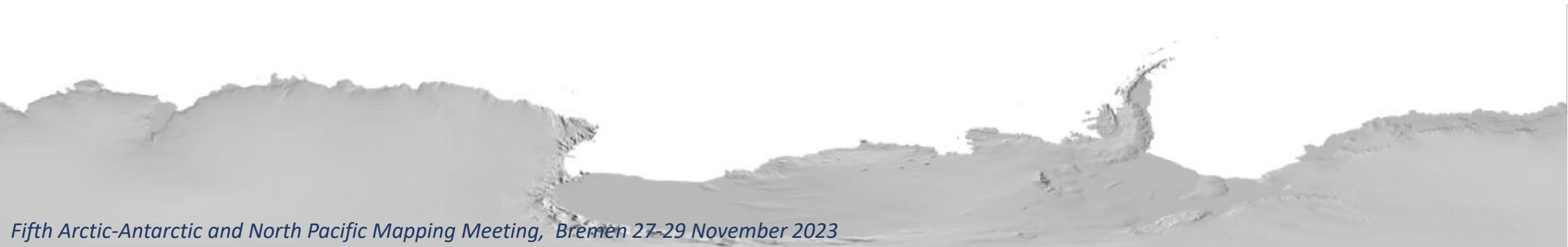


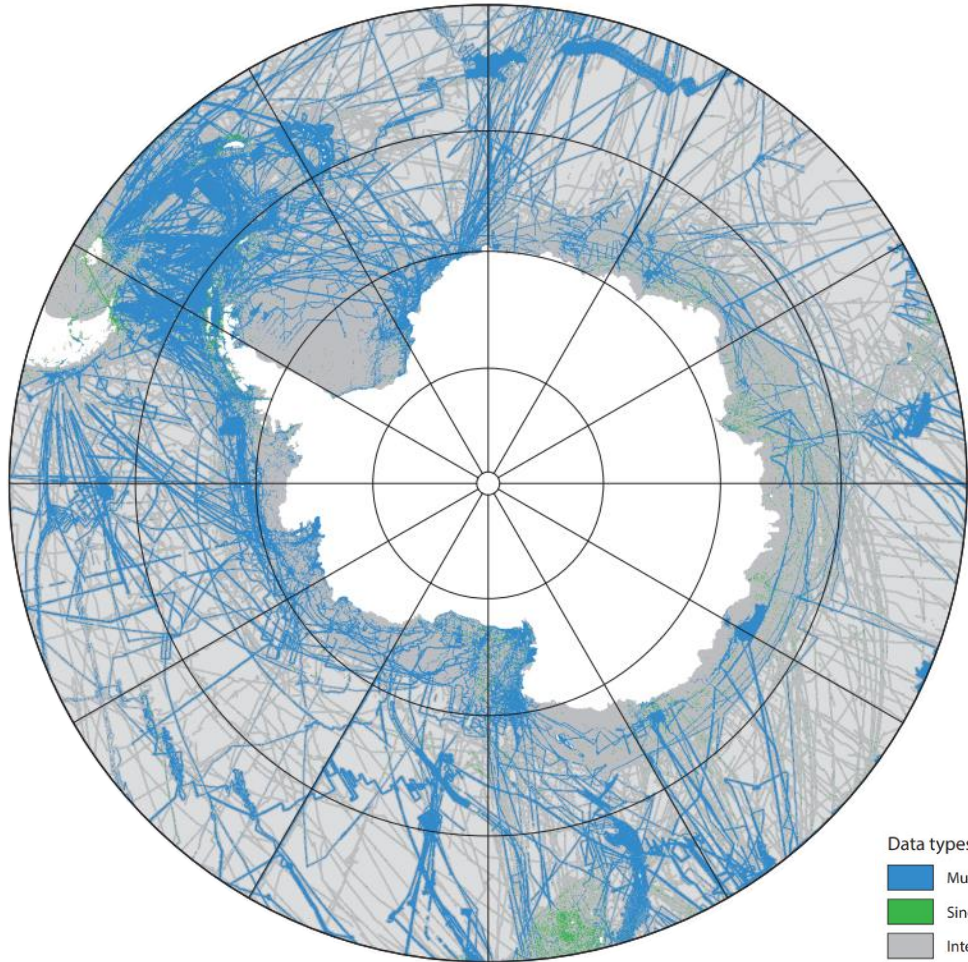
Advancing Cross-Disciplinary Frontiers in the Southern Ocean through Opportunistic MultiBeam Acquisitions



- ❑ *Laura Bassi Main Route and PNRA Activities in Antarctica*
- ❑ *ISOBatA Project Overview*
- ❑ *Some Results: Ross Sea (mooring B-G-H), Southern Ocean*
- ❑ *Conclusions*



Challenges and Breakthroughs



Data types (TID)

- Multibeam
- Singlebeam (various types)
- Interpolated data
- Predicted bathymetry

IBCSO V2: Dorschel et al 2022



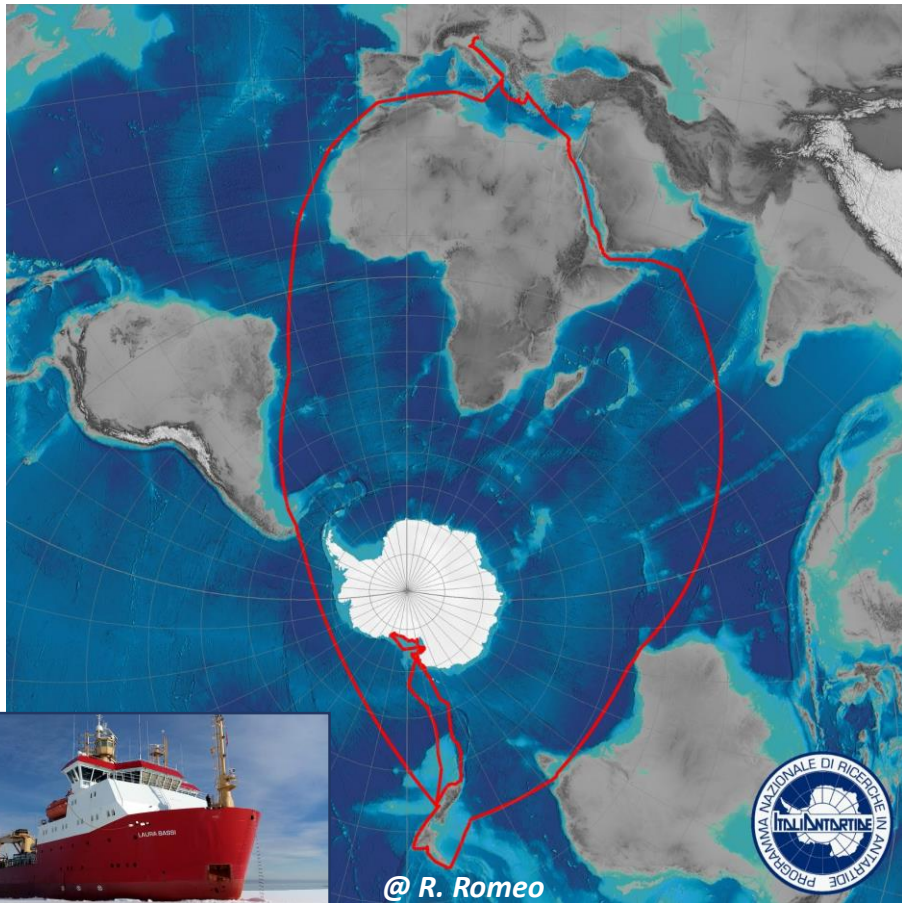
IBCSO Cell size 500m x 500m:

22.32%: MBES coverage (datasets + transits)

1.47%: Other: echosounder, etc...

- ❑ Transits data “clusters” along Icebreakers main routes >> redundant acquisitions
- ❑ Opportunistic acquisitions during oceanographic expeditions in Antarctica are strategically important for advancing cross-disciplinary frontiers
- ❑ Achieving the goals of Seabed2030 requires a targeted approach to optimizing opportunistic acquisitions for every vessel operating in Antarctica

Icebreaker Laura Bassi & PNRA Activities in Antarctica



Laura Bassi Travel Back & Forth Italy - Antarctica

- ☐ 90 days It-NZ-IT
- ☐ 14 days NZ-MZS-NZ
- ☐ Antarctic activities (logistic and research)

Logistics:

- Provide logistical support and supply to MZS & Concordia
- Supply & Support to research activities in MZS & Concordia

Researches:

- Ross Sea – *MORSEA* Mooring Observatory Maintenance
- Research Projects

N/R Laura Bassi

ISOBatA Project Overview (1)

- ❑ Acquisition planning based on prior metadata to fill critical bathymetric gaps (key study areas) and “PNRA recurrent areas” lacking mapping
- ❑ Vessel Time => speed reduction (20%) and rerouting strategies.



Equipments (Acoustic)

- ❑ MB: Simrad EM304
- ❑ Topas PS 18
- ❑ ADCP 150 Khz

Equipments (Others)

- ❑ Mag. SeaSpy
- ❑ Sound Velocity: MORSEA CTD- XBT

Metadata Used For Planning:

- ❑ Previous PNRA MBES datasets.
- ❑ IBCSO Coverage (*Dorschel et al 2022*)
- ❑ MCS SDL Navigation
- ❑ Previous PNRA Cores-Box Cores
- ❑ Mooring Sites

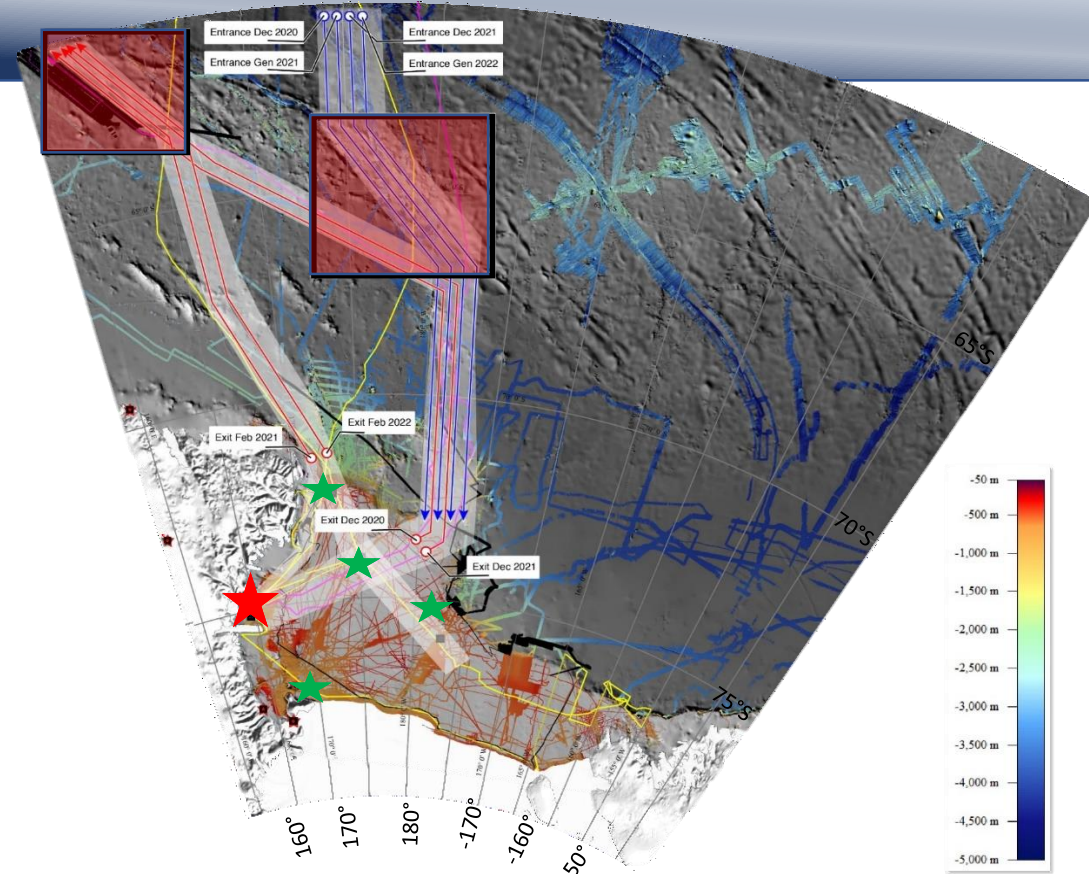
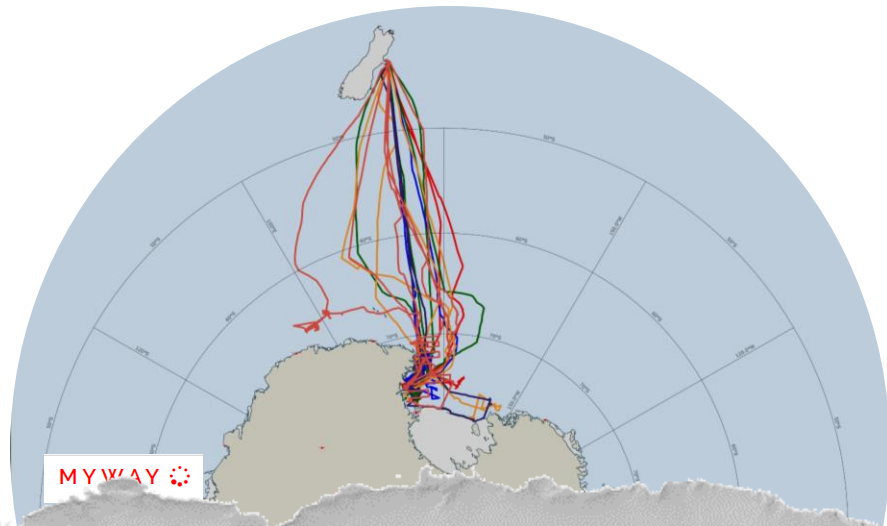
ISOBatA Project Overview (2)

White: ISOBatA acquisitions corridors (2021 SurveyPlan).

Area in colors: existing Ross Sea MBES bathymetric coverage

Blue lines: routes from NZ to MZS, passing across the eastern part of the MQ TJ (*Gasperini et al 2022*) and EFZ (East. black box)

Red lines: routes from MZS to NZ, passing across the western part of the Emerald Fracture Zone (West. black box).



Purple and yellow lines: XXXV & XXXVI R/V Laura Bassi ship-tracks.

Red Rectangles: Case Studies Area (MQ TJ & EFZ)

Black areas: 2017 OGS Explora bathymetric datasets.

Green Stars: active Italian mooring sites and Floaters.

Red stars: MZS Antarctic Stations.

ISOBatA acquisition Challenges & Opportunities

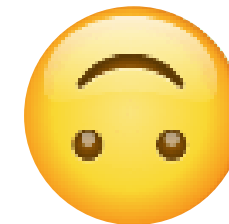


Southern Ocean:

QC & speed reduction to 8.5/9 Kn (-30%)
Mainly Time Consuming
EM304 is a 30 KHZ

Ross Sea:

Good Data
Mainly Opportunistic



Sound Velocity correction:

MORSea XBT & CTD



Ice along the route :

No: EM2040 & SV pole deployment

XXXVII: Seapath & Topas Break-down



Tests Opportunities

4000m depth EM304 (30 kHz)
swath is = 1 x depth

EA600 -TOPAS-MBES-EK80

Interferences: **multibeam priority**

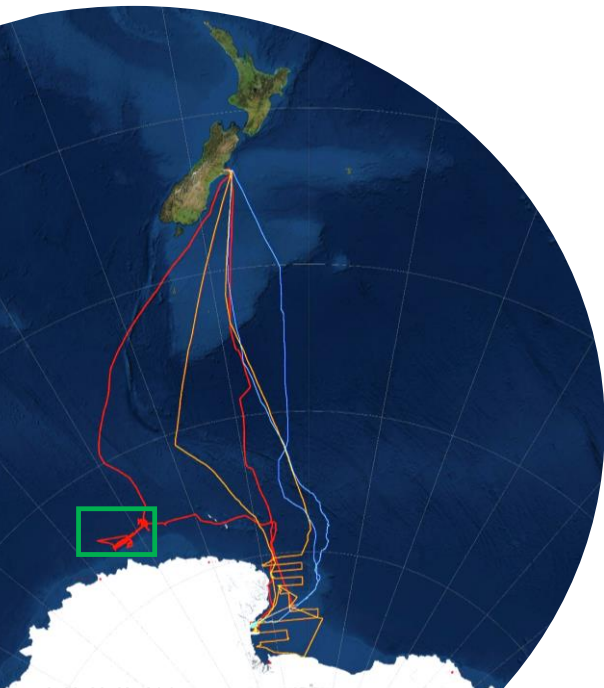


MBES Titanium Ice Shields
-20% signal strength

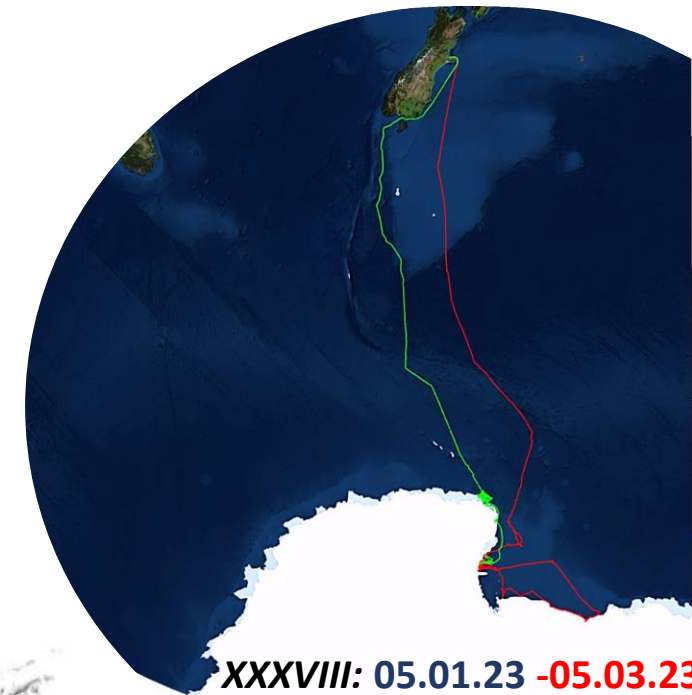
ISOBATA XXXVII & XXXVIII onboard activities:

Activities on board went beyond ISOBatA data collection:

- Realtime data sharing: (ISOBatA Open Data Policy) increased onboard collaborative approach and results:
 - LASAGNE–Edisto Bay (data collection, merge of ISOBATA, LASAGNE and GLEVORS data)
 - GRETA (data collection & use of ISOBATA dataset for planning)
 - COLLAPSE (data collection & use of ISOBATA dataset for planning)
 - BOOST (data collection and onboard QC)
 - DISGELI (data collection along MCS Line use of ISOBATA dataset for planning)
- ISOBATA team shared its expertise and engaged scientists on board fostering a culture of collective exploration and knowledge sharing as well as the Seabed 2030 initiative preventing data dispersion



XXXVII 04.12.21- 25.03.22

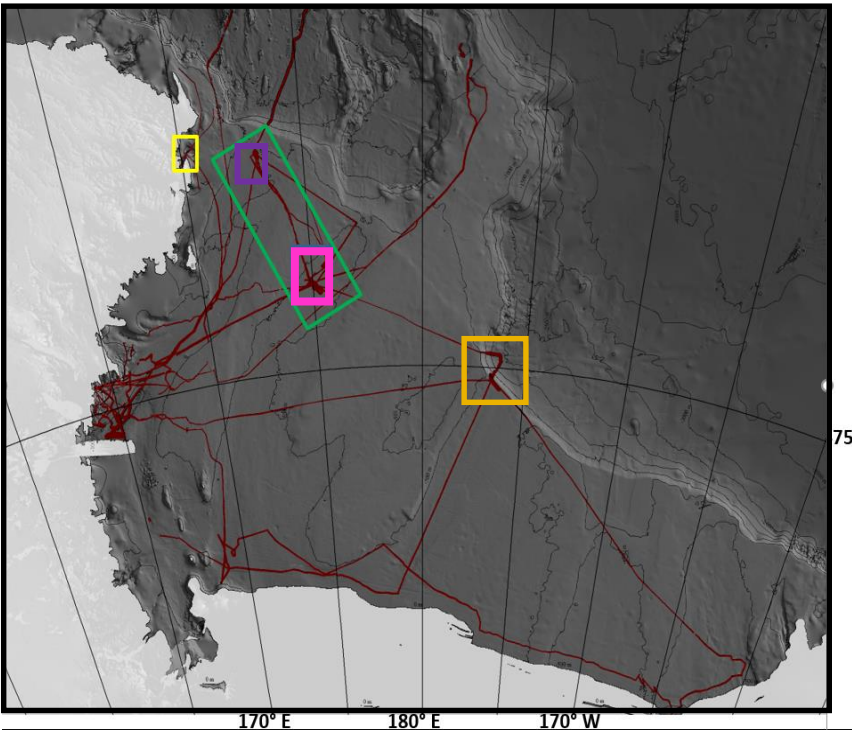


XXXVIII: 05.01.23 -05.03.23

Thanks to:

- IIM: thanks for 1° Leg night shifts & Knowledge exchange
- MORSea observatory projects for XBTs & CTDs!!!

Ross Sea: Mooring B Area



- MB: Simrad EM304
- Topas PS 18
- ADCP 150 Khz
- Sound Velocity: CTD MORSEA

IT Corers

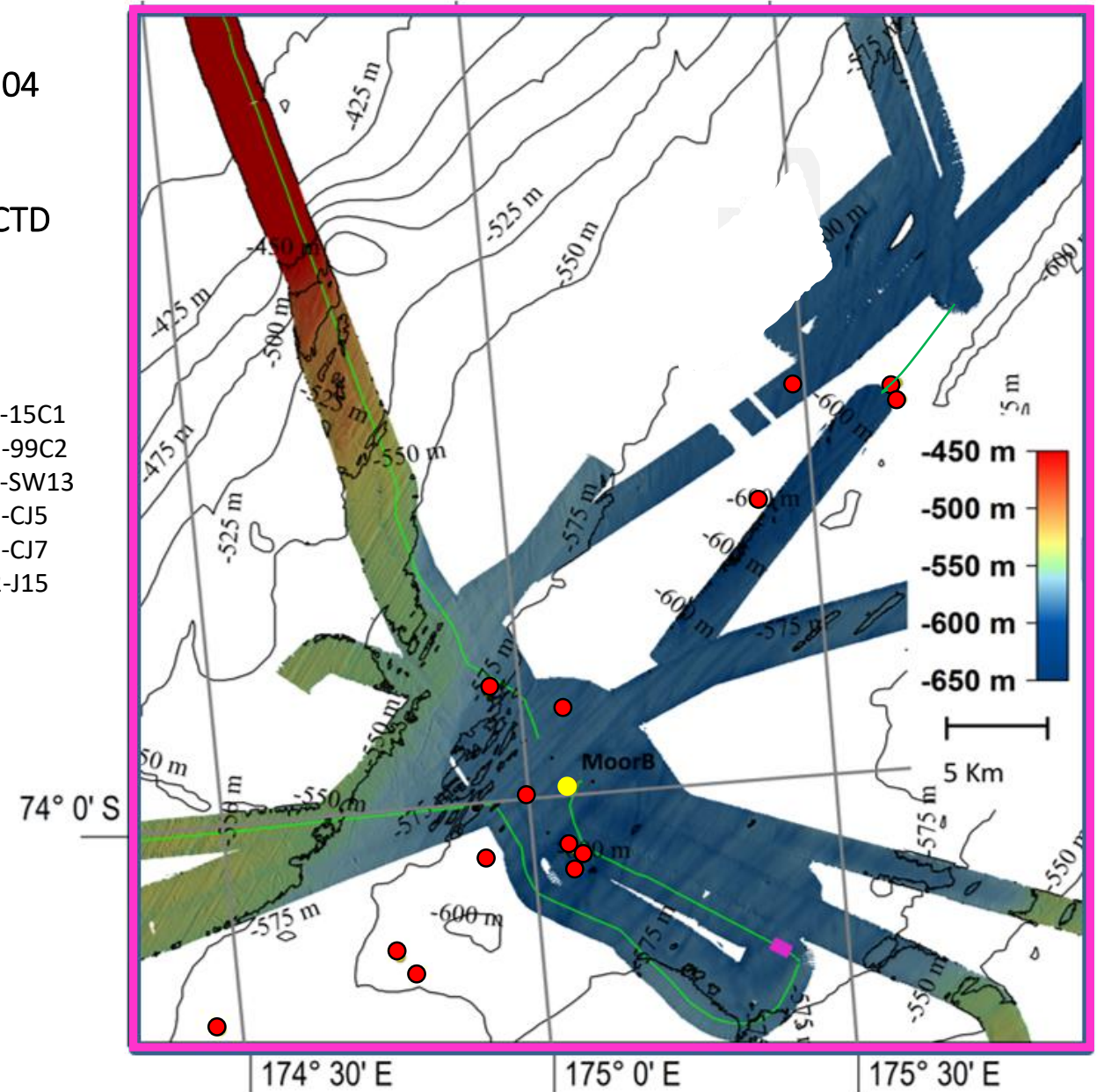
- ANTA91-14C
- ANTA95-15C1
- ANTA95-15C2
- ANTA95-99C2
- ANTA99-C12
- ANTA98-SW13
- ANTA99-CJ4
- ANTA99-CJ5
- ANTA99-CJ6
- ANTA99-CJ7
- ANTA99-CJ11
- ANTA02-J15
- XXXII_TR17-002PC

MOORING Areas:

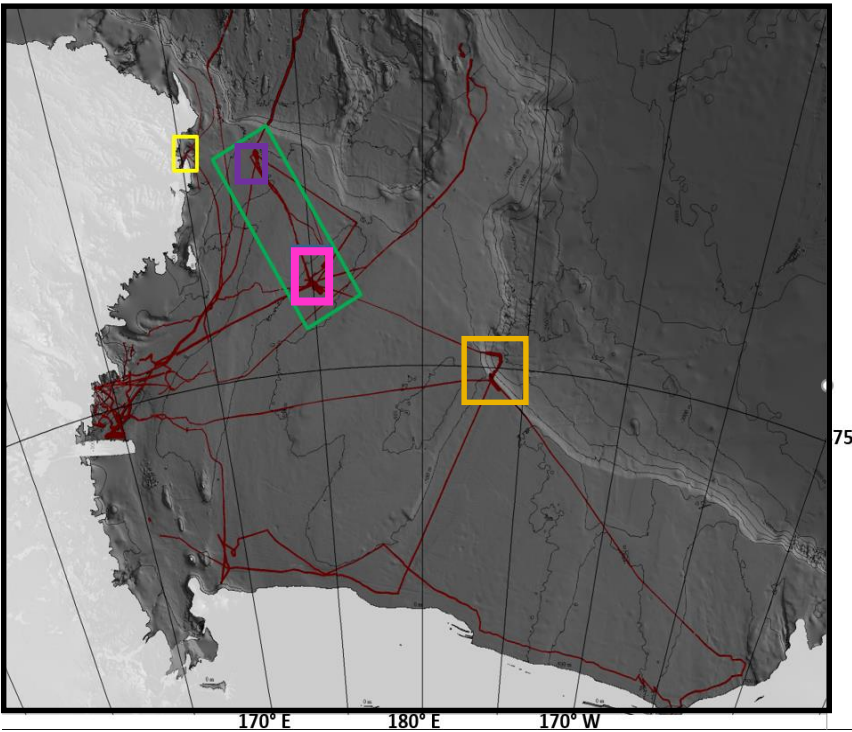
Metadata:

- MZS, Moor L
- Moor G
- Moor B
- Moor H
- Edisto B.

- Previous PNRA MBES datasets
- IBCSO Coverage
- SDL Navigation
- IT Cores & BoxCorers



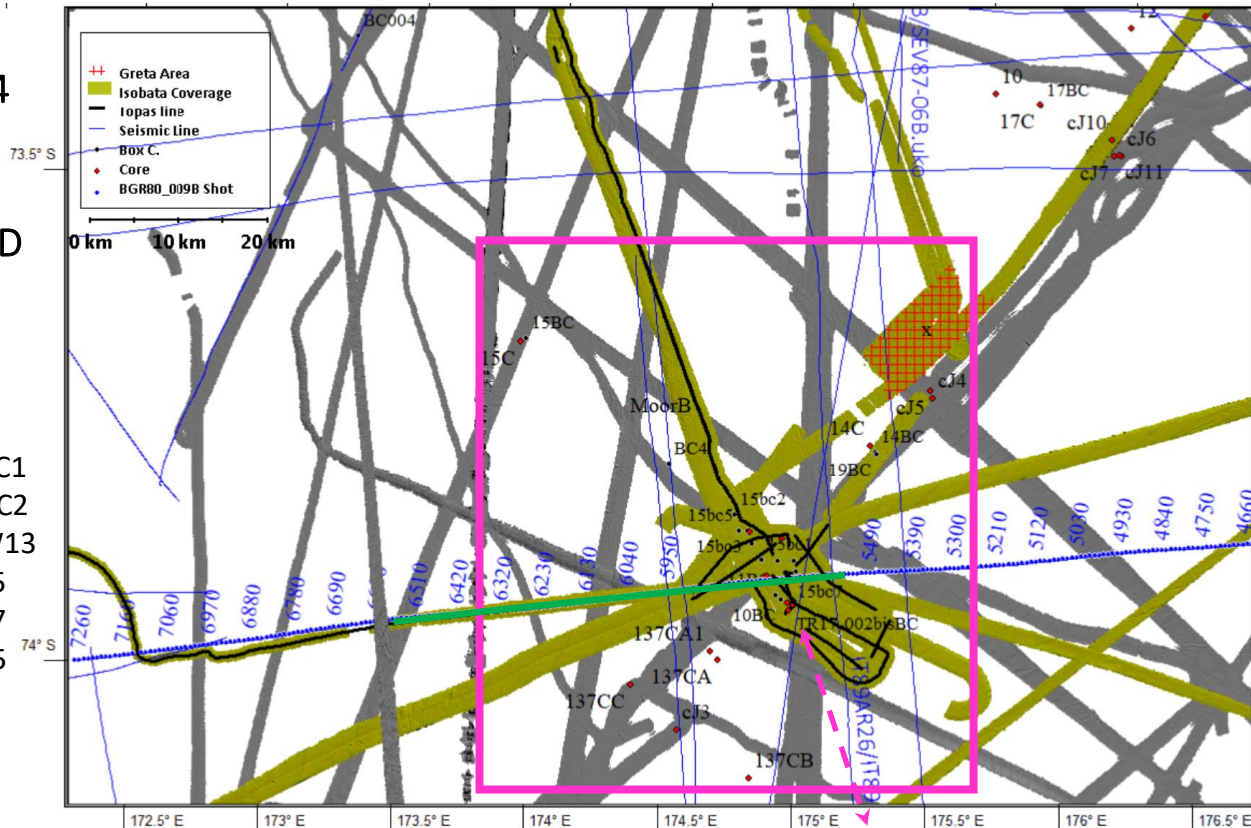
Ross Sea: Mooring B Area



- MB: Simrad EM304
- Topas PS 18
- ADCP 150 Khz
- Sound Velocity: CTD MORSEA

IT Corers

- ANTA91-14C
- ANTA95-15C1
- ANTA95-15C2
- ANTA95-99C2
- ANTA99-C12
- ANTA98-SW13
- ANTA99-CJ4
- ANTA99-CJ5
- ANTA99-CJ6
- ANTA99-CJ7
- ANTA99-CJ11
- ANTA02-J15
- XXXII_TR17-002PC



TR17-002PC

MOORING Areas:

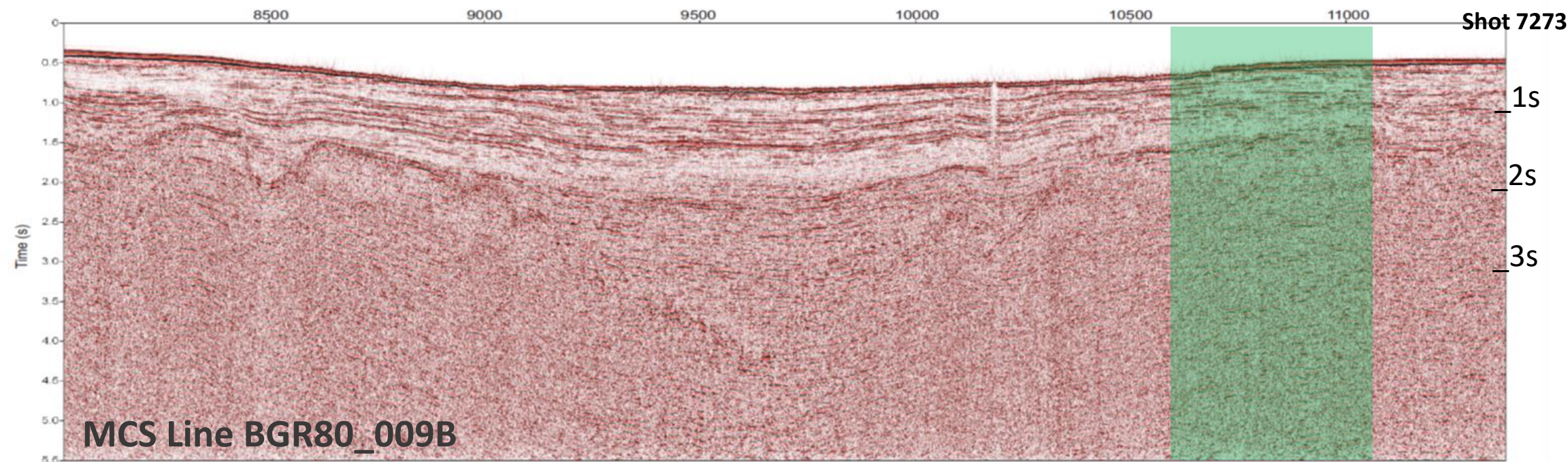
Metadata:

- MZS, Moor L
- Moor G
- Moor B
- Moor H
- Edisto B.

- Previous PNRA MBES datasets
- IBCSO Coverage
- SDL Navigation
- IT Cores & BoxCorers

- MB.ISOBATA
- MB.USA (cell50m)
- MB.Greta (T. Tesi)
- SLD
- TOPAS ISOBATA
- Corers
- BGR80_009B
- MBES on BGR80-009B
- Box Cores

Ross Sea: Mooring B Area



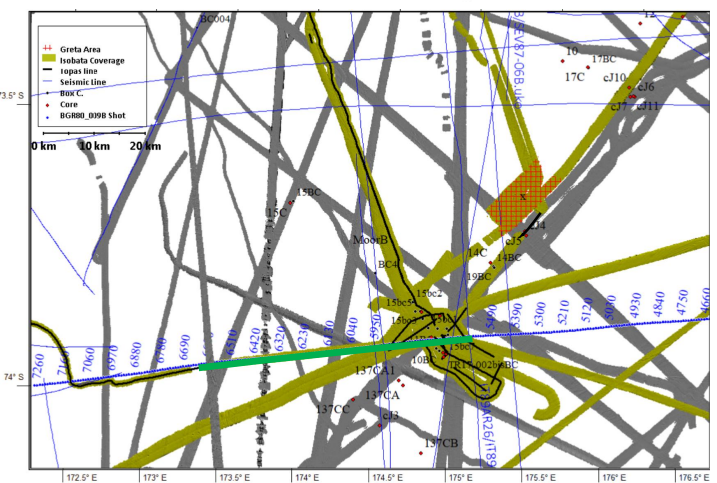
MCS Line BGR80_009B

BGR80_009B shots covered by ISOBatA MBES & TOPAS

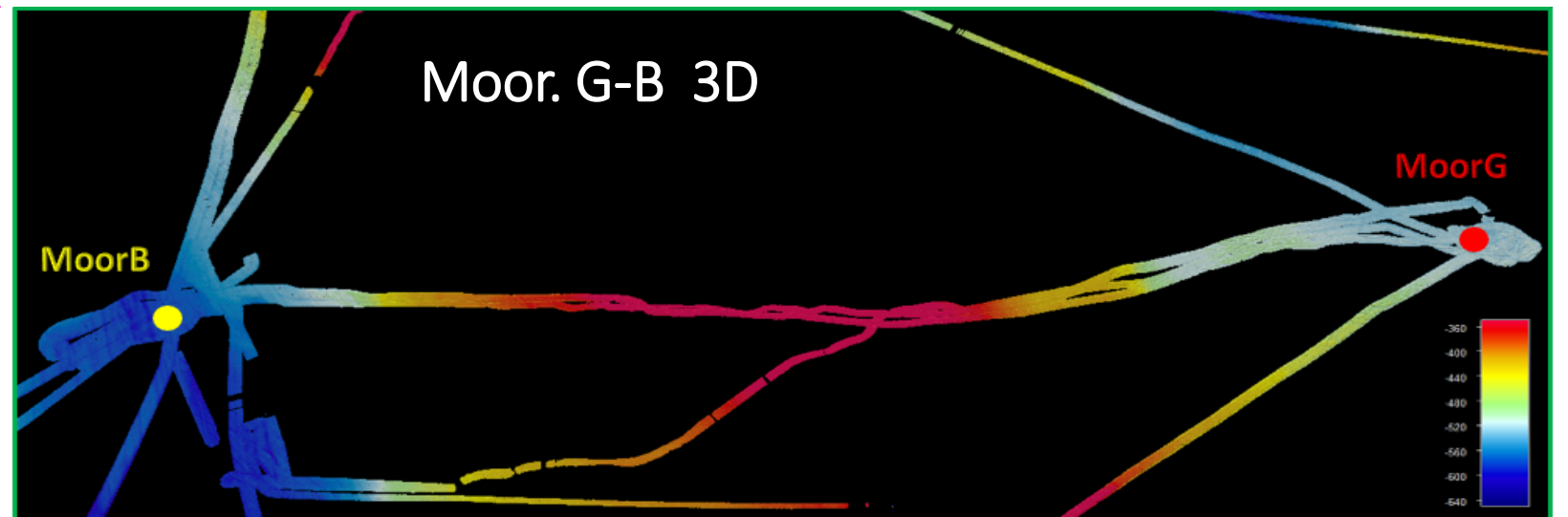
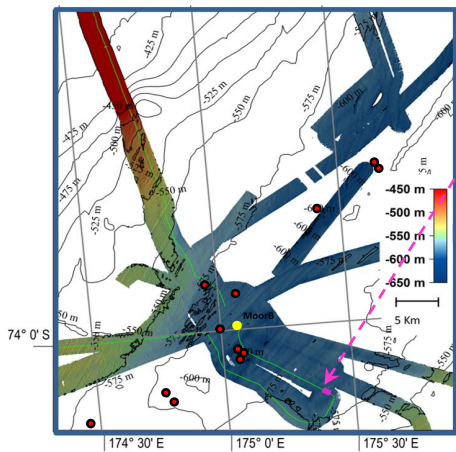
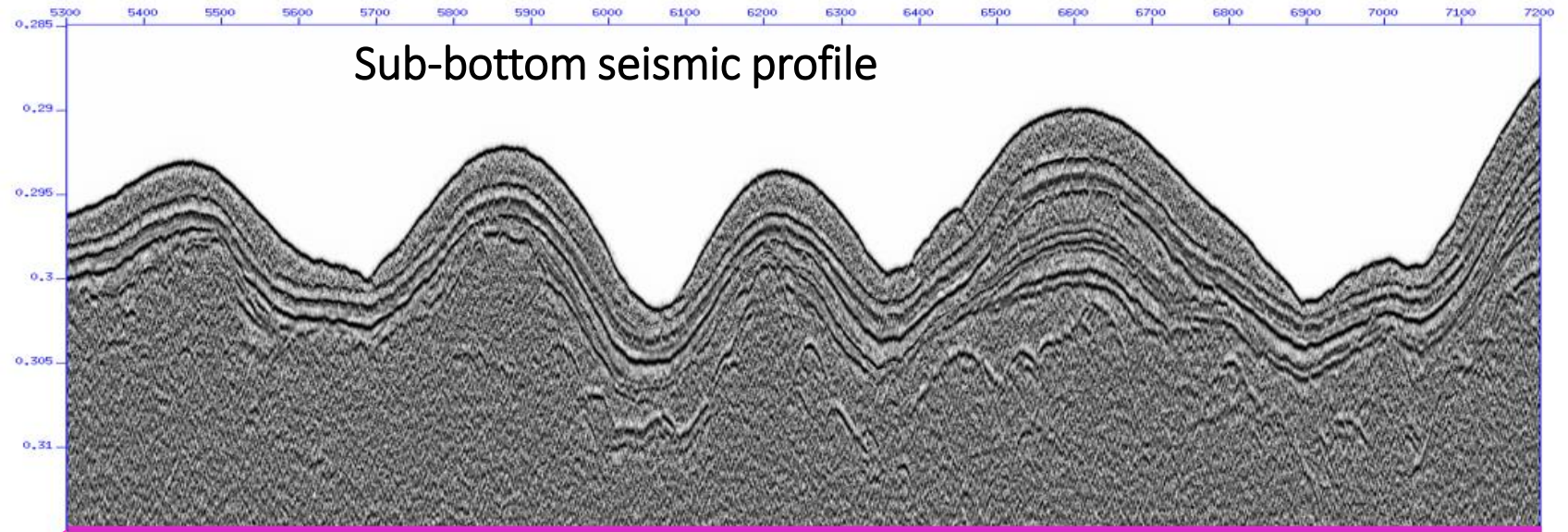
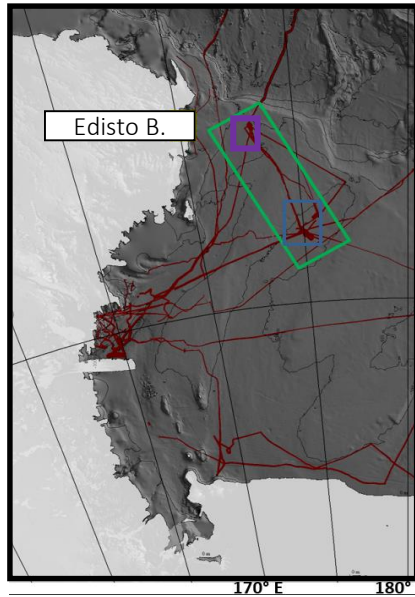
LINE BGR 80_009B MCS line collected in 1980: SDL

	SP.	SOL LAT LONG	SP	EOL LAT LONG	LENGTH (KM)
009	100	-74.76111 179.17545	7040	-77.97342 179.21161	352
009B	7039	-74.77881 179.13794	11036	-72.98681 178.99428	199

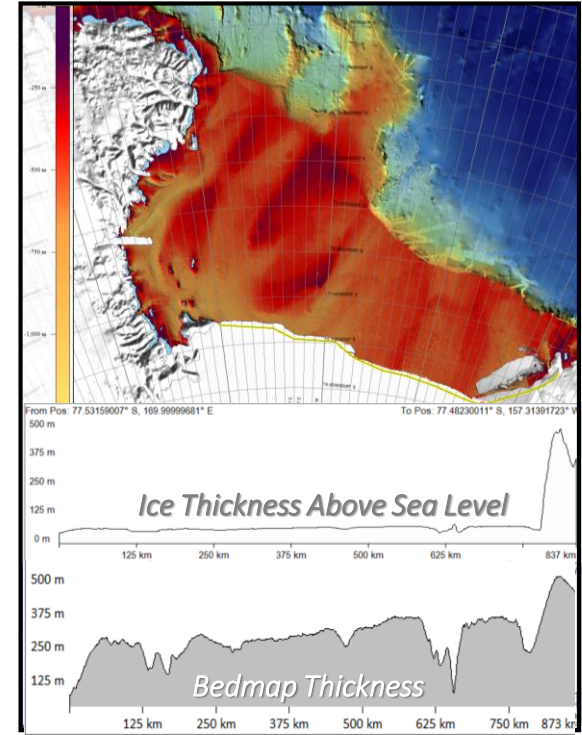
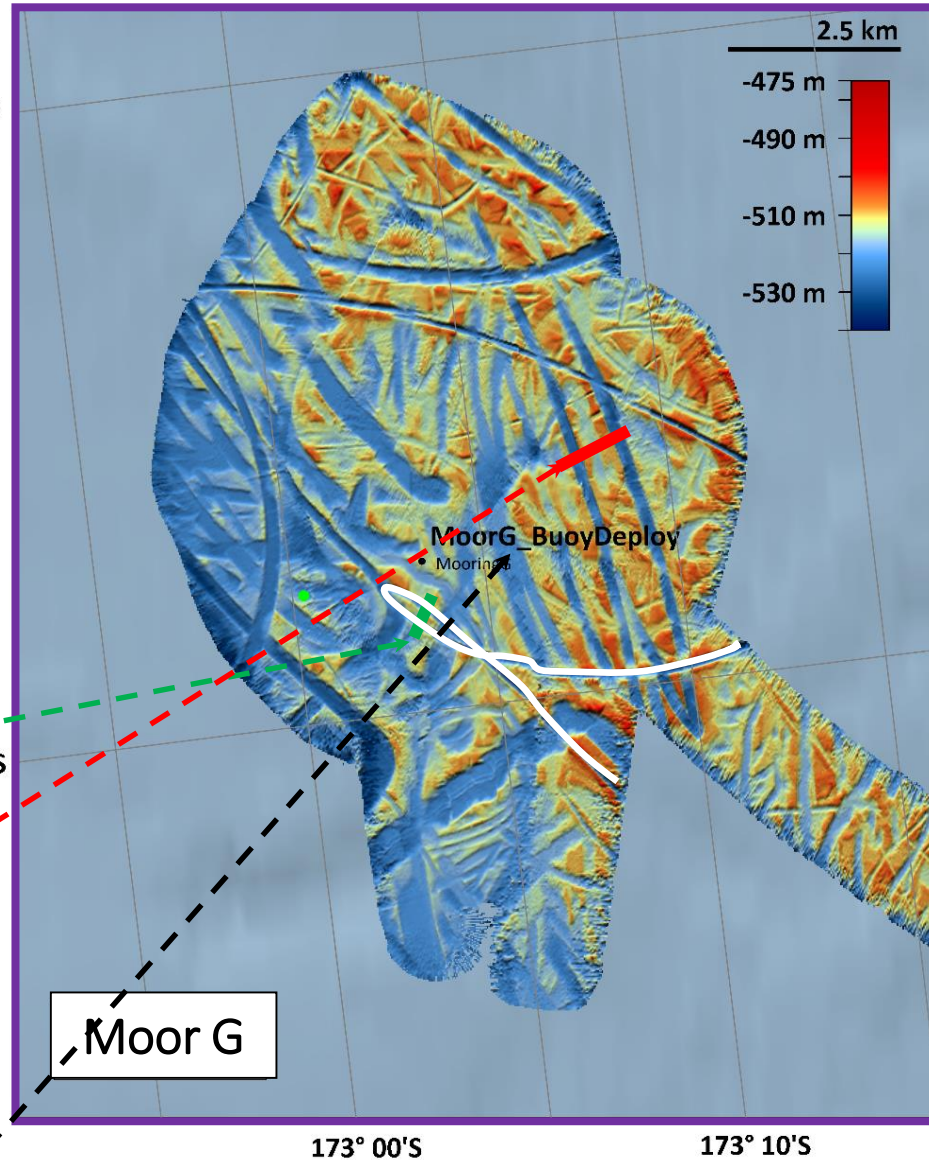
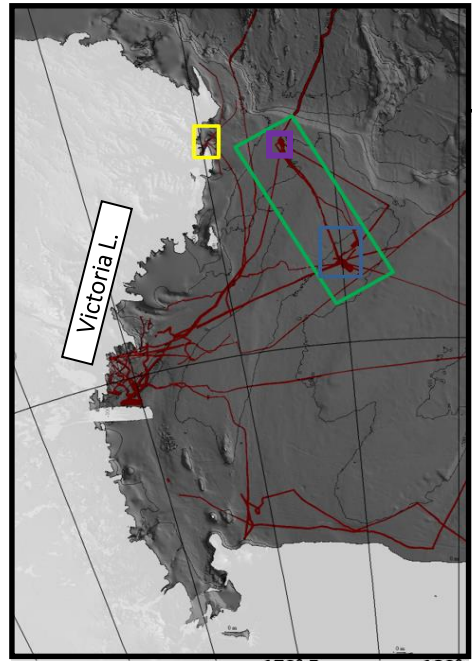
LINE TRACE RANGE (SP) : 009B -22 to 3961 SDLS-4



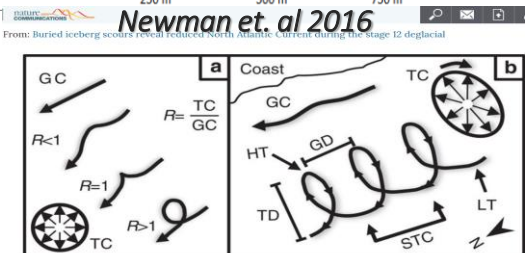
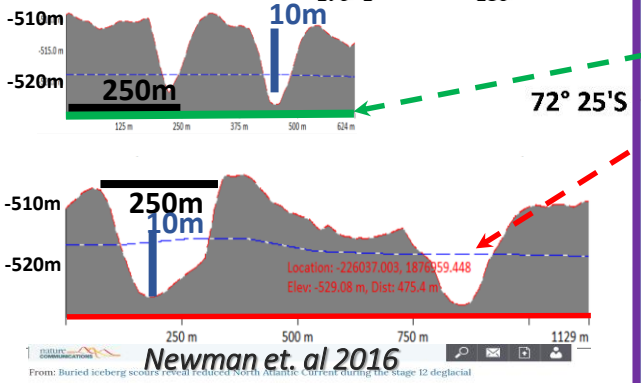
Ross Sea: Mooring B-G Area



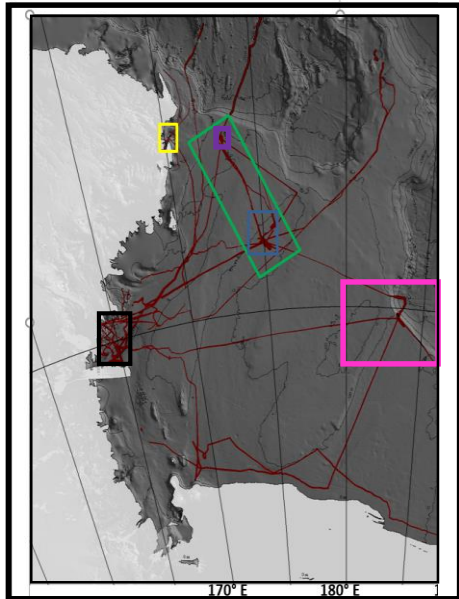
Ross Sea: Mooring G Area



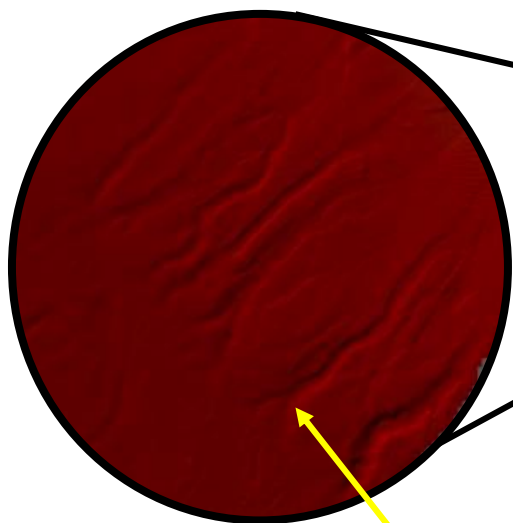
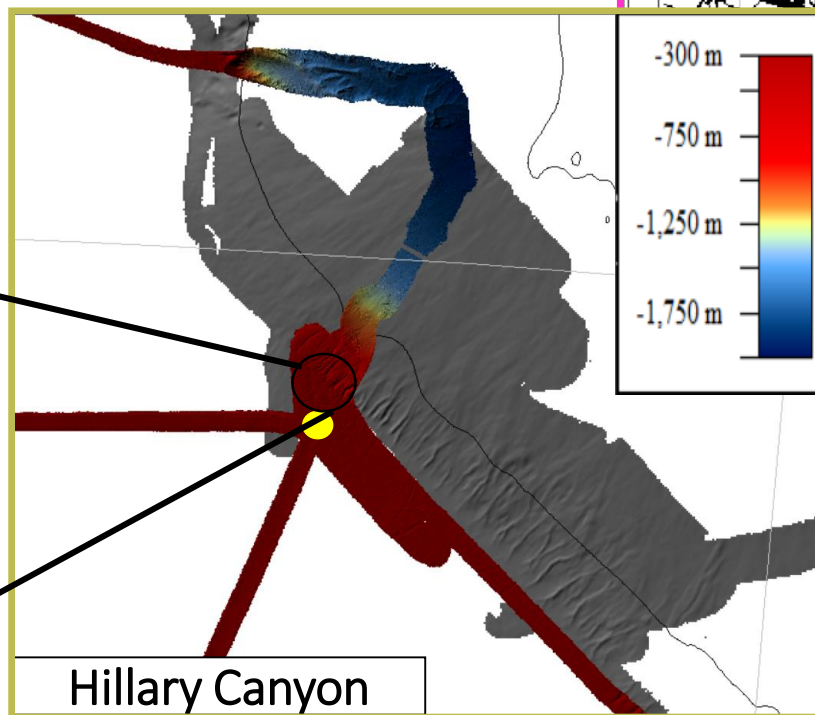
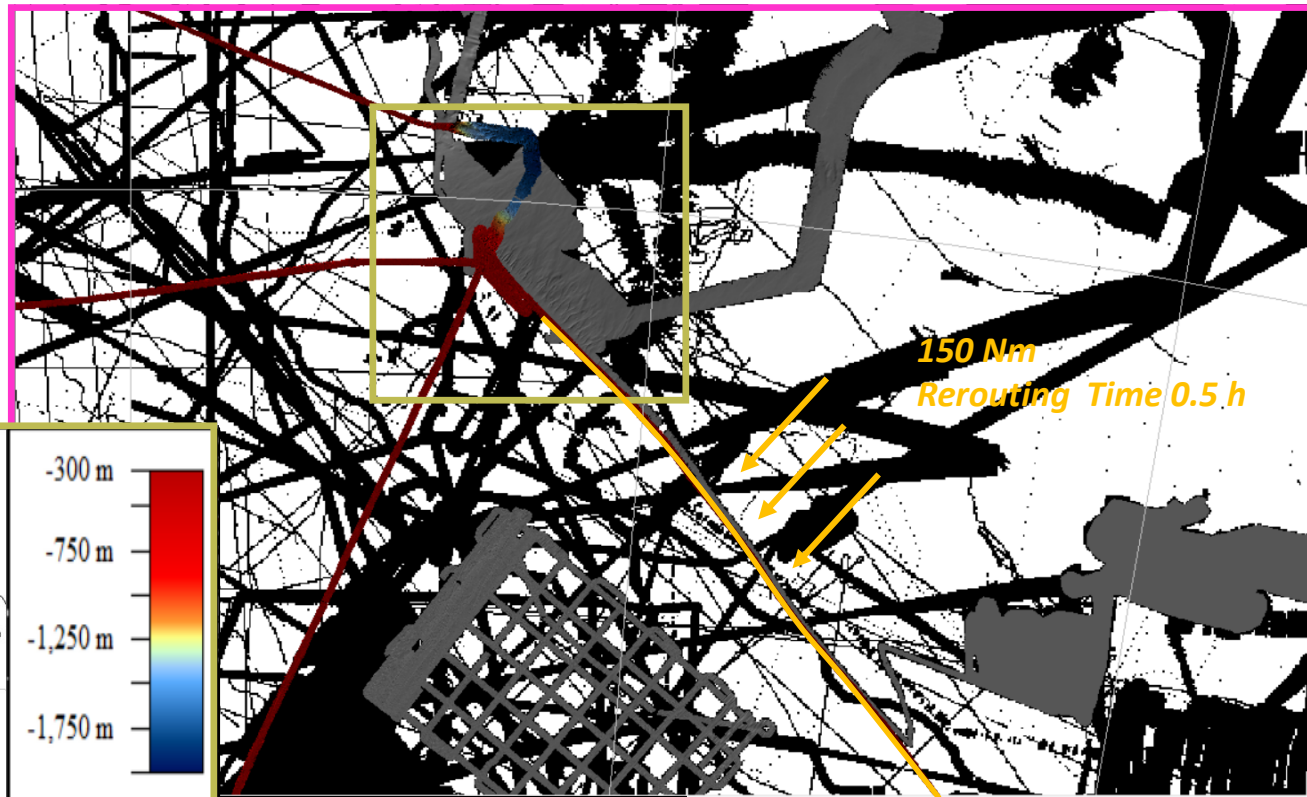
MBES data Collected in Mooring G Area: spiral geometries generated by gouging icebergs illustrate the interplay of tidal rise and geostrophic currents.



Ross Sea: Hillary Canyon



ISOBatA Mooring H dataset
acquired in 2 years
complementary to
OGS-Explora XXXII PNRA
Expedition

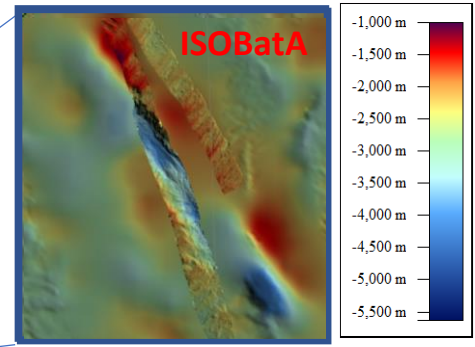
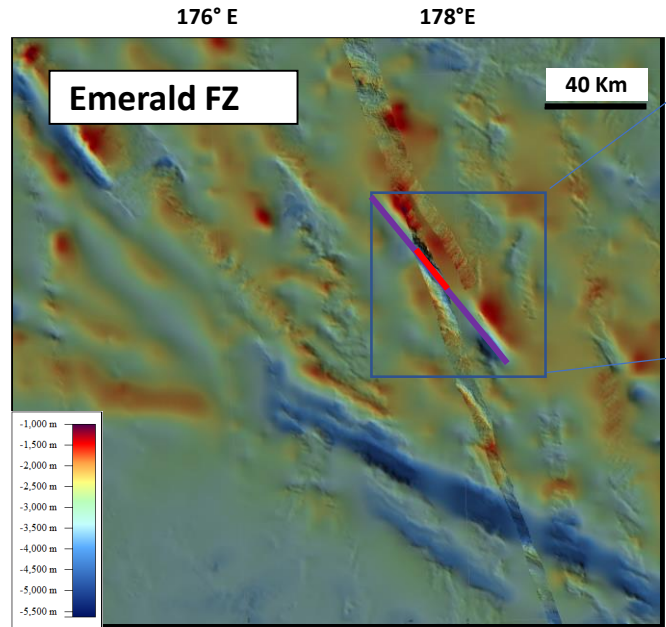
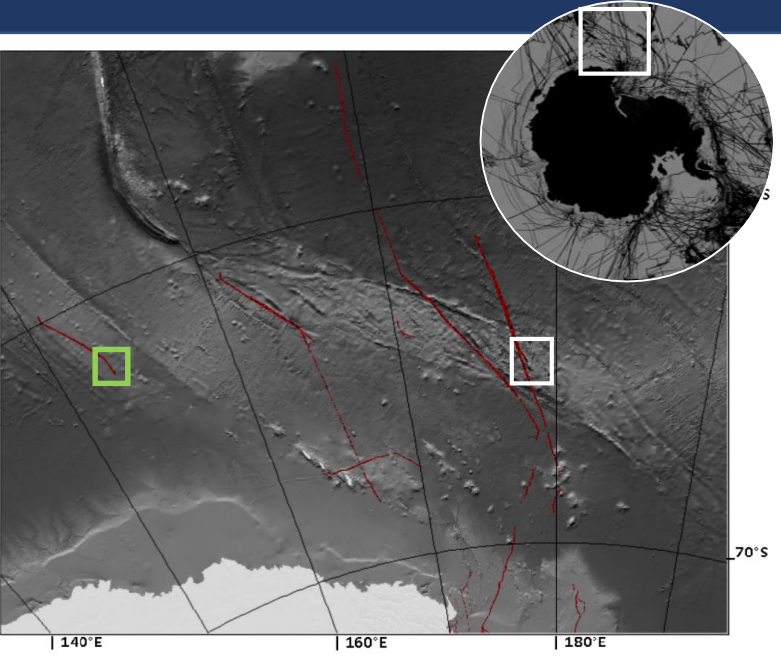


Gullies

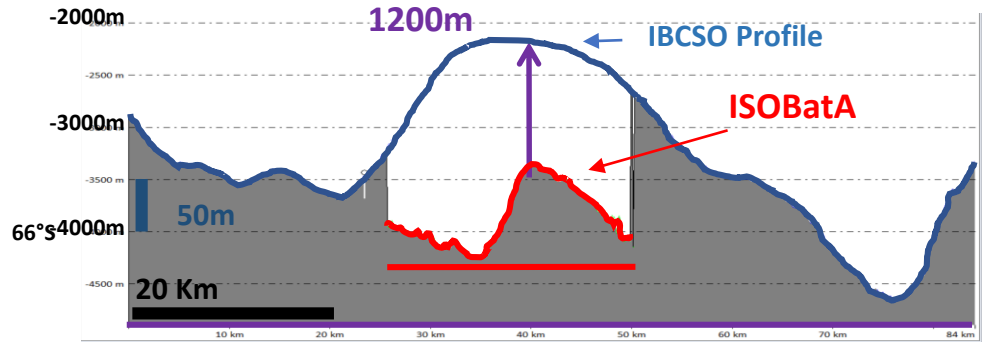
- IBCSO Coverage
- MB. OGS-Explora
- MBES ISOBatA
- Mooring H

Past OGS- Explora datasets:
Whispers (XXXII)
ODYSSEA (XXXII)
ANTSSS (Jennifer Gale)
WISE (XXI)
Future Project: IOPPERS Area

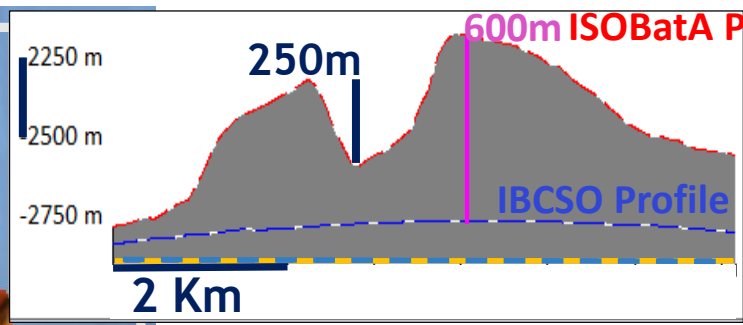
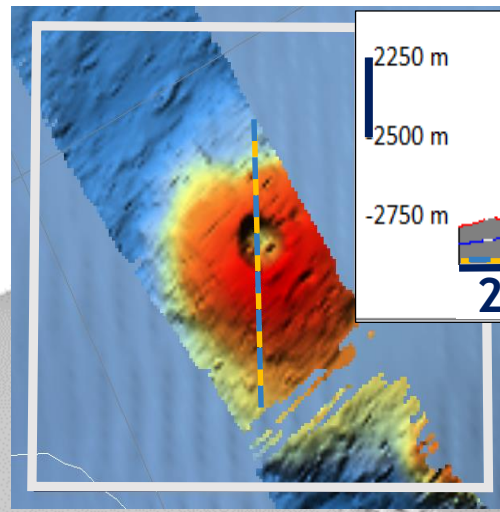
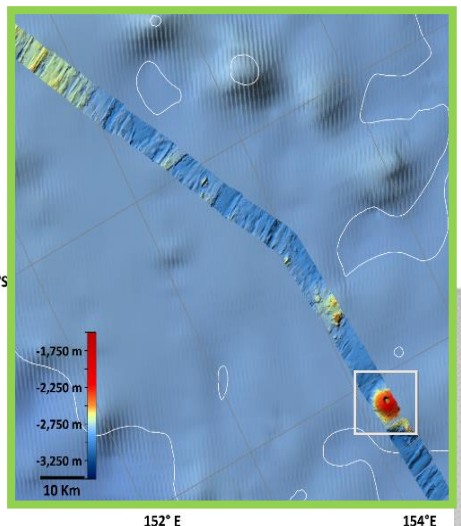
Southern Ocean:



ISOBATA – IBCSO= 1200 m!!



DIFFERENCE ISOBATA - IBCSO= 600 m

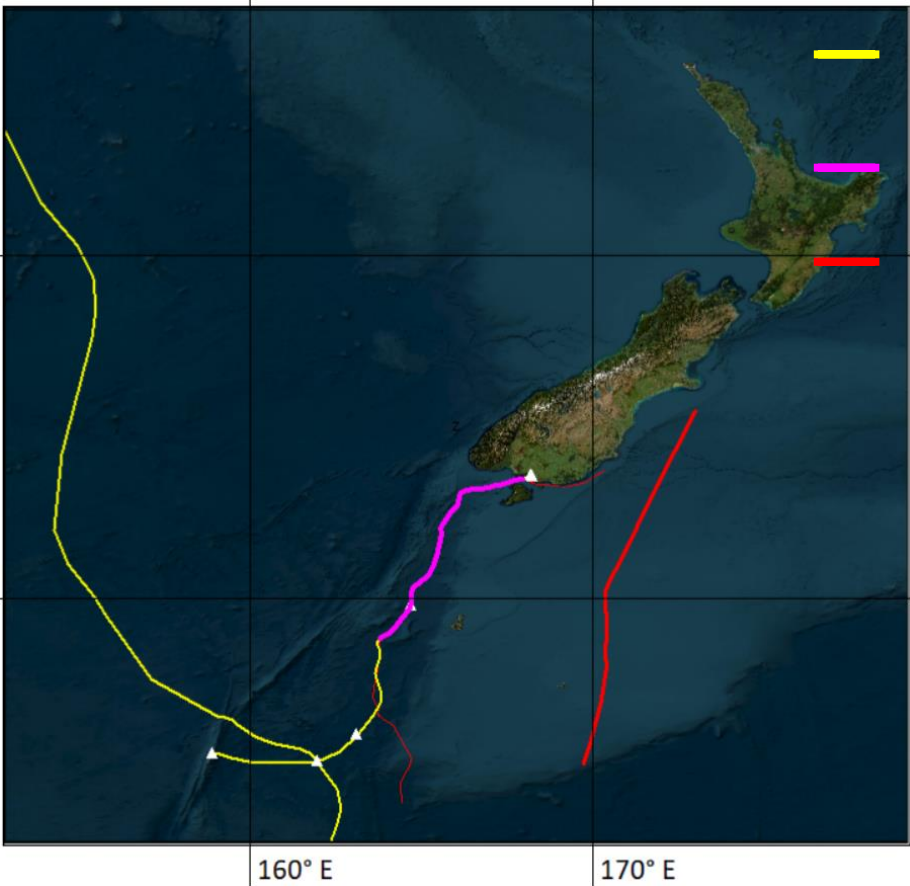


XXXVII PNRA Expedition: unmapped volcano along the route back to NZ. Depth difference between IBCSO map and ISOBAT profile is 600m.

J. Gevorgian, D. T. Sandwell et al 2023, Global Distribution and Morphology of Small Seamounts

-Not detected-

NZ Waters Acquisition:



NSF-USA Antarctic Internet Cable NZ- McMurdo

ISOBatA Data Along NSF-USA Cable



NFS-USA

ISOBatA Data acquired in NZ Water



GEBCO Seabed 2030 South and West Pacific Regional Map (Project's)

Toitū Te Whenua
Land Information
New Zealand

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Radio New Zealand House
155 The Terrace
PO Box 5501
Wellington 6145
New Zealand
T 0800 665 463
E MSR-NZ@linz.govt.nz
W www.linz.govt.nz

22 December 2022

Daniela Accettella
daccettella@ogs.it

Dear Daniela Accettella

Request to collect bathymetric data whilst transiting New Zealand's EEZ

Toitū Te Whenua Land Information New Zealand (LINZ) understands that the RV Laura Bassi may, from time to time, undertake voyages that include transits of New Zealand's Exclusive Economic Zone.

LINZ has been authorised by NZ's Ministry of Foreign Affairs and Trade (MFAT) to request vessels to:

- activate their seafloor mapping systems whilst transiting NZ's EEZ, and
- subsequently transmit the data to LINZ.

MFAT has confirmed that a marine science research (MSR) application is not required for such activities undertaken at LINZ's request, whilst noting that this waiver does not give away any of New Zealand's existing rights in relation to MSR under UNCLOS.

Data received will be used for the sole purpose of increasing the coverage of the GEBCO grid within NZ's EEZ; the data will not be used for navigation purposes.

LINZ affirms that any data collected on a 'best endeavours' basis will be accepted and treated accordingly, and that the supplying agency will not be held liable for any consequences arising from the the quality of such data.

In the first instance I ask that you contact our MSR Coordinator at MSR-NZ@linz.govt.nz to assist us to understand your schedule, and facilitate delivery of the transit data to LINZ.

Please also note that this request is not voyage-specific; it applies to any expeditions undertaken by the above-named vessel during transits of NZ's EEZ.

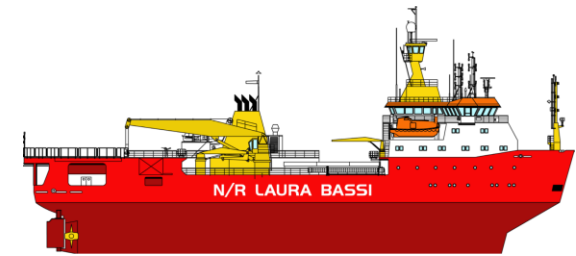
We look forward to receiving your co-operation to enhance our understanding of the nature of the seafloor within NZ's EEZ.

Yours sincerely

Adam Greenland, National Hydrographer

ISOBATA in Numbers

Equipment	Area	XXXVII	XXXVIII	XXXVII+XXXVIII
MBES	RossSea	7590 kmq	7920 kmq	15510 kmq
	S. Ocean	9495 kmq	8490 kmq	17985 kmq
MAG	S. Ocean	1120 km	EMZ MQ 715 km 270	2105 km
TOPAS	Moor. B-G 176 Km	MZSArea 129 km	RossSea 300km	Tot. XXXVIII: 605 km
ADCP 150 kHz	SO-Ross Sea	III leg	I-II Leg	Tot. XXXVIII: 8450 km



XXXVIII ISOBatA Vessel Time: Speed Reduction and Rerouting Acquisition

SOL (UTC)	EOL (UTC)	Speed	Area	Acq. nm	Rerouting	TIME
2023.01.09 10:50	2023.01.10 19:35	8.5 - 9 kn	EMZ	390 nm (280 SpeedR.)	Routing also due to bad weather	~ 12 h
2023.02.27 07:03	2023.02.27 23.18	8.5 – 5 kn	MQ	147 nm (99 nm Speed R)	Shared with NSF Cable	16h+ ~X
2023.01.121 02:30	2023.02.21 20:40	No speed Reduction	Ross Sea	7920 kmq	Yes	~4 h



Conclusions:

- ❑ ISOBatA collected relevant datasets in PNRA key areas
- ❑ Underway acquisition along planned corridors, speed reduction and the use of coverage maps are key to improving knowledge of the seafloor
- ❑ Underway acquisition needs vessel time
- ❑ Laura Bassi Underway data acquisition are possible only in the framework of PNRA approved projects (ISOBatA end: 2024)

