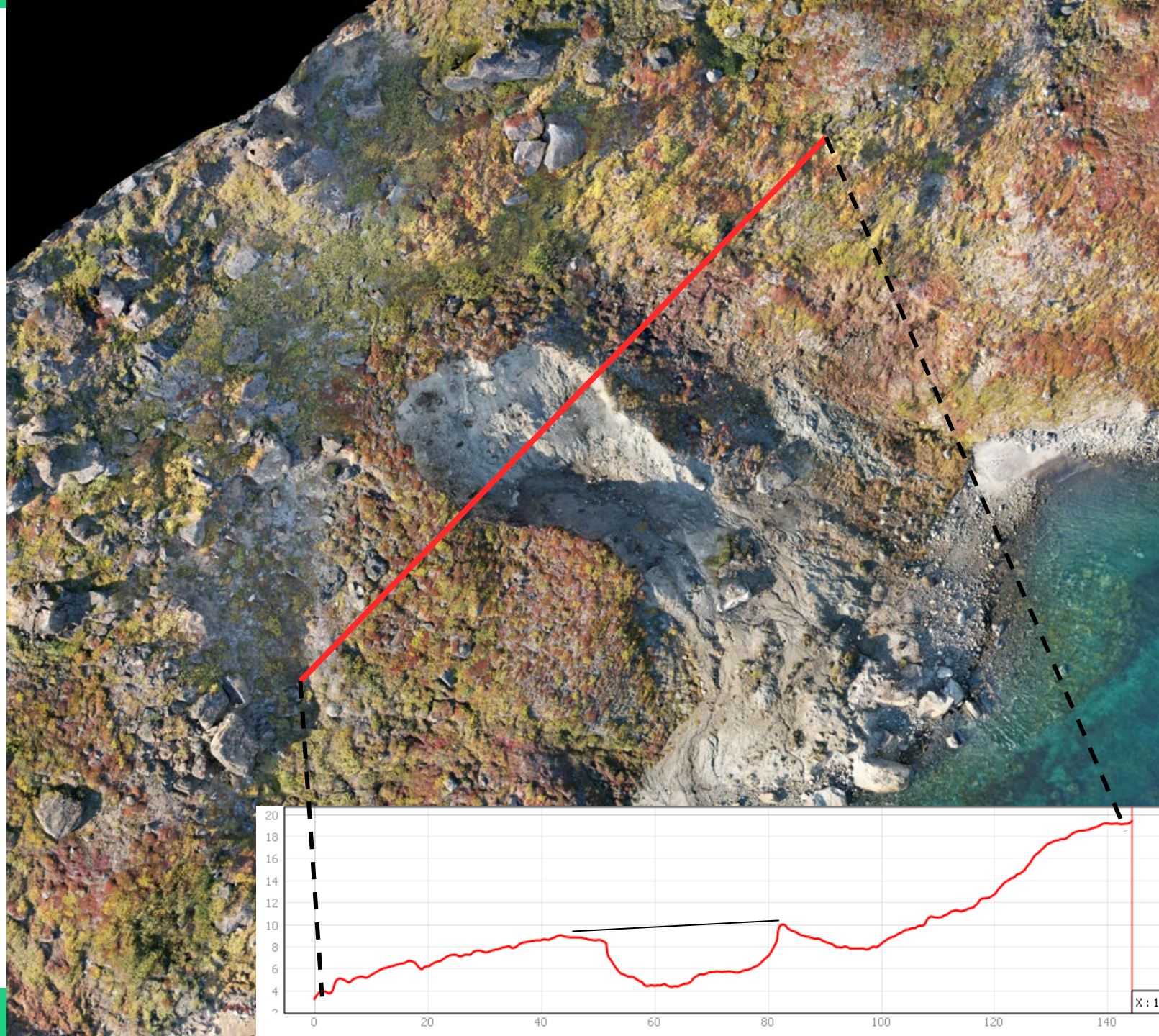
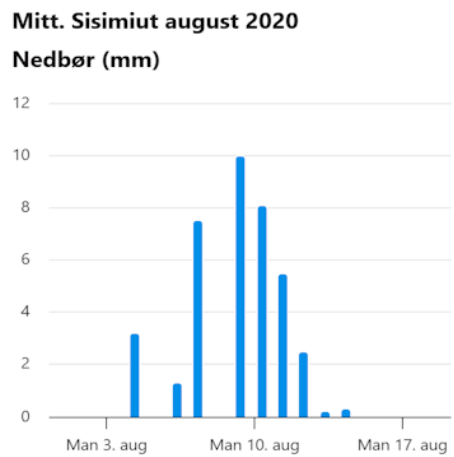
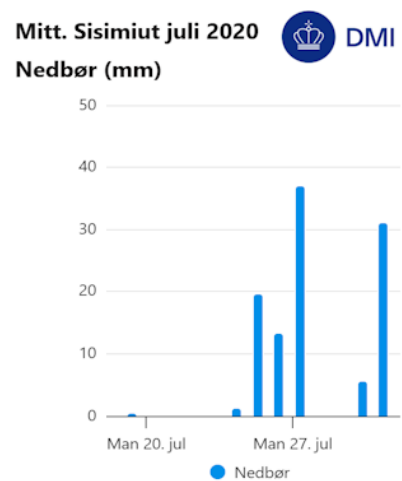
1) Olesen et. Al, 2003. Active-Layer and Permafrost Temperatures, Sisimiut (Holsteinsborg)

# Methodology of landslide investigation

- In-situ AUV for Digital Elevation models (DEM)
- Geotechnical investigations
- Geophysical investigation: ERT, TEM and seismic

# Narsaq

- Slide: 23 juli – 16. August 2020
- Glacial Till:  
32% fine grained sediments ( $< 63\mu\text{m}$ )
- 5 meter deep

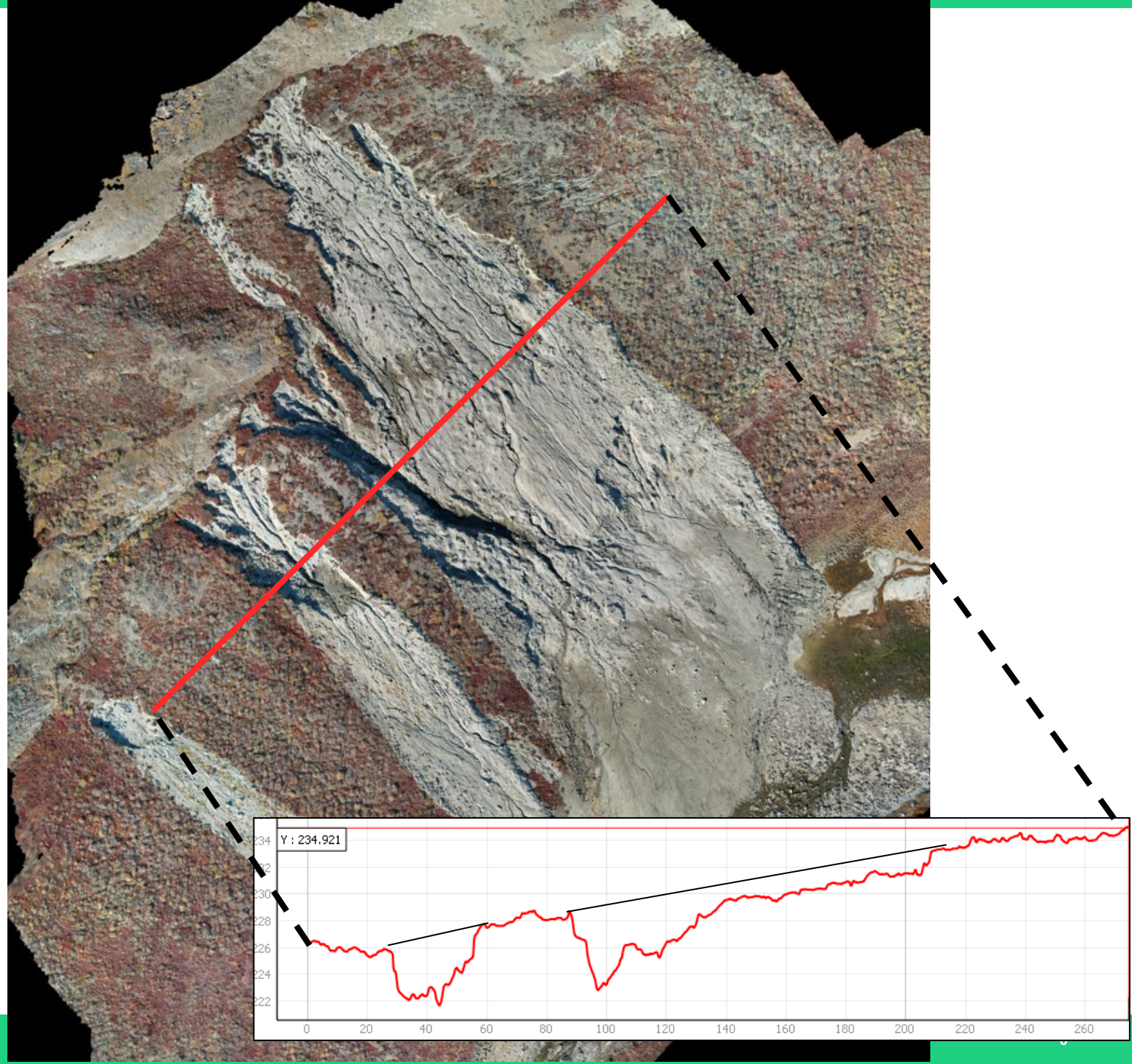
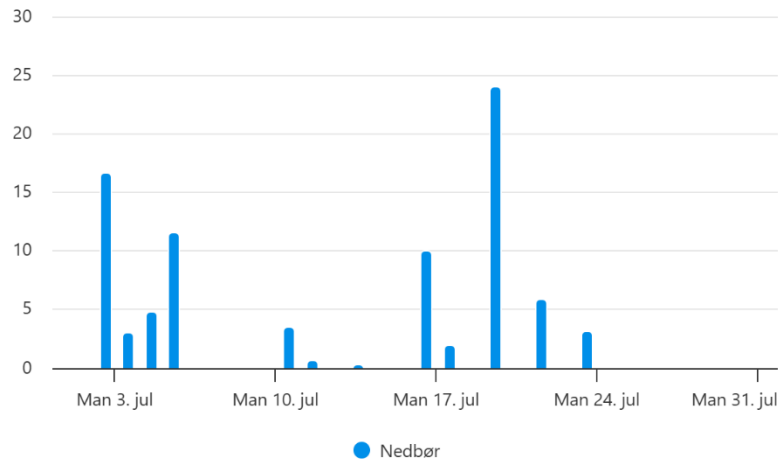


# Aasivissuit

- Slide: 15<sup>th</sup> – 20<sup>th</sup> July 2023
- Glacial Till:  
40% fine grained sediments ( $< 63\mu\text{m}$ )
- 5 – 6 meters deep

Mitt. Kangerlussuaq juli 2023

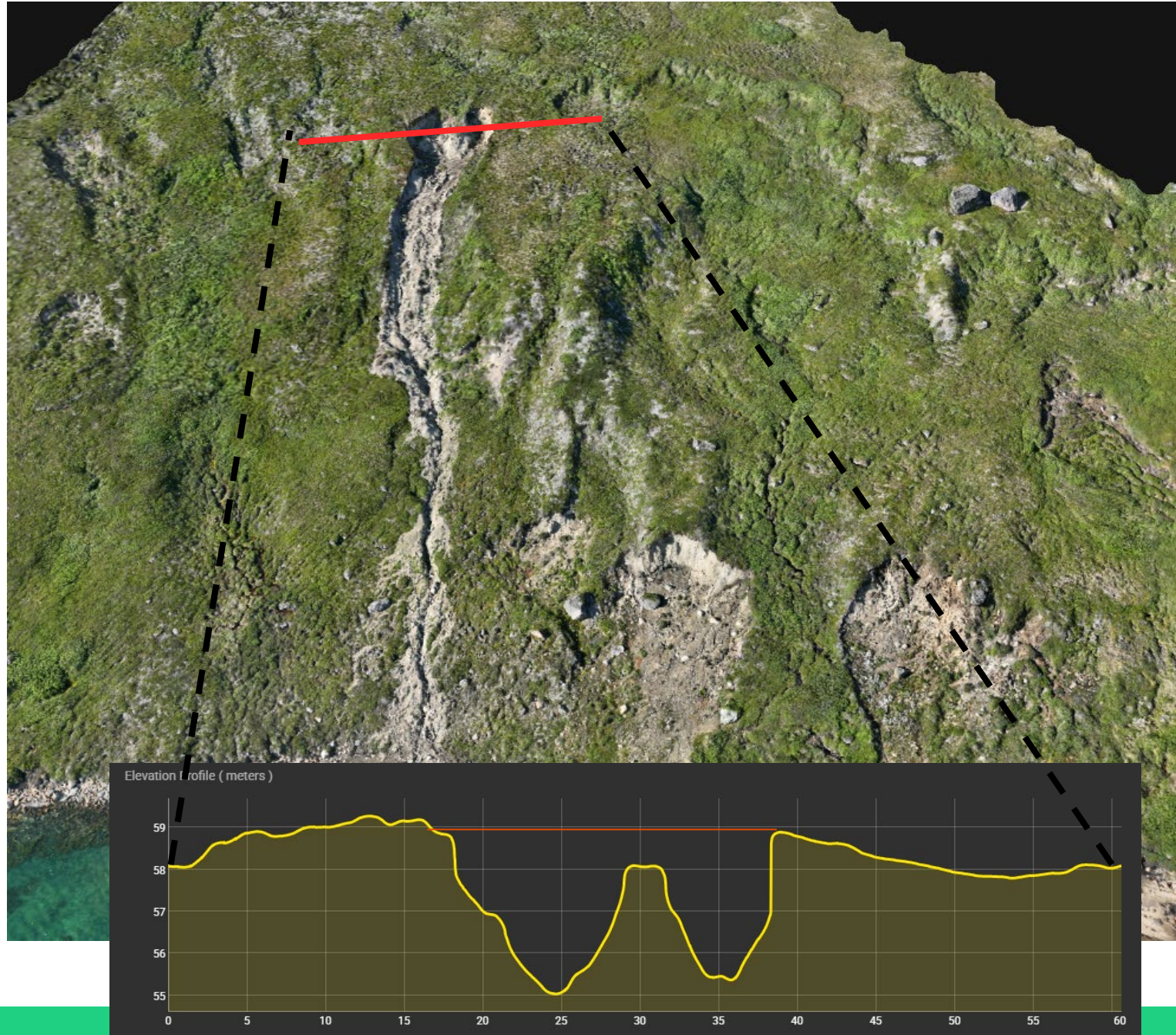
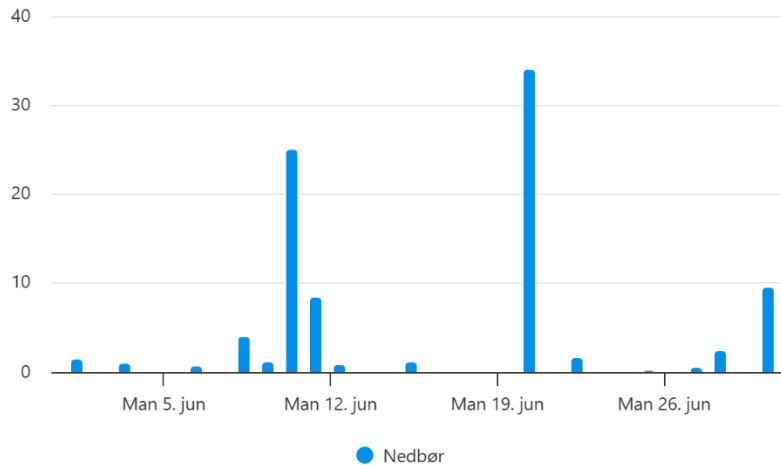
Nedbør (mm)



# Tulleq

- 25 Juni – 2. July 2023
- Glacial till:  
31% fine grained sediments ( $< 63\mu\text{m}$ )
- 4.5 meters deep

Mitt. Sisimiut juni 2023  
Nedbør (mm)

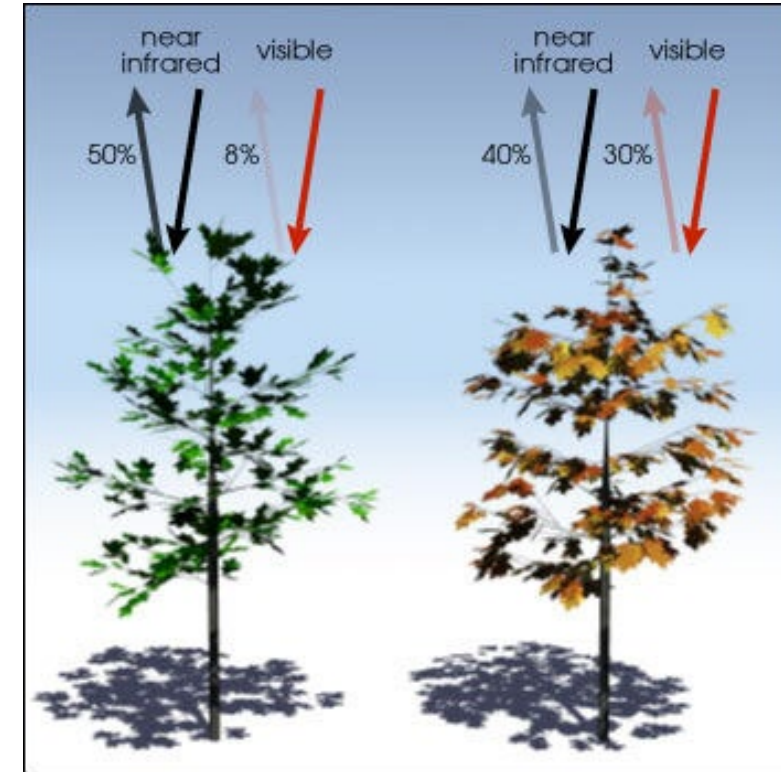
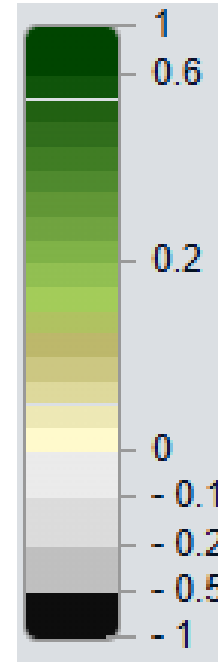
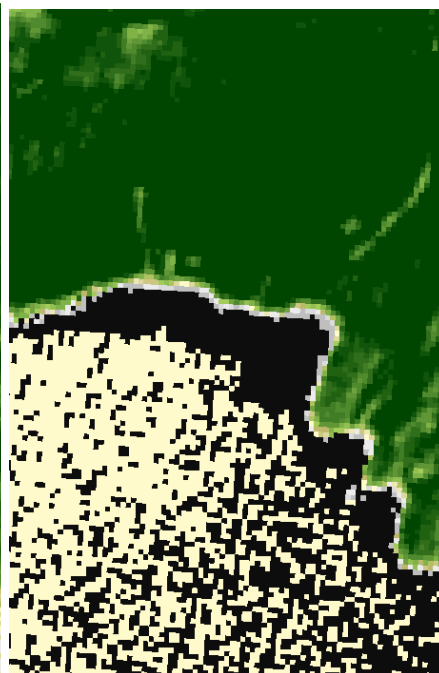
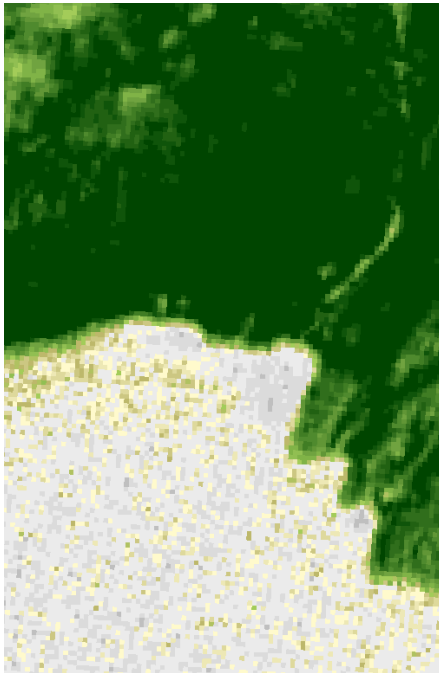


# Broader investigation

- Normalized Difference Vegetation Index
- Differences in color with Multi spectral imagery

Before Slide

After Slide



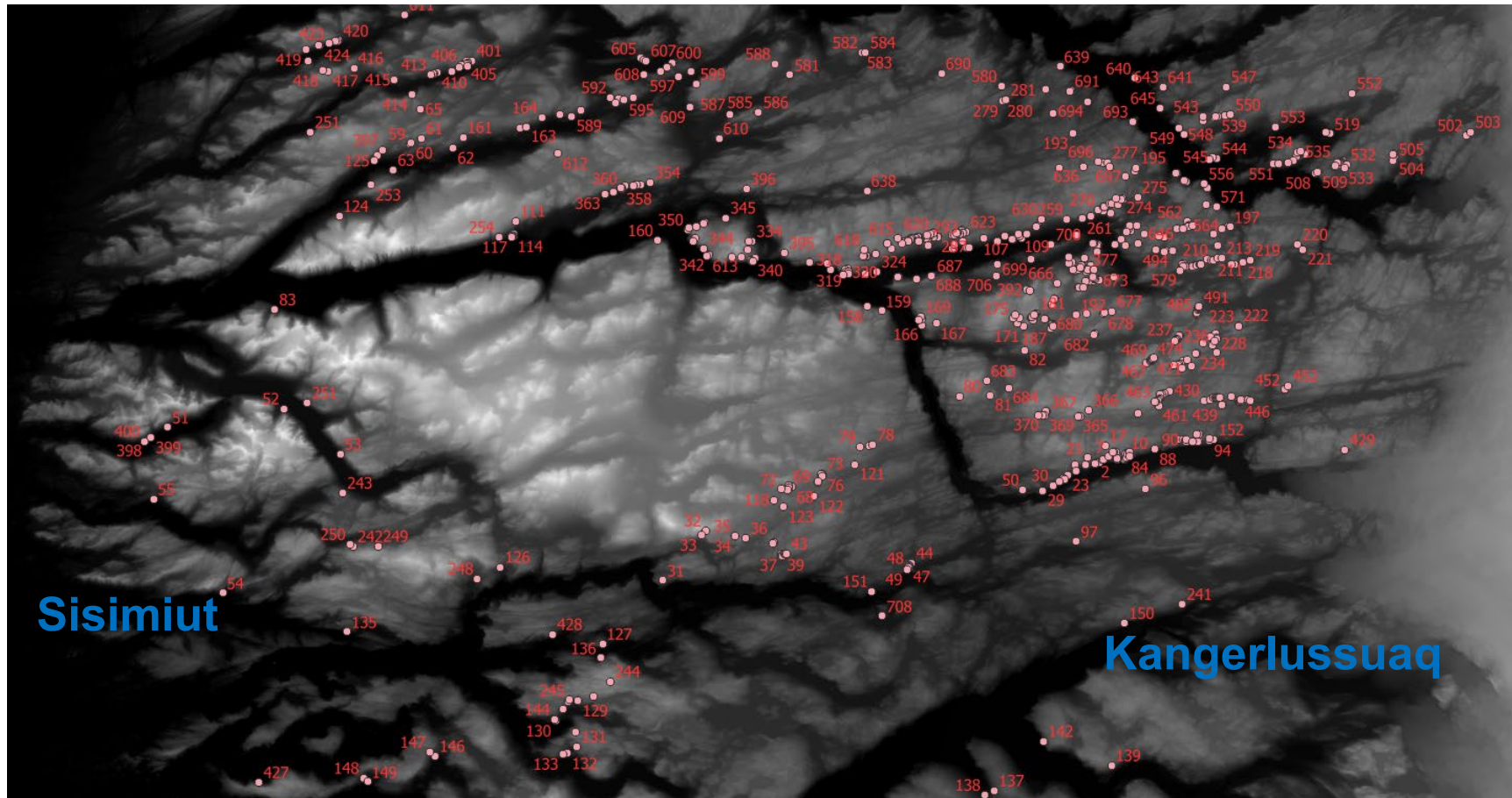
$$\frac{(0.50 - 0.08)}{(0.50 + 0.08)} = 0.72$$

$$\frac{(0.4 - 0.30)}{(0.4 + 0.30)} = 0.14$$

Haggag, Wafaa & Ali, Rafat & Al-Ansary, Noran. (2023). Geographic information systems and remote sensing: Innovative tools for plant health. 19. 2449-2464.

# Landslides

- 700 new landslides between 2019-2024 years!



# NDVI differences 2019-2024



# Field Work – Summer 2025



PKT. 660



- More than 100 km

# TEM2Go

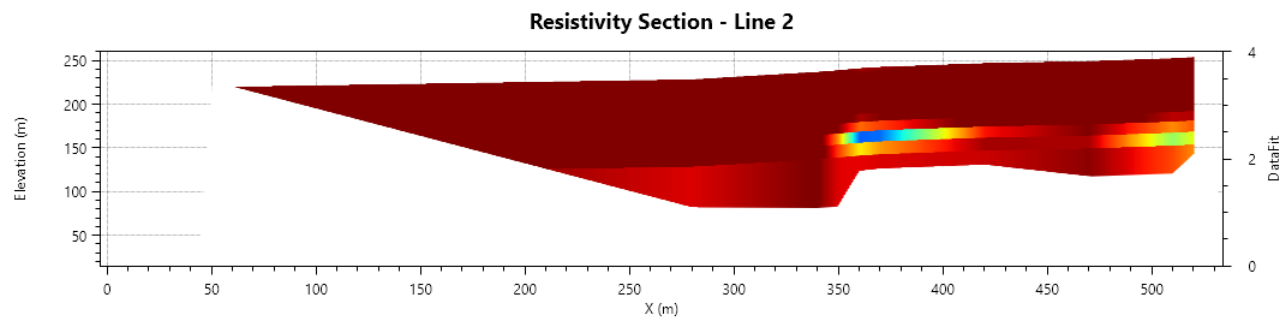
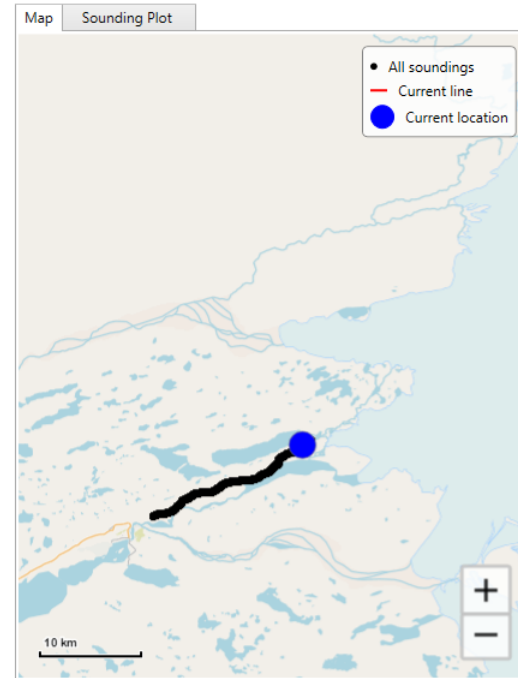
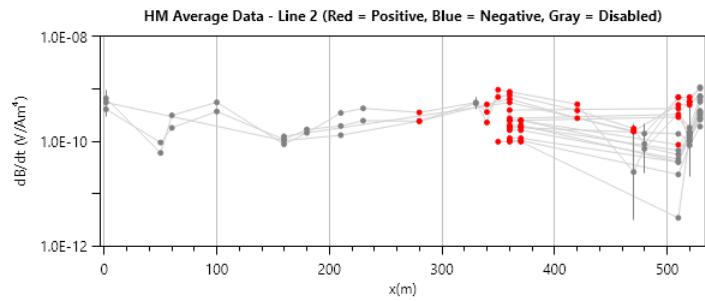
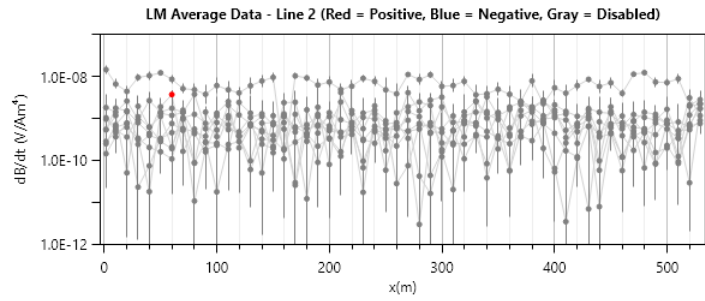
- Measures continuously while walking
- Many 1D measurements



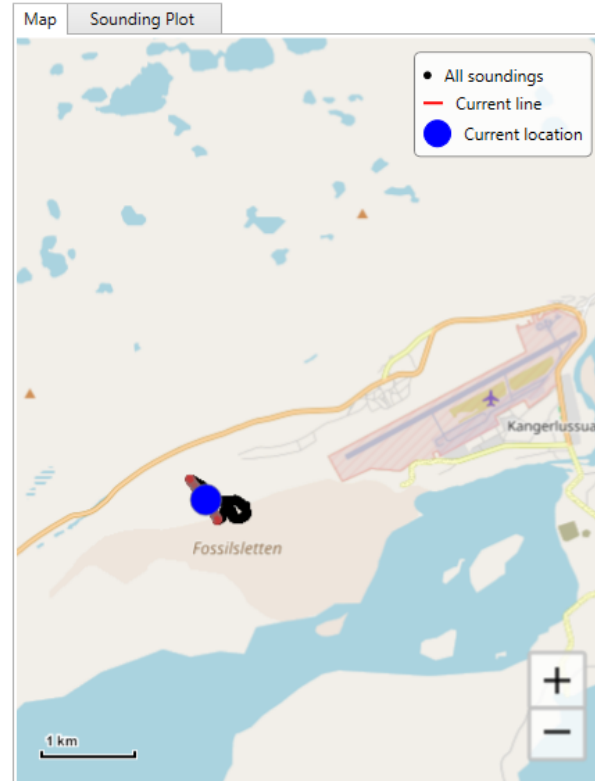
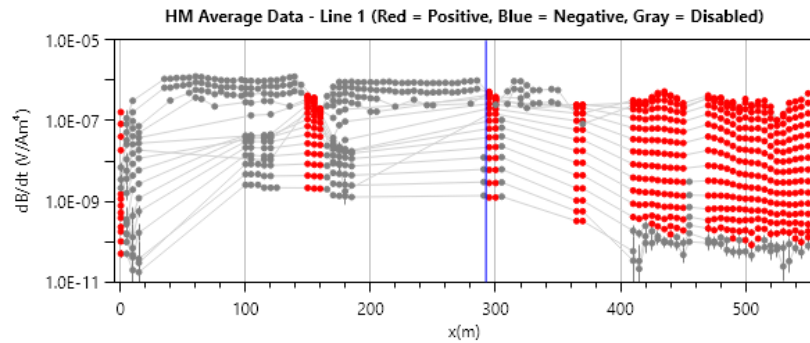
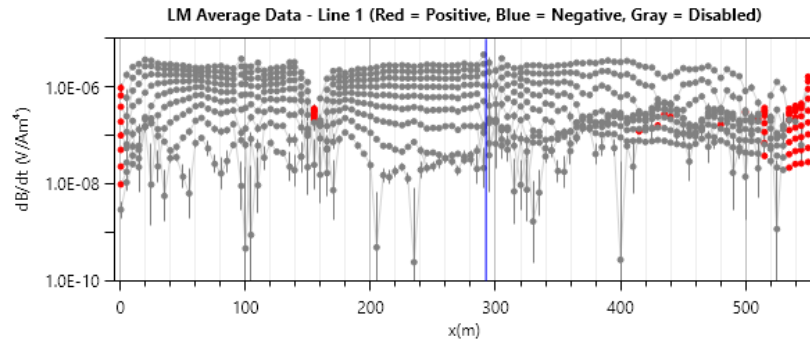
# TEM2Go



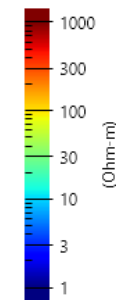
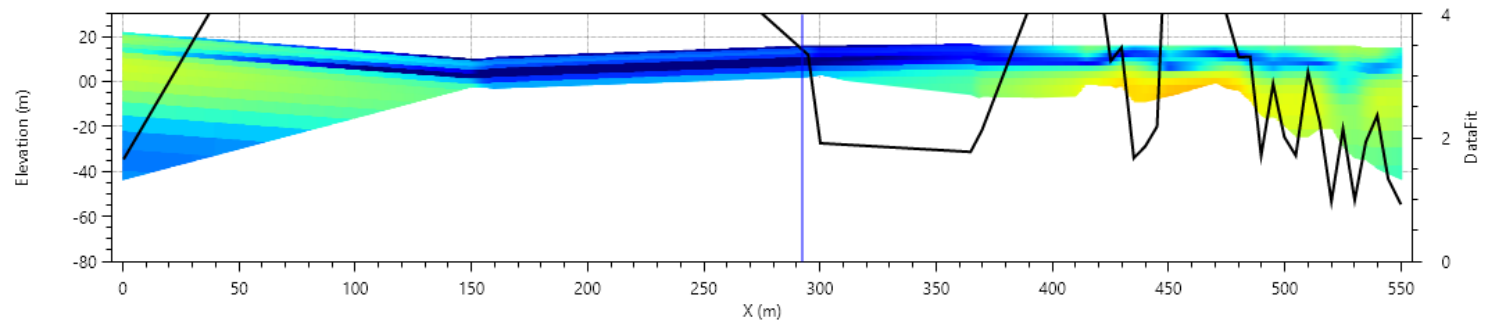
# Icecap



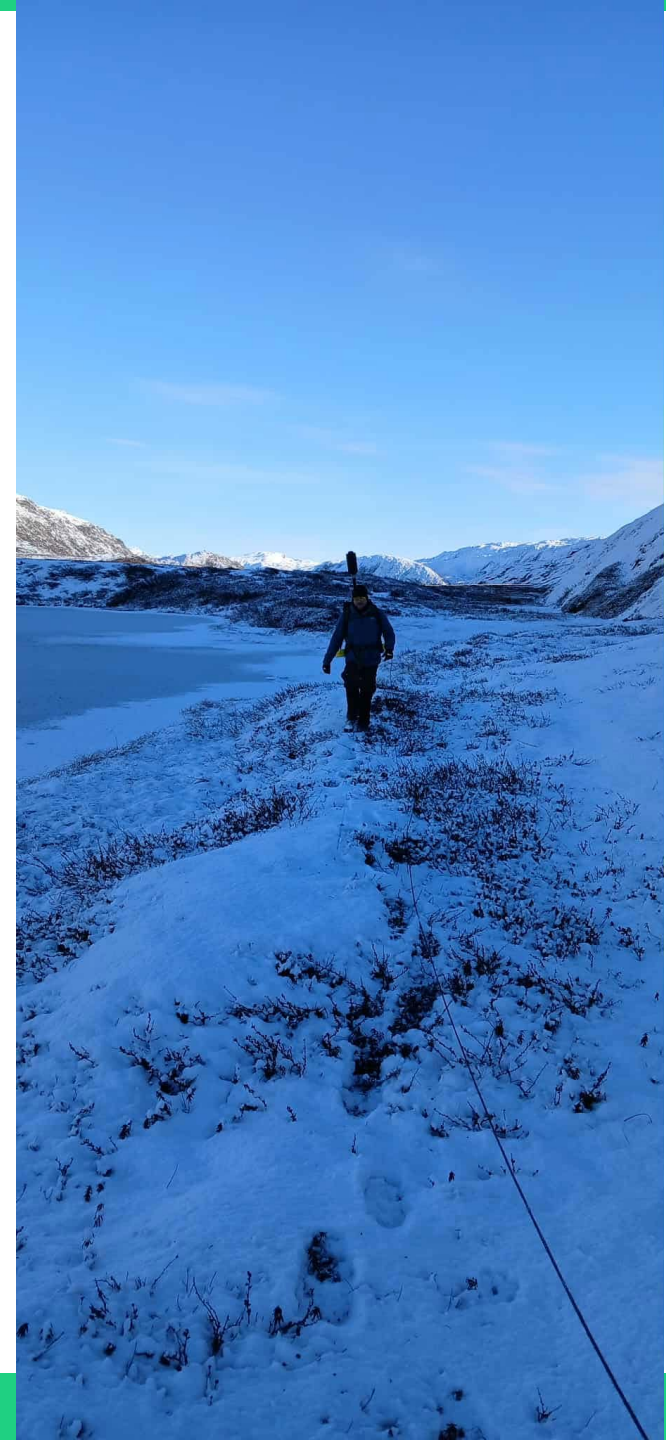
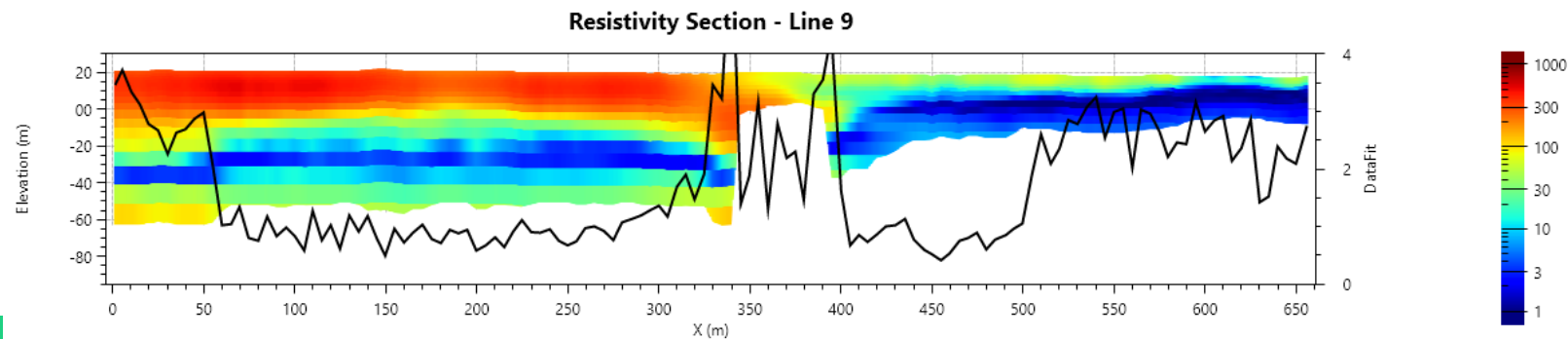
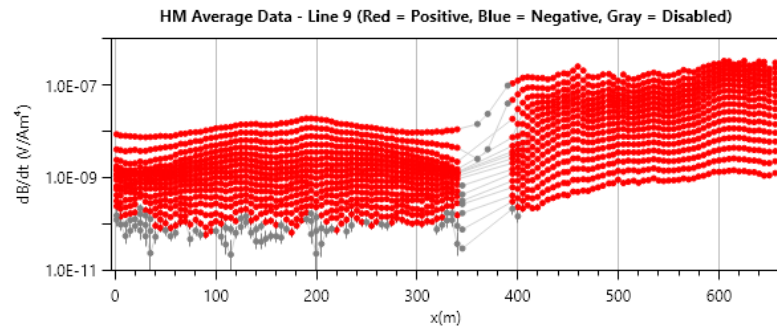
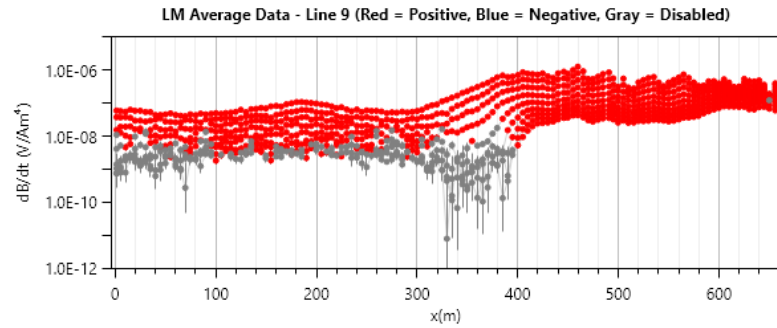
# Kangerlussuaq (Marine Sediments)



Resistivity Section - Line 1

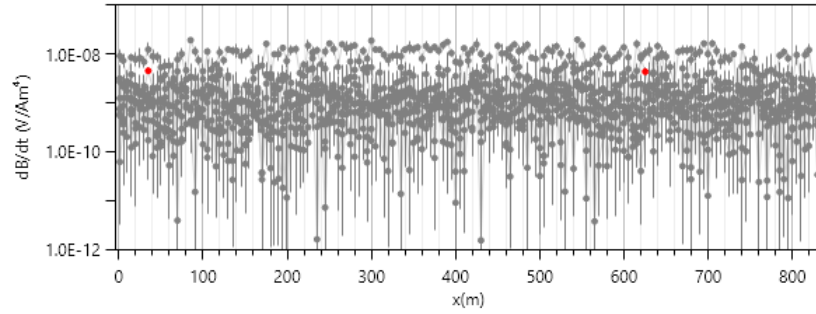


# Itinneq (Marine sediments)

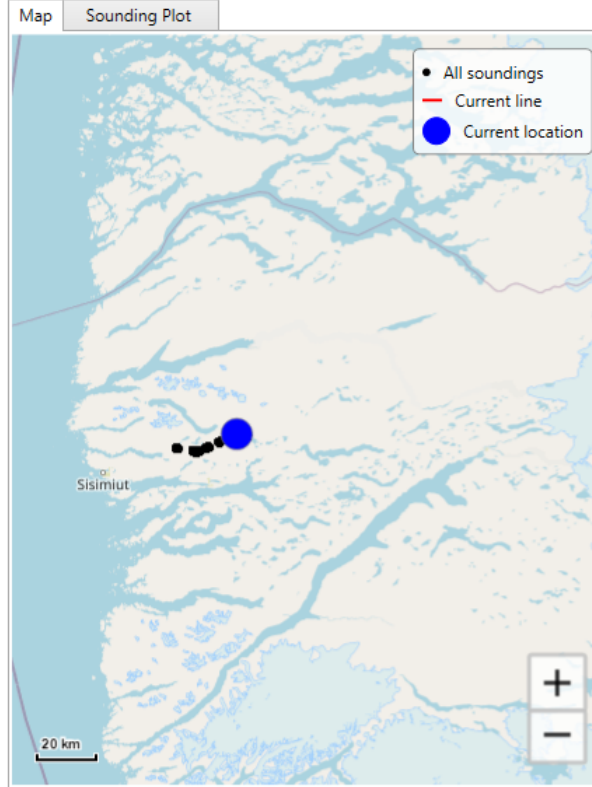
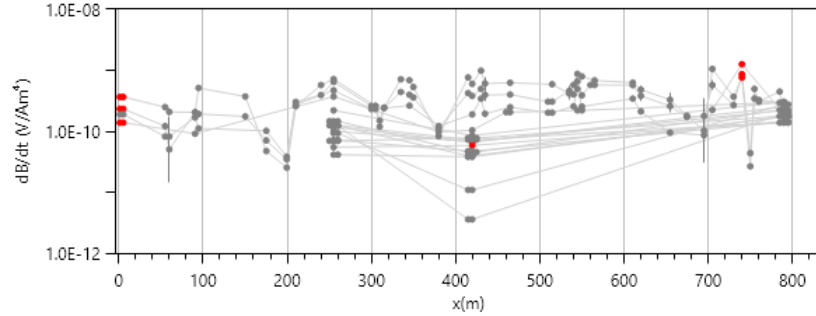


# Luxury hut – High altitude 270m

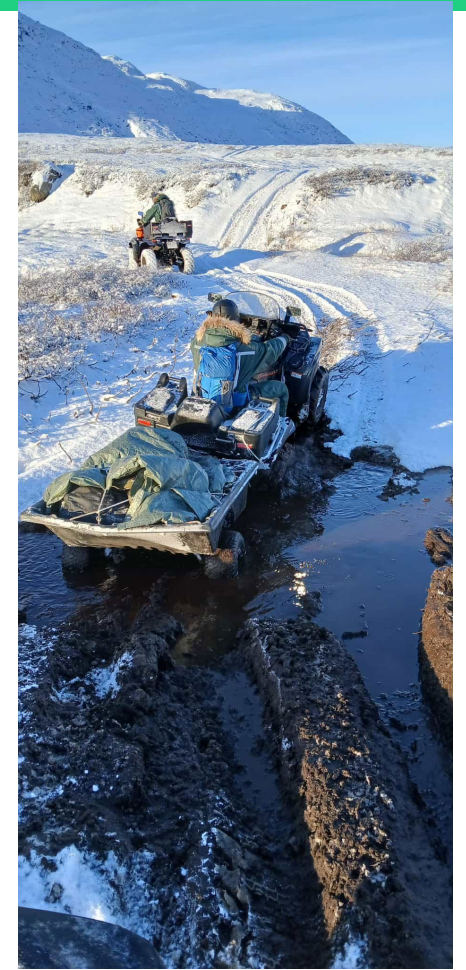
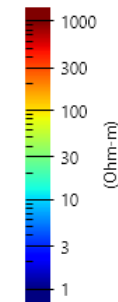
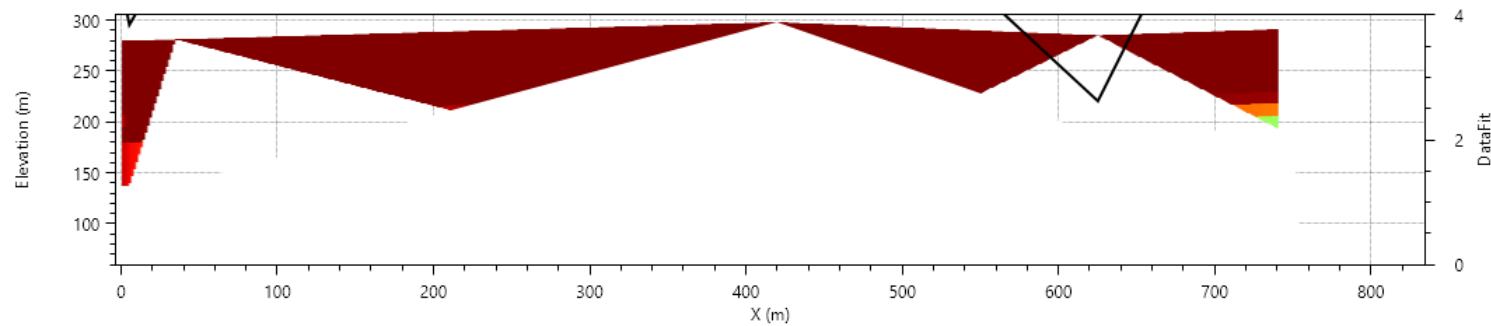
LM Average Data - Line 6 (Red = Positive, Blue = Negative, Gray = Disabled)



HM Average Data - Line 6 (Red = Positive, Blue = Negative, Gray = Disabled)



Resistivity Section - Line 6



# Sisimiu

