

DTU





Greenland Integrated Observing System

Permafrost Monitoring Transect

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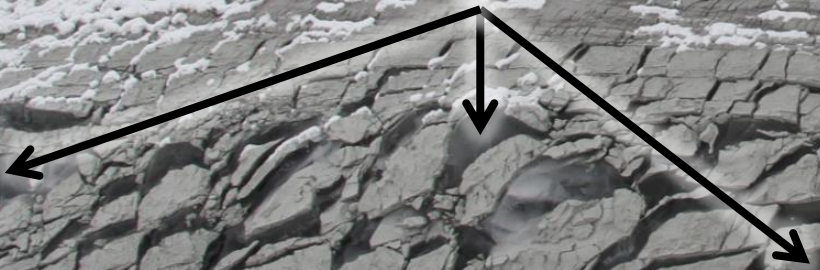


Nunatsinni Ilisimatusarnermik Siunnersuisoqatigiit
Greenland Research Council





Ice in the permafrost



Sand

Silt

Sand

Silt

Impacts of ice-rich permafrost thaw



Differential settlements
of paved surfaces
Kangerlussuaq

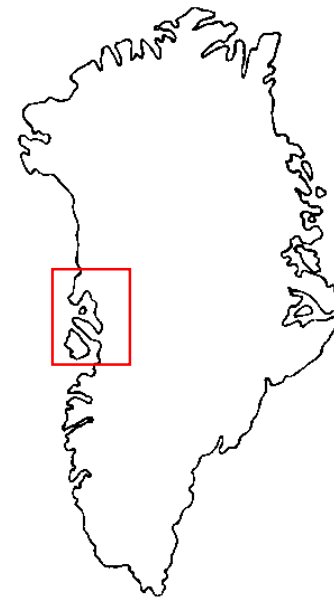


Differential settlements
of building foundations
Kangerlussuaq

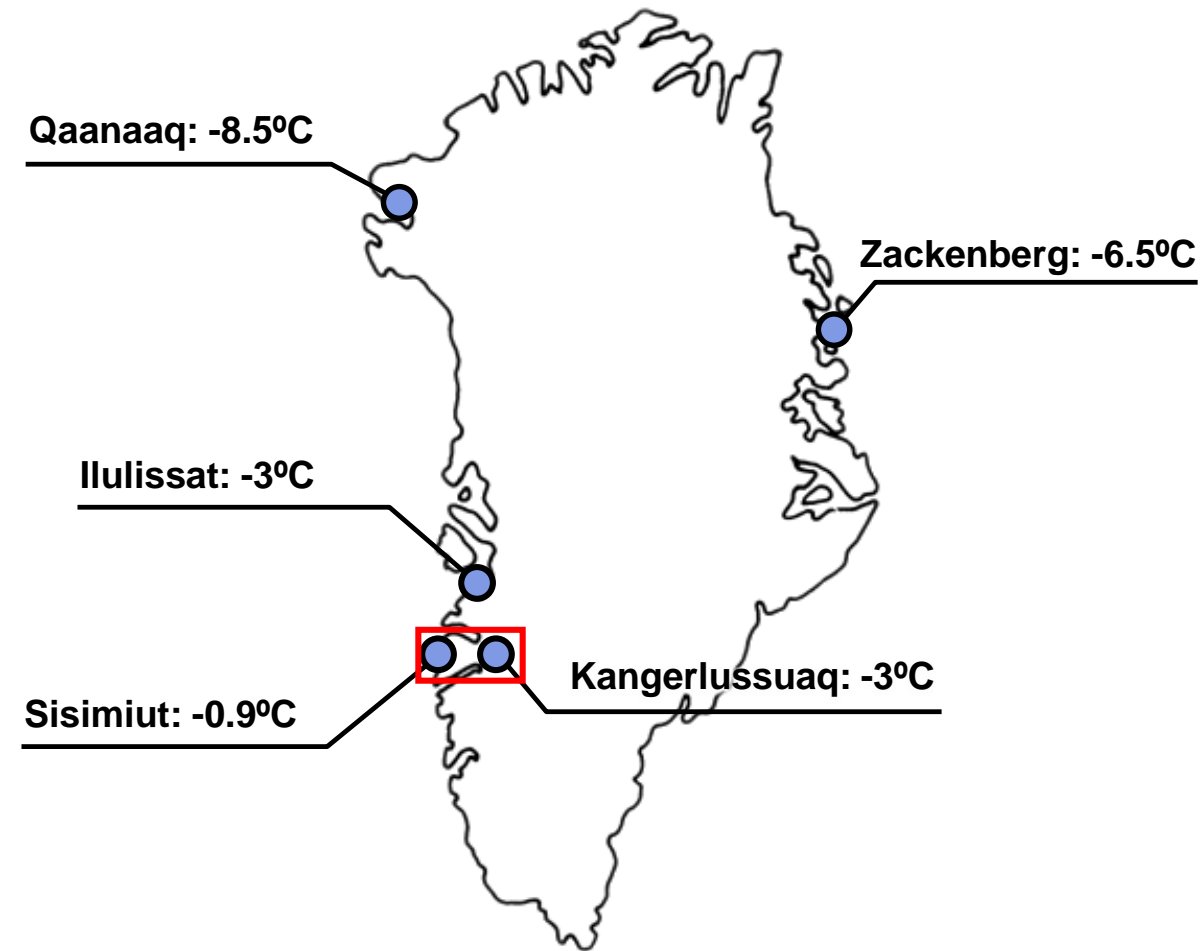
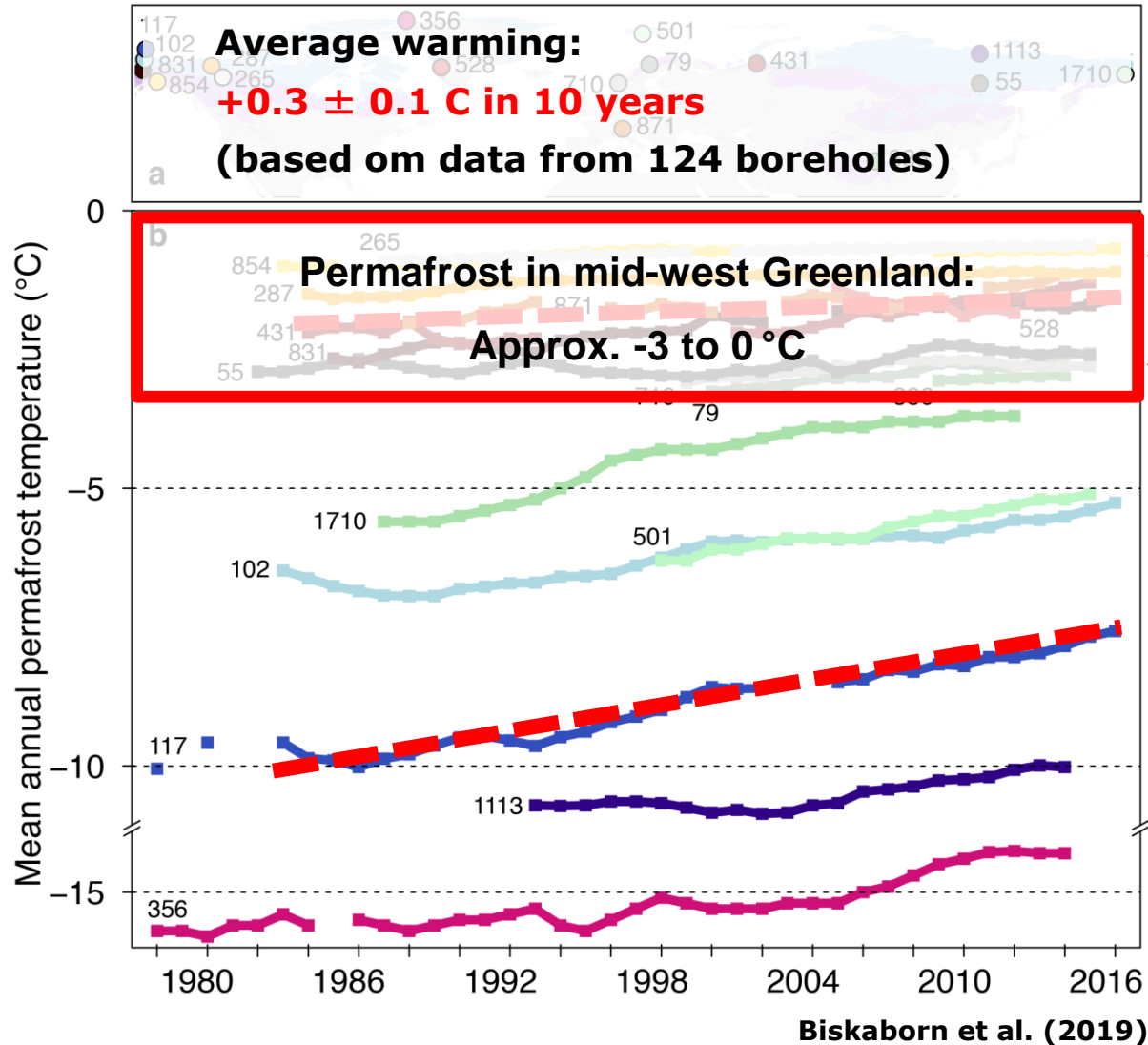
Natural hazards related to permafrost



Tsunami in Karrat fjord caused by major rock slide with permafrost thaw as likely triggering mechanism



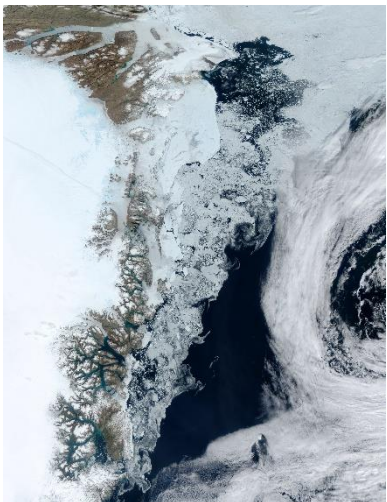
Permafrost monitoring network



Greenland Integrated Observing System (GIOS)

Observing the Arctic from sea, on land, and in the air

- A collaboration across seven institutions from across the Kingdom of Denmark to develop infrastructure to resolve and understand the mechanisms behind climate and environmental change within and around Greenland
- Part of the Danish Roadmap for Research Infrastructure
- Project budget of 80 mio DKK (~11 mio EUR).
- Project web-site: www.gios.org



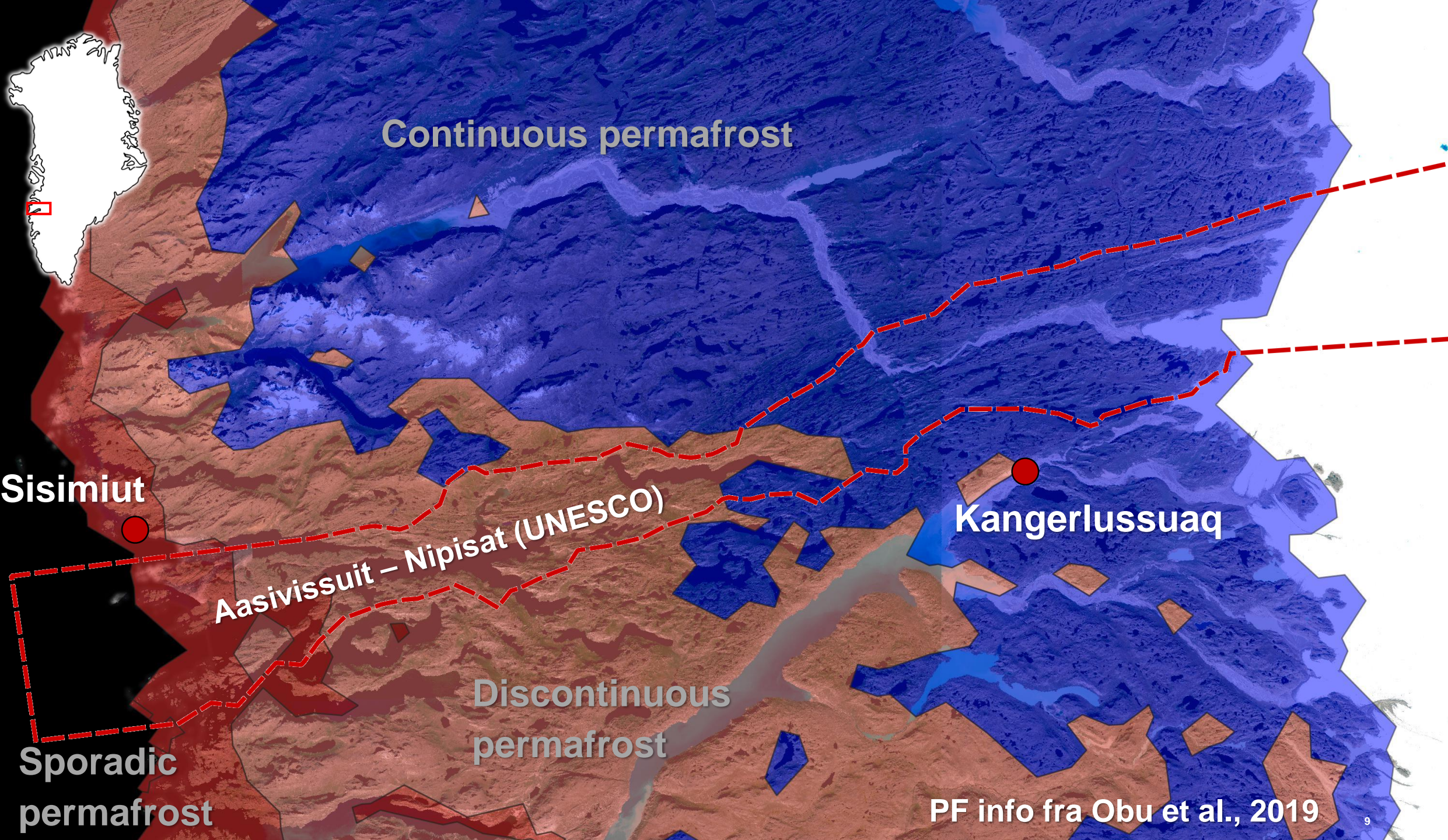


Sisimiut

160 km

Aasivissuit - Nipisat (UNESCO)

Kangerlussuaq



Continuous permafrost

Sisimiut

Kangerlussuaq

Aasivissuit – Nipisat (UNESCO)

Discontinuous permafrost

Sporadic permafrost

PF info fra Obu et al., 2019



ATV Track & planned road

Sisimiut

Kangerlussuaq

Aasivissuit – Nipisat (UNESCO)





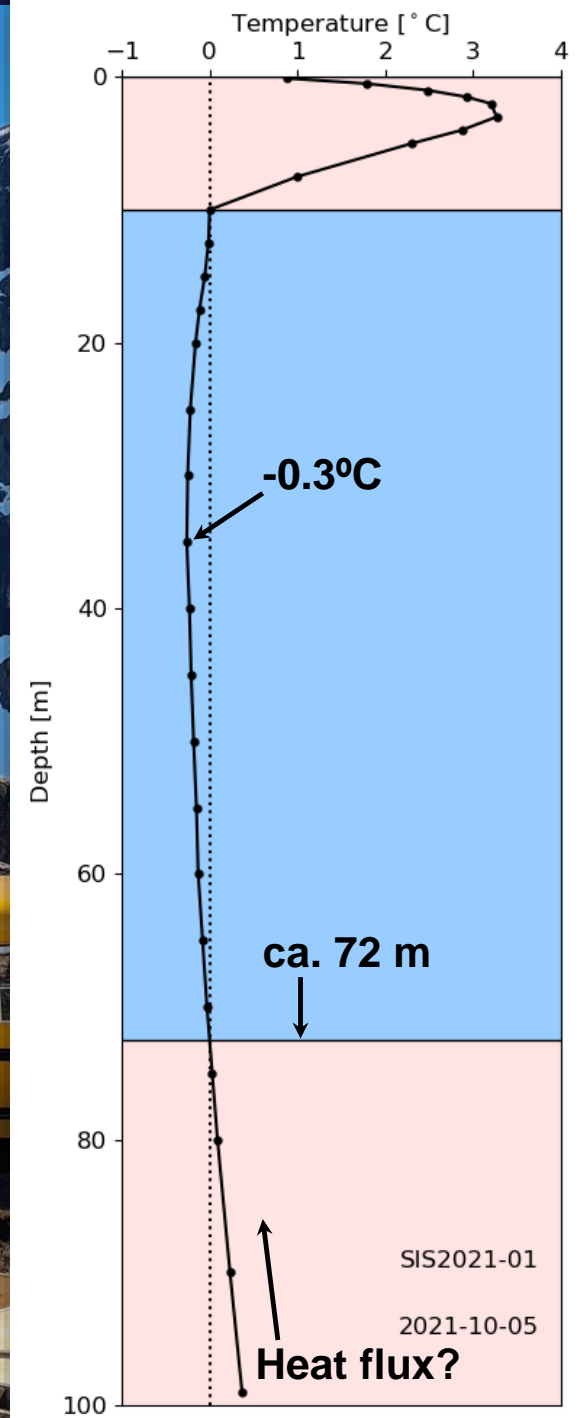
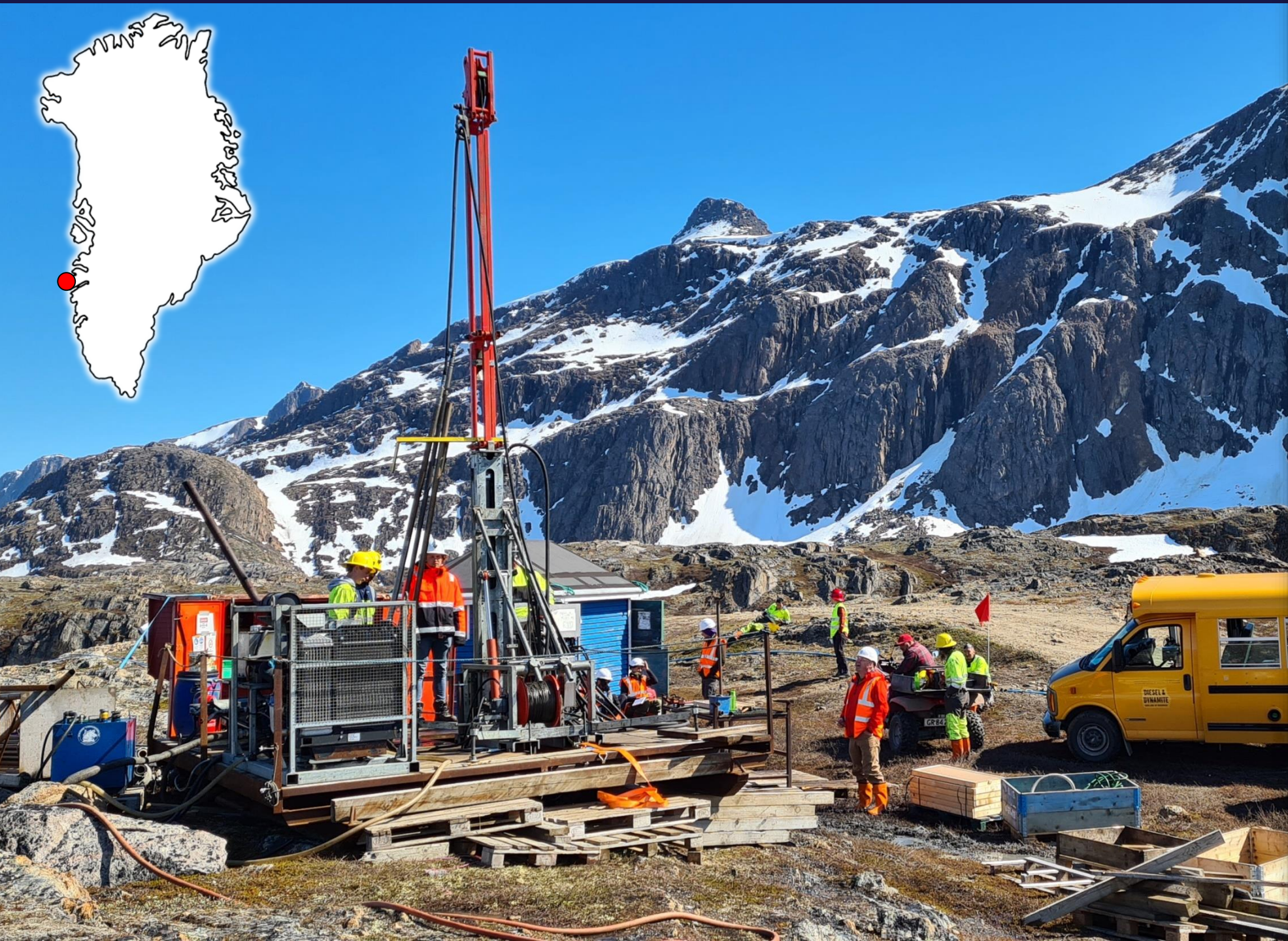
GIOS Transect

- 5 boreholes
- 100-150 m depth

Sisimiut

Aasivissuit – Nipisat (UNESCO)

Kangerlussuaq



Instrumentation

Ground temperature monitoring

100 m closed PE casing

Estisol 240 – plantoil based di-ester,
as anti-freeze and thermal couplant

Automatic Weather stations (AWS)

- Air temperature
- Humidity
- Pressure
- Wind speed and dir.
- LW / SW in- and outgoing
- Precipitation
- Snow depth

Manual data download (Once/twice a year)



Photo: Jason Box

Time plan

Summer 2021 (Jun)

- Borehole 1: Sisimiut (completed)

Summer 2022 (Jun-Aug)

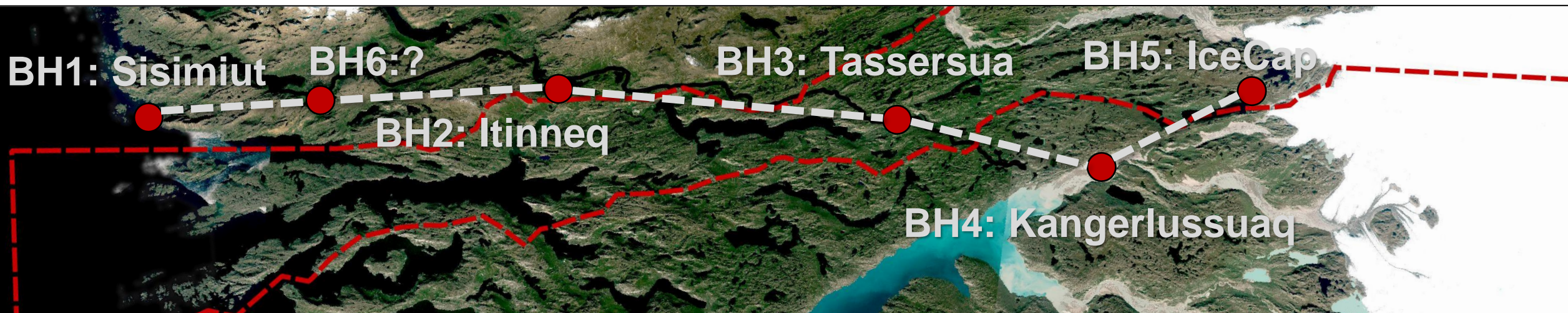
- Borehole 2: Itinneq
- Borehole 3: Tassersua

Summer 2023 (Jun-Aug)

- Borehole 4: Kangerlussuaq
- Borehole 5: Ice cap (??)

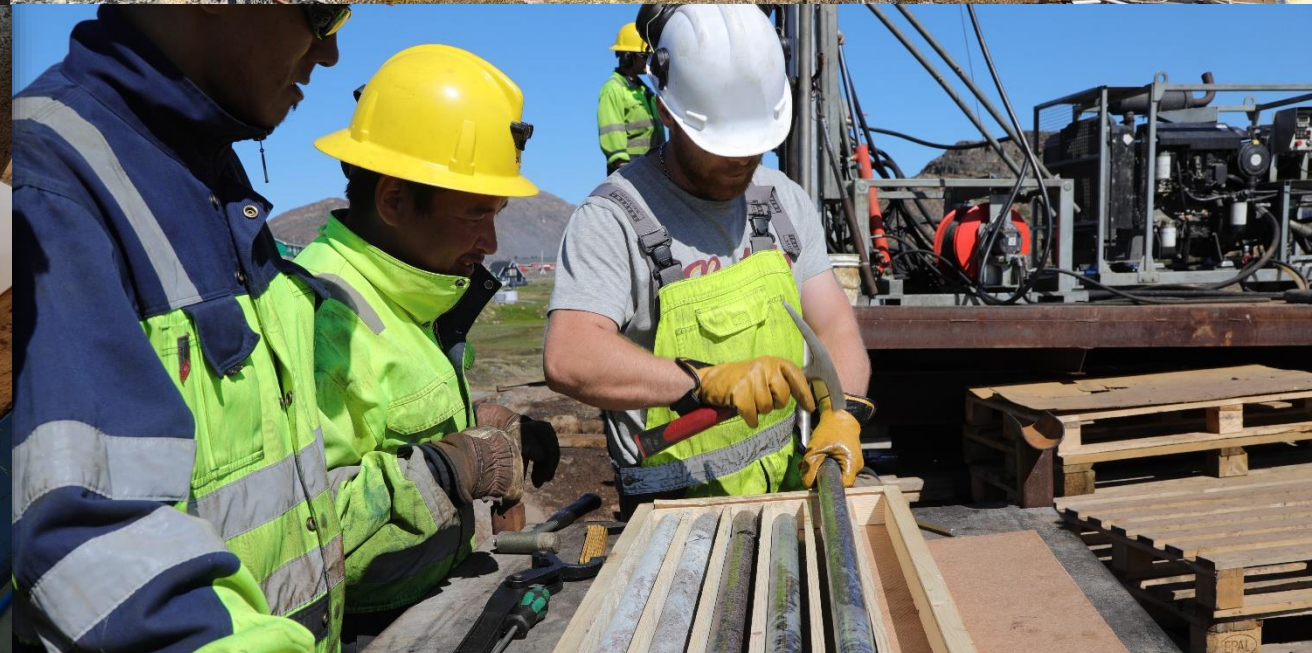
Summer 2024 (Jun)

- Borehole 6: First Fjord (if funding allows)



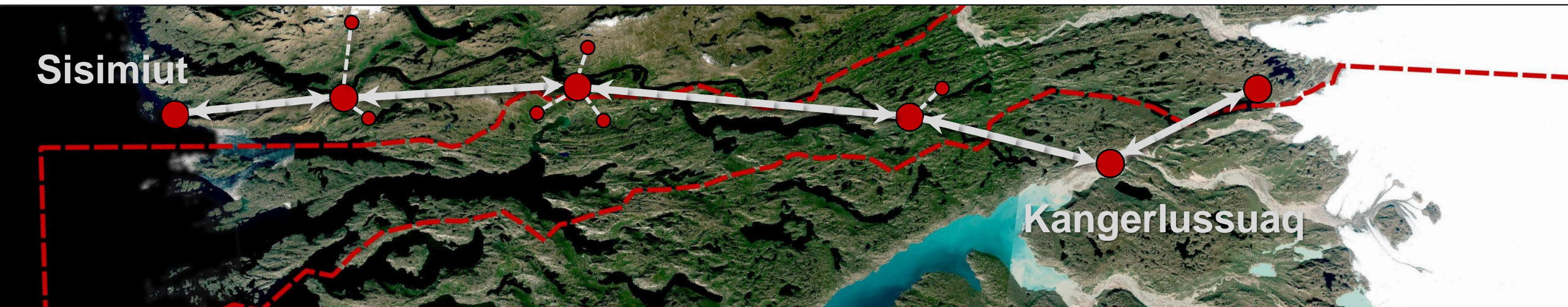


Educational collaboration
Råstofskolen: Drilling operators
DTU: Engineering Students
30-40 Students (pending funding)

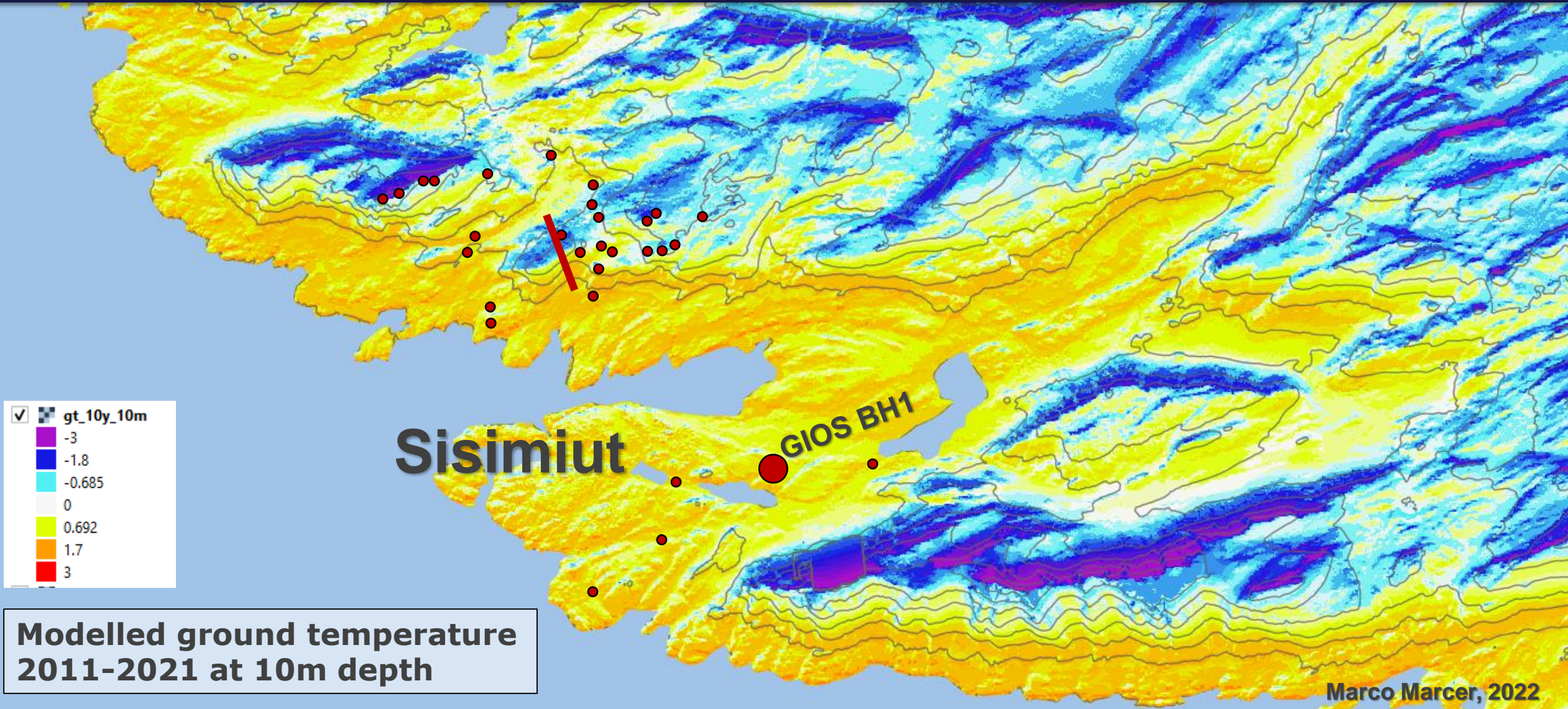


Research platform - possibilities

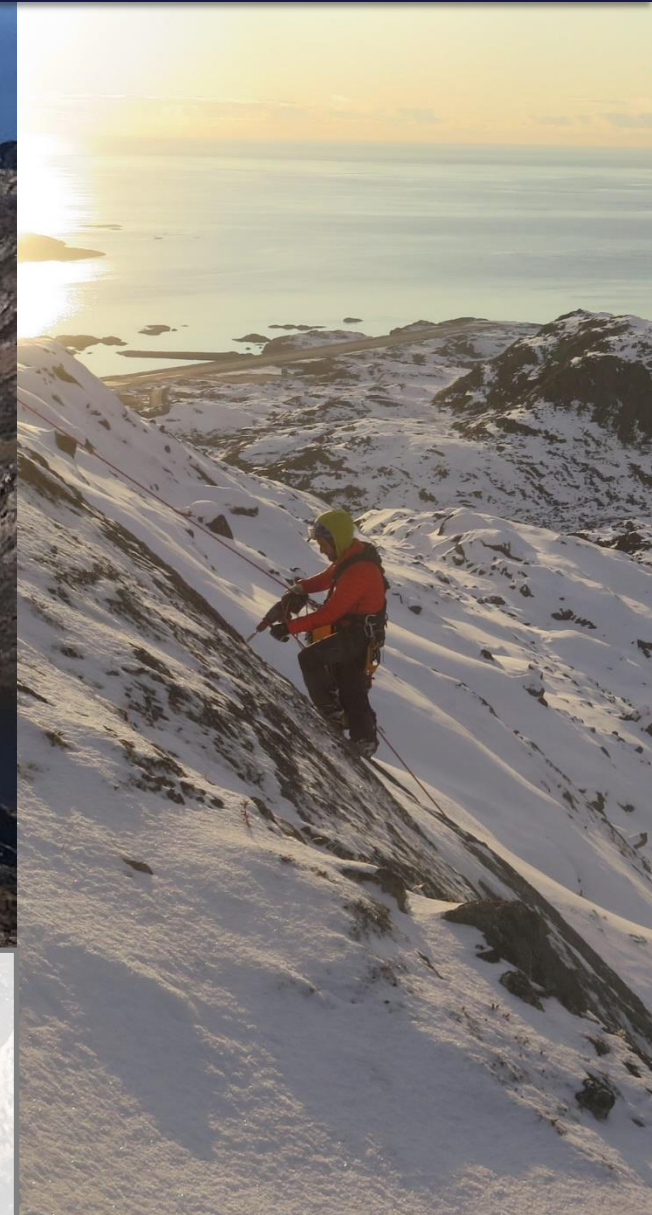
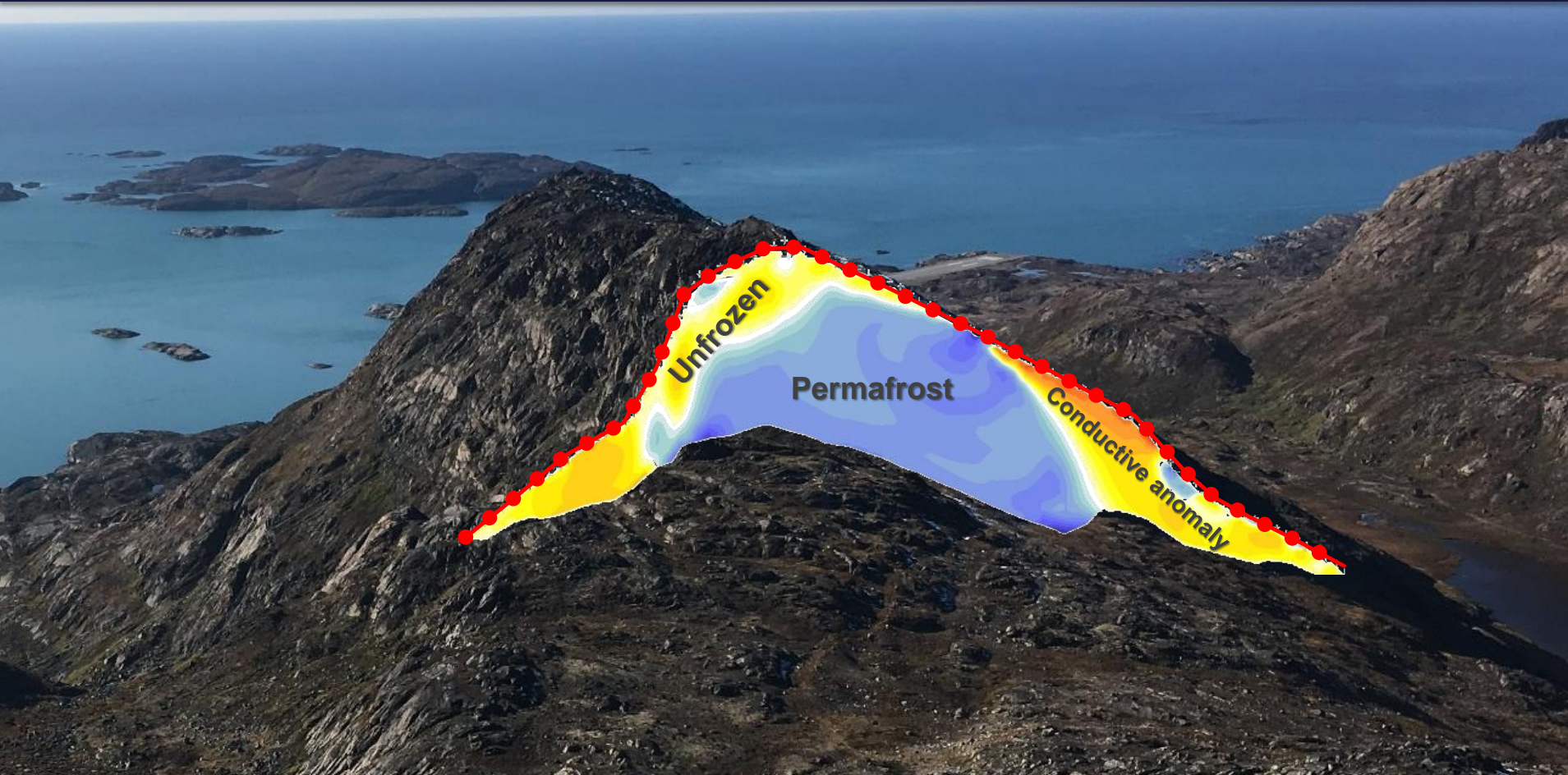
- **Open & FAIR data – international databases**
- **Future upgrade to real-time data link**
- **Backbone weather data transect**
- **Platform for additional experiments**
 - Open for collaboration through GIOS protocol



High-res mountain permafrost map

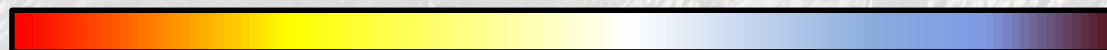


Validation with electrical resistivity tomography



No Permafrost

Permafrost



Summary:

- **New transect of PF monitoring stations provides long-term environmental data**
- **New understanding of PF & ground stability changes in West Greenland**
- **Data will be free and openly available**
- **A research platform for future collaborative experiments**
- **Infrastructure development increases accessibility & and research opportunities**