

Fibre Optic Sensing on Seafloor Cables across Cook Strait

Wellington Earthquake Resilience
Collaboratory
2 July 2026

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Optical Fibre Cables

Onshore



Offshore

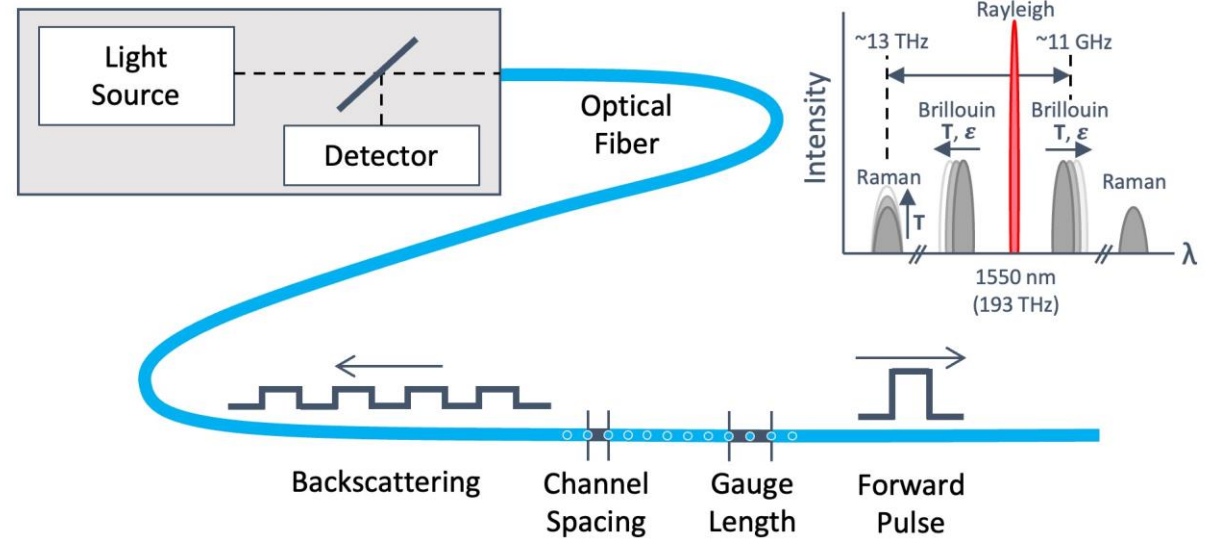


Fibre Optic Sensing

- Developed in the mid 1960's
- Came into service in the early 1970's
- Combining two new technologies (Laser and thin glass fibres transmit light with low loss)
- Developed in 2000 – 2024 into Distributed Acoustic, Temperature, and Strain Sensing (DAS, DTS, DSS)

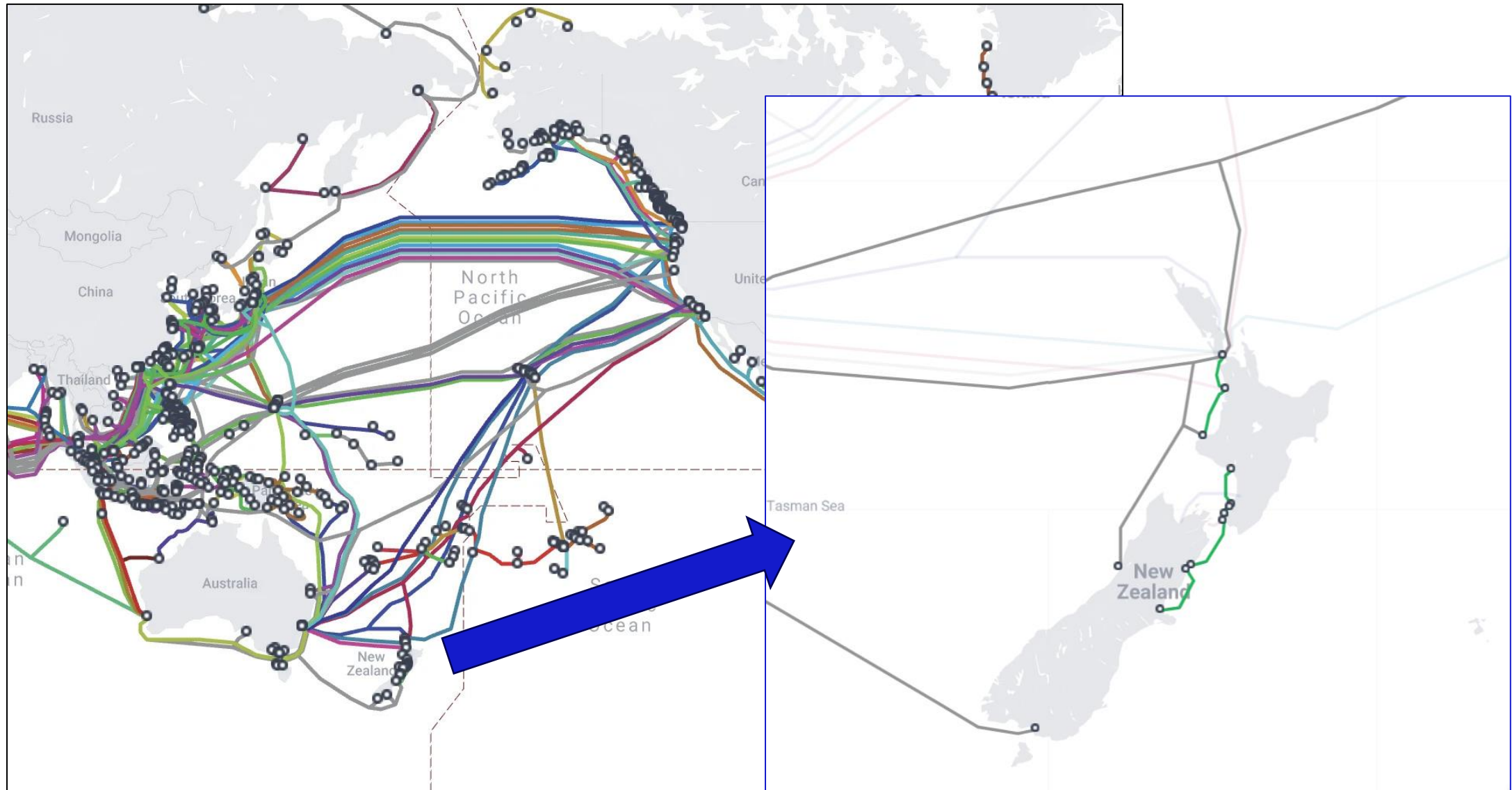


Schlumberger hDVS : Alpine Fault Well 2016



Sintela Onyx Peta : Cook Strait Cable 2025

Global Network of Submarine Cables



The Cook Strait fibre: Datasets, signals and timelines

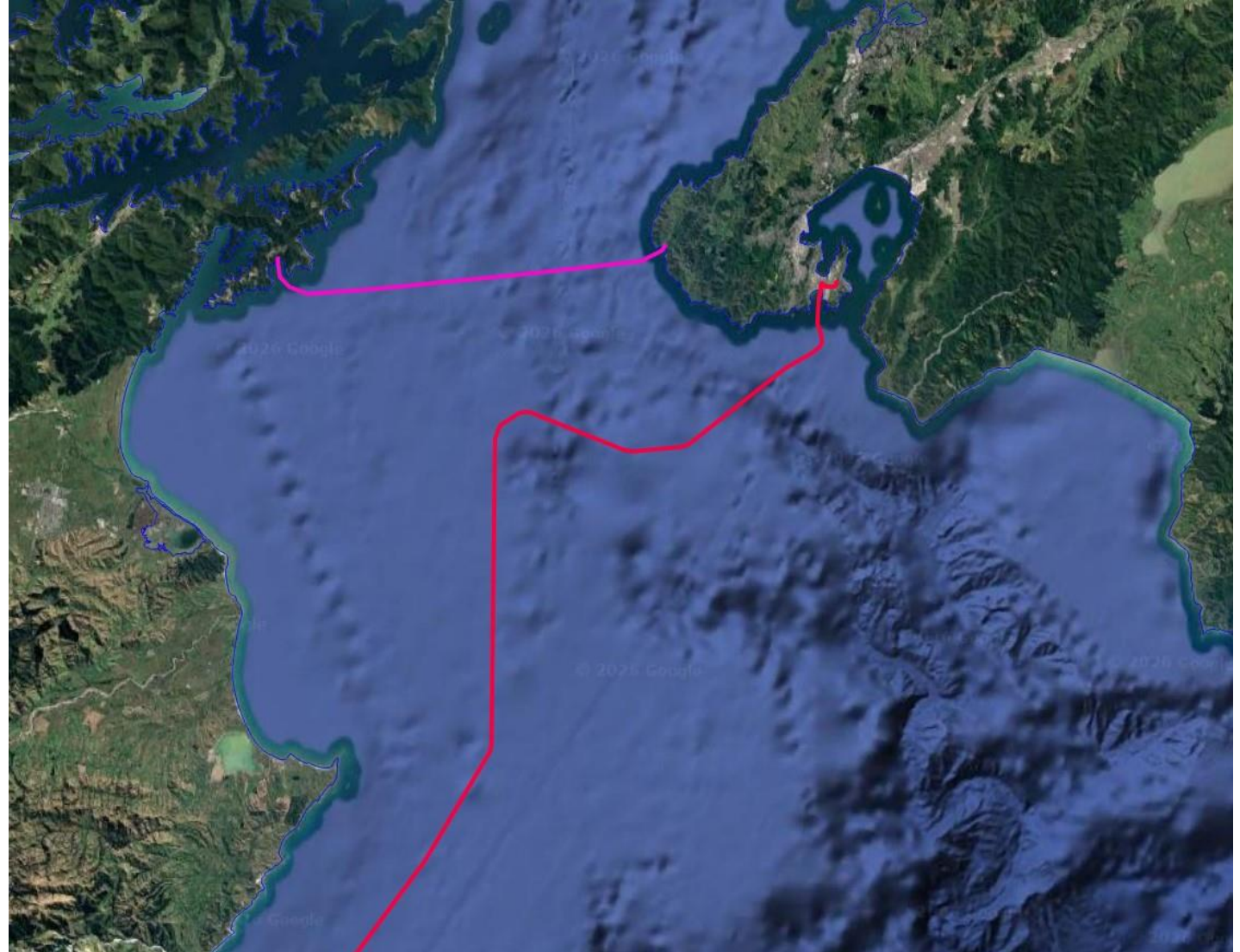
Eon Fibre Aqualink Cable (One NZ)
Lyall Bay to Kaikoura (185 km)

Transpower Cable
Oteranga Bay to Ōraumoa/Fighting Bay (32 km)

Critical communications infrastructure

Transpower cable is within the
DC cable protection corridor
Damaged during Kaikoura earthquake and
Replaced

Eon Fibre Aqualink un-affected by the Kaikoura
earthquake



Project Scope

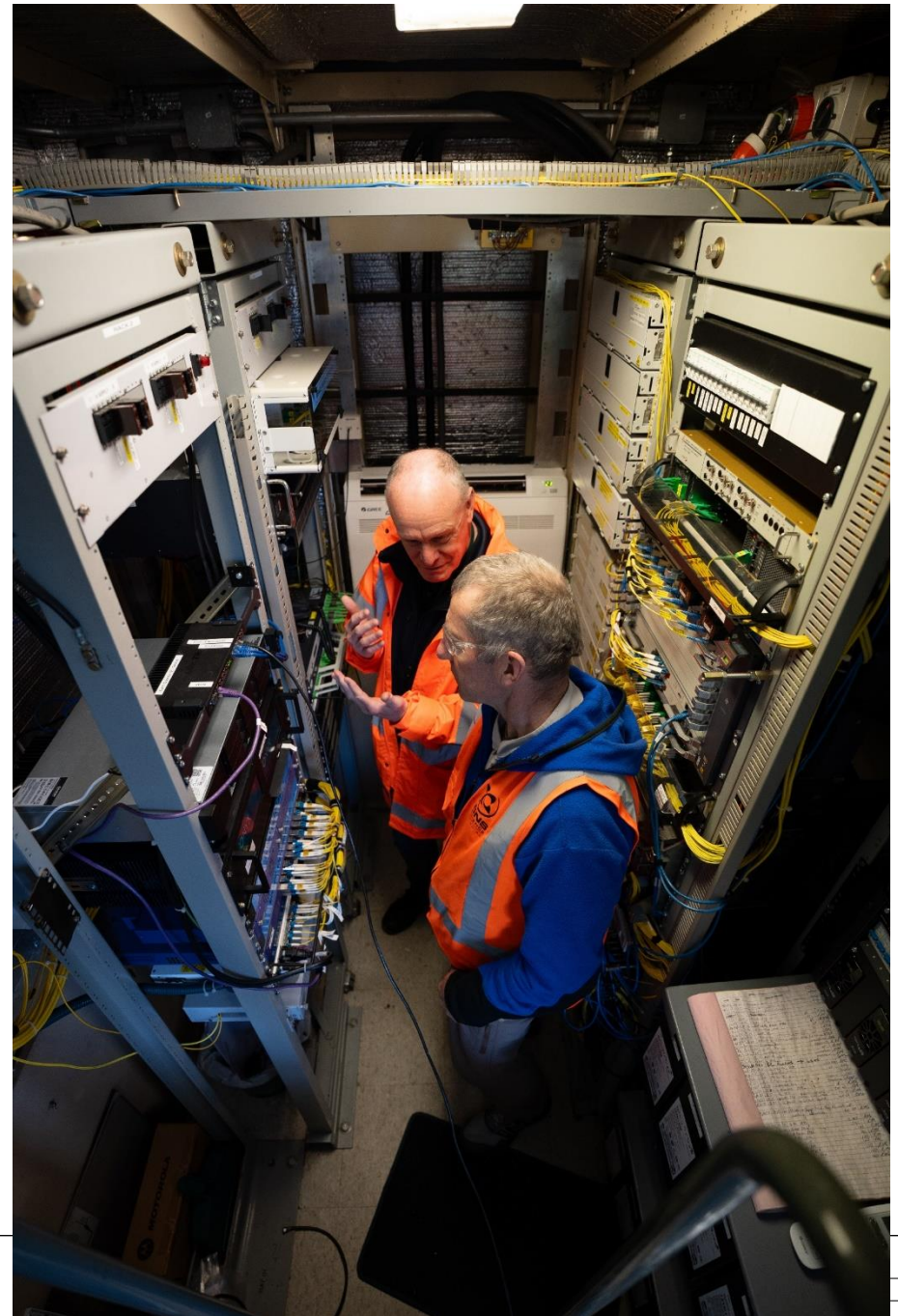
Fibre optic sensing on submarine cables is key to understanding the risks to critical communications and security assets

The cables provide access to hard-to-instrument areas on the seafloor

- Observe earthquakes
- Identify oceanographic and sediment transport signals
- Image shallow depths around the cable
- Image deeper structure using the Tangaroa airgun signals

ESNZ in partnership with other fibre sensing groups in NZ and internationally took advantage of an opportunity to work on the Cook Strait cables to increase capability

Funding provided by LPIF, CDF, and Endeavour (NNW), Support from Eon Fibre



Cook Strait DAS : Project Time Line

Phase	From	To	Comment
Setup and Testing	13 Aug 2025	29 Aug 2025	Problem with damage to fibre
Passive Recording	30 Aug 2025	09 Oct 2025	500 Hz, 5092 channels, 1440 files/day
RV Tangaroa Survey	10 Oct 2025	20 Oct 2025	1000 Hz 5092 channels, 2 fibres 2880 files/day
Passive Tests	21 Oct 2025	24 Oct 2025	1 fibre, 10 km section, smaller gauge 1440 files/day

Interrogator rented from FiberLAB

Rest of gear purchased as a local resource

Simple installation in cabinet

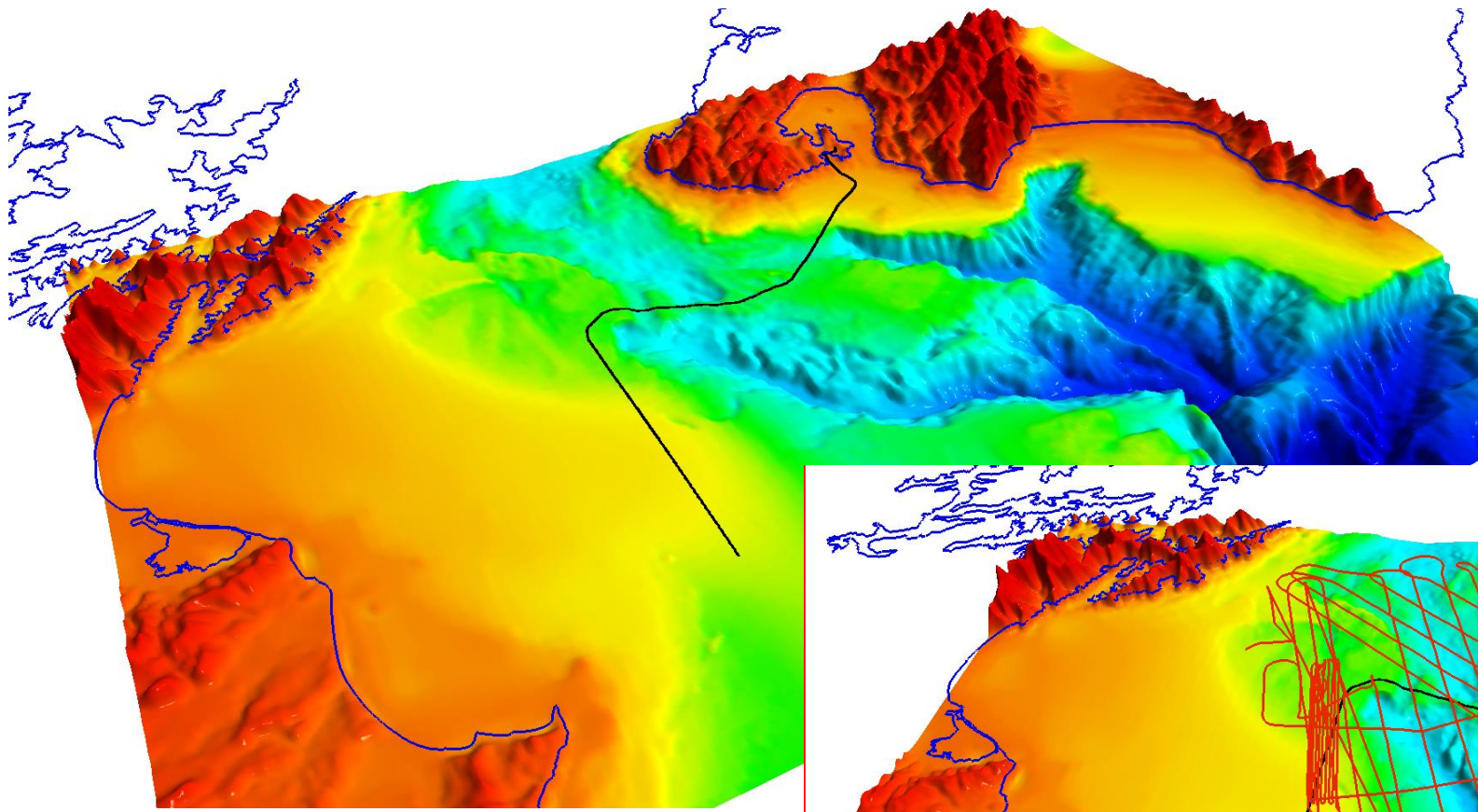
Good access to Sintela interface and NAS menus via internet

Able to monitor data, identify fault, change system parameters

Total data collected 96 TB

Working on 40 TB transferred to ESNZ storage





Final Cable Configuration

5092 channels

12.76 m channel spacing

20.71 m gauge length

64.97 km of cable active

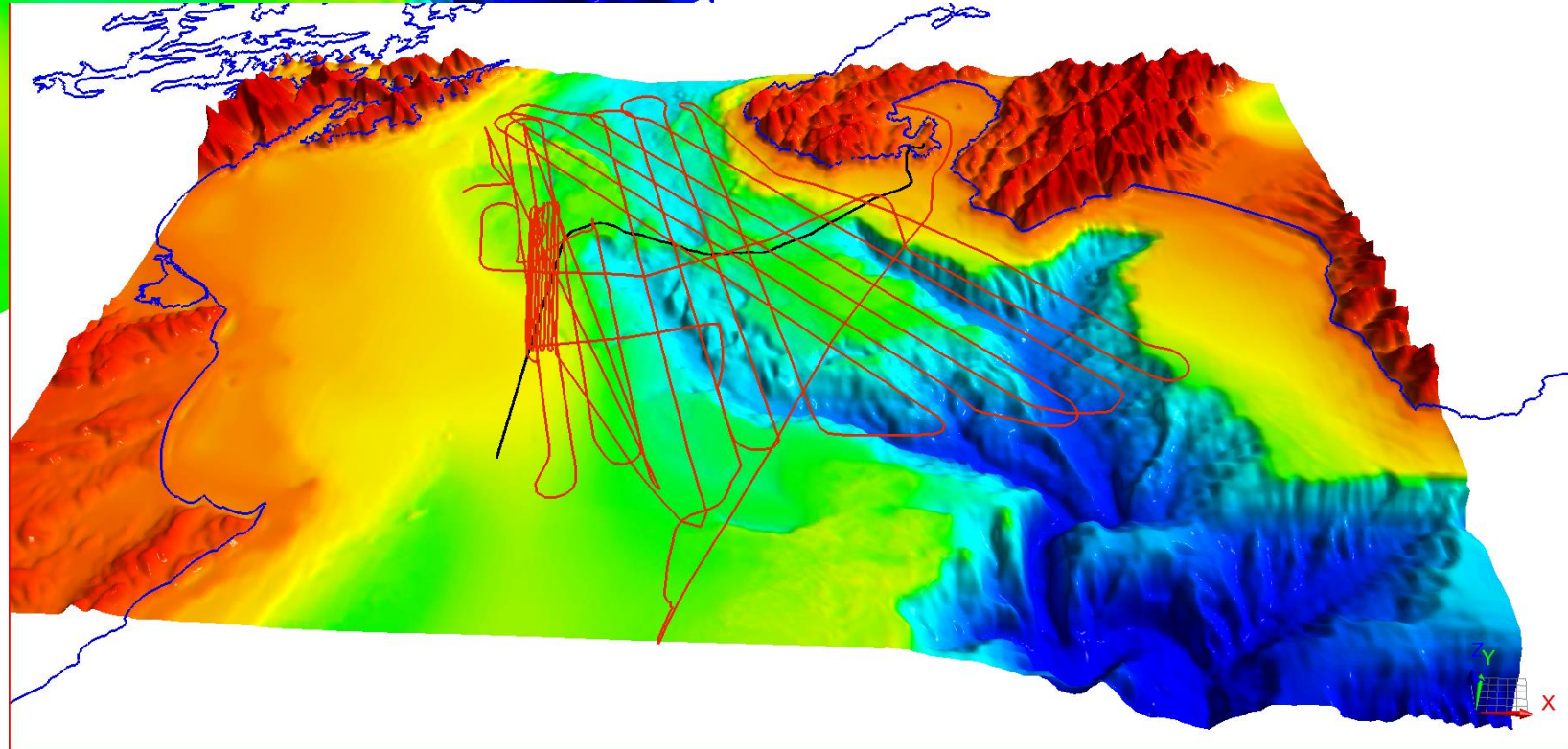
RV Tangaroa Seismic Survey

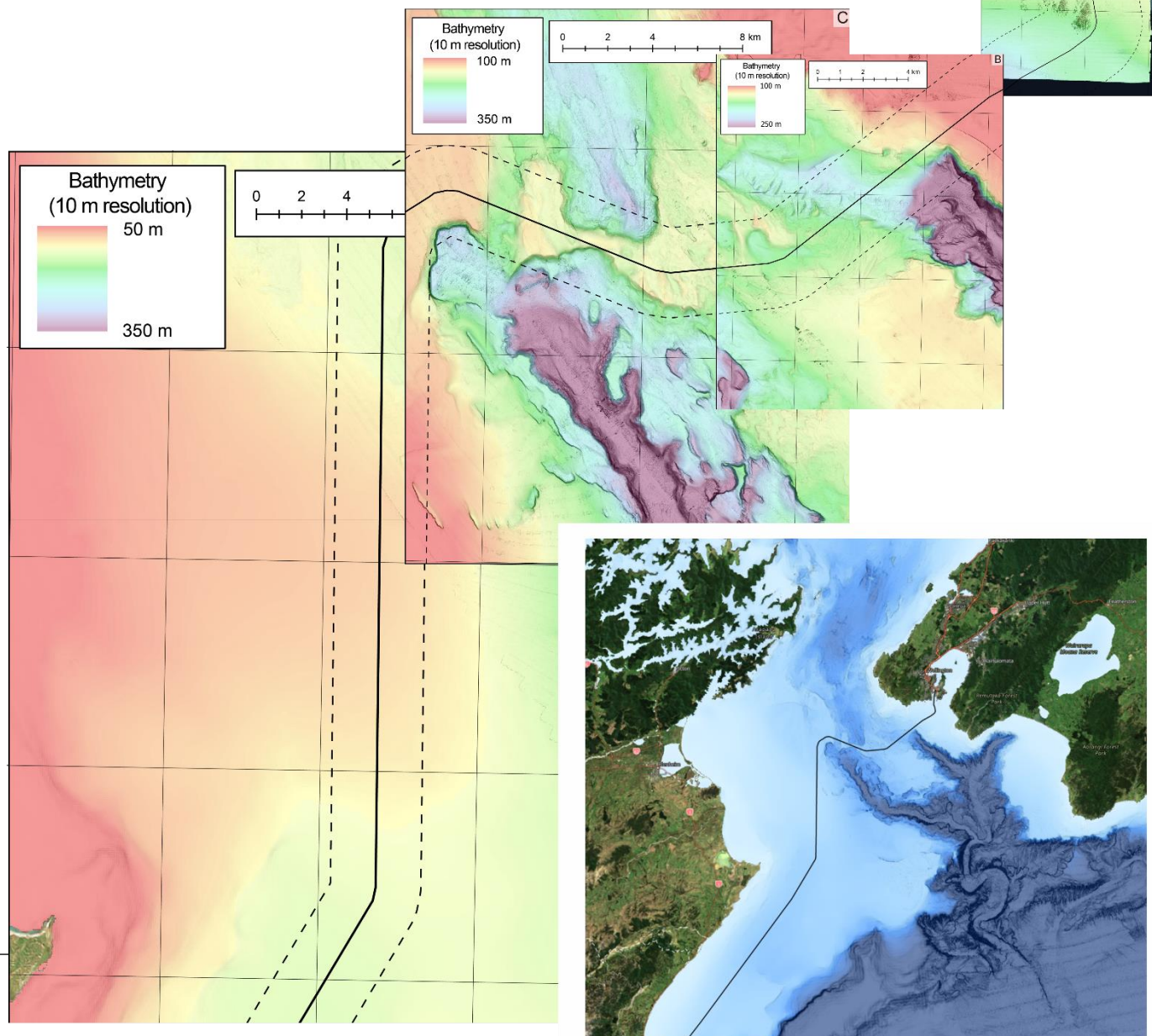
33 Lines

20 crossing over cable

79,000 airgun shots at 7 s intervals

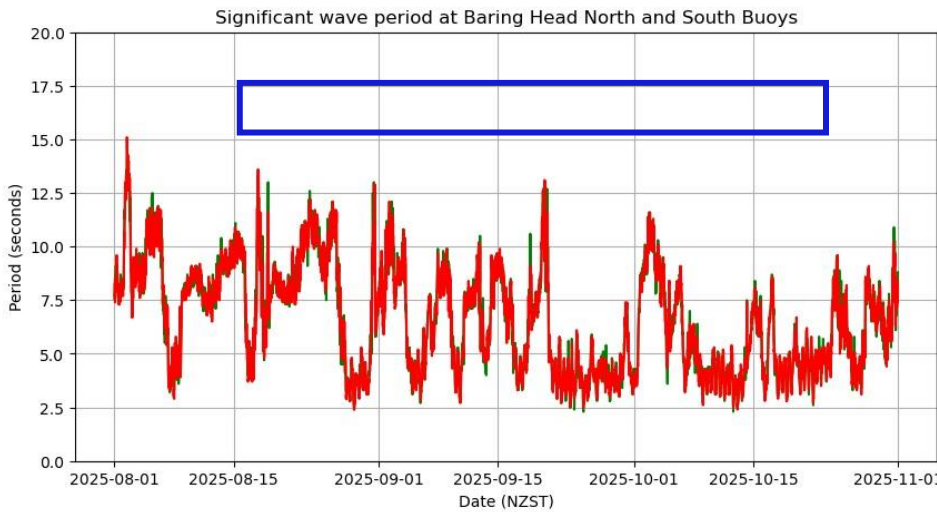
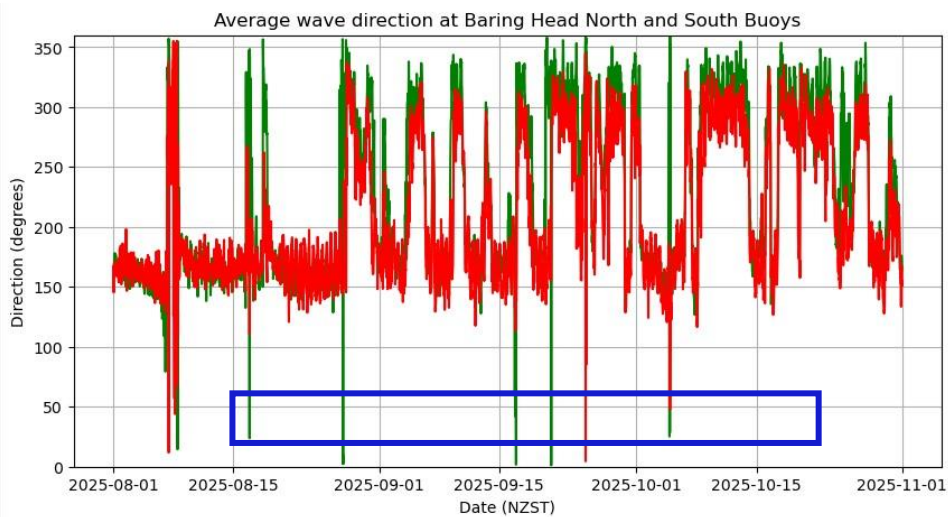
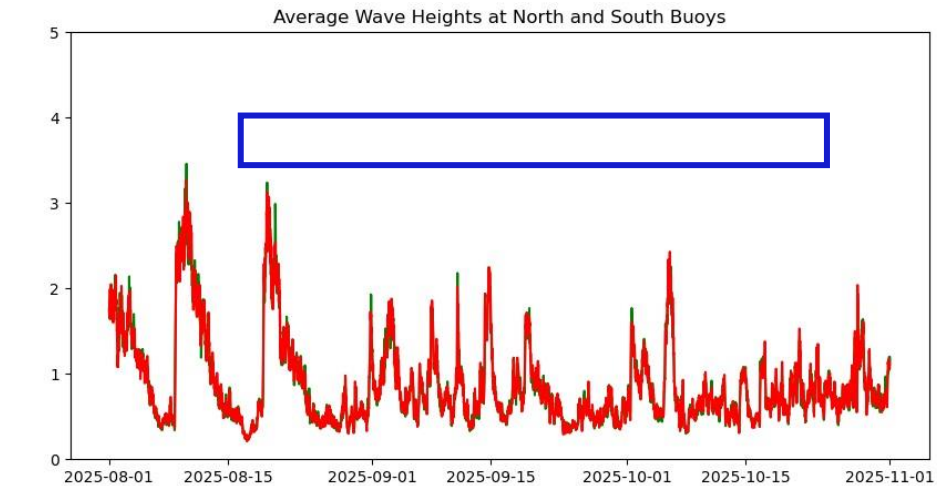
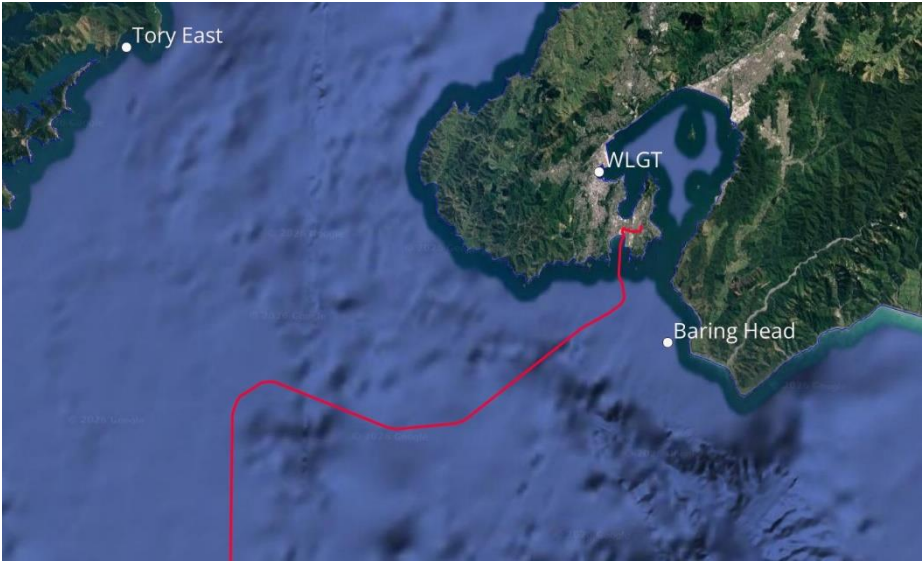
2 sections of the cable were overshot
for seabed cable 2D processing (34 km)



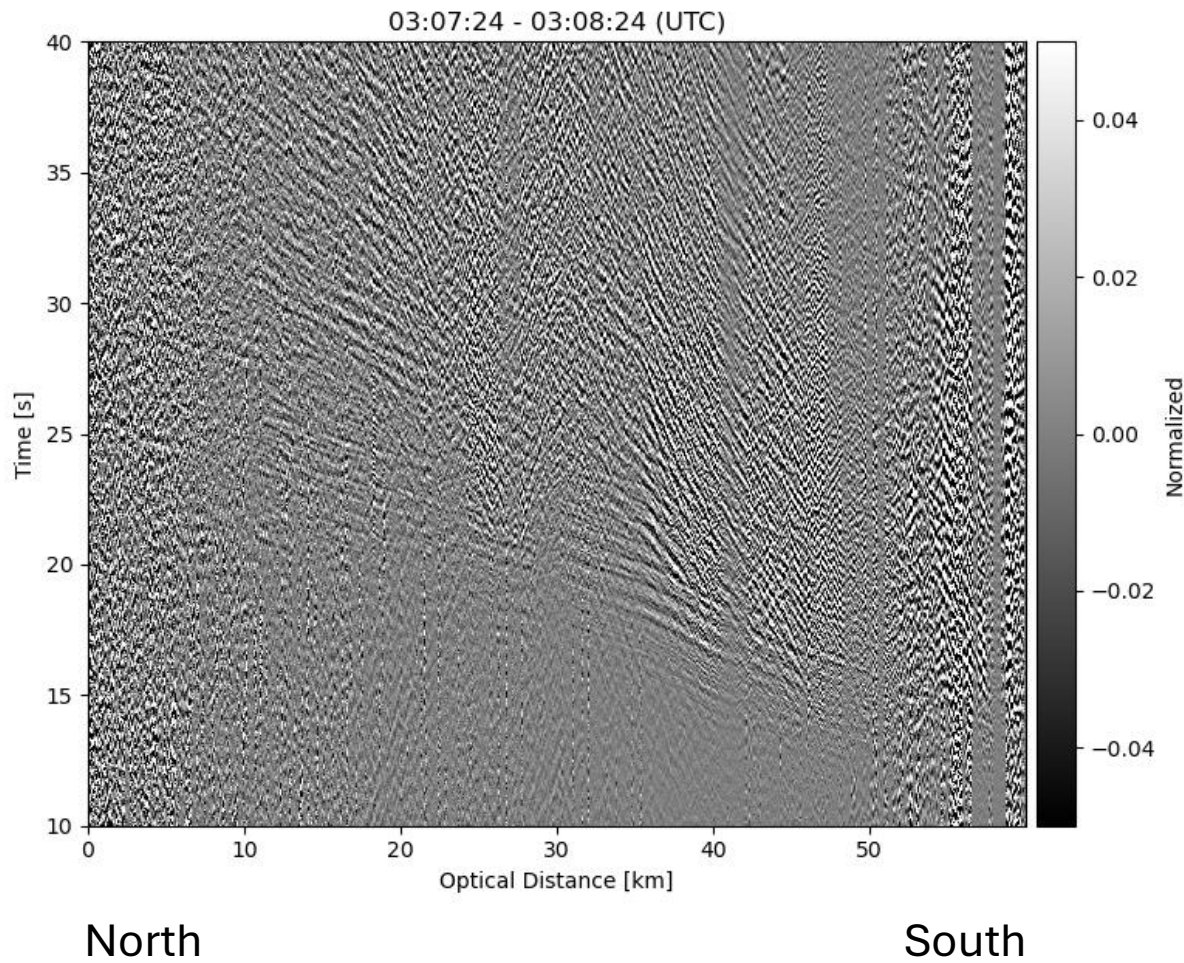
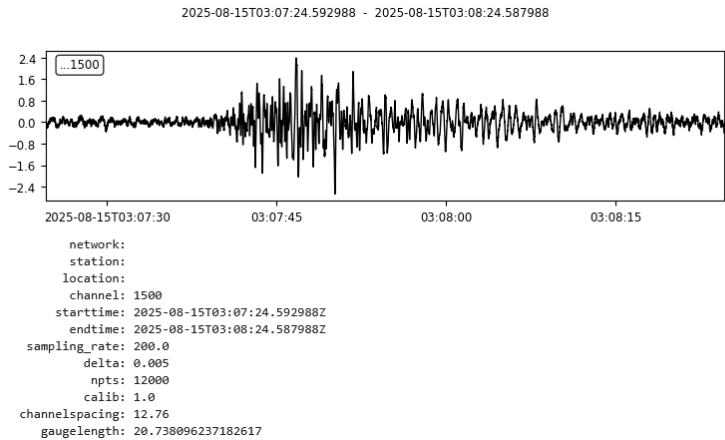
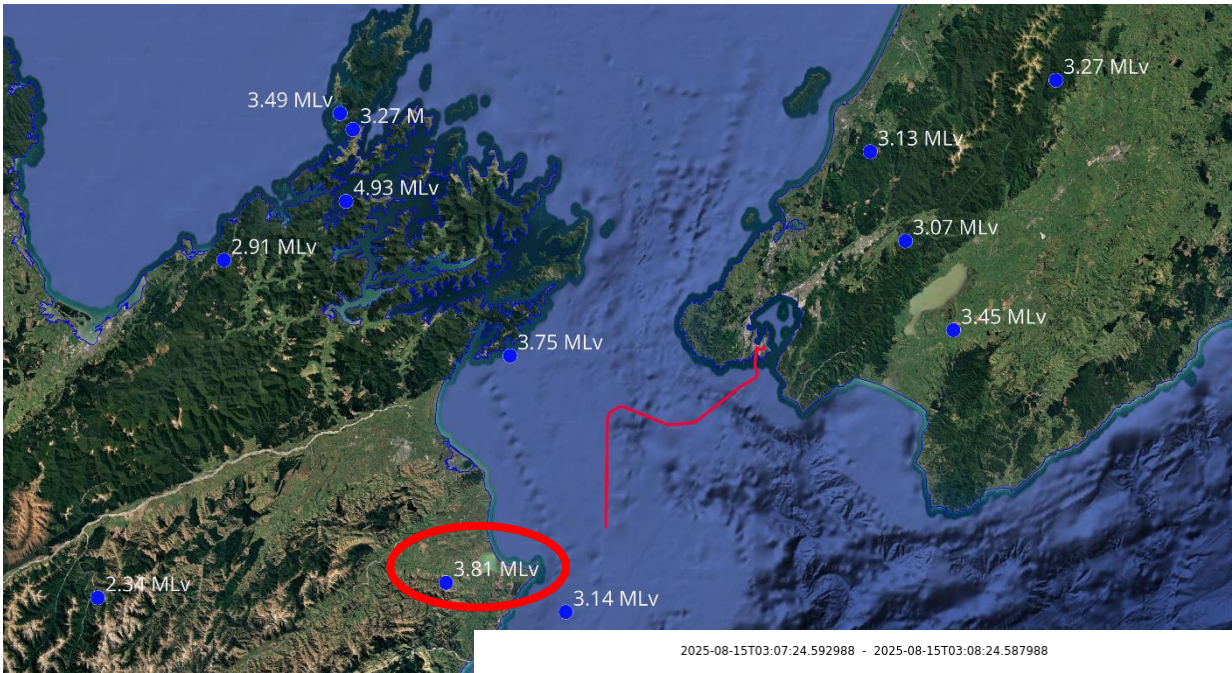


Supporting data

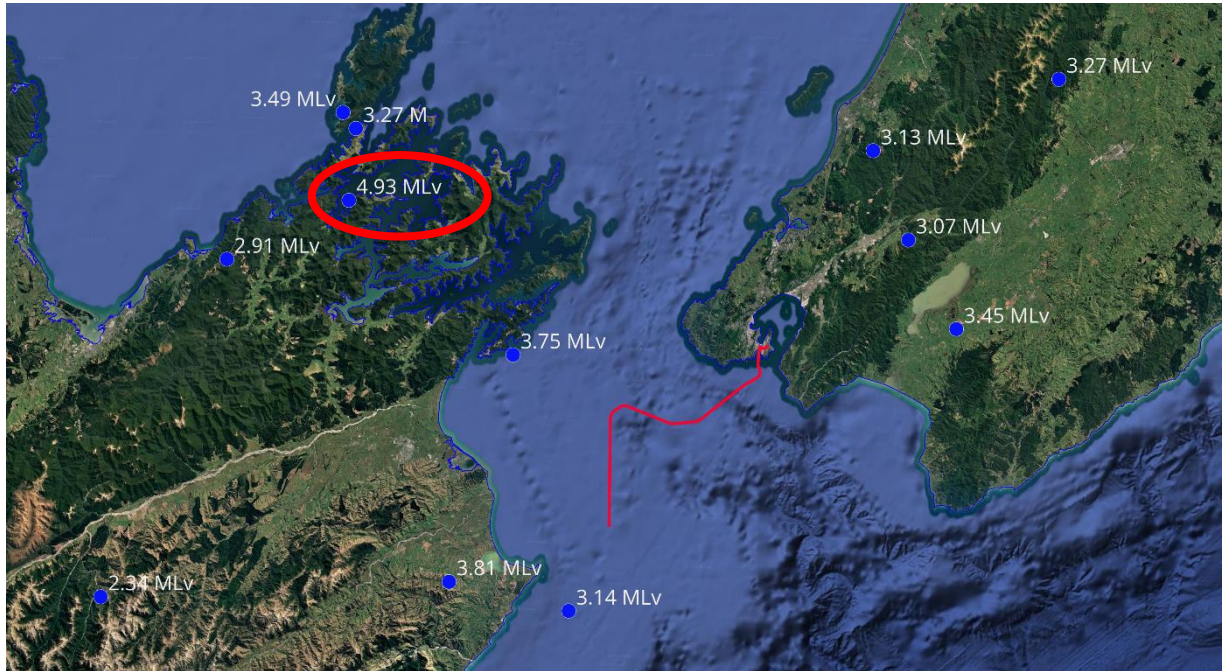
Wave buoys at Baring Head and Tory Channel E
Tide gauge in Wellington Harbour
Underway data from RV Tangaroa during voyage



Earthquakes



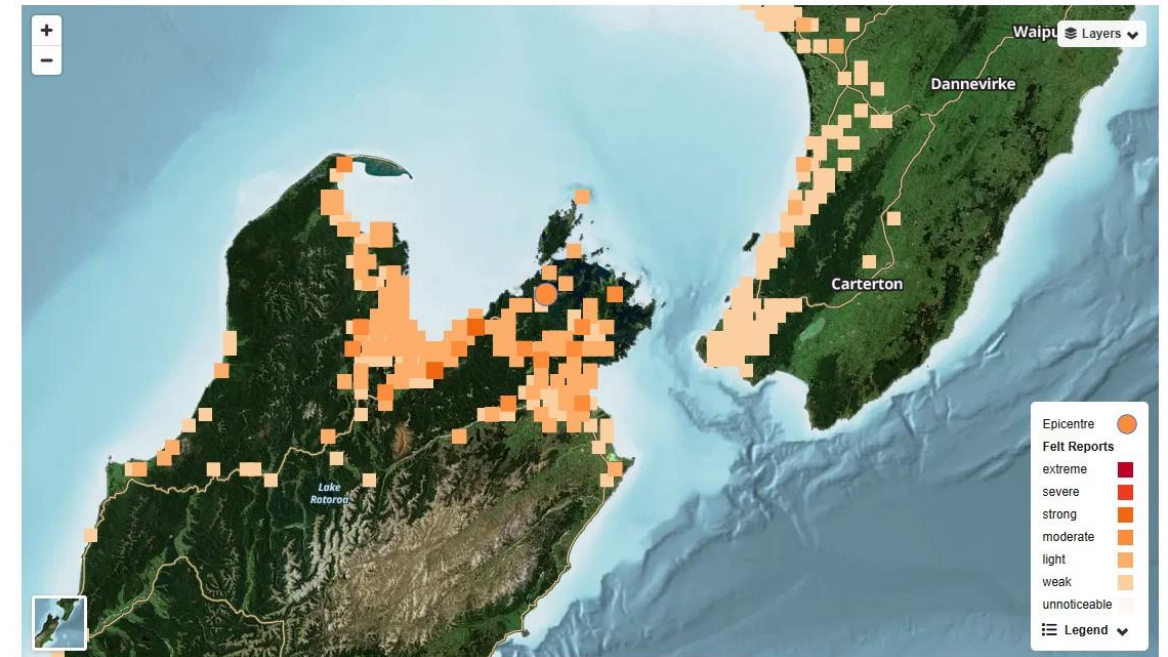
Earthquakes



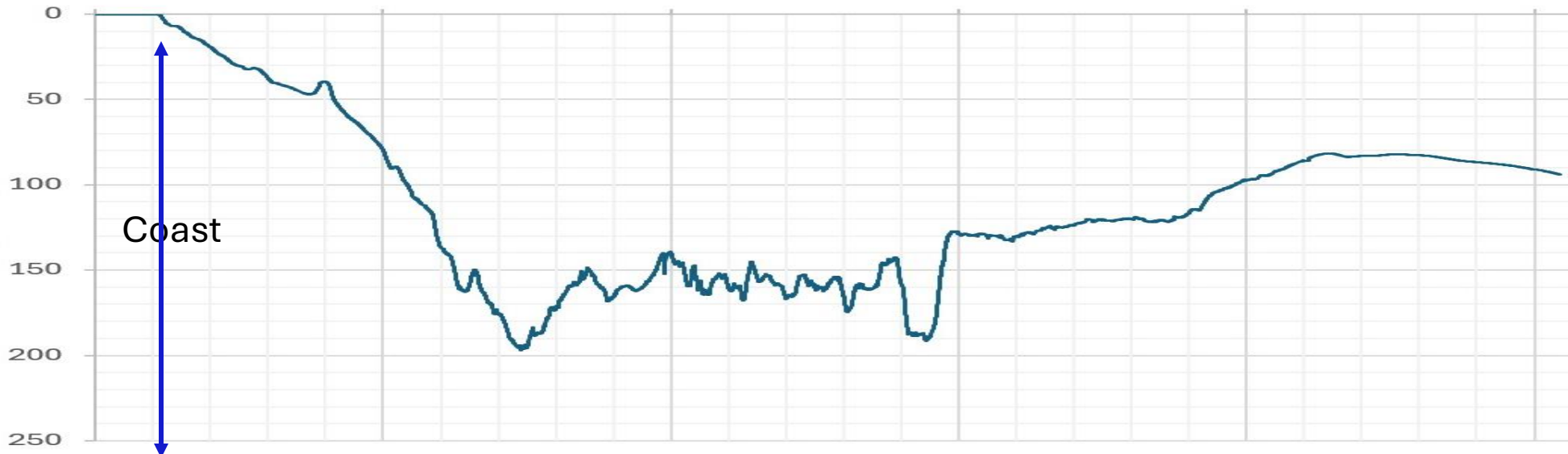
Fibernsense Wellington Loop was active at the same time.

49 events $M > 3$ and within 150 km of Wellington recorded on terrestrial fibre

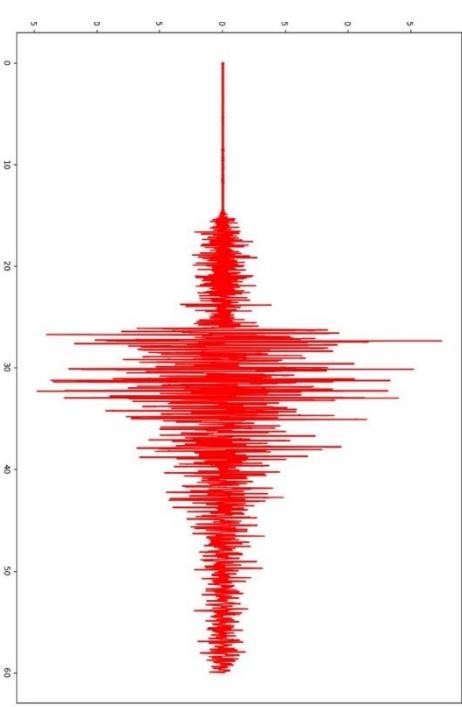
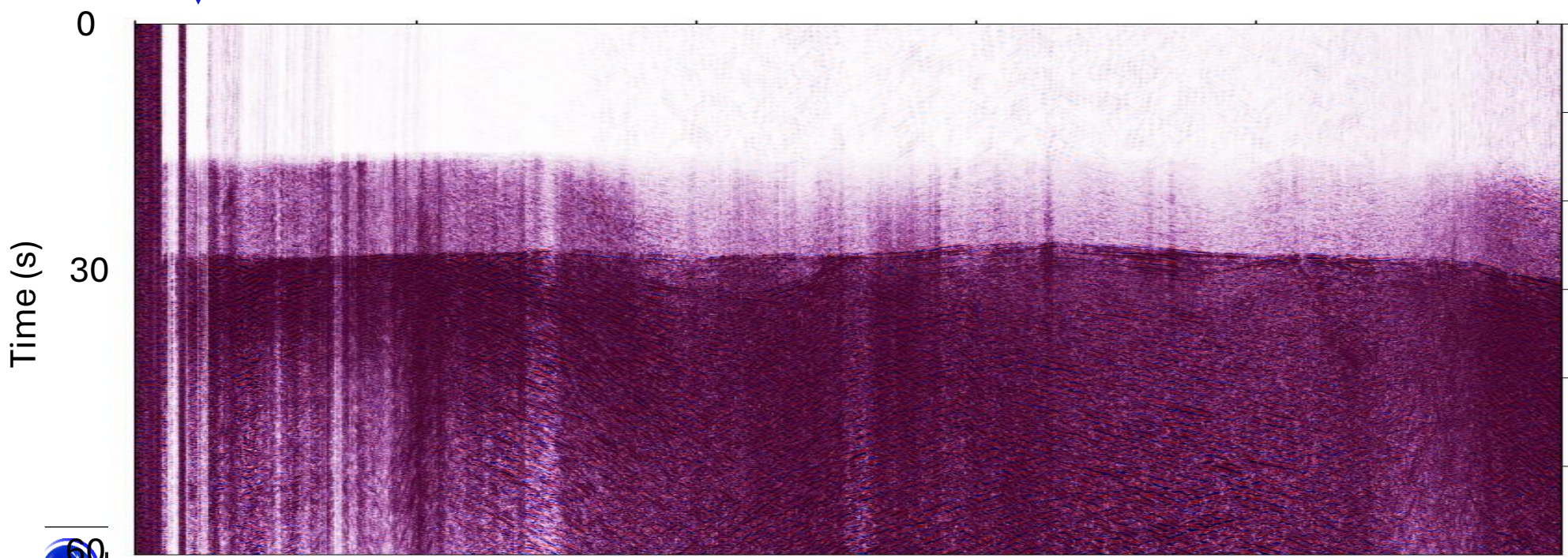
Magnitude 4.9, Sat Aug 30 2025 11:31 PM

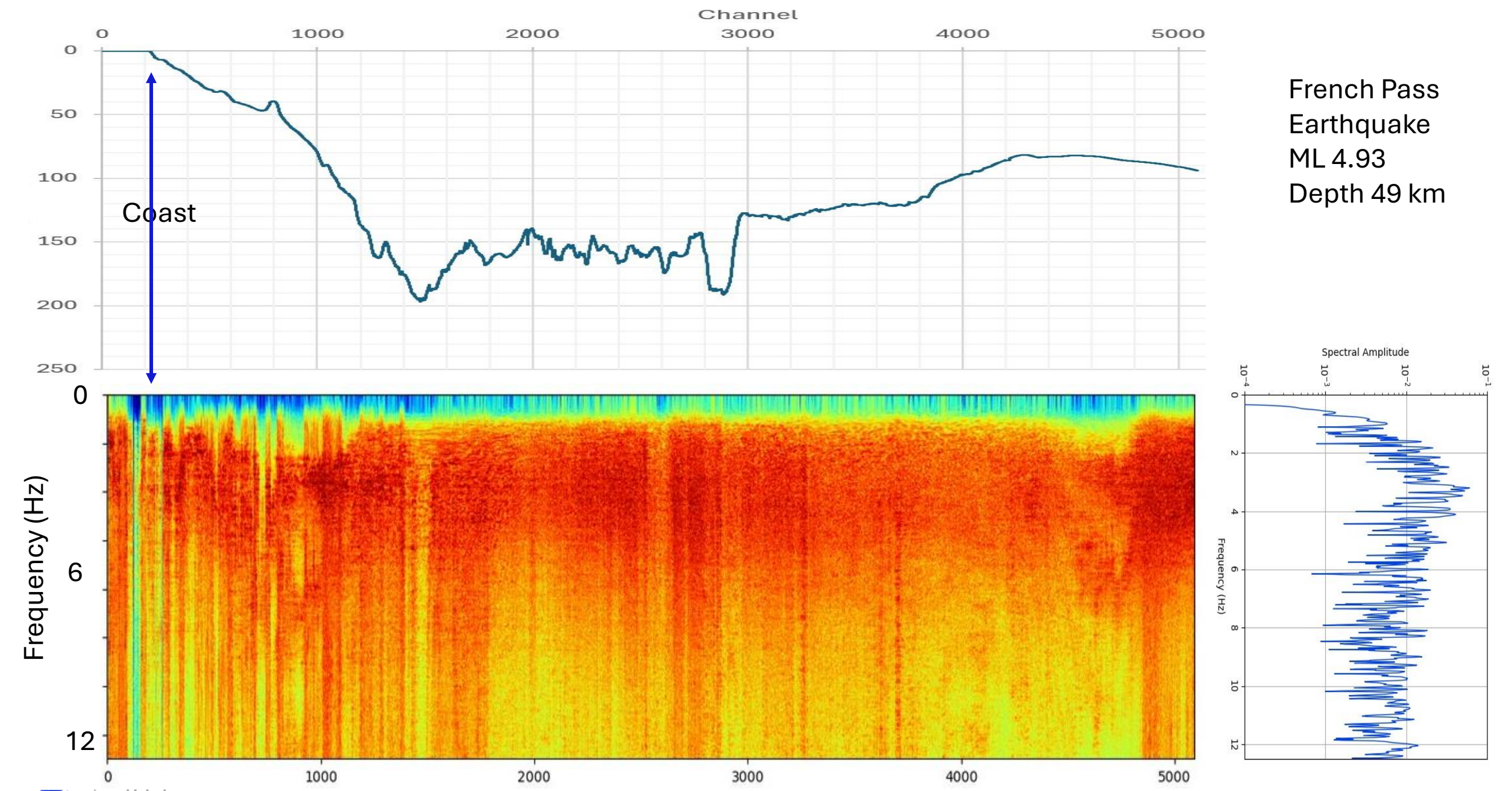


North 0 1000 2000 3000 4000 5000 South



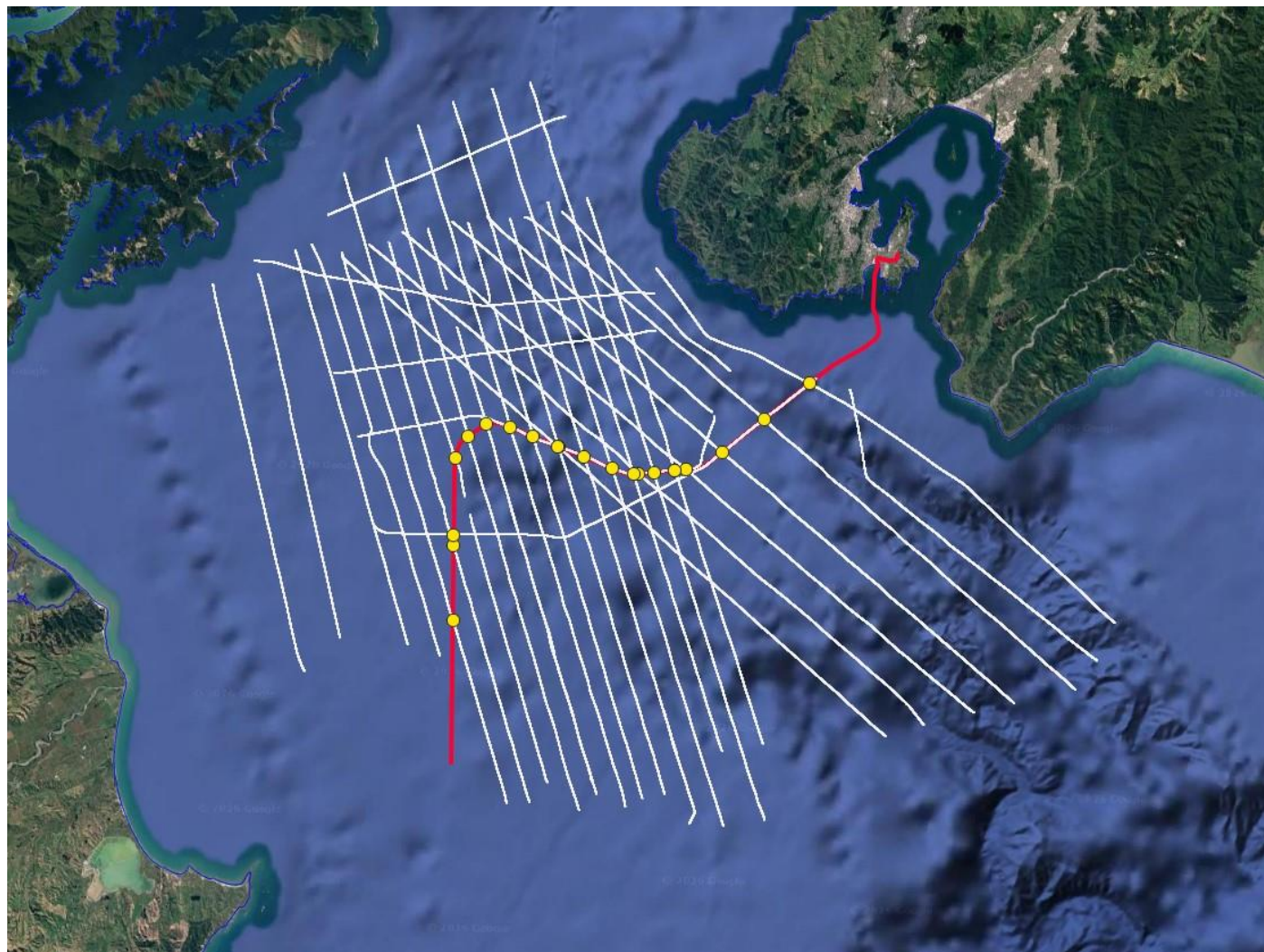
French Pass
Earthquake
ML 4.93
Depth 49 km





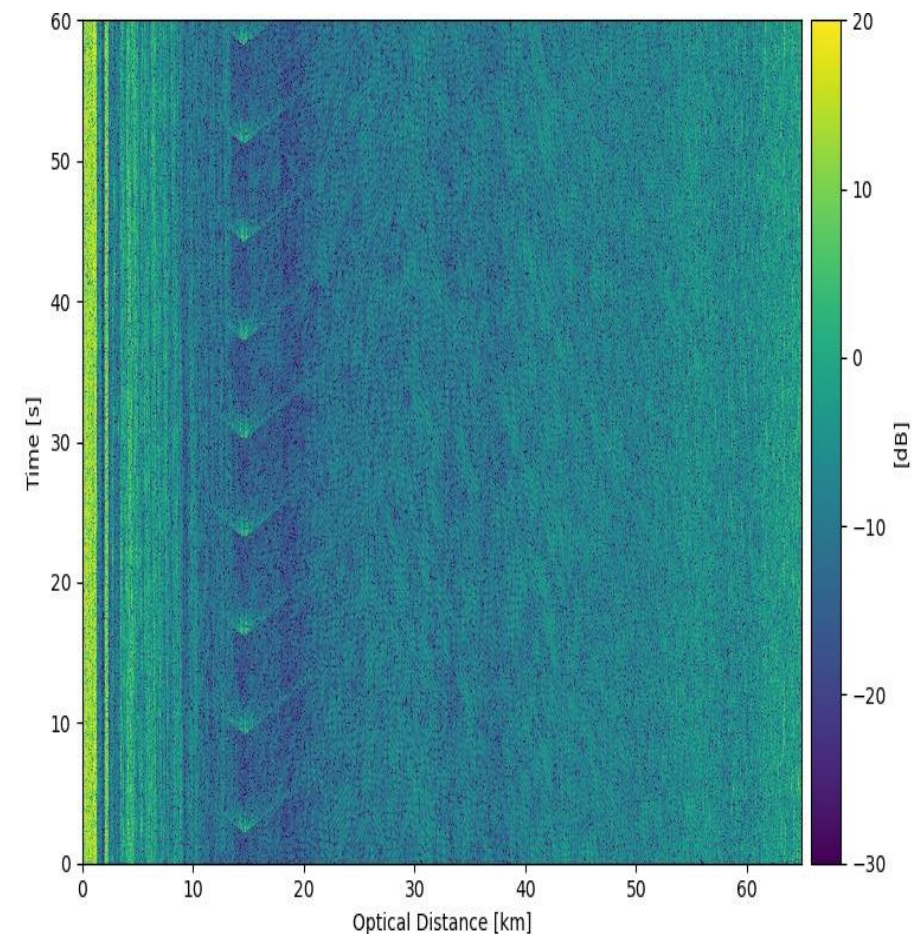
French Pass
Earthquake
ML 4.93
Depth 49 km

TAN2505 Airgun Survey

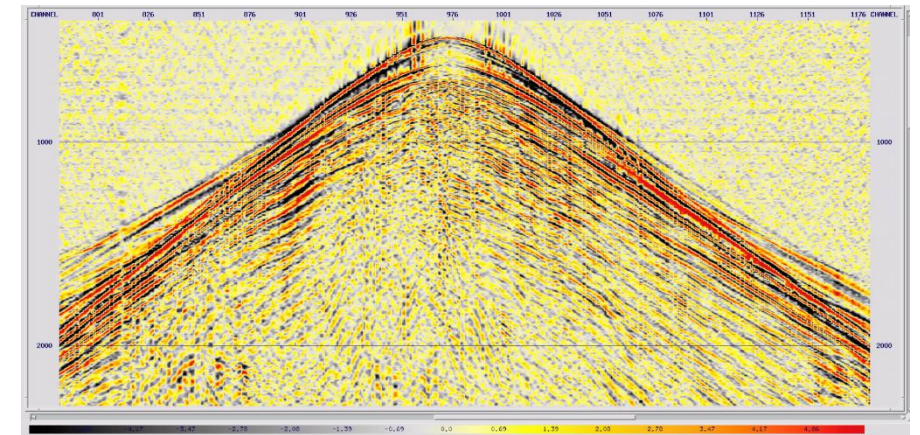
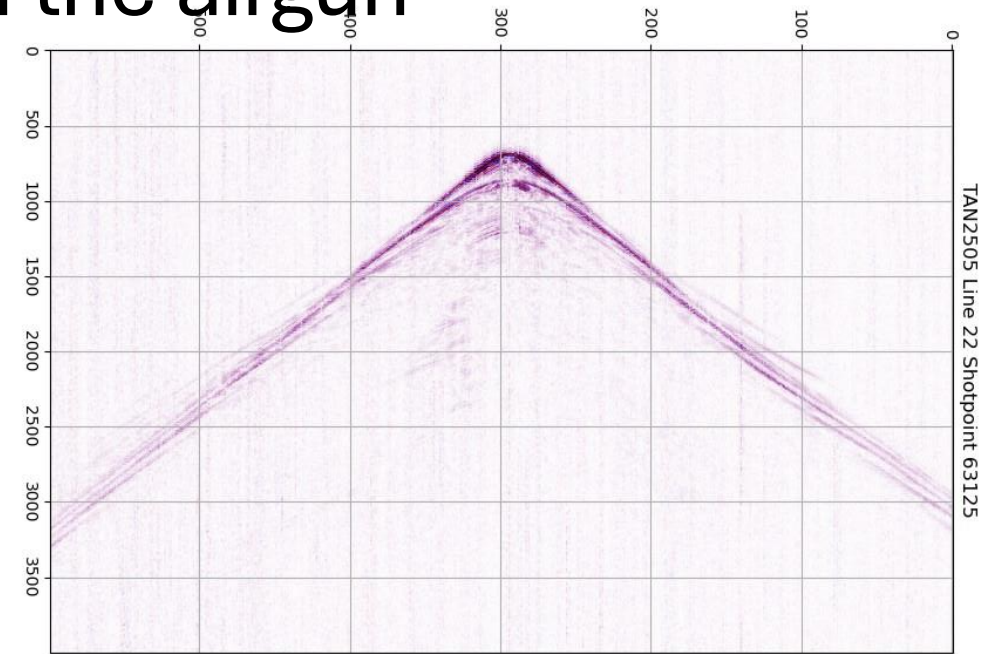
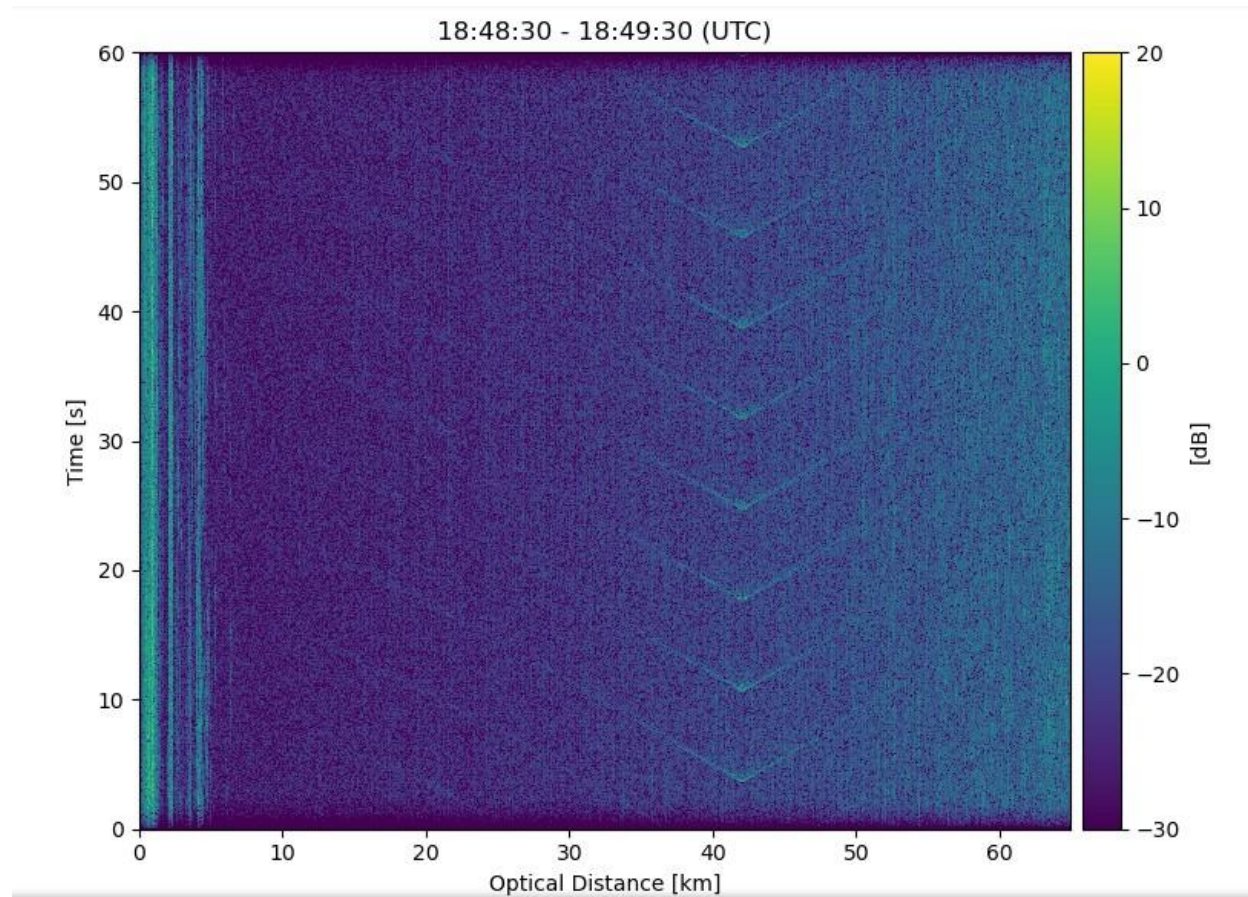


33 Survey Lines
7 second shot interval
79,000 shots

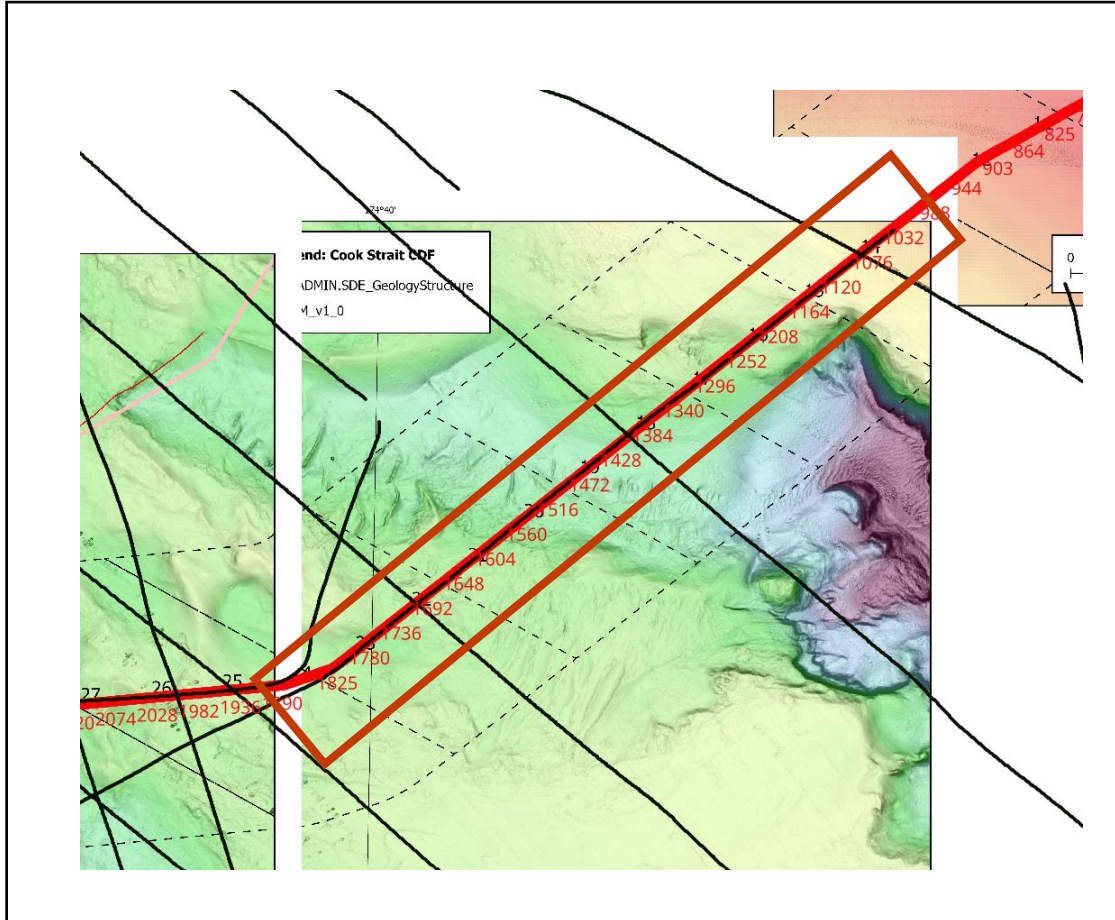
20 crossing points
2 sections of line shot
as a seabed cable geometry



Direct arrivals seen out to 30 km from the airgun



Next steps



Geophysical imaging around the cable
Natural sources
Tangaroa airgun shots
Sediment thickness
Faults

Feb 2027

RV Sonne SUB TRANS Experiment
Larger airgun array
Longer Offsets

Two Cables : Aqualink and Transpower