Polar Connnect Meeting, Brussel 5th May 2023

Research using the North Pole Fibre infrastructure

by Martin Landrø

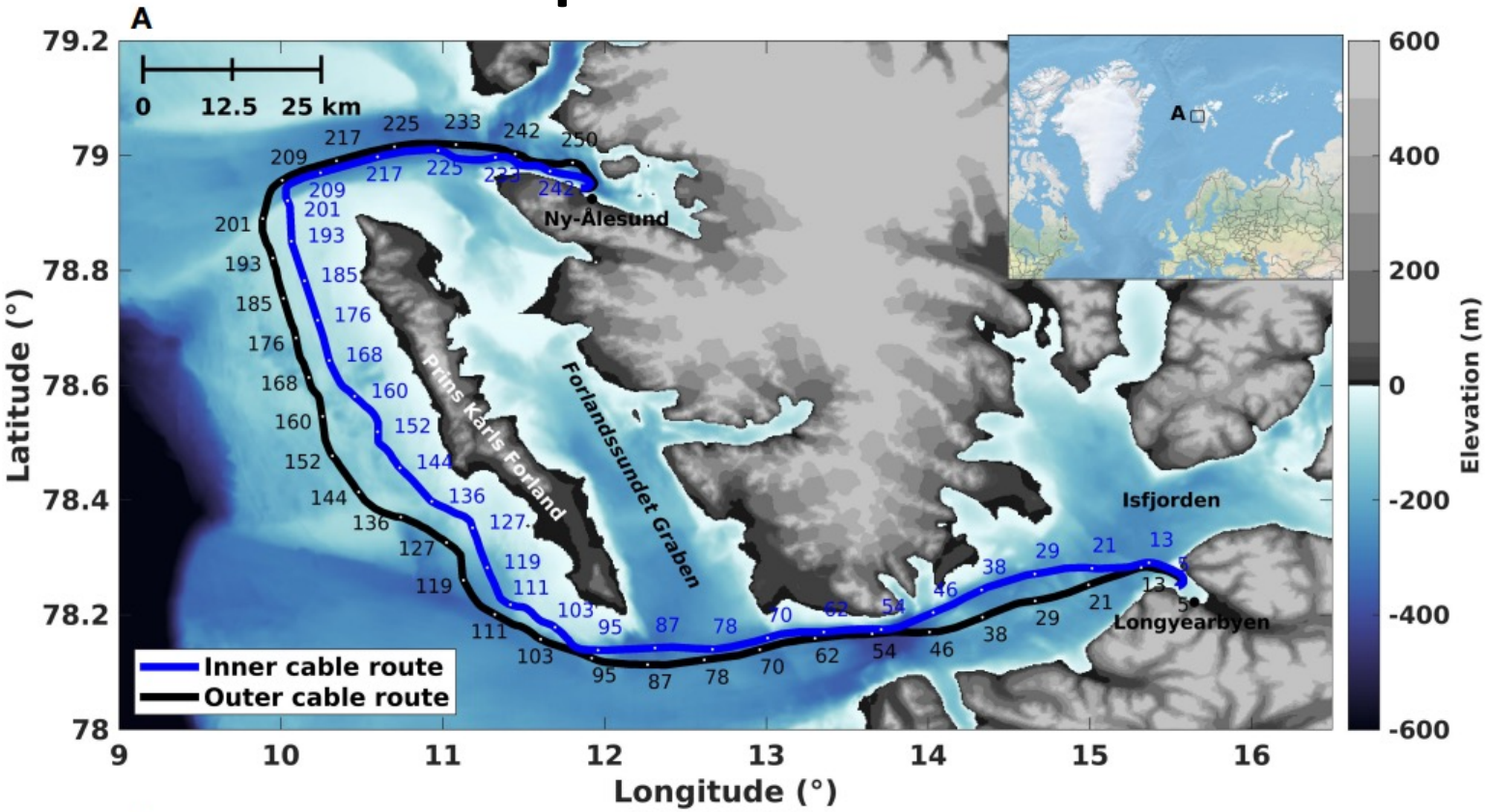
SFI Centre for Geophysical Forecasting

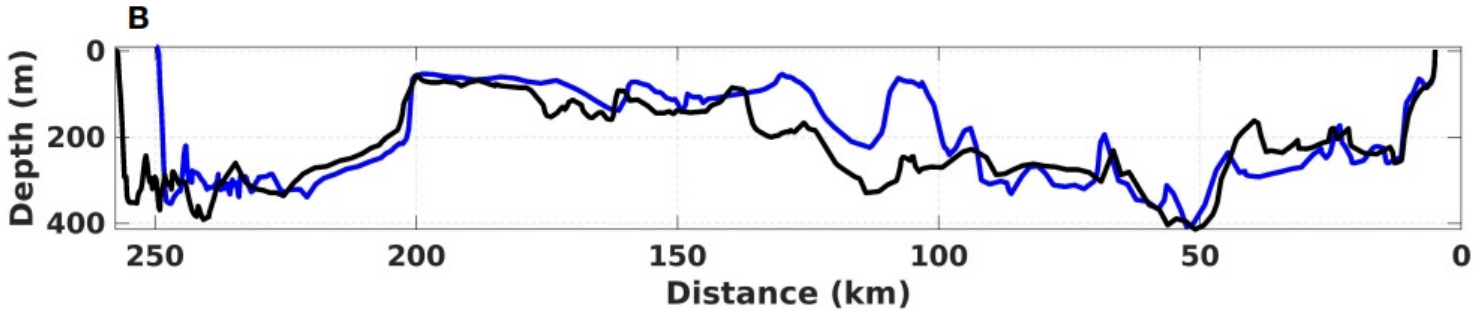
NTNU

Centre for Research-based Innovation

The Research Council of Norway

The two fibre optic cables offshore Svalbard



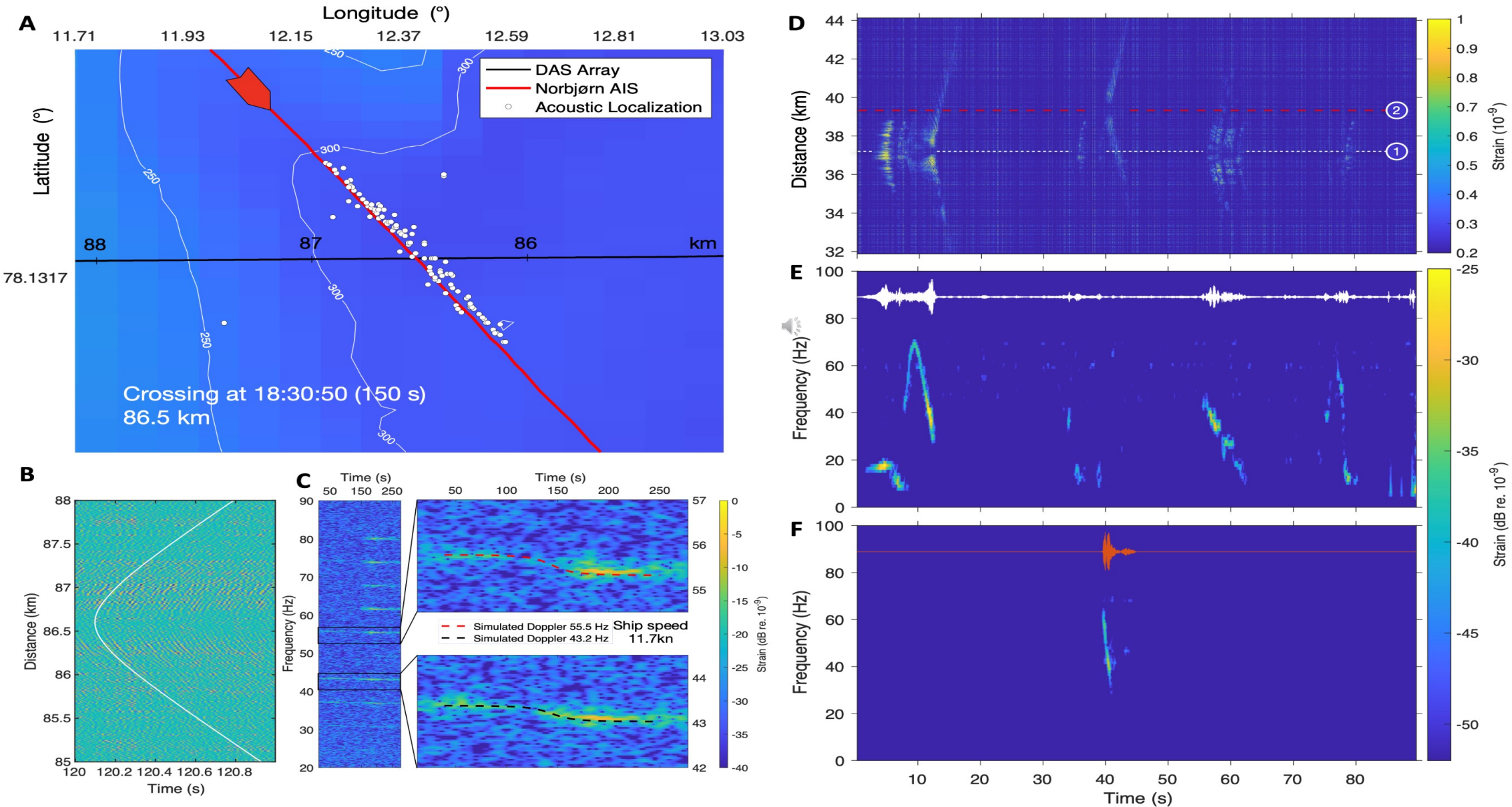


These fibres are being used by:

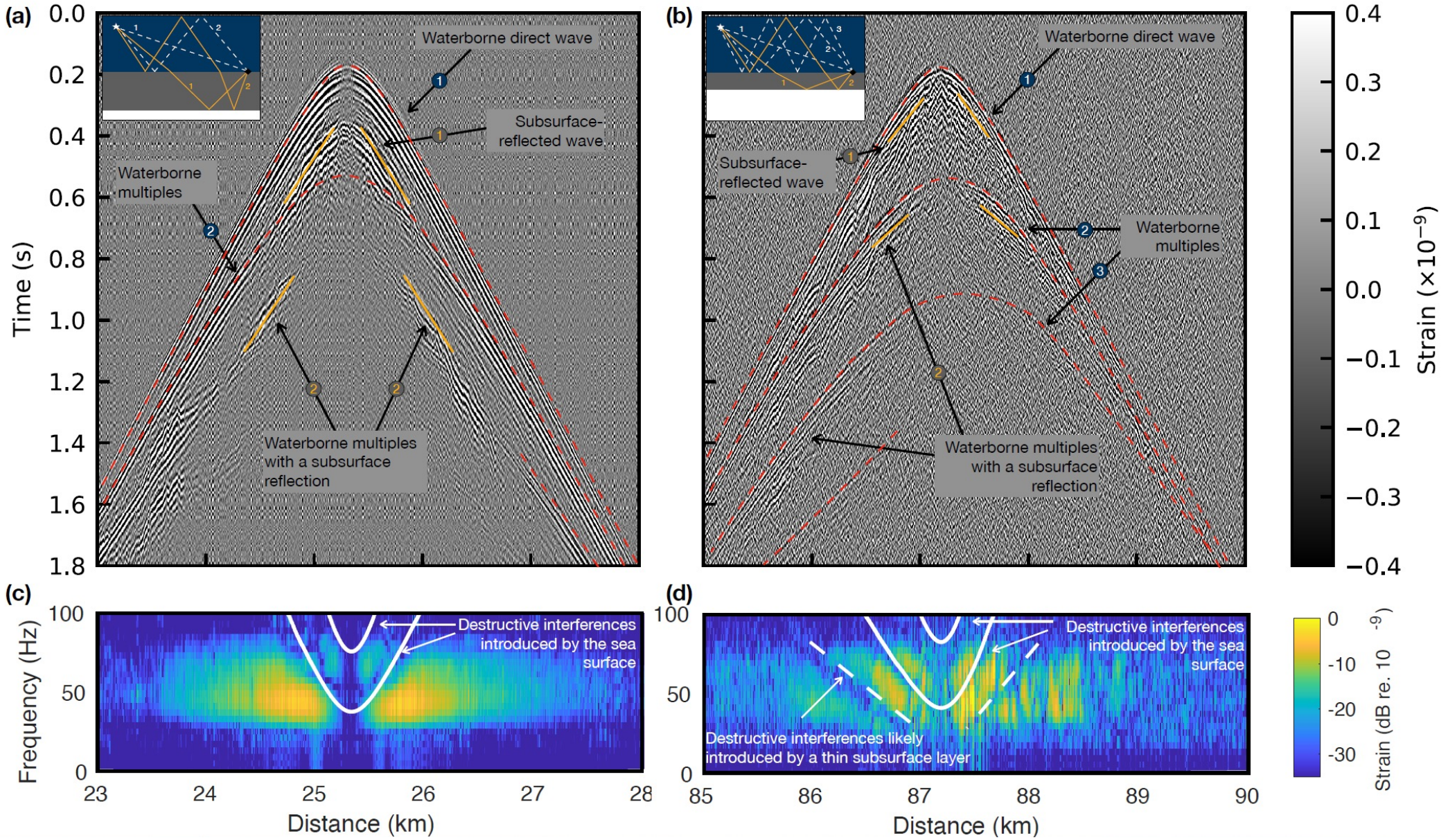
- **CGF(Centre for Geophysical Foreasting, NTNU)**
- **SUBMERSE (EU Tech01 project)**
- **SeaSounds (EU ITN project)**

JAMSTEC in Japan is a partner in CGF

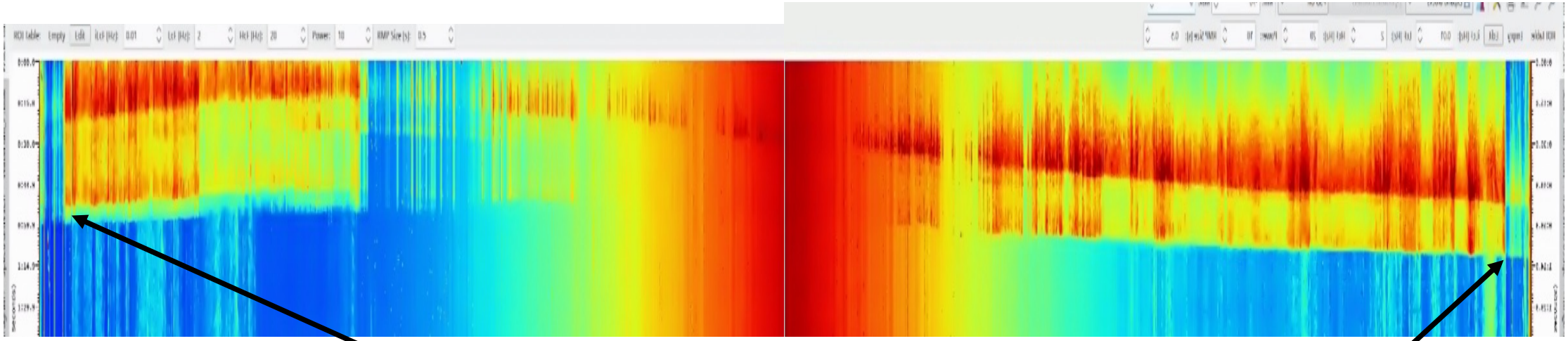
Sensing whales, storms, ships and earthquakes - Arctic fibre-optic cable

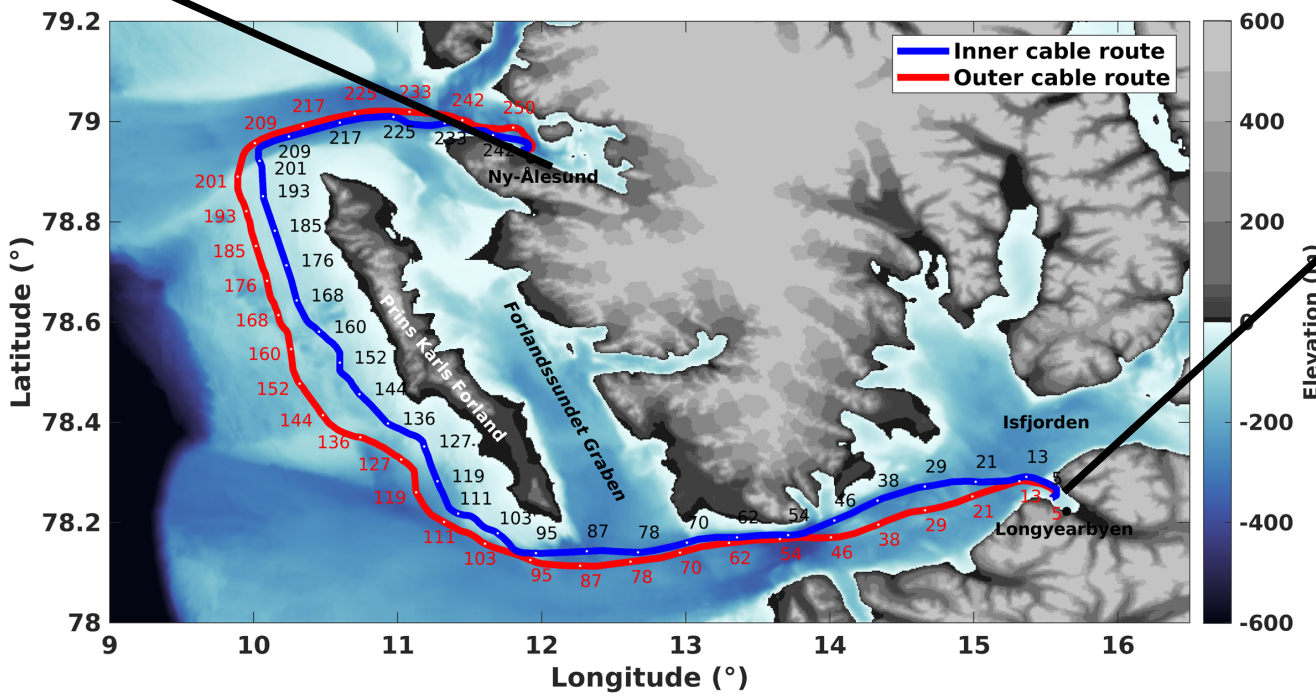


Blue whale interferometry: Subsurface reflections

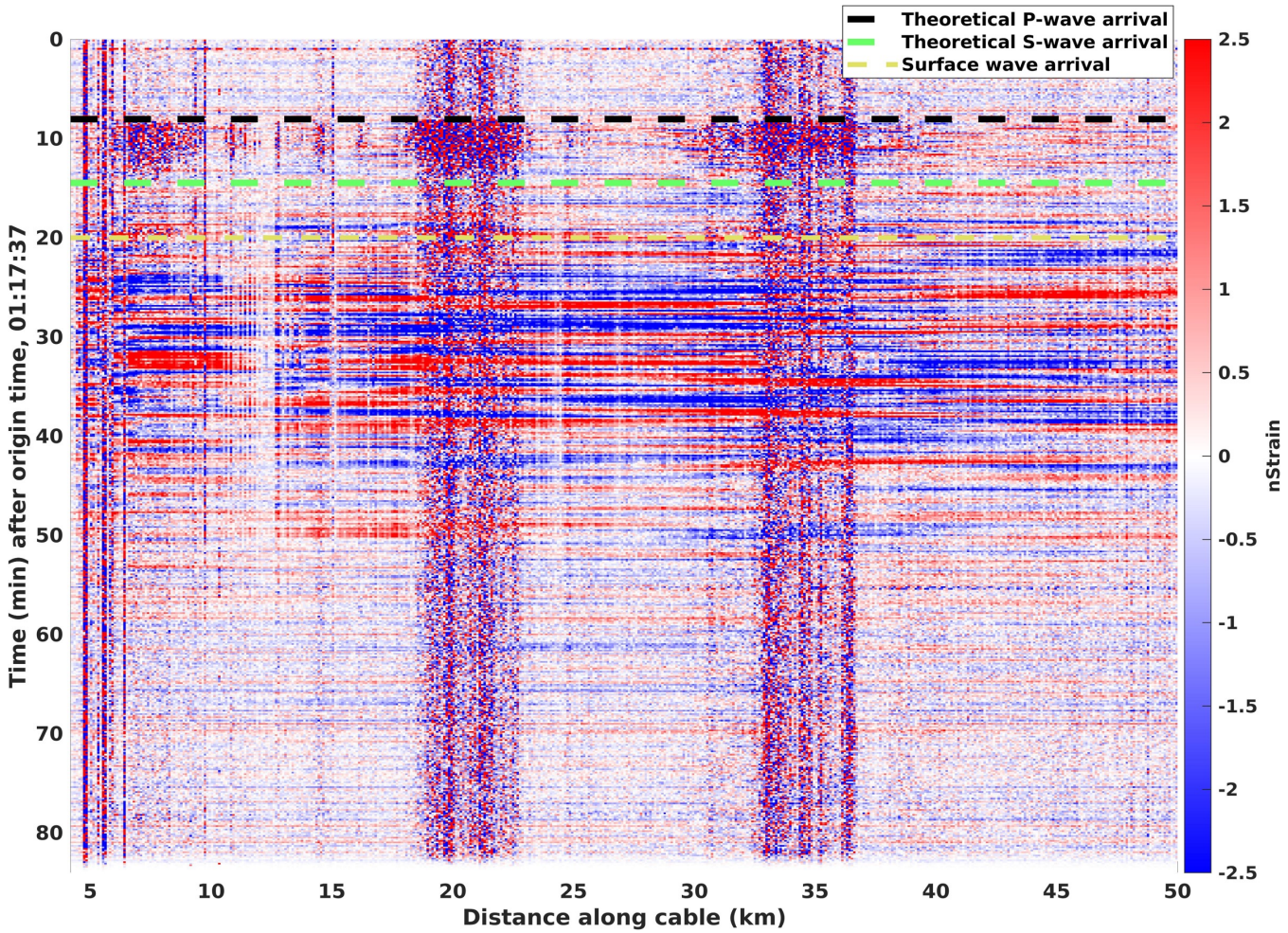


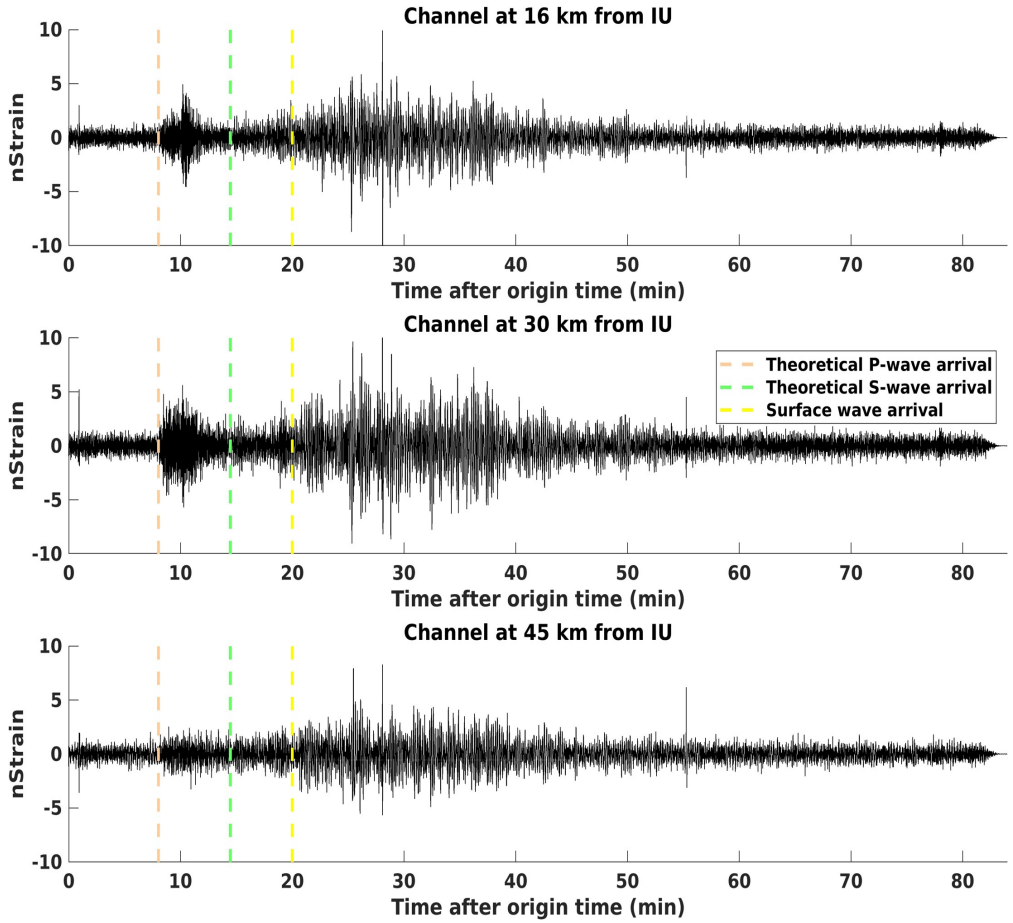
The 2022 CGF Svalbard field campaign: Using 4 interrogators



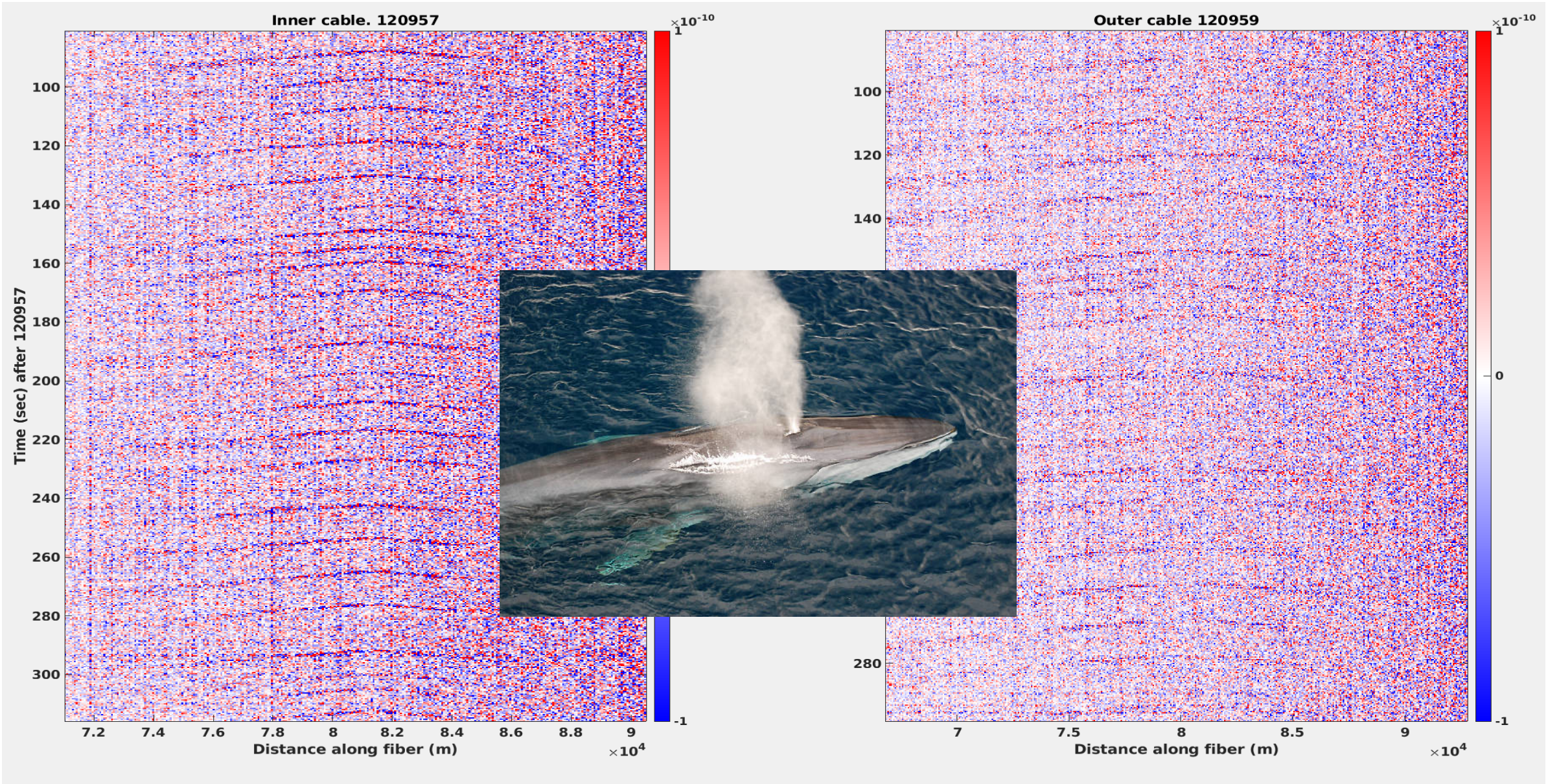


The 6th February Turkey Earthquake recorded offshore Ny Ålesund. Filter 0.1 to 3 Hz

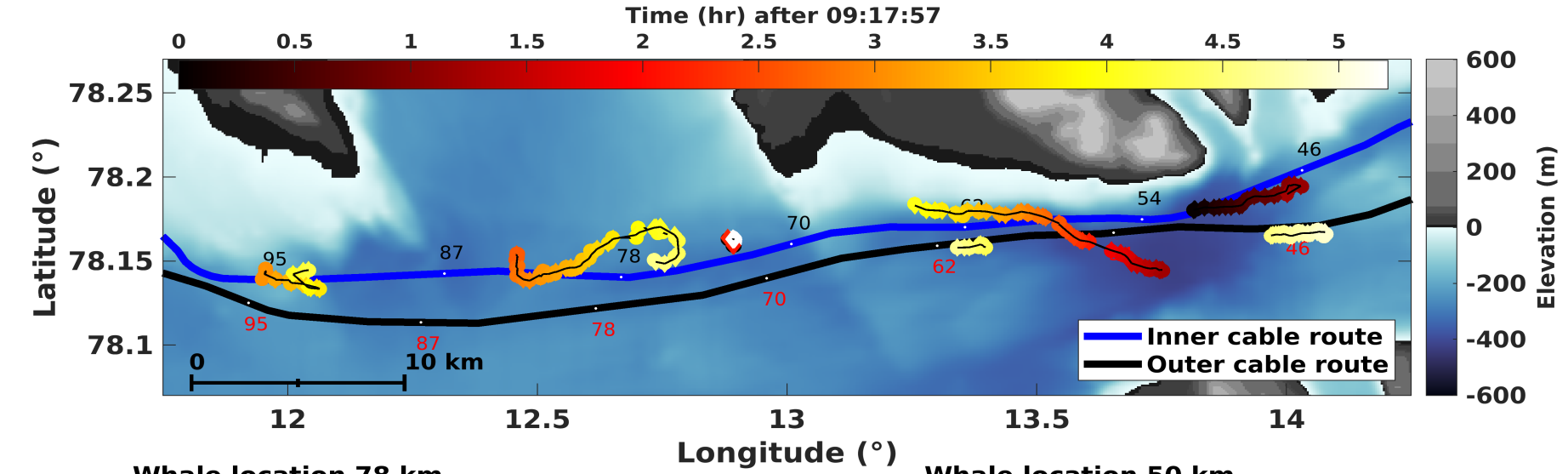


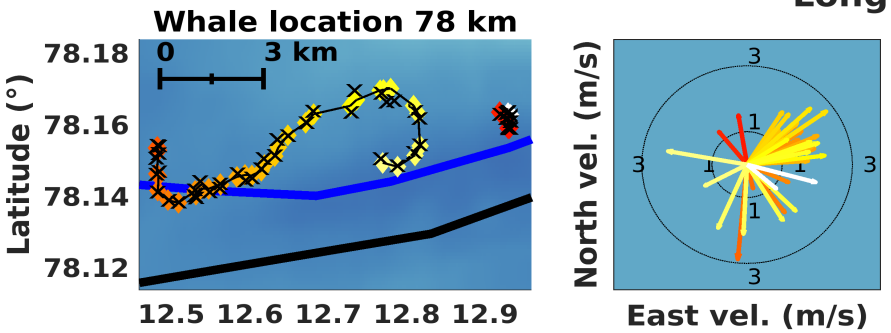


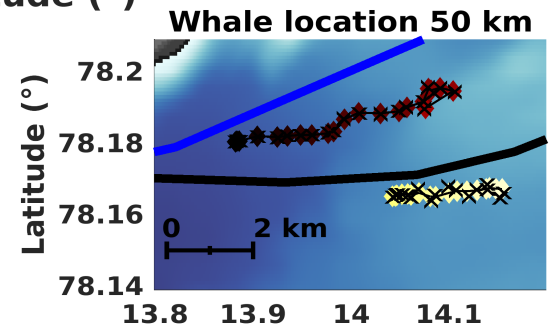
24 fin whale calls recorded simultaneously on both cables

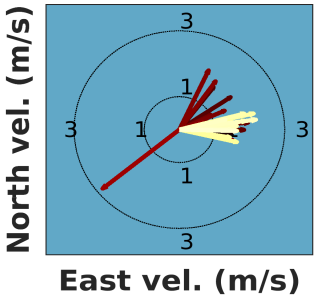


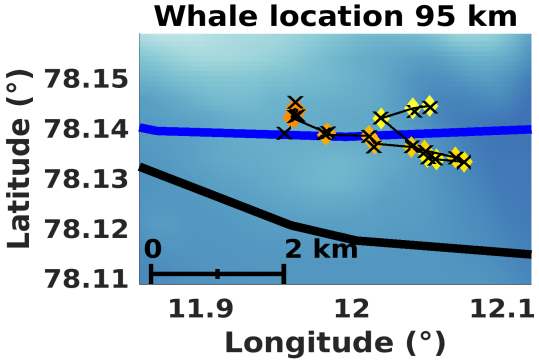
Tracking several fin whales for 5 hours

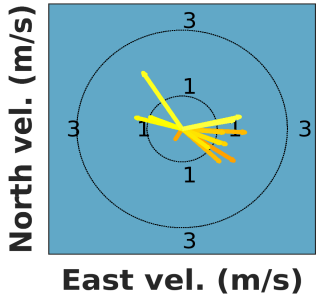


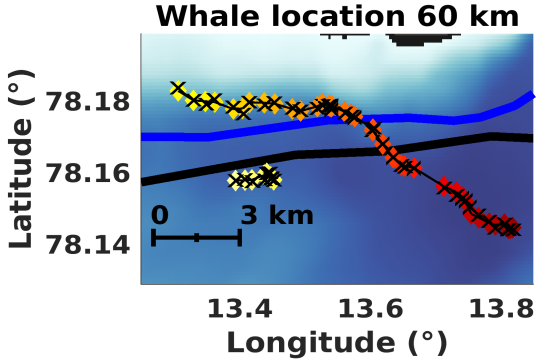


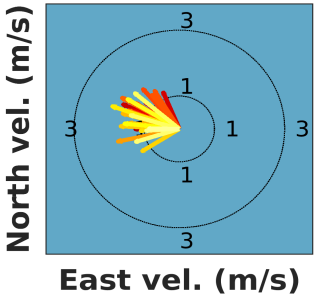




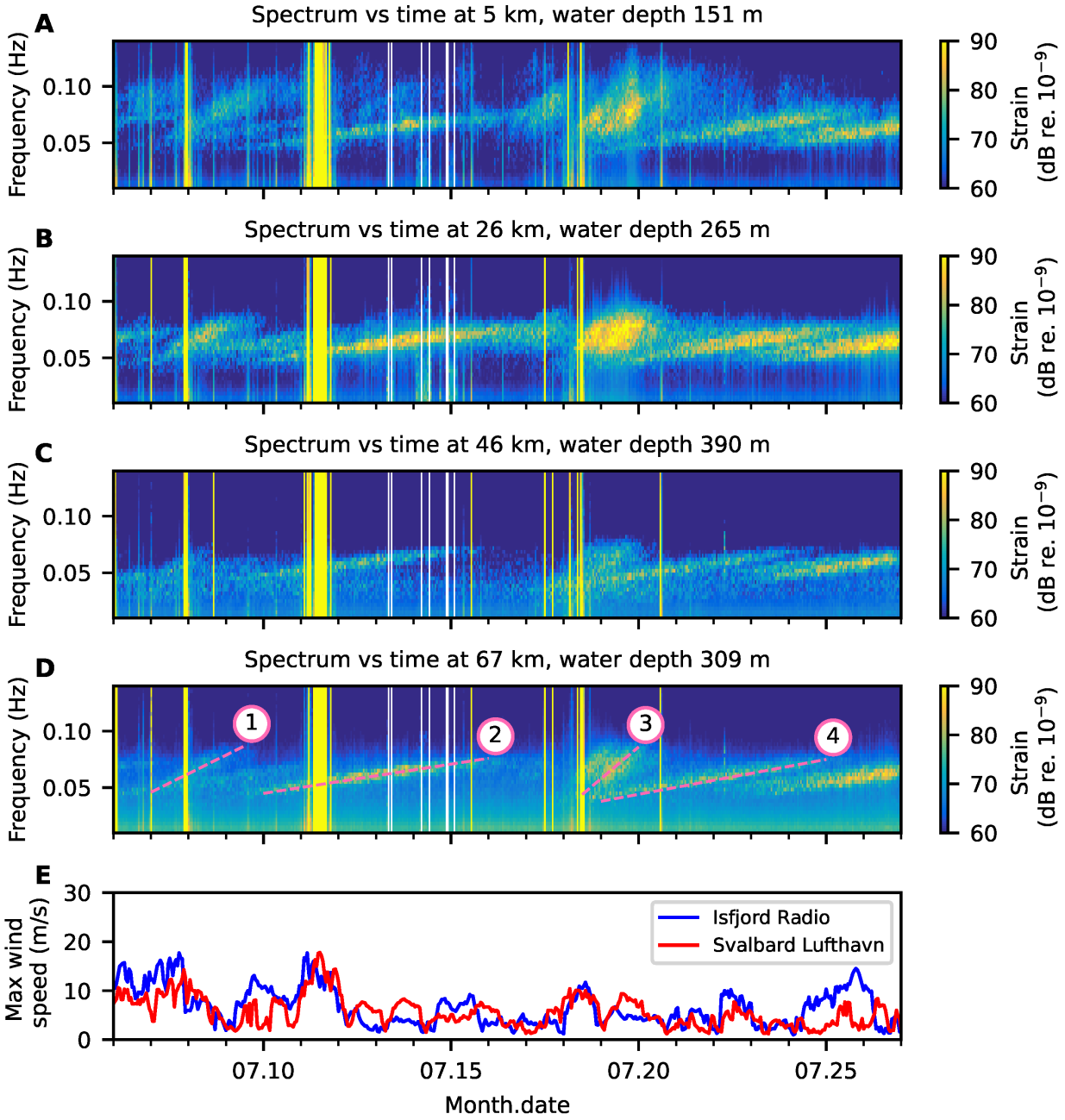


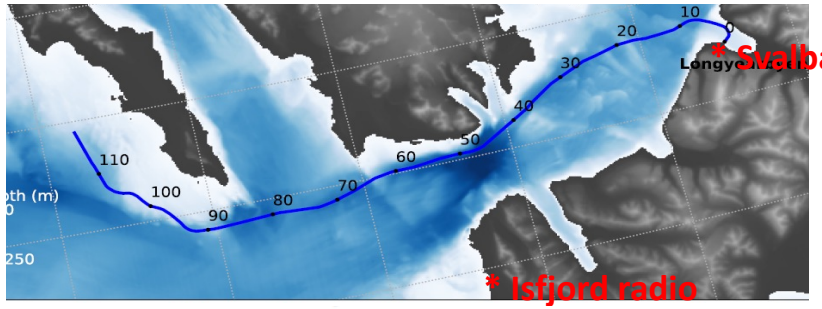






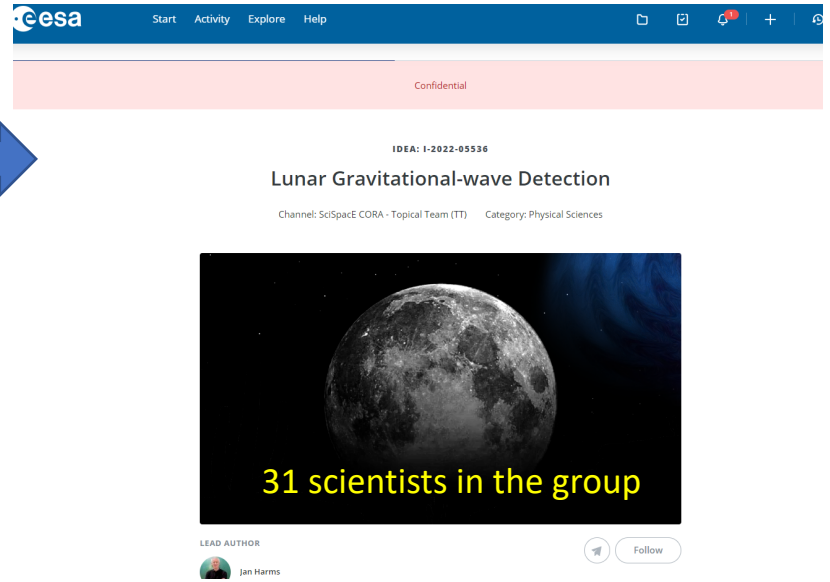
Low frequency DAS – Distant storms

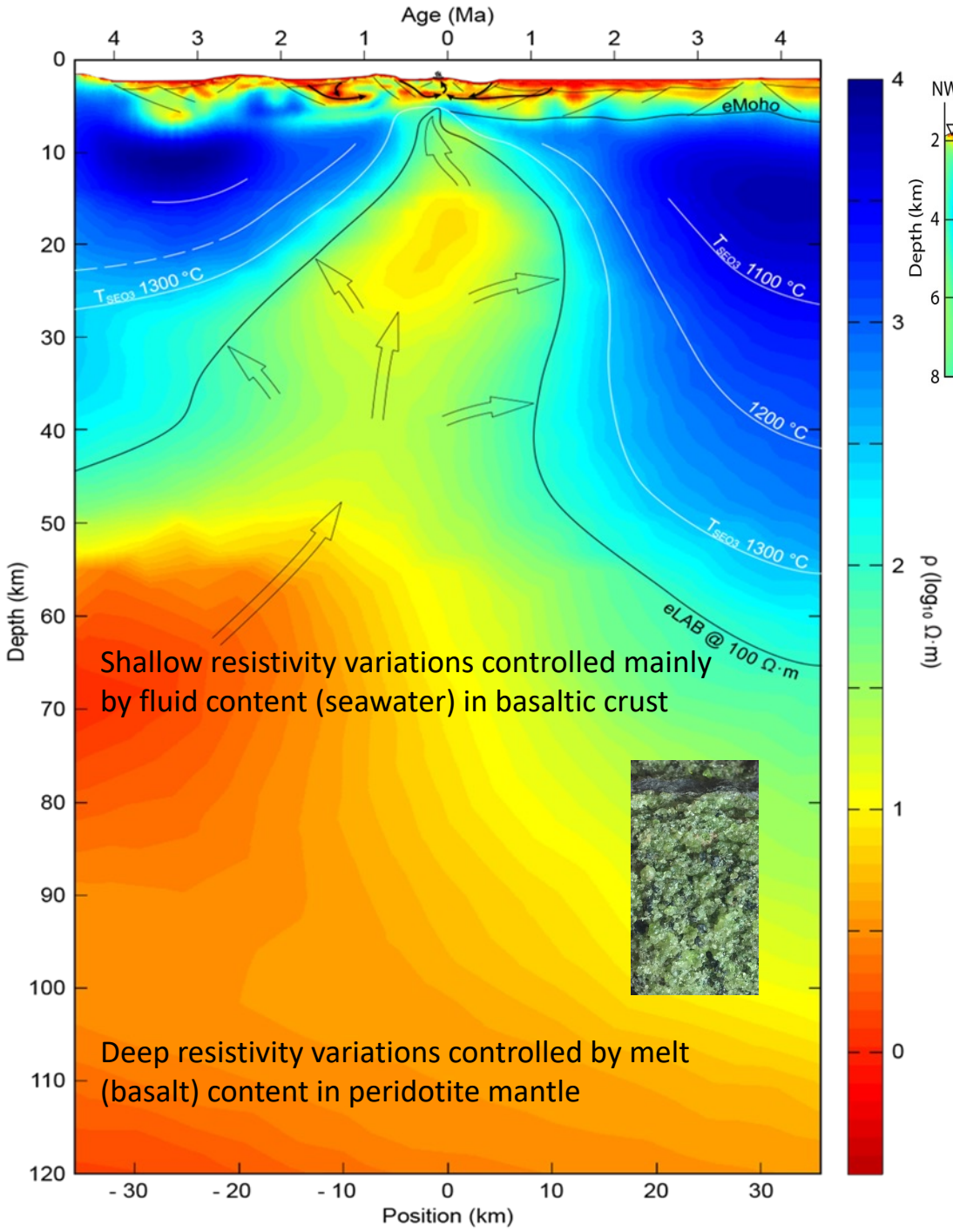




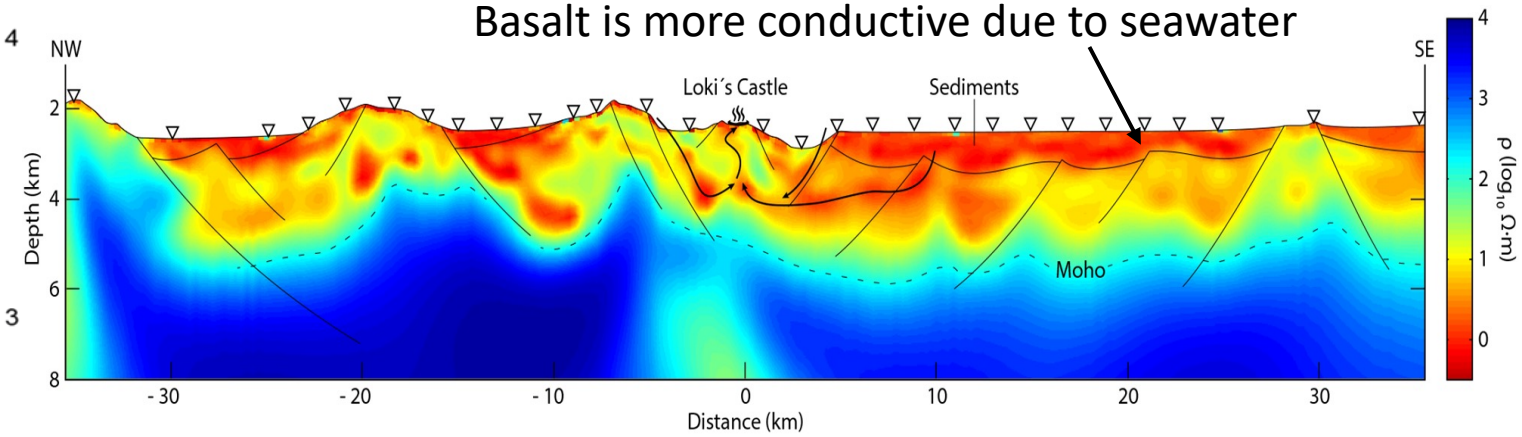
Munk, 1963: $$x = \frac{g}{4\pi\left(\frac{df}{dt}\right)}$$

1: Edouard 4100 km
2: Offshore Brazil, 13000 km
3: Storm between Iceland and Greenland 2400 km
4: Offshore Brazil, 11 000 km





Basalt is more conductive due to seawater



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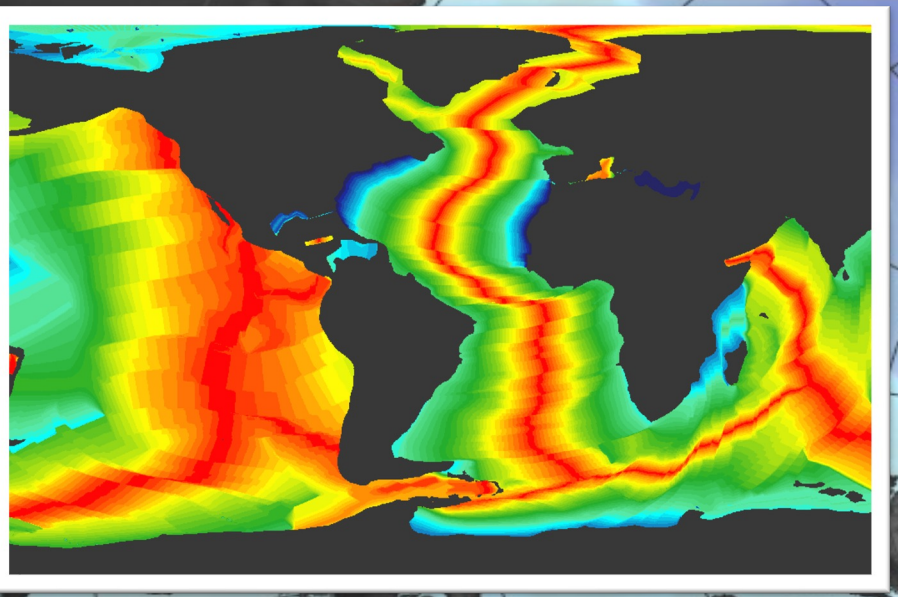
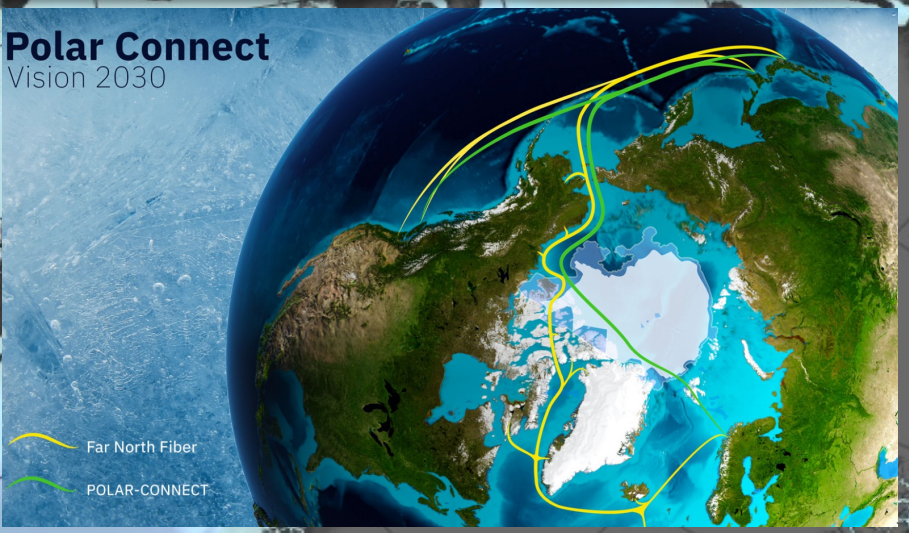
Letter | Published: 20 March 2019

Deep electrical imaging of the ultraslow-spreading Mohns Ridge

Ståle Emil Johansen ✉, Martin Panzner, Rune Mittet, Hans E. F. Amundsen, Anna Lim, Eirik Vik, Martin Landrø & Børge Arntsen

Nature **567**, 379–383 (2019) | Download Citation ⬇

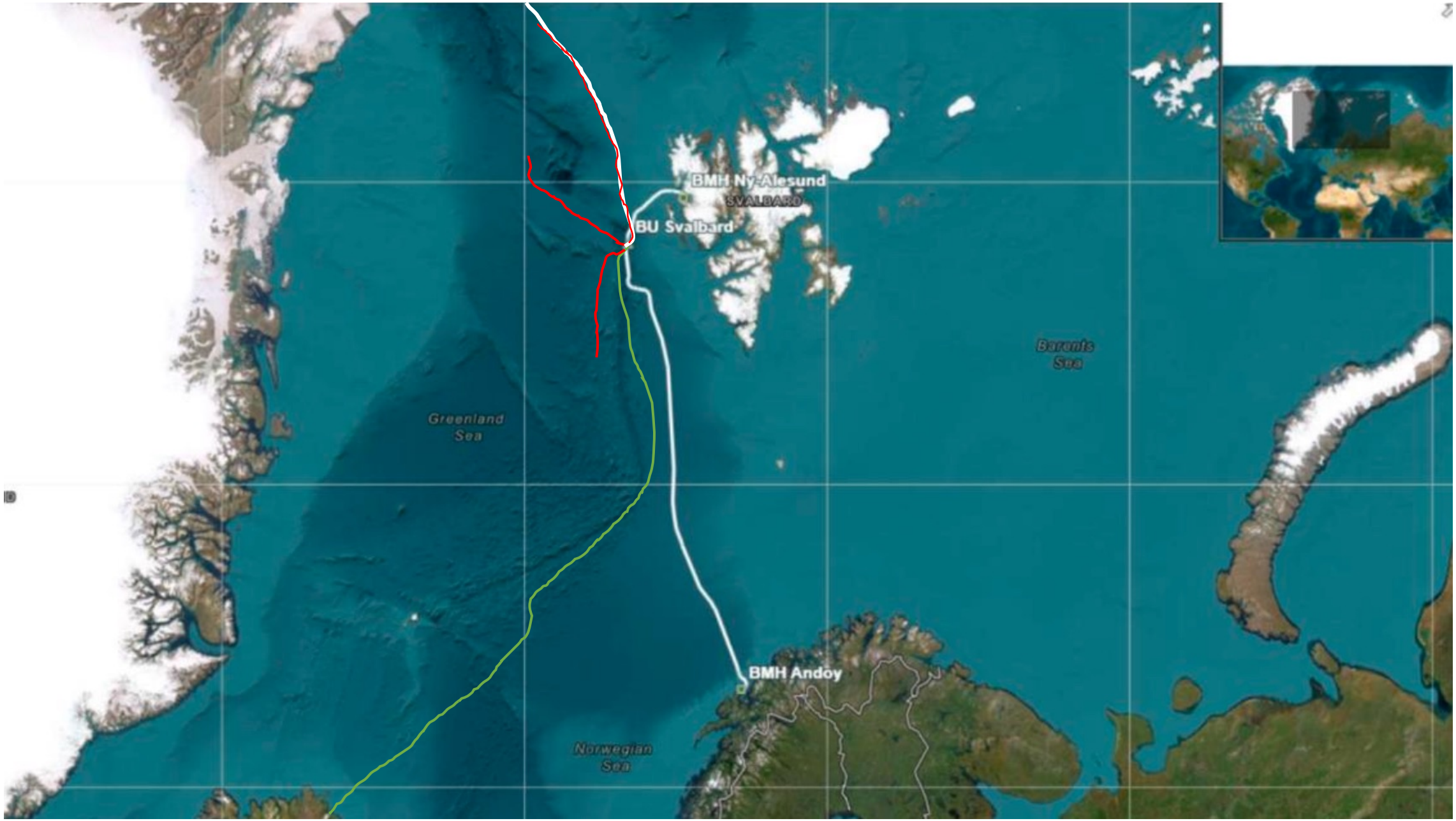




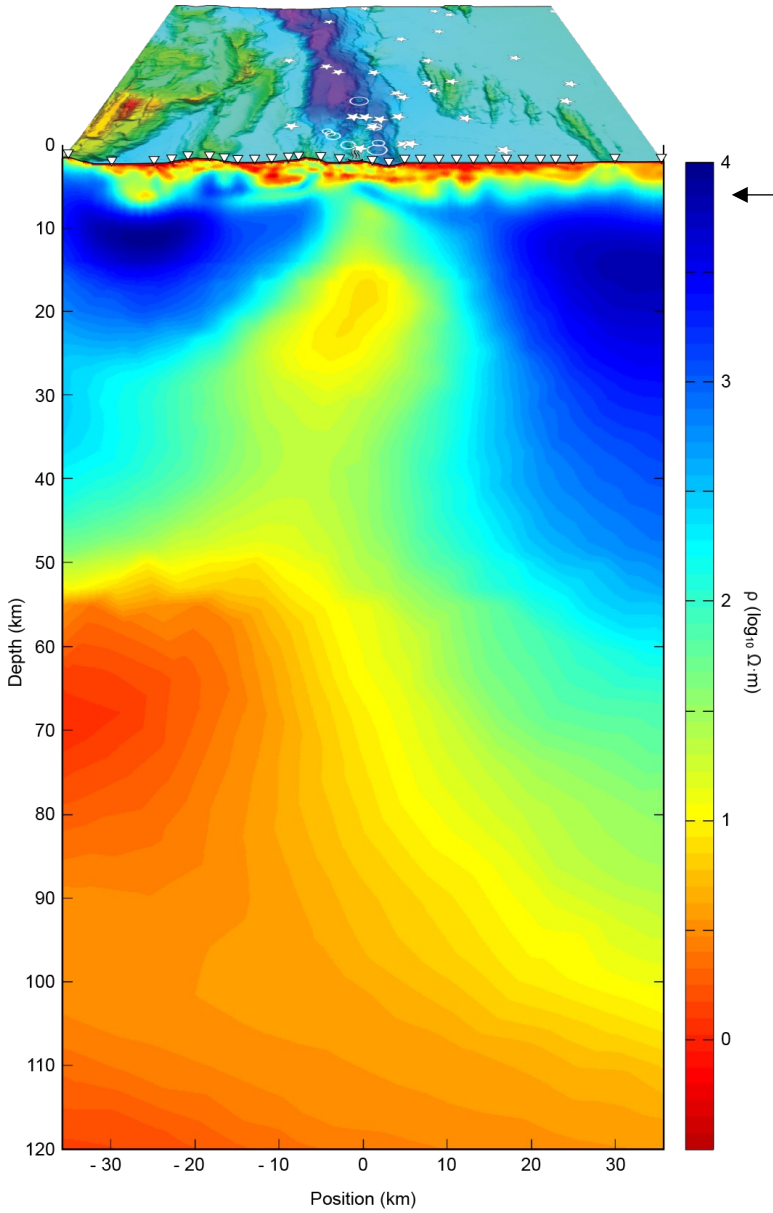
We are interested in data close to the polar spreading ridges

Mohns Ridge

Mid-Atlantic rigde sensing infrastructure

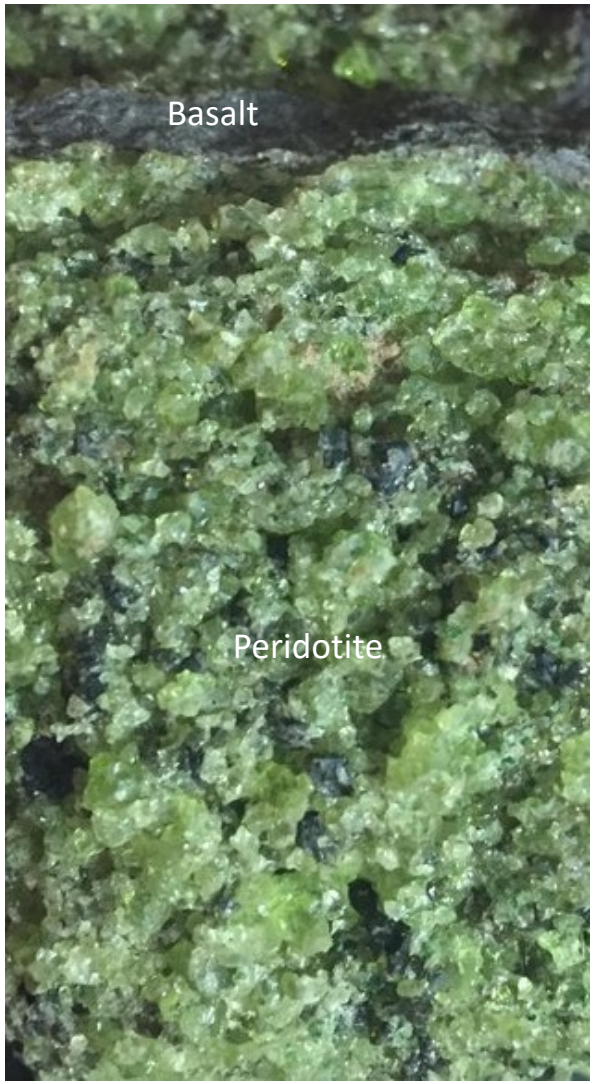


Oceanic lithosphere and upwelling asthenosphere imaged to 120 km depth



Shallow resistivity variations controlled mainly by fluid content (seawater) in basaltic crust

Deep resistivity variations controlled by melt (basalt) content in peridotite mantle



Summary

CGF SFI Centre for Geophysical Forecasting

- **Ocean floor DAS:**
  - Efficient tool for tracking of whales:
    - Need to develop efficient and fast algorithms (huge amount of data)
    - Potential tool to avoid/reduce amout of ship strikes
  - Oceanography (distant storms, ocean currents, …)
  - Seismological studies (earthquakes, gas flares, explosions,..)

  - Present range of DAS is 100-150 km – need amplifiers every 100 km => under development
  - Possible to combine DAS and telecommunication in near future

Thanks to CGF partners and the Norwegian Research Council for financial support to the centre

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