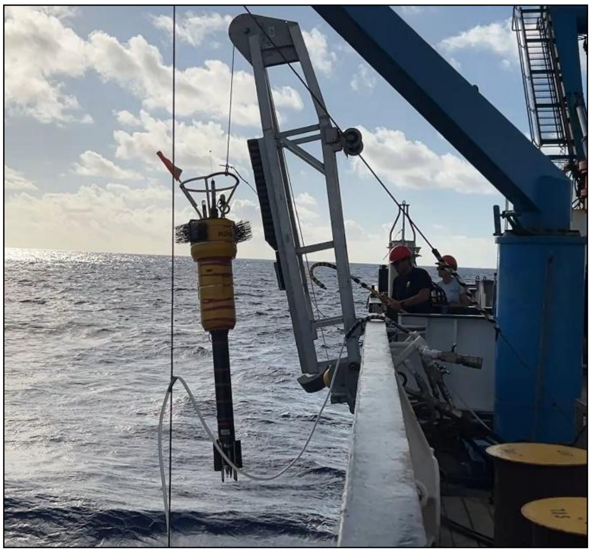
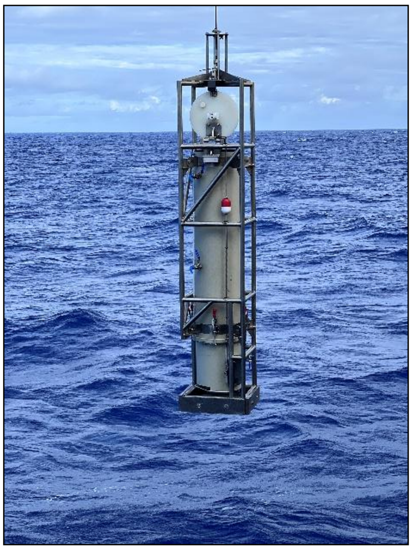
JC275

Cruise Report

RRS *James Cook*
Rio de Janeiro to Walvis Bay
20th February – 30th March 2025

PSO: Jonathan Sharples
University of Liverpool UK





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Introduction to JC275

Research cruise JC275 is associated with the CarTRidge project (Enhanced carbon export driven by internal tides over the mid-Atlantic ridge). CarTRidge is a Pushing the Frontiers project supported by the UK Natural Environment Research Council. The overall aim of the project is to assess the role of internal tidal mixing over the steep seabed topography of the mid-Atlantic ridge in augmenting the downward carbon export to the ocean depths.

Our hypothesis is that the breaking internal tidal waves generated over the ridge mixing greater quantities of nutrients upward into the base of the deep chlorophyll maximum (DCM). The extra nutrients shift the phytoplankton community to contain larger-celled species in the ridge DCM, which in turn support greater numbers of mesozooplankton. The combination of larger phytoplankton, mesozooplankton faecal pellets and mesozooplankton diurnal migration leads to a greater downward flux of organic carbon over the ridge compared to a site away from the ridge.

Our cruise track allows the comparison between two main sites. Station R is on top of the mid-Atlantic ridge in the subtropical gyre of the South Atlantic. Station B is about 1400 km west of the ridge in the deeper waters of the Brazil Basin. A third site, station A to the east of the ridge in the Angola Basin, was also sampled to provide further off-ridge contrast in a region that may be more influenced by horizontal eddy fluxes of nutrients.

At each of stations B and R a static mooring, a wirewalker drifting mooring and a glider were deployed. The static moorings provided full-depth temperature and current structure with high temporal resolution. The wirewalkers had profiling CTDs operating in the upper 300 metres of the ocean. The gliders contained CTD, chl and optical backscatter sensors, along with microrider turbulence sensors, and operated between the surface and 500 metres remaining in the vicinity of the moorings. All moorings and gliders were deployed and recovered during the cruise.

Core measurements from CTD profiles at the sampling stations include dissolved inorganic nutrients, chlorophyll (including size-fractionated), salinity, dissolved oxygen and dissolved organic matter. Oxygen, salinity and bulk chlorophyll samples were used to calibrate CTD sensors. Water was collected from some CTDs, usually pre-dawn casts, for phytoplankton species and for carbon and nitrogen uptake incubations. The inorganic nutrient and DOC samples were collected and stored in the ship's scientific freezers and fridges for analysis later in the summer when the shop has returned to the UK.

Freefall turbulent microstructure profilers were used at all three stations to quantify turbulent kinetic energy dissipation and diapycnal diffusivities. At all three stations 2 x 13-hour sets of yo-yo profiles to 500 metres depth were carried out using a VMP2000 tethered profiler. These sets of profiles were designed to measure turbulence through full tidal cycles. At stations B and R additional profiles to full depth were collected using a VMP6000 microstructure profiler.

Zooplankton and particles were imaged and collected using bongo nets, marine snowcatchers, underwater vision profiler (UVP), and holographic camera (LISSTHolo). Optical sensors for backscatter on the gliders and the camera frame will be used to determine particulate organic carbon (POC) via calibration with POC samples from a subset of the CTDs.

In addition to the core measurements for the CarTRidge project, experiments on nutrient limitation, phytoplankton photosystem efficiency and phytoplankton epigenetics were carried out. Also, 4 sites were sampled in the upper 500 metres with VMP2000 and CTD around each of B, R and A. These extra sites will provide estimates of horizontal eddy transfer of nutrients so that we can compare the relative strengths of vertical and horizontal nutrient sources.

The start of the cruise was delayed by 7 days in Rio de Janeiro because of problems with getting our equipment containers through customs. Because of this delay, we were given permission by the NERC to take the ship to 13 knots for the main transits to and from the study sites. This proved invaluable, as without the extra speed we would not have been able to reach the ridge station R in time for the spring tides.

Personnel List (science and NMF support)

1. Jonathan Sharples (University of Liverpool UK) PSO
2. Sophie Durston (University of Liverpool UK)
3. Ric Williams (University of Liverpool UK)
4. Jing Jin (University of Liverpool UK)
5. Chris Balfour (National Oceanography Centre UK)
6. Geoff Hargreaves (National Oceanography Centre UK)
7. Andre Paloczy (National Oceanography Centre UK)
8. Will Major (National Oceanography Centre UK)
9. Marika Takeuchi (National Oceanography Centre UK)
10. Louwin Anand (Annamalai University India, POGO visiting fellow at the NOC)
11. Unai Abascal (University of Seville, Spain)
12. Alex Poulton (Heriot-Watt University)
13. Ben Fisher (Heriot-Watt University)
14. Arianwen Herbert (Oxford University)
15. Alex Forryan (University of Southampton)
16. Espe Broullon-Mandado (University of Southampton)
17. Felipe Pereira (Scripps Institution for Oceanography, USA)
18. Megan O'Hara (Bangor University)
19. Frieda Schlegel (Marine Biological Association UK)
20. Barbie Duckworth (MIT USA and University of Liverpool UK)

NMF Support:

21. Jon Short (National Marine Facilities)
22. Paul Provost (National Marine Facilities)
23. Paul Henderson (National Marine Facilities)
24. John Clarke (National Marine Facilities)
25. Richie Phipps (National Marine Facilities)
26. Tina Thomas (National Marine Facilities)
27. Daniel Phillips (National Marine Facilities)
28. Felipe Marques dos Santos (National Marine Facilities)

Main Station Positions

Station Name	Latitude	Longitude
B	16° 00.0' S	19° 00.00' W
R	16° 00.0' S	13° 00.00' W
A	16° 00.0' S	01° 00.00' W
X1a	16° 00.0' S	19° 14.04' W
X1b	15° 46.5' S	19° 00.00' W
X1c	16° 13.5' S	19° 00.00' W
X1d	16° 00.0' S	18° 45.96' W
X2a	16° 00.0' S	13° 14.04' W
X2b	15° 46.5' S	13° 00.00' W
X2c	16° 13.5' S	13° 00.00' W
X2d	16° 00.0' S	12° 46.56' W
X3a	16° 00.0' S	01° 14.04' W
X3b	15° 46.5' S	01° 00.00' W
X3c	16° 13.5' S	01° 00.00' W
X3d	16° 00.0' S	00° 45.60' W
A1	22° 54.6' S	37° 21.60' W
A2	22° 04.2' S	34° 39.00' W
A3	21° 23.4' S	32° 58.20' W
A4	18° 34.2' S	25° 12.60' W
A5	17° 26.4' S	22° 03.60' W
A6	16° 00.0' S	19° 00.00' W
A7	16° 00.0' S	13° 00.00' W
A8	16° 00.0' S	10° 00.00' W
A9	16° 13.5' S	01° 00.00' W
A10	19° 00.0' S	06° 00.00' E
A11	20° 00.0' S	08° 00.00' E

B: Brazil Basin station (static mooring, wirewalker, glider)

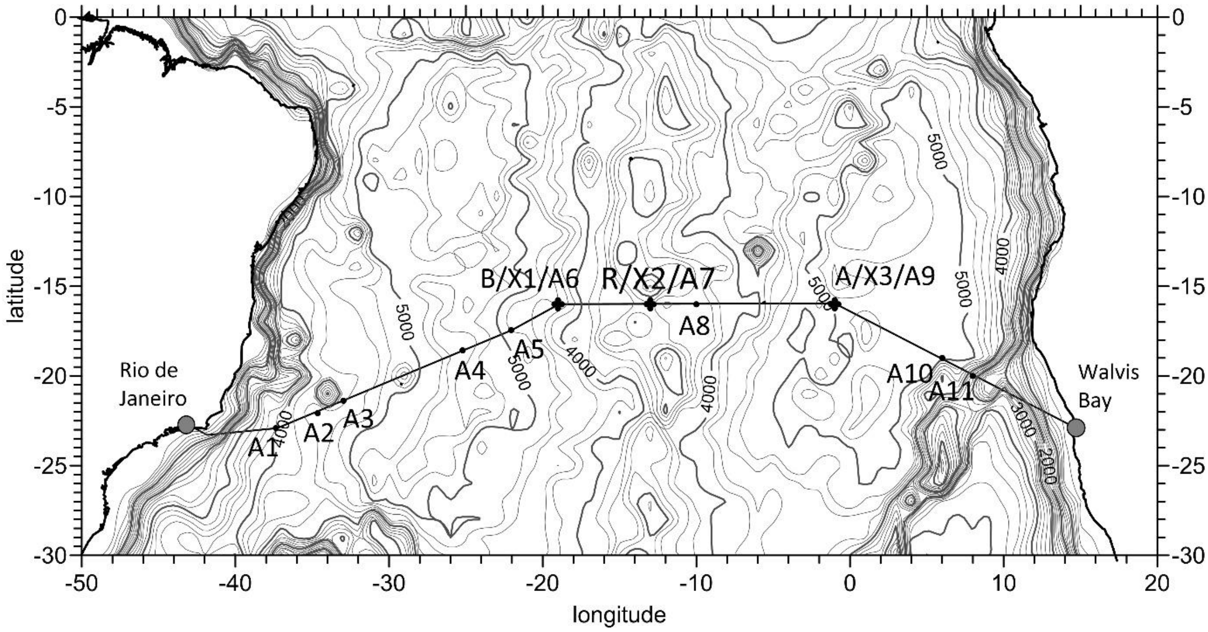
R: Ridge station (static mooring, wirewalker, glider)

A: Angola Basin station (short-term glider only)

X1, X2, X3: stations for eddy flux measurements centred on B, R and A respectively

A1 – A11: Argo float deployments

Cruise Track.



JC275 Cruise Narrative

Date	Time	Activity	Event No.	Weather & notes
20th Feb	09:00 (UTC-3)	Leave Rio		AM: Light winds. 0.5 metre swell from the SE PM: wind 15-20 knots from NE
21st Feb	12:28 (UTC-2) 12:50 (UTC-2)	ARGO 1 (German core AI2600-24DE019) deployed. Lat: -22.908742 Long: -37.362114 Surfmet turned on	1	Wind NE'ly 12-15 knots, slight sea, 1 m swell.
22nd Feb	00:54 (UTC-2) 09:48 (UTC-2)	ARGO 2 (WHOI BGC 1563) Lat: -22.07016 Long: -34.653842 ARGO 3 (UK 10523) Lat: -21.392709 Long: -32.973628 Surfmet off while in EEZ	2 3	AM: 10 – 12 knots E'ly, slight sea. PM: 12 – 15 knots ESE'ly, slight sea, 1 metre swell.
23rd Feb	23:37 (UTC-2) 23:58 (UTC-2)	ARGO 4 ((German AI2600-24DE020/WMO 7902181) Lat: -18.570787 Long: -25.209611 Trace metal fish deployed Lat: -18.570163 Long: -25.199244	4 5	AM: 12 – 15 knots E'ly, slight sea, 1 metre swell. PM: 10 – 15 knots E'ly, slight sea, 1 metre swell.
24th Feb	 01:20 (UTC-1) 16:20 (UTC-1)	Ship's time + 1 hour Trace metal fish recovered Lat: -18.554054 Long: -25.142861 Problems with pipe attachment to cable. ARGO 5 (UK 10522) Lat: -17.443386 Long: -22.074269	 6	AM: 15 – 18 knots E'ly, slight sea, 0.5m swell. PM: 10-12 knots E'ly, slight sea, 0.5m swell.

25th Feb	06:45 (UTC-1) 07:01 (UTC-1) 08:55 (UTC-1)	Arrive at CTD station for sound velocity and release tests. CTD01(event 7) deployed to 2000m Lat: -16.128021 Long: -19.260174 CTD01 recovered Lat: -16.128018 Long: -19.260174 Start swath survey towards station B.	 7	AM: E'ly 12 – 15 knots, slight sea.
	12:55 (UTC-1)	Mooring deployment commences. Lat: -15.979441 Long: -19.084435 Final mooring position will be slightly west of B to get correct water depth.	8	PM: E'ly 12-15 knots. Slight sea.
	17:27 (UTC-1)	Mooring deployed. Lat: -16. 001605 Long: -19.039964 Depth: 4372m Heave to at B overnight.		There was a mismatch between the earlier swath survey and the instantaneous central depth from the swath. Deployment was based on the instantaneous swath depth, with the mooring anchor released 700m after the ship passed over the position of nominal 4375m depth.
26th Feb	04:42 (UTC-1)	CTD02 (event 9) deployed Lat: -15.999865 Long: -19.000263 Problems with CTD gantry hydraulics.	9	E'ly 15 knots, to 17-18 knots in showers.
	08:00 (UTC-1)	Start tests of RCF, bongo nets and snowcatchers. Several problems with the winch – level-wind issues.	10 – 13	 PM: E'ly 12 – 16 knots, slight sea, 1.5m swell.
	14:00 (UTC-1)	VMP testing.	14 – 16	

		VMP6000 tested OK. VMP2000 has a possible wire termination problem.		
	15:00 (UTC-1)	Wirewalker ballasting tests begin.	17	
	18:15 (UTC-1)	Wirewalker deployment begins.	18	Times from here to glider deployment appear wrong in event log. These times in the narrative should be OK – checked against photo times and consistent.
	18:55 (UTC-1)	Wirewalker away Lat: -16.000827 Long: -18.997701		
	19:15 (UTC-1)	Glider deployed Lat: -16.000834 Long: -18.997862	19	
	21:13 (UTC-1)	Glider checks completed. Head for station R.		
27th Feb		Transiting to R		
28th Feb	04:00 (UTC-1)	CTD03 to 2000 metres (sound velocity plus pre-dawn sampling upper 300m)	20	AM: E'ly 12-15 knots. Slight sea.
	06:50 (UTC-1)	Swath survey starts.		
	10:05 (UTC-1)	Mooring operations start.		
	13:17 (UTC-1)	Mooring deployed Lat: -15.991378 Long: -13.020436 Depth: 2950 metres	22	PM: E'ly 10-12 knots, slight sea.
	14:00 (UTC-1)	VMP2000 tests	23, 24	
	16:39 (UTC-1)	Wirewalker ballasting tests	25, 26	
	18:36 (UTC-1)	Wirewalker deployed Lat: -15.997337 Long: -13.005071	27	
	19:15 (UTC-1)	Glider deployed Lat: -15.99771 Long: -13.003592	28	
		Swath overnight.		

1st March	03:07 (UTC-1)	CTD04 to 250m Lat: -15.999954 Long: -12.999764	29	AM: 15-20 knots E'ly, slight sea.
	08:04 (UTC-1)	Snowcatcher (euphotic + 10m) - unsuccessful Lat: -15.999944 Long: -12.999777	30	
	08:39 (UTC-1)	Camera frame to 600m Lat: -15.999948 Long: -12.999768	31	
	09:55 (UTC-1)	Snowcatcher to 290m Lat: -15.999957 Long: -12.999766	32	
	10:33 (UTC-1)	Snowcatcher to 200m Lat: -15.99996 Long: -12.999785	33	
	11:08 (UTC-1)	Snowcatcher to 290m Lat: -15.999964 Long: -12.999771	34	
	14:30 (UTC-1)	Snowcatcher to Lat: -15.999933 Long: -12.999762	35	PM: E'ly 10-15 knots. Slight sea.
	15:56 (UTC-1)	CTD05 (Polonium sampling to 500m) Lat: -15.999947 Long: -12.999783	36	
	19:16 (UTC-1)	SAPs deployed Lat: -15.999949 Long: -12.999772	37	
	22:24 (UTC-1)	SAPs recovered		
2nd March	00:03 (UTC-1)	Camera frame deployed Lat: -15.999957 Long: -12.999763	38	AM: E'ly 15-20 knots, slight sea. 1-1.5m swell.
	01:12 (UTC-1)	Bongo net Lat: -15.999972 Long: -12.9999799	39	
	03:05 (UTC-1)	CTD06 Lat: -15.999955 Long: -12.999768	40	

	05:16 (UTC-1) 05:50 (UTC-1) 18:19 (UTC-1) 19:55 (UTC-1) 22:00 (UTC-1)	Turbulence float deployed Lat: -15.99995 Long: -12.999771 VMP2000 station begins Station R spring tide VMP station complete. VMP recovered. Lat: -16.057292 Long: -12.909244 CTD07 to 500m Lat: -16.060601 Long: -12.903533 TM fish deployed	41 42 43 44	
3rd March	03:17 (UTC-1) 06:25 (UTC-1) 07:08 (UTC-1) 09:24 (UTC-1) 10:06 (UTC-1) 10:46 (UTC-1) 12:50 (UTC-1) 13:42 (UTC-1) 15:25 (UTC-1) 16:34 (UTC-1)	CTD08 to 250m Lat: -15.99969 Long: -12.999795 Snowcatcher Camera frame Snowcatcher to 270m Snowcatcher Bongo nets (200m) Snowcatcher to 500m Bottle leaking on recovery. Snowcatcher to 500m Operations paused to pump waste from ship's tanks. CTD09 deployed Lat: -15.999697 Long: -12.999791 VMP6000 deployed (cast 01) Lat: -15.999685 Long: -12.999784	45 46 47 48 49 50 51 52 53 54	15 knots ESE'ly. Slight sea. Wirewalker B currently at: -16.02°, -19.24° moving west at about 5 km day^{-1}. Wirewalker R currently at: -15.84°, -13.175° moving northwest at about 8 km day^{-1}. PM: 20 knots ESE'ly. Moderate sea. 1.5 – 2 m swell. Event 55 is VMP recovery Event 56 was CTD used to hold cameras at the surface

	19:11 (UTC-1)	VMP6000 recovered Lat: -15.996144 Long: -13.011684		
4th March	00:02 (UTC-1)	Camera frame deployed to 600m Lat: -16.00001 Long: -13.00000	57	
	00:54 (UTC-1)	Bongo net to 300m	58	
		CTD operations cancelled because of deployment boom hydraulic problems.		AM: 12-15 knots E'ly. Slight sea.
	05:35 (UTC-1)	VMP6000 deployed (cast 02) Lat: -16.00000 Long: -13.000012	59	
	07:40 (UTC-1)	VMP6000 recovered Lat: -15.994459 Long:-13.004103		
	09:57 (UTC-1)	Arrive X2a and begin VMP2000 Lat: -15.996191 Long: -13.253134	60	
	12:08 (UTC-1)	VMP2000 recovered briefly to change a shear sensor.		PM: E'ly 15 – 18 knots, slight sea.
	12:14 (UTC-1)	VMP2000 redeployed Lat: -15.999996 Long: -13.233758	61	
	22:35 (UTC-1)	VMP2000 recovered Lat: -16.034528 Long: -13.151836		
	22:46 (UTC-1)	CTD010 to 500m Lat: -16.034524 Long: -13.151842	62	
5th March	03:55 (UTC-1)	CTD011 to 250m Lat: -15.999814 Long: -12.999997	63	AM: E'ly 15-18 knots, slight sea.
	06:10 (UTC-1)	Snowcatcher Lat: -15.999827 Long: -12.999989	64	

	06:51 (UTC-1)	Snowcatcher Lat: -15.999827 Long: -13.000002	65	
	07:26 (UTC-1)	Camera frame Lat: -15.999826 Long: -13.000001	66	
	09:34 (UTC-1)	Snowcatcher Lat: -15.99979 Long: -12.999984	67	
	11:03 (UTC-1)	Bongo nets Lat: -15.999799 Long: -12.999984	68	
	12:23	Snowcatcher Lat: -15.999795 Long: -12.99979 Snowcatcher needed to remain in water partway through recovery because of the ship's hydraulics system overheating.	69	PM: E'ly 12 – 15 knots. Slight sea.
	13:22 (UTC-1)	CTD012 (500 metres) Lat: -15.999786 Long: -12.999985	70	
	14:21 (UTC-1)	Snowcatcher recovered		
	15:08 (UTC-1)	SAPS deployed Lat: -15.999794 Long: -12.999982	71	
	18:42 (UTC-1)	VMP6000 deployed Lat: -15.999798 Long: -12.999981	72	
	19:05 (UTC-1)	VMP2000 deployed to 2000m Lat: -15.999081 Long: -12.999524	73	
	21:13 (UTC-1)	VMP6000 recovered Lat: -15.996458 Long: -13.007153	74	
	22:54 (UTC-1)	VMP6000 deployed	75	

		Lat: -15.996411 Long: -13.007114		
6th March	00:03 (UTC-1)	Camera frame Lat: -15.994501 Long: -13.007341	76	AM: E'ly 10 – 12 knots, slight sea.
	01:13 (UTC-1)	VMP6000 recovered Lat: -15.994342 Long: -13.008468	77	
	01:48 (UTC-1)	Bongo net Lat: -15.994336 Long: -13.008449	78	
	03:01 (UTC-1)	CTD013 Lat: -15.996603 Long: -13.005042	79	
	04:10 (UTC-1)	Transit to X2b		
	05:47 (UTC-1)	VMP2000 for 5 profiles Lat: -15.777328 Long: -12.99879	80	
	07:53 (UTC-1)	VMP2000 recovered		
	08:12 (UTC-1)	CTD014 to 500m Lat: -15.779973 Long: -12.984298 Transit to X2c	81	Wind increases to E'ly 20 – 25 knots. Moderate sea.
	12:40 (UTC-1)	CTD015 at X2c Lat: -16.224976 Long: -13.000011	82	Wind 10 knots E'ly, slight sea.
	13:53 (UTC-1)	VMP2000 for 5 profiles Lat: -16.225168 Long: -12.999186	83	
	16:06 (UTC-1)	VMP2000 recovered Lat: -16.229873 Long: -12.98052 Transit to X2d		
	18:31 (UTC-1)	CTD016 to 500m Lat: -1.001382 Long: -12.78176	84	

	20:02 (UTC-1)	VMP2000 for 5 profiles Transit to R	85	
7th March	03:00	CTD017 to 250m Lat: -16.000006 Long: -12.999995	86	AM: E'ly 10 – 15 knots, slight swell.
	04:04 (UTC-1)	ARGO 7 (WHOI BGC 1638) Lat: -16.000019 Long: -12.999997	87	
	05:54 (UTC-1)	Snowcatcher to euphotic+100m	88	
	07:24 (UTC-1)	Camera Frame Lat: -16.000014 Long: -12.999995	89	
	09:45 (UTC-1)	Snowcatcher 510m Lat: -16.000007 Long: -13.000009	90	
	10:57 (UTC-1)	Bongo net Lat: -16.000017 Long: -12.999996	91	
	12:27 (UTC-1)	Snowcatcher Lat: -16.00002 Long: -12.999996	92	
	12:46 (UTC-1)	Snowcatcher Lat: -16.000006 Long: -13.00001	93	
	13:33 (UTC-1)	CTD018 to 500m Lat: -15.999997 Long: -12.999996	94	
	14:32 (UTC-1)	SAPS Lat: -16.000008 Long: -13.000004 Recovered 17:02 (UTC-1)	95	
	18:19 (UTC-1)	CTD019 full depth Lat: -16.000007 Long: -12.999999	96	
	19:33 (UTC-1)	VMP6000 deployed Lat: -16.000015 Long: -13.000001	97	

		VMP6000 recovered Lat: -15.996674 Long: -13.003908		
	23:58 (UTC-1)	Camera frame Lat: -16.000003 Long: -12.999978	99	
8th March	00:52 (UTC-1)	Bongo net Lat: -16.000011 Long: -12.999996	100	AM: E'ly 12-15 knots, slight sea.
	03:58 (UTC-1)	CTD020 to 250m Lat: -15.999997 Long: -12.99999	101	
	05:16 (UTC-1)	VMP2000 station started Lat: -16.000031 Long: -12.999918	102	
	18:16 (UTC-1)	VMP2000 station finished. Lat: -16.046161 Long: -12.902203 Transit to station B		
9th March		Transit		
10th March	03:02 (UTC-1)	CTD021 to 250m Lat: -16.000051 Long: -19.000011	103	AM: E'ly 20 knots. Moderate sea.
	04:10 (UTC-1)	VMP2000 13-hour station starts. Lat: -16.000052 Long: -19.000022	104	
	17:16 (UTC-1)	VMP2000 recovered Lat: -16.046755 Long: -18.894666		
	18:26 (UTC-1)	VMP6000 deployed Lat: -16.005095 Long: -18.991048	105	PM: E'ly 14 -18 knots, slight sea.
	20:05 (UTC-1)	CTD022 to full depth Lat: -16.00432 Long: -18.990865	106	
	22:00 (UTC-1)	VMP6000 recovered Lat: -16.006594		

		Long: -18.995765		
11th March	03:02 (UTC-1) 05:51 (UTC-1) 06:20 (UTC-1) 06:47 (UTC-1) 09:06 (UTC-1) 10:53 (UTC-1) 12:17 (UTC-1) 14:43 (UTC-1) 15:55 (UTC-1) 18:12 (UTC-1) 20:16 (UTC-1) 20:31 (UTC-1) 23:56 (UTC-1)	CTD023 to 250m Lat: -15.999996 Long: -19.00000 Snowcatcher Lat: -15.999989 Long: -18.999997 Snowcatcher (23) Camera Frame Lat: -15.999989 Long: -18.999997 Snowcatcher (500m) Lat: -16.000003 Long: -18.999993 Bongo nets Lat: -15.999992 Long: -19.000035 Snowcatcher Lat: -16.000012 Long: -18.999994 CTD024 to 500m Lat: -15.999995 Long: -18.999991 SAPS deployed Lat: -16.000006 Long: -18.999997 SAPS recovered VMP6000 deployed Lat: -16.049797 Long: -18.895439 CTD025 full depth Lat: -16.048704 Long: -18.895231 CTD recovered	108 109 *109a* 110 111 112 113 114 115 116 117	AM: E'ly 15 – 18 knots, slight sea. Note: this Snowcatcher is missing from the ship's event log. PM: E'ly 15 – 20 knots.
12th March	00:16 (UTC-1)	VMP6000 recovered Lat: -16.05095 Long: -18.897145		AM: E'ly 10-16 knots, slight sea.

	01:26 (UTC-1) 02:17 (UTC-1) 03:01 (UTC-1) 05:45 (UTC-1) 07:18 (UTC-1) 09:24 (UTC-1) 11:49 (UTC-1) 13:03 (UTC-1) 15:22 (UTC-1) 18:44 (UTC-1) 19:46 (UTC-1)	Camera frame Lat: -15.999971 Long: -19.000614 Bongo net Lat: -15.999957 Long: -19.000601 CTD026 to 250m Lat: -15.999992 Long: -19.000003 Reposition to X1d CTD027 to 500m Lat: -16.000007 Long: -18.767346 VMP2000 deployed for 5 profiles Lat: -16.000067 Long: -18.76717 VMP2000 recovered Lat: -16.008151 Long: -18.750978 Transit to X1b CTD028 to 500m Lat: -15.775084 Long: -19.000481 VMP2000 deployed for 5 profiles Lat: -15.77533 Long: -18.999759 VMP2000 recovered Lat: -15.783185 Long: -18.977234 Transit to X1c CTD029 to 500m Lat: -16.221525 Long: -19.000757 VMP2000 for 5 profiles Lat: -16.221536	119 120 121 122 123 124 125 126 127	PM: E'ly 10-15 knots, slight sea.

		Long: -19.000706		
13th March	03:01 (UTC-1) 04:17 (UTC-1) 05:45 (UTC-1) 05:59 (UTC-1) 06:03 (UTC-1) 07:20 (UTC-1) 07:48 (UTC-1) 10:10 (UTC-1) 10:59 (UTC-1) 13:30 (UTC-1) 14:29 (UTC-1) 17:20 (UTC-1) 18:35 (UTC-1)	CTD030 to 250m Lat: -16.000035 Long: -18.99991 ARGO 6 (WHOI BGC 1639) deployed Lat: -15.98958 Long: -18.993158 Snowcatcher Lat: -15.998459 Long: -18.996547 Snowcatcher Lat: -15.998467 Long: -18.996538 Snowcatcher Lat: -15.998473 Long: -18.99655 Snowcatcher Lat: -15.998473 Long: -18.99654 Camera frame Lat: -15.998478 Long: -18.996548 Snowcatcher Lat: -15.999474 Long: -18.997417 Snowcatcher Lat: -15.999475 Long: -18.997414 CTD031 to 500m Lat: -15.999472 Long: -18.997424 SPAS deployed Lat: -15.999477 Long: -18.997417 SAPS recovered VMP6000 deployed Lat: -15.999408 Long: -18.997396	128 129 130 131 132 133 134 135 136 137 138 139	AM: E'ly 12-16 knots, slight sea. PM: E'ly 12-15 knots. Slight sea.

	18:47 (UTC-1) 21:50 (UTC-1) 23:54 (UTC-1)	CTD032 to full depth Lat: -15.999147 Long: -18.997329 VMP6000 recovered Lat: -16.00216 Long: -19.000439 Camera frame Lat: -15.999995 Long: -18.999968	140 141 142	
14th March	00:47 (UTC-1) 05:33 (UTC-1) 07:06 (UTC-1) 13:34 (UTC-1) 13:43 (UTC-1) 14:36 (UTC-1) 15:01 (UTC-1) 21:31 (UTC-1) 21:47 (UTC-1)	Bongo net Lat: -15.999991 Long: -18.999962 Transit to X1a CTD033 to 500m Lat: -15.999823 Long: -19.234068 VMP2000 for 5 profiles Lat: -15.999921 Long: -19.233905 Transit to find wirewalker. Wirewalker spotted CTD034 for wirewalker calibration Lat: -16.003003 Long: -19.877302 Wirewalker hooked. Wirewalker recovered. Transit to B VMP6000 deployed Lat: -15.999864 Long: -19.000052 CTD035 to full depth (not sampled) Lat: -15.998613 Long: -18.999565	143 144 145 146 147 147 148 149	AM: E'ly 10 knots, calm. PM: E'ly 10 knots, calm.

15th March	00:43 (UTC-1)	VMP6000 recovered Lat: -16.000849 Long: -19.003017	150	AM: E'ly 8 – 12 knots. Calm. Slight swell.
	03:05 (UTC-1)	CTD036 to 250m Lat: -15.999996 Long: -19.000001	151	
	05:51 (UTC-1)	Snowcatcher Lat: -15.999997 Long: -19.000003	152	
	06:30 (UTC-1)	Snowcatcher Lat: -15.999998 Long: -19.000004	153	
	07:11 (UTC-1)	Camera frame Lat: -15.99999 Long: -18.999996	154	
	09:12 (UTC-1)	Snowcatcher Lat: -15.999982 Long: -19.000015	155	
	12:17 (UTC-1)	Snowcatcher Lat: -16.000004 Long: -18.999987	156	PM: E'ly 8 – 12 knots. Calm. Slight swell
	12:36 (UTC-1)	Snowcatcher Lat: -15.999994 Long: -18.999992	157	
	12:55 (UTC-1)	Snowcatcher Lat: -15.999996 Long: -18.99999	158	
	13:29 (UTC-1)	CTD037 to 500m Lat: -15.999996 Long: -18.999987	159	
	14:31 (UTC-1)	SAPS deployed Lat: -16.000000 Long: -18.99999	160	
	17:19 (UTC-1)	SAPS recovered		
	18:16 (UTC-1)	VMP6000 deployed Lat: -15.999972 Long: -18.999947	161	
	18:27 (UTC-1)	CTD038 to full depth	162	

		Lat: -15.999783 Long: -18.999708		
	21:31 (UTC-1)	VMP6000 recovered Lat: -16.001569 Long: -19.002915		
	23:56 (UTC-1)	Camera frame Lat: -15.999997 Long: -18.999984	164	
16th March	00:50 (UTC-1)	Bongo net Last: -15.999993 Long: -18.999989	165	AM: E'ly 10-12 knots. Calm. Slight swell – confused, from 2 directions.
	01:38 (UTC-1)	VMP2000 13-hour station B begins Lat: -15.999996 Long: -18.999489	166	
	14:50 (UTC-1)	End VMP2000 station Lat: -15.995871 Long: -18.894543		
	15:38(UTC-1)	VMP6000 to full depth Lat: -16.001528 Long: -18.891576	167	
	15:52 (UTC-1)	CTD039 full depth Lat: -15.999998 Long: -18.892396	168	
	19:33 (UTC-1)	VMP6000 recovered Lat: -16.000913 Long: -18.900179		
	20:48 (UTC-1)	VMP6000 deployed Lat: -16.001484 Long: -18.891325	169	Miscount of event numbers in ship's log 169-171.
	21:03 (UTC-1)	Bongo nets 300m Lat: -16.000836 Long: -18.891251	170	
	22:14 (UTC-1)	Camera frame: Lat: -16.001199 Long: -18.891426	171	
17th March	00:32 (UTC-1)	VMP6000 recovered Lat: -16.004202 Long: -18.892257		AM: E'ly 5 – 10 knots, calm, slight swell.

		Transit to B		
	02:59 (UTC-1)	CTD040 250m Lat: -16.000007 Long: -19.000005	172	Event numbers back on track
	05:53 (UTC-1)	Snowcatcher Lat: -15.999999 Long: -19.000007	173	
	06:31 (UTC-1)	Snowcatcher Lat: -16.000001 Long: -19.000005	174	
	07:04 (UTC-1)	Camera frame Lat: -15.999999 Long: -19.000004	175	
	09:14 (UTC-1)	Snowcatcher Lat: -15.999986 Long: -19.000006	176	
	12:13 (UTC-1)	Snowcatcher Lat: -15.999992 Long: -19.000004	177	
	13:49 (UTC-1)	CTD041 to 500m Lat: -15.999999 Long: -19.000004	178	
	14:40 (UTC-1)	SAPS deployed Lat: -16.000002 Long: -19.000009	179	
	17:20 (UTC-1)	SAPS recovered Lat: -15.999994 Long: -19.000005		
	23:54 (UTC-1)	Camera frame Lat: -15.999996 Long: -19.000001	180	
18th March	00:47 (UTC-1)	Bongo net Lat: -15.999994 Long: -18.999999	181	AM: E'ly 12-16 knots. Calm. Slight swell.
	03:03 (UTC-1)	CTD042 to 250m Lat: -16.000001 Long: -18.99999	182	

	05:47 (UTC-1) 08:28 (UTC-1) 09:07 (UTC-1) 11:59 (UTC-1)	Glider recovered Lat: -16.026752 Long: -19.087609 Mooring B released Mooring hooked All mooring recovered Transit to wirewalker	183 184	
19th March	11:29 (UTC-1) 11:52 (UTC-1) 16:45 (UTC-1)	Wirewalker hooked and recovery starts Lat: -15.323308 Long: -14.268075 Recovery complete. Transit to turbulence float. Turbulence float recovered. Lat: -15.263034 Long: -13.420916 Transit to R.	 185 186	AM: E'ly 10 knots. Calm. Slight swell. PM: E'ly 10-15 knots Calm. Slight swell.
20th March	04:20 (UTC-1) 04:33 (UTC-1) 06:36 (UTC-1) 08:10 (UTC-1) 08:45 (UTC-1) 10:42 (UTC-1) 11:01 (UTC-1)	Arrive R CTD043 to 500m Lat: -15.915073 Long: -13.02088 Glider recovered Lat: -15.895778 Long: -13.041901 Mooring R released and spotted. Lat: -15.986336 Long: -13.023201 Grappled and recovery commences. Recovery complete. Trace metal fish deployed. Lat: -15.965 Long: -13.060964	 187 188 189 190	AM: E'ly 10-12 knots, calm, slight swell.

21st March	Ship's time forward 1 hour to UTC 03:12 (UTC) 03:16 (UTC)	 TM fish recovered ARGO 8 (WHOI BGC 1637) Lat: -16.002297 Long: -9.989806	 191	E'ly 10-15 knots, calm, slight swell.
22nd March		Transit to A/X3		
23rd March	02:59 (UTC) 05:06 (UTC) 06:43 (UTC) 08:33 (UTC) 21:48 (UTC) 22:58 (UTC) 23:23 (UTC) 23:43 (UTC)	CTD044 to 250m Lat: -15.999994 Long: -0.999972 CTD045 to 500m Lat: -15.999989 Long: -0.999964 Glider deployed Lat: -15.993756 Long: -0.992852 Winch problems prevent plan to do snowcatchers etc. so switch to VMP2000 13-hour station. VMP2000 deployed for 13-hour station Lat: -15.993868 Long: -0.992482 VMP2000 recovered Lat: -16.111847 Long: -0.948456 Transit to X3 Snowcatcher Lat: -16.00001 Long: -1.000003 Snowcatcher Lat: -16.000004 Long: -1.000000 Camera frame Lat: -16.000006 Long: -1.000002	192 193 194 195 196 197 198	SSE'ly 10-15 knots

24th March	00:34 (UTC) 02:49 (UTC) 05:18 (UTC) 06:50 (UTC) 09:12 (UTC) 10:51 (UTC) 15:43 (UTC) 16:45 (UTC) 19:21 (UTC) 21:41 (UTC)	Bongo net Lat: -16.00001 Long: -0.999994 Transit to X3a VMP2000 for 5 profiles Lat: -15.999801 Long: -1.240244 CTD046 to 500m at X3c Lat: -16.009772 Long: -1.229165 ARGO 9 (German core AI2600-24DE02) Lat: -16.007438 Long: -1.228862 Transit to X3b CTD047 at X3b to 500m Lat: -15.775876 Long: -1.00116 VMP2000 for 5 profiles Lat: -15.776453 Long: -1.000878 VMP2000 recovered Lat: -15.793598 Long: -0.996052 Transit to X3c CTD048 at X3c Lat: -16.225385 Long: -1.000773 VMP2000 for 5 profiles Lat: -16.225388 Long: -1.000777 VMP2000 recovered Lat: -16.236767 Long: -0.987183 Transit to X3d CTD049 to 500m Lat: -15.99992	199 200 201 202 203 204 205 206 207	AM: ESE'ly 8-12 knots calm, slight swell. PM: ESE'ly 8-12 knots calm, slight swell.

	 23:04 (UTC)	Long: -0.760086 VMP2000 for 5 profiles Lat: -16.000198 Long: -0.759821	 208	
25th March	01:15 (UTC) 02:59 (UTC) 06:29 (UTC) 07:55 (UTC) 21:01 (UTC) 21:30 (UTC)	VMP2000 recovered Lat: -16.012101 Long: -0.751068 Transit to X3 CTD050 to 250m Lat: -16.000081 Long: -1.00027 Camera problems, so reorder schedule. CTD051 to 500m Lat: -16.000079 Long: -1.000253 Begin VMP2000 13-hour station Lat: -16.000389 Long: -0.999862 End VMP2000 station Lat: -16.0788 Long: -0.926709 CTD052 to 1000m Lat: -16.078822 Long: -0.926713 Transit to X3	 209 210 211 212	AM: SE'ly 20 knots, slight sea and swell. PM: SE'ly 20-25 knots, moderate sea.
26th March	00:13 (UTC) 02:22 (UTC) 03:59 (UTC)	Camera frame Lat: -15.999987 Long: -0.999982 Bongo net Lat: -16.000007 Long: -0.999988 Transit to glider position CTD053 to 500m Lat: -15.951786 Long: -0.949561	213 214 215	AM: SE'ly 15-20 knots, slight sea and swell.

	06:19 (UTC)	Recover glider Lat: -15.952385 Long: -0.964899 Transit to A10	216	
27th March	21:36 (UTC)	ARGO 10 (WHOI BGC 1553) Lat: -18.997892 Long: 5.996946	217	
28th March	08:55 (UTC)	ARGO 11 (WHOI BGC 1642) Lat: -19.999582 Long: 7.999196	218	
29th March		Transit		
30th March		Arrive Walvis Bay		

BODC Ship Fitted Systems Information Sheet

Cruise	JC275
Technician	Daniel Phillips
Date	20/02/2025 – 30/03/2025

Ship-fitted instruments:

The following table lists the logging status of ship-fitted instrumentation and suites.

Manufacturer	**Model**	**Function/data types**	**Logged? (Y/N)**	**Comments**
Steatite	MM3S	GPS network time server (NTP)	N	Not logged
Applanix	POS MV	DGPS and attitude	Y	
C-Nav	3050	DGPS and DGNSS	Y	
Kongsberg Seatex	Seapath 330+	DGPS and attitude	Y	
Sonardyne	Ranger2 USBL	USBL	Y	
Sperry Marine		Ship gyrocompass	Y	
Kongsberg Maritime	Simrad EA640	Single beam echo sounder (hull)	Y	
Kongsberg Maritime	Simrad EM122	Multibeam echo sounder (deep)	Y	Run discretely
Kongsberg Maritime	Simrad EM710	Multibeam echo sounder (shallow)	N	
Kongsberg Maritime	Simrad SBP27	Sub bottom profiler	N	
Kongsberg Maritime	Simrad EK80	Scientific echo sounder (fisheries)	N	
NMFSS	CLAM	CLAM system winch log	Y	
NMFSS	Surfmet	Meteorology suite	Y	
NMFSS	Surfmet	Surface hydrography suite	Y	
		Skipper log (ship's velocity)	Y	
Rutter OceanWaveS GmbH	WaMoS II Sigma S6	Wave Radar	Y	
RSAqua	Rex2	Wave Height Sensor	Y	
Teledyne RD Instruments	Ocean Observer 75 kHz	UHDAS	Y	

Teledyne RD Instruments	Ocean Observer 150 kHz	UHDAS	Y	
DGS	AT1M	Gravity	N	
Micro g LaCoste	S84	Gravity	N	

Ship Scientific Systems

Daniel Phillips

Cruise ID	Departure	Arrival	SSS Technician(s)
JC275	2025-02-20 BRRIO	2025-03-30 NAWVB	Daniel Phillips

Cruise Overview

Ship Scientific Systems (SSS) is responsible for operating and managing the Ship's scientific information technology infrastructure, data acquisition, compilation and delivery, and the suite of ship-fitted instruments and sensors in support of the Marine Facilities Programme (MFP)

The work site was the mid-Atlantic ridge in the South Atlantic ocean.

The main objectives for SSS in the service of the science party on this cruise were:

1. Acquire underway data and metadata, including sea-surface, meteorological, position and attitude, depth and multibeam swath.
2. Provide services for recording metadata and events and monitoring data streams.
3. Undertake multibeam surveys of mooring sites around the ridge.
4. Operate and support USBL equipment for tracking VMP6000 deployments.
5. Provide basic IT support.

All times in this report are in UTC.

Summary

A summary of the progress made against objectives is shown below.

[X] Objectives, [X] completed, [X] partially completed, [X] not completed.

Target	Outcomes	Objective met?
Acquire underway data and metadata, including sea-surface, meteorological,		**Yes**

position and attitude, depth and multibeam swath.		
Provide services for recording metadata and events and monitoring data streams.		Yes
Undertake multibeam surveys of mooring sites around the ridge.		Yes
Operate and support USBL equipment for tracking VMP6000 deployments		Yes
Provide basic IT support		Yes

Scientific computer systems

Underway data acquisition

Data from the suite of ship-fitted scientific instrumentation was aggregated onto a network drive on the ship's file server. This was available throughout the voyage in read-only mode to permit scientists to work with the data as it was acquired. A Public network folder was also available for scientists to share files.

A copy of these two drives are written to the end-of-cruise disks that are provided to the Principal Scientist and the designated data centre.

The designated data centre for this cruise is: British Oceanographic Data Centre

List of logged ship-fitted scientific systems:

`/Cruise_Reports/JC275_Ship_fitted_information_sheet.docx`

The data acquisition systems used on this cruise are detailed in the table below. The data and data description documents are filed per system in the *Data* and *Documentation* directories respectively within Ship Systems folder on the cruise data disk.

Table 1: Data acquisition systems used on this cruise.

Data acquisition system	Usage	Data products	Directory system name
Ifremer TechSAS	Continuous	NetCDF ASCII pseudo-NMEA	`/TechSAS/`
NMF RVDAS	Continuous	ASCII Raw NMEA SeaDataNet NetCDF (Testing)	`/RVDAS/`
Kongsberg SIS (EM122)	Discrete	Kongsberg .all	`/Acoustics/EM-122/`
Kongsberg EA640	Continuous	None, redirected to Techsas/RVDAS RAM	`/Acoustics/EA-640/`
UHDAS (ADCPs)	Continuous	ASCII raw, RBIN, GBIN, CODAS files	`/Acoustics/ADCP/`
Sonardyne Ranger2	Discrete	None, redirected to Techsas/RVDAS RAM	`/Acoustics/USBL/`

Data description documents per system:

`/Ship_Systems/Documentation/[systemName]/`

Data directories per system:

`/Cruise_Reports/Documentation/[systemName]/`

Significant acquisition events and gaps

On this cruise, the NMF Event Logger/BAS Event Logger was used with CSV records of events saved to the cruise data directory.

Path and pattern to event log CSV files:

`/Cruise_Reports/Event_Logs/backups/csv/[logName]/*.csv`

Summary of main events

Date	Time start*	Time end*	Event
2025-02-10	16:35:00		Data acquisition started
2025-02-20	12:00:00		RRS James Cook left Rio port.
2025-03-30	06:00		RRS James Cook arrived in Walvis Bay port.
2025-03-30	07:00		Data acquisition ended.

Summary of data gaps

Date	Time start	Time end	Event
2025-02-21		14:00	Left Brazilian EEZ. Science systems started.
2025-02-22	12:15		Entered Brazilian EEZ. Science acquisition stopped
2025-03-23		22:40	Left Brazilian EEZ. Science acquisition resumed.
2025-03-21	06:50		Entered Saint Helena EEZ. Science acquisition stopped.
2025-30-22		18:30	Left Saint Helena EEZ. Science acquisition resumed.
2025-03-28	13:10		Entered Namibian EEZ. Science acquisition stopped.

Internet provision

Satellite communications were provided with Starlink, VSat and Iridium Certus.

*Note: OneWeb should have been the main high-speed internet link instead of Starlink, but it is still not fully operational.

The ship operated with bandwidth controls to prioritise business use.

Outreach and streaming

None.

Instrumentation

Coordinate reference

Path to ship survey files:

`/Ship_Systems/Documentation/Vessel_Survey`

Origin (RRS James Cook)

The common coordinate reference was defined by the Blom Maritime survey (2006) as:

1. The reference plane is parallel with the main deck abeam (transversely) and with the baseline (keel) fore- and aft-ways (longitudinally).
2. Datum (X = 0, Y = 0, Z = 0) is centre topside of the Applanix motion reference unit (MRU) chassis.

Multibeam

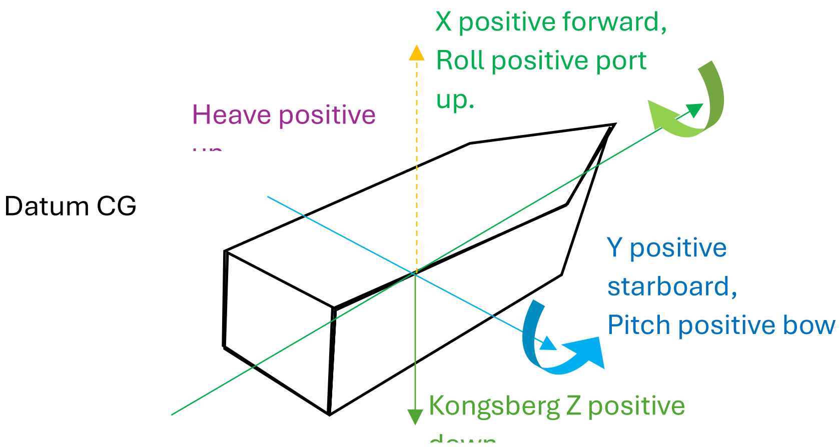


Figure 1: Conventions used for position and attitude. On the Discovery, the Datum is the CRP at the CG. On the Cook the Datum is on the centre, topside of the Applanix MRU.

The Kongsberg axes reference conventions are (see Figure 1) as follows:

1. X positive forward,
2. Y positive starboard,
3. Z positive downward.

The rotational sense for the multibeam systems and Seapath is set to follow the convention of Applanix PosMV (the primary scientific position and attitude system), as per Figure 1.

Primary scientific position and attitude system

The translations and rotations provided by this system (Applanix PosMV) have the following convention:

1. Roll positive port up,
2. Pitch positive bow up,
3. Heading true positive to starboard,
4. Heave positive up.

Position, attitude and time

System	Navigation (Position, attitude, time)		
Data product(s)	NMEA (mvpos,mvatt,spatt,sppos,cnpos): `/Ship_Systems/Data/TechSAS/NMEA/` NetCDF (GPS): `/Ship_Systems/Data/TechSAS/NetCDF/` Raw NMEA (POSMV,SEAPATH,CNAV): `/Ship_Systems/Data/RVDAS/rawdata`		
Data description	`/Ship_Systems/Documentation/GPS_and_Attitude/Data_Description`		
Other documentation	`/Ship_Systems/Documentation/GPS_and_Attitude`		
Component	Purpose	Outputs	Headline Specifications
Applanix PosMV	Primary GPS and attitude.	Serial NMEA to acquisition systems and multibeam	Positional accuracy within 0.15 m.
Kongsberg Seapath 330	Secondary GPS and attitude.	Serial and UDP NMEA to acquisition systems and multibeam	Positional accuracy within 1 m.
Oceaneering CNav 3050	Correction service for primary and secondary GPS and dynamic positioning.	RTCM to primary and secondary GPS	Positional accuracy within 0.15 m.
Meinberg NTP Clock	Provide network time	NTP protocol over the local network.	

Significant position, attitude or time events or losses

Date	Time start*	Time end*	Event
			None

Ocean and atmosphere monitoring systems

SURFMET

System	SURFMET (Surface water and atmospheric monitoring)	
Data product(s)	NMEA (surfm,sbe38,sbe45,winds): `/Ship_Systems/Data/TechSAS/NMEA/` NetCDF (SURFMETV3, SBE38,TSG,WINDSONIC): `/Ship_Systems/Data/TechSAS/NetCDF/` Raw NMEA (SURFMET,SBE38,SBE49, WINDSONIC): `/Ship_Systems/Data/RVDAS/rawdata`	
Data description	`/Ship_Systems/Documentation/Surfmet/Data_Description`	
Other documentation	`/Ship_Systems/Documentation/Surfmet`	
Calibration info	See Ship Fitted Sensor sheet for calibration info for each sensor.	
Component	Purpose	Outputs
Inlet temperature probe (SBE38)	Measure temperature of water at hull inlet.	Serial to Interface Box.
Drop keel temperature probe (SBE38)	Measure temperature of water in drop keel space.	Serial to Interface Box.
Thermosalinograph (SBE45)	Measure temp. and conductivity at sampling board. Salinity is calculated.	Serial to Interface Box.
Interface Box (SBE90402)	Signals management.	Serial to Moxa.
Debubbler	Reduces bubbles through instruments.	None.
Transmissometer (CST)	Measure of transmittance.	Analogue to NUDAM.

Fluorometer (WS3S)	Measure of fluorescence.	Analogue to NUDAM.
Air temperature and humidity probe (HMP45A, HMP155)	Temperature and humidity at met. platform.	Analogue to NUDAM.
Ambient light sensors (PAR, SKE510; TIR, CMP6)	Ambient light at met. platform.	Analogue to NUDAM.
Barometer (PTB110, PTB210)	Atmospheric pressure at met. platform.	Analogue to NUDAM.
Anemometer (Windsonic)	Wind speed and direction at met. platform.	Serial to Moxa.
NUDAM	A/D converter.	Serial NMEA to Moxa.
Moxa	Serial to UDP converter.	UDP NMEA to Surfmet VM.
Surfmet Virtual Machine	Data management.	UDP NMEA to TechSAS, RVDAS.

The below calibration equations are used for the TechSAS NetCDF data products.

Component	Calibrated product steps
SBE38: Temperature (°C)	No calibration to apply because the residuals are below uncertainty.
SBE45: Temperature (°C)	No calibration to apply because the residuals are below uncertainty.
SBE45: Conductivity (S m^{-1})	No calibration to apply because the residuals are below uncertainty.
CST: Transmission (%)	$\mathrm{Product} = (\mathrm{Data} - V_{\mathrm{dark}})/(V_{\mathrm{ref}} - V_{\mathrm{dark}})$. Here product has units % and data, V_{dark} and V_{ref} have units V.
WS3S: Fluorescence (µg L^{-1})	$\mathrm{Product} = \mathrm{Coefficient} \times (\mathrm{Data} - \mathrm{Offset})$. Here product has units µg L^{-1}, coefficient has units µg L^{-1} V^{-1}, and data and offset have units V.
HMP45A / HMP155: Temperature (°C)	No calibration to apply because the residuals are below uncertainty.

HMP45A / HMP155: Relative humidity (%)	No calibration to apply because the residuals are below uncertainty.
PTB110 / PTB210: Pressure (hPa)	No calibration to apply because the residuals are below uncertainty.
SKE510: PAR (W m^{-2})	$\text{Product} = \text{Data} \times \left(\frac{10^6}{\text{Coefficient}}\right)$. Here product has units W m^2, data has units 10^{-5} V, the 10^6 scalar has units μV V^{-1}, and coefficient has units μV m^2 W^{-1}.
CMP6: TIR (W m^{-2})	$\text{Product} = \text{Data} \times \left(\frac{10^6}{\text{Coefficient}}\right)$. Here product has units W m^2, data has units 10^{-5} V, the 10^6 scalar has units μV V^{-1}, and coefficient has units μV m^2 W^{-1}.
Windsonic: Wind speed (m s^{-1})	No calibration to apply.
Windsonic: Wind direction (m s^{-1})	No calibration to apply.

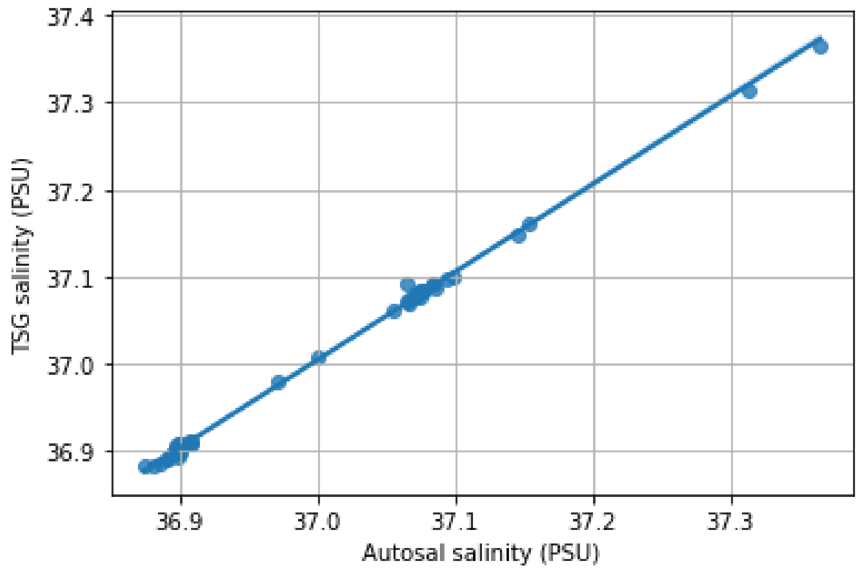
The NMF Surfmet system was run throughout the cruise, excepting times for cleaning, entering and leaving port, and whilst alongside. Please see the separate information sheet for details of the sensors used and whether their recorded data have calibrations applied or not.

Surface water sampling board maintenance

Date	Time start*	Time end*	Event	Fluoro (V)
2025-02-28	10:00	11:13	Cleaning	0.0379
2025-03-07	11:03	12:20	Cleaning	0.0383
2025-03-14	10:54	12:00	Cleaning	0.0407
2025-03-21	~10:00	~12:00	Cleaning	Not recorded.
2025-03-298	~09:00	~10:00	Cleaning	Not recorded.

The system was cleaned prior to the cruise.

48 samples of seawater, from the underway board siphon near the TSG instrument, were collected and analysed with the Autosal (J Clarke, S&M). Note the script used here does not bilinearly interpolate the known standard value offset to the measured sample values. This should be done by the data processor.



Wave radar

System	WAMOS Wave Radar	
Data product(s)	NMEA (wamos, rexwr): `/Ship_Systems/Data/TechSAS/NMEA/` NetCDF (NC): `/Ship_Systems/Data/TechSAS/NetCDF/` Raw NMEA (WAMOS, REX2): `/Ship_Systems/Data/RVDAS/rawdata`	
Data description	`/Ship_Systems/Documentation/Wamos/Data_Description`	
Other documentation	`/Ship_Systems/Documentation/Wamos`	
Component	Purpose	Outputs
Rutter OceanWaves WAMOS	Measure wave height, direction, period and spectra.	Summary statistics in NMEA to TechSAS and RVDAS. Spectra files.
RsAqua Rex2 Wave Height Sensor	Measure wave height at bow to provide calibration reference dataset.	Wave height NMEA, UDP to TechSAS, RVDAS.
Furuno Radar	Measures radar reflection on sea surface.	Radar data to WAMOS.

The wave radar magnetron requires annual replacement. Following replacement, WAMOS needs to collect wave data within 5 km of another wave height sensor over the full range of seastates in order to derive wave height calibration coefficients for the new magnetron. This reference dataset can be derived by examining the ship's track for wave buoys and downloading their data, or by using the onboard RsAqua Wave Height sensor fitted on the ship's bow.

Summary of data gaps

Date	Time start	Time end	Event
			None

Hydroacoustic Systems

System	Acoustics	
Data product(s)	Raw (EA-640, EM-122): `/Ship_Systems/Data/Acoustics` NMEA (eadep, emdep): `/Ship_Systems/Data/TechSAS/NMEA` NetCDF (EA600, DEPTH): `/Ship_Systems/Data/TechSAS/NetCDF` Raw NMEA (EA640, EM122cb): `/Ship_Systems/Data/RVDAS/rawdata`	
Data description	`/Ship_Systems/Documentation/Acoustics`	
Other documentation	`/Ship_Systems/Documentation/Acoustics`	
Component	**Purpose**	**Operation and Outputs**
10/12 kHz Single beam (Kongsberg EA-640)	Primary depth sounder	Continuous, free running NMEA over serial, raw files
12 kHz Multibeam (Kongsberg EM-122)	Full-ocean-depth multibeam swath.	Discrete Binary swath, centre-beam NMEA, *.all files, optional water column data
Drop keel sound velocity sensor	Provide sound velocity at transducer depth	Continuous, free running Value over serial to Kongsberg SIS.
75 kHz ADCP (Teledyne OS75)	Along-track ocean current profiler	Continuous, free running (via UHDAS)

150 kHz ADCP (Teledyne OS150)	Along-track ocean current profiler	Continuous, free running (via UHDAS)
USBL (Sonardyne Ranger2)	Underwater positioning system to track deployed packages or vehicles.	Discrete NMEA over serial

Marine Mammal Protection

NMF policy is to follow JNCC guidelines for marine mammal observations before operating any equipment which causes significant acoustic disturbance in the water column. Such equipment includes the deep-water multibeam and sub-bottom profiler. For these systems, an MMO procedure is followed, which, in summary, involves a 60-minute bridge observation with a ramped start 45 minutes into the observation.

Path to Marine Mammal Observations logs:

`/Ship_Systems/Documentation/Acoustics/MMOs`

A member of the technical party was responsible for carrying out and recording MMO activities.

Table 2: Marine mammal observation events by SSS.

Date	System	Obs. Start Time	Sys. Start Time Full Power	Notes (inc. any observations or actions)
2025-02-24	EM122	13:23	14:43	No mammals spotted. Multibeam kept on for remainder of expedition.

Sound velocity profiles

Sound velocity profiles were measured directly with a Midas SVP, derived from CTD or calculated from the WOA13 model using Ifremer DORIS.

Path of sound velocity profile data on the cruise datastore:

`/Ship_Systems/Data/Acoustics/Sound_Velocity`

Details of when sound velocity profiles were taken and applied are shown in the table below:

Table 3: Sound velocity profiles.

Datetime	Method	Location (Lat/Lon)	Filename	Datetime SVP applied to SIS / Ranger2
2025-02-25 09:30	CTD	-16.128, -19.260	JC275_250225_CTD001_thinned.asvp	Same
2025-02-28 07:20	CTD	-16.000, -13.000	JC275_CTD_003.asvp	Same

Equipment-specific comments

ADCPs

Path of ADCP data on the cruise datastore:

`/Ship_Systems/Data/Acoustics/ADCP`

Attribute	Value
Acquisition software	UHDAS
Frequencies used	75 kHz, 150 kHz
Running mode	Free-running (untriggered)

The 75 kHz ADCP showed poor return quality in depths of 300-450 m. On 2025-02-27, the deck unit to transducer cable “BEAM2 XMIT to XMIT RTN” had a resistance of 6.6 Ω compared to the expected 1.5 M Ω indicating an electrical short. On 2025-03-07, the cable was reconnected and the fault was no longer present.

When processing the data up until 2025-03-07, it is recommended to try to remove BEAM2 from the data product.

EM-122 Configuration and Surveys

Path of Multibeam data on the cruise datastore:

`/Ship_Systems/Data/Acoustics/EM-122`

Path of EM122 CARIS Vessel Configuration File:

`/Ship_Systems/Data/Acoustics/EM-122/CARIS_Processed/VesselConfig`

<table>
<tr><th>Attribute</th><th>Value</th></tr>
<tr><td>Number of surveys</td><td>2 main surveys of moorings sites. SIS configured for continuous survey</td></tr>
<tr><td>Date of patch test</td><td>Not undertaken.</td></tr>
<tr><td>Offsets and rotations</td><td>
<table>
<tr><th>Item</th><th>X (m, + Forward)</th><th>Y (m, + Starboard)</th><th>Z (m, + Down)</th></tr>
<tr><td>Tx transducer</td><td>19.205</td><td>1.830</td><td>6.934</td></tr>
<tr><td>Rx transducer</td><td>14.094</td><td>0.950</td><td>6.932</td></tr>
</table>
<table>
<tr><th>Item</th><th>Roll (deg)</th><th>Pitch (deg)</th><th>Yaw (deg)</th></tr>
<tr><td>Tx transducer</td><td>-0.35</td><td>-0.1</td><td>0.19</td></tr>
<tr><td>Rx transducer</td><td>-0.06</td><td>0.1</td><td>0.15</td></tr>
</table>
</td></tr>
<tr><td>Post-processing undertaken</td><td>None.</td></tr>
</table>

USBL Configuration and deployments

Path of Multibeam data on the cruise datastore:

NMEA: `/Ship_Systems/Data/TechSaS/NMEA/usblp`

NetCDF: `/Ship_Systems/Data/TechSaS/NetCDF/USBL`

$PSONLLD ASCII:
`/Ship_Systems/Data/RVDAS/rawdata/*RANGER2USBL*.txt`

Attribute	Value
Number of deployments	For each VMP6000 deployment.
Heads used for operations	Port
Datetime of last CASIUS	2023-02-15
Port Head 1DRMS	0.50 % of depth

Other systems

Cable Logging and Monitoring

Winch activity is monitored and logged using the CLAM system.

NMF Sensors Technical Details

Paul Henderson, John Clarke, Tina Thomas, Paul Provost & Jon Short

Cruise Summary

CTD frame with water samplers and LADCPs:

Total number of deployments = 53; deepest deployment = 4754 m (cast 025).

SAPs:

Total number of deployments = 7; deepest deployment = 500m

FastOcean FRRf3 (on Red Camera Frame):

Total number of deployments = 18; deepest deployment = 600m

VMP 2000

Total number of deployments = 274; deepest deployment = 1600m

VMP 6000

Total number of deployments = 12; deepest deployment = 4650m

Stainless Steel CTD

Stainless Steel CTD Wire

CTD Wire 2 was used for all casts. The wire was mechanically and electrically terminated and load tested to 2 tonnes. Resistance and insulation of the cable were checked periodically. Fastener torque settings of the mechanical termination were checked throughout and no slippage was noted. The termination was left on at the end of the cruise.

CTD Wire 2 before cast 001 readings:

Resistance 74 Ohms, Insulation >1000 MOhms @500 VDC

CTD Wire 2 readings after cast 053 readings:

Resistance 73 Ohms, insulation >1000 MOhms @500 VDC

Stainless Steel CTD sensor set-up

The CTD frame was setup with primary conductivity, temperature, and dissolved oxygen sensors on the vane and secondary conductivity and temperature sensors on the 9plus. Other sensors on the frame included an altimeter, fluorometer, transmissometer, backscatter, and 2 × PAR. There were 2 × 300Hz LADCPs deployed on the frame.

On cast 043, 2 × RBR Concerto, Tridente optical sensor and Li-cor PAR were added to the vane to compare against data from the Wire-Walker drifting moorings.

During the first two casts, low signal voltage from light scattering sensor s/n BBRTD–5466 gave <0 m^{-1}/sr values in SeaSave. Swapping to sensor s/n BBRTD–6043 resolved this issue.

Full sensors information can be found on the Sensor information sheet in Appendix 1. Configuration reports for the SeaSave setup can be found in Appendix 2.

Stainless Steel Water Samplers

OTE 20L water samples were used on the stainless-steel frame and performed well throughout the cruise with only the occasional misfire. The carousal was removed from the frame at the start of the cruise to wash and exercise the release mechanisms. A number of the water samplers' taps had their O-rings replaced over the cruise.

SeaBird Data Processing

Basic post-processing of the CTD cast data was carried out following guidelines established by BODC (ref. Moncoiffe 7th July 2010). Casts were processed using SBE Data Processing, V7.26.7. The following modules were used:

- Data Conversion
- Bottle Summary

Data from each cast was processed using CTD2MET and sent to the Met Office.

All SeaBird and associated CTD data and documents were saved to the following folder:

Current_cruise\Sensors_and_Moorings\CTD

Autosal

A Guideline Autosal salinometer, s/n: 72227, located in the ET workshop/Salinometer laboratory, was used for the salinity measurements. The rubber band driving the stirrer was initially replaced as it had perished and broken. Bath temperature was set at 21°C with ambient room temperature approximately 18.5°C-20°C. The salinometer was standardized before the first set of samples and then not adjusted for the duration of the cruise. A standard, recorded in the spreadsheet as '0', was analysed before and after each crate of samples to monitor and record drift. Standard deviation was set to 0.00002 for all conductivity readings.

Standard used:

IAPSO Standard Seawater
Batch: P168
Expiry: 1st December 2026
K15: 0.99993
Practical Salinity: 34.997

Water samples were taken from CTD casts and analysed. Results are tabulated in .xls spreadsheets JC275 04 25 Mar 2025, JC275 11 11 Mar 2025, JC275 30 25 Mar 2025, JC275 33 11 Mar 2025, JC275 36 13 Mar 2025, JC275 37 26 Mar 2025, JC275 38 09 Mar 2025, JC275 Standard 09 Mar 2025 & JC275 38 29 Mar 2025.

The "Autosal" application, written in Labview, was used to record salinity data.

All Autosal and associated salinity data were saved to the following folder:

Current_cruise\Sensors_and_Moorings\Autosal

LADCP

2 × 300Hz TRDI Workhorse Lowered Acoustic Doppler Current Profilers (LADCP) were attached on each deployment of the the stainless-steel CTD frame with the Master setup as the Down-looker and the Slave setup as the Up-looker. Charging and data transfer was done via the MOXA in the Main Lab. Occasionally, the Master LADCP froze but would respond following power cycling or sending breaks to the slave. Data was downloaded using BBTalk. Command Files for each LADCP can be found in Appendix 3.

All LADCP and associated data were saved to folder Current_cruise\Sensors_and_Moorings\LADCP.

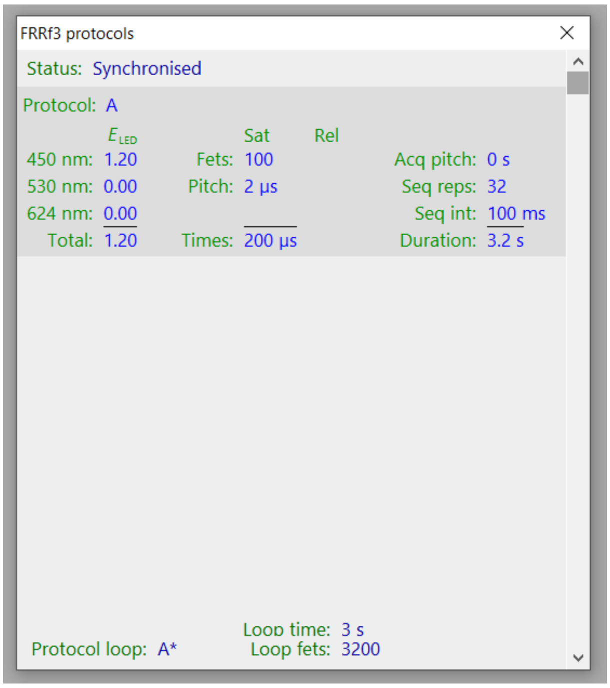
CTG FastOcean FRRf3

The CTG FastOcean FRRf3 was attached to the Red Camera Frame for casts 001 – 020 (excluding 008 & 016) down to 600 meters. The battery pack and instrument were set in profiling mode with remote start via key fob.

Instrument setup settings were:

- FRRf3 data archiving
    - Archiving options
        - Within FRRf3
    - New file trigger
        - Duration
    - Trigger value
        - 2
- FRRf3 PMt eht (V)
    - 400
- FRRf3 automation
    - Deployment mode
        - Autonomous
    - Function
        - N/A
- FRRf3 acquisition
    - Mode
        - Continuous
    - Pre start delay:
        - 0S

The settings used for the sampling protocol are shown below:



Data was downloaded and renamed after each cast and saved to Current_cruise\Sensors_and_Moorings\FastOcean

FastOcean FRRf3 on Red Camera Frame prior to deployment

SAPs

Four Stand Alone Pumps (SAPs) were deployed on seven occasions to a maximum depth of 500m. Deployments were from the Romica deck winch (8mm wire), using the starboard pedestal crane. POLLY, DAISY, HOLLY and SOPHIE were used with KITTY on board as a spare. During the second deployment DAISY slipped down the wire, damaging an impeller housing. A tool was subsequently manufactured to ensure the clamps were adequately attached to the wire. Each SAP was setup with a 1.5hr delay and a 2hr pump time.

SBE39 sensors attached to the SAP frame recorded deployment pressure and temperature at one-minute intervals.

All SAP and associated data were saved to folder Current_cruise\Sensors_and_Moorings\SAPS

VMP 2000

The VMP winch and line thrower were installed inboard of the port pedestal crane. In total, 274 VMP2000 (Vertical Microstructure Profiler) casts, using s/n 291, were successfully completed to a target depth of 600m. During the first cast a number of "bad buffers" were noted and the instrument was recovered. Following instrument and termination inspection, no obvious faults were found. There were no other issues on any subsequent cast. One deep cast to around 1600m was used to fix a scrolling error on the winch.

Probe setup for s/n 291

Date	SBE 3F (temp)	SBE 4C (cond)	SBE 5T (pump)	Shear 1	Shear 2	microT 1	microT 2	microC	Comments
26/02/2025	6309	4644	9482	M399	M542	T1183	T1574	C123	Initial setup
01/03/2025			9905	M1090					Shear 1 replace due to signal noise. Pump replaced after deck tests in air
03/03/2025					M1100				Shear 2 replaced due to noisy signal - possibly from snagging or biofouling
04/03/2025					M1410				Shear 2 replaced due to noisy signal
08/02/2025					M1412				No signal on previous shear probe - Probe failed insulation and capacitance tests
10/03/2025								C202	microC swapped out
24/03/2025				M1090					shear 1 cleaned - noticed a little green buildup

The setup file used for s/n 291 can be found in Appendix 4. s/n 023 was setup as a spare but was unused, other than for a test cast. During this cast a small number of bad buffers occurred.

Probe setup for s/n 023

Date	SBE 3F (temp)	SBE 4C (cond)	SBE 5T (pump)	Shear 1	Shear 2	microT 1	microT 2	microC	Comments
26/02/2025	4869	3490	4767	M1039	M1042	T1585	T1586	C137	Initial setup
01/03/2025								C201	micro C swapped out due to broken sensor

All VMP2000 and associated data were saved to folder Current_cruise\Sensors_and_Moorings\VMP\VMP2000

VMP2000 s/n 291 setup prior to deployment

VMP 6000

The VMP Launch and Recovery System (LARS) was situated on the starboard side of the aft deck and the VMP6000 container on the port side inboard aft container slot. 12 VMP6000 (Vertical Microstructure Profiler) full depth casts were successfully completed using s/n 016. No problems were noted on any cast, other than the standard swapping out of probes. After the recovery of the final cast, water ingress was noticed between the release mechanism and the release cable, causing some corrosion.

Probe setup for s/n 016

Date	SBE 3F (temp)	SBE 4C (cond)	Shear 1	Shear 2	microT 1	micro T 2	microC	Comments
26/02/2025	4634	3240	M544	M989	T1576	T1584	C124	Initial setup
04/03/2025			M1408					Shear 1 swapped out due to noisy signal
05/03/2025				M542				Shear 2 replaced
11/03/2025			M1432					Shear 1 replaced
13/03/2025			M1434					Shear 1 replaced

Release and recovery aids setup for s/n 016

Date	Release	Iridium	VHF Beacon	Strobe	USBL WMT
26/02/2025	Hope	H02-053	X04-061	U03-042	2613

The setup file used for s/n 016 can be found in Appendix 5. s/n 107 was configured as a spare but not used and therefore no probes were assigned to it.

All VMP6000 and associated data were saved to folder
Current_cruise\Sensors_and_Moorings\VMP\VMP6000

VMP6000 s/n 016 setup prior to deployment

Appendix 1 – Sensor Information Sheets

SHIP: RRS JAMES COOK	CRUISE: JC275
FORWARDING INSTRUCTIONS / ADDITIONAL INFORMATION: Setup of Stainless Steel 24-way CTD frame JC275	
Checked By: P. Henderson | J. Clarke	DATE: 10/02/2025

Instrument / Sensor	Manufacturer/ Model	Serial Number	Channel	Casts Used
Stainless steel 24-way CTD frame	NOCS	SBE CTD10	n/a	All casts
Primary CTD deck unit	SBE 11plus	11P-24680-0589	n/a	All casts
CTD Underwater Unit	SBE 9plus	09P-77801-1182	n/a	All casts
24-way Carousel	SBE 32	32-31240-0423	n/a	All casts
Primary Temperature Sensor (Vane)	SBE 3P	03P-4814	F0	All casts
Primary Conductivity Sensor (Vane)	SBE 4C	04C-4139	F1	All casts
Digiquartz Pressure sensor	Paroscientific	129735	F2	All casts
Secondary Temperature Sensor (9plus)	SBE 3P	03P-5700	F3	All casts
Secondary Conductivity Sensor (9plus)	SBE 4C	04C-6109	F4	All casts
Primary Pump	SBE 5T	05T-4513	n/a	All casts
Secondary Pump	SBE 5T	05T-3609	n/a	All casts
Primary Dissolved Oxygen Sensor	SBE 43	43-4581	V0	All casts
Free	-	-	V1	All casts
Altimeter	Valeport VA500	81632	V2	All casts
Light Scattering Sensor	WET Labs ECO BBrtd	BBRTD-5466	V3	001 – 002
Light Scattering Sensor	WET Labs ECO BBrtd	BBRTD-6043	V3	003 – 053
Transmissometer	WET Labs C-Star DR	CST-1602DR	V4	All casts
Fluorometer	CTG AquaTracka Mk3	88-2615-126	V5	All casts
PAR Down-looking UWIRR	Satlantic Cosine PAR-LOG	PARLOGICSW-2367	V6	All casts
PAR Up-looking DWIRR	Satlantic Cosine PAR-LOG	PARLOGICSW-2366	V7	All casts
LADCP Down-looking (Master)	TRDI WHM 300KHz	4275	n/a	All casts
LADCP Up-looking (Slave)	TRDI WHM 300KHz	12369	n/a	All casts
LADCP battery pack	NOCS	WH007	n/a	All casts
20L Water Samplers	Ocean Test Equipment	1 through 24	n/a	All casts
Titanium EM CTD Swivel	MDS ST6003-2E2-Ti	1267-1	n/a	All casts

Appendix 2 – CTD Setup

Stainless Steel CTD Setup

```
PSA file: C:\Users\sandm\Documents\Cruises\JC275\CTD\Data\Seasave Setup
Files\JC275_1182_SS_NMEA.psa

Date: 03/29/2025

Instrument configuration file:
C:\Users\sandm\Documents\Cruises\JC275\CTD\Data\Seasave Setup
Files\JC275_1182_SS_NMEA.xmlcon

Configuration report for SBE 911plus/917plus CTD
------------------------------------------------

Frequency channels suppressed : 0
Voltage words suppressed      : 0
Computer interface            : RS-232C
Deck unit                     : SBE11plus Firmware Version >= 5.0
Scans to average              : 1
NMEA position data added      : Yes
NMEA depth data added         : No
NMEA time added               : Yes
NMEA device connected to      : PC
Surface PAR voltage added     : No
Scan time added               : Yes

1) Frequency 0, Temperature

   Serial number : 03P-4814
   Calibrated on : 25-Jul-24
   G             : 4.30074650e-003
   H             : 6.24052887e-004
   I             : 1.81702760e-005
   J             : 1.19832634e-006
   F0            : 1000.000
   Slope         : 1.00000000
   Offset        : 0.0000

2) Frequency 1, Conductivity

   Serial number : 04C-4139
   Calibrated on : 25-Jul-24
   G             : -9.91028410e+000
   H             : 1.46328141e+000
   I             : -1.31531228e-003
   J             : 1.82537978e-004
   CTcor         : 3.2500e-006
   CPcor         : -9.57000000e-008
   Slope         : 1.00000000
   Offset        : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

   Serial number : 129735
   Calibrated on : 17-Sep-24
   C1            : -6.064446e+004
   C2            : 6.966022e-002
   C3            : 1.971200e-002
   D1            : 2.882500e-002
```

```
   D2             : 0.000000e+000
   T1             : 3.029594e+001
   T2             : -6.713680e-005
   T3             : 4.165390e-006
   T4             : 0.000000e+000
   T5             : 0.000000e+000
   Slope          : 0.99980000
   Offset         : -3.77620
   AD590M         : 1.279180e-002
   AD590B         : -8.821250e+000

4) Frequency 3, Temperature, 2

   Serial number : 03P-5700
   Calibrated on : 25-Jul-24
   G              : 4.34184543e-003
   H              : 6.29044029e-004
   I              : 1.90537087e-005
   J              : 1.22708256e-006
   F0             : 1000.000
   Slope          : 1.00000000
   Offset         : 0.0000

5) Frequency 4, Conductivity, 2

   Serial number : 04C-6109
   Calibrated on : 08-May-24
   G              : -1.03775366e+001
   H              : 1.43610453e+000
   I              : -2.17432222e-003
   J              : 2.37424377e-004
   CTcor          : 3.2500e-006
   CPcor          : -9.57000000e-008
   Slope          : 1.00000000
   Offset         : 0.00000

6) A/D voltage 0, Oxygen, SBE 43

   Serial number : 43-4581
   Calibrated on : 29-May-24
   Equation       : Sea-Bird
   Soc            : 3.87100e-001
   Offset         : -5.12300e-001
   A              : -3.32260e-003
   B              : 1.68100e-004
   C              : -2.65000e-006
   E              : 3.60000e-002
   Tau20          : 1.25000e+000
   D1             : 1.92634e-004
   D2             : -4.64803e-002
   H1             : -3.30000e-002
   H2             : 5.00000e+003
   H3             : 1.45000e+003

7) A/D voltage 1, Free

8) A/D voltage 2, Altimeter

   Serial number : 81632
   Calibrated on : 09-Jun-22
   Scale factor  : 15.000
```

```
   Offset        : -0.013

9) A/D voltage 3, OBS, WET Labs, ECO-BB

   Serial number : BBRTD-6043
   Calibrated on : 05-Jan-23
   ScaleFactor   : 0.003084
   Dark output   : 0.069200

10) A/D voltage 4, Transmissometer, WET Labs C-Star

    Serial number : CST-1602DR
    Calibrated on : 12-Feb-25
    M             : 21.2319
    B             : -0.1295
    Path length   : 0.250

11) A/D voltage 5, Fluorometer, Chelsea Aqua 3

    Serial number : 88-2615-126
    Calibrated on : 10-Jul-23
    VB            : 0.166500
    V1            : 2.148400
    Vacetone      : 0.257850
    Scale factor  : 1.000000
    Slope         : 1.000000
    Offset        : 0.000000

12) A/D voltage 6, PAR/Irradiance, Biospherical/Licor

    Serial number        : PARLOGICSW-2367
    Calibrated on        : 16-Apr-24
    M                    : 0.80989300
    B                    : 1.03035300
    Calibration constant : 735890000.00000000
    Conversion units     : umol photons/m^2/sec
    Multiplier           : 1.00000000
    Offset               : 0.00000000

13) A/D voltage 7, PAR/Irradiance, Biospherical/Licor, 2

    Serial number        : PARLOGICSW-2366
    Calibrated on        : 16-Apr-24
    M                    : 0.80709400
    B                    : 1.05595400
    Calibration constant : 735890000.00000000
    Conversion units     : umol photons/m^2/sec
    Multiplier           : 1.00000000
    Offset               : 0.00000000

Scan length                  : 45
---------------------------------------------
Pump Control
   This setting is only applicable to a custom build of the SBE 9plus.
   Enable pump on / pump off commands: NO
---------------------------------------------
Data Acquisition:
   Archive data:                    NO
   Delay archiving:                 NO
   Data archive:
C:\Users\sandm\Documents\Cruises\JC275\CTD\Data\Raw Data\JC275_CTD_053.hex
```

```
   Timeout (seconds) at startup:    60
   Timeout (seconds) between scans: 20
---------------------------------------------
Instrument port configuration:
   Port      = COM5
   Baud rate = 19200
   Parity    = N
   Data bits = 8
   Stop bits = 1
---------------------------------------------
Water Sampler Data:
   Water Sampler Type:   SBE Carousel
   Number of bottles:    36
   Port:                 COM6
   Enable remote firing: NO
   Firing sequence:      User input
   Tone for bottle fire confirmation uses PC sound card.
---------------------------------------------
Header information:
   Header Choice = Prompt for Header Information
      prompt 0 = Ship: RRS James Cook
      prompt 1 = Cruise: JC275
      prompt 2 = Cast:
      prompt 3 = Station:
      prompt 4 = Event:
      prompt 5 = Date:
      prompt 6 = Time (UTC):
      prompt 7 = Latitude:
      prompt 8 = Longitude:
      prompt 9 = Depth (uncorrected m):
      prompt 10 = Principal Scientist: Jonathan Sharples
      prompt 11 = Operator:
---------------------------------------------
TCP/IP - port numbers:
   Data acquisition:
      Data port:            49163
      Status port:          49165
      Command port:         49164
   Remote bottle firing:
      Command port:         49167
      Status port:          49168
   Remote data publishing:
      Converted data port:  49161
      Raw data port:        49160
---------------------------------------------
Miscellaneous data for calculations
   Depth, Average Sound Velocity, and TEOS-10
      Latitude when NMEA is not available:  -16.00000000
      Longitude when NMEA is not available: 0.00000000
   Average Sound Velocity
      Minimum pressure [db]:                20.00000000
      Minimum salinity [psu]:               20.00000000
      Pressure window size [db]:            20.00000000
      Time window size [s]:                 60.00000000
   Descent and Acceleration
      Window size [s]:                      2.00000000
   Plume Anomaly
      Theta-B:                              0.00000000
      Salinity-B                            0.00000000
      Theta-Z / Salinity-Z                  0.00000000
      Reference pressure [db]               0.00000000
```

```
   Oxygen
      Window size [s]:                         2.00000000
      Apply hysteresis correction:             0
      Apply Tau correction:                    1
   Potential Temperature Anomaly
      A0:                                      0.00000000
      A1:                                      0.00000000
      A1 Multiplier:                           Salinity
---------------------------------------------
Serial Data Output:
   Output data to serial port: NO
---------------------------------------------
Mark Variables:
   No variables are selected.
---------------------------------------------
Shared File Output:
   Output data to shared file: NO
---------------------------------------------
TCP/IP Output:
   Raw data:
      Output raw data to socket:                 NO
      XML wrapper and settings:                  NO
      Seconds between raw data updates:          0.00000000
   Converted data:
      Output converted data to socket:           NO
      XML format:                                NO
---------------------------------------------
SBE 11plus Deck Unit Alarms
   Enable minimum pressure alarm:    NO
   Enable maximum pressure alarm:    NO
   Enable altimeter alarm:           NO
---------------------------------------------
SBE 14 Remote Display
   Enable SBE 14 Remote Display:     NO
---------------------------------------------
PC Alarms
   Enable minimum pressure alarm:    NO
   Enable maximum pressure alarm:    NO
   Enable altimeter alarm:           NO
   Enable bottom contact alarm:      NO
   Alarm uses PC sound card.
---------------------------------------------
Options:
   Prompt to save program setup changes: YES
   Automatically save program setup changes on exit: NO
   Confirm instrument configuration change: YES
   Confirm display setup changes: YES
   Confirm output file overwrite: YES
   Check scan length: YES
   Compare serial numbers: YES
   Maximized plot may cover Seasave: NO
```

Appendix 3 – LADCP Config Files

Master (downlooker)

```
;JC275 CarTRidge
;Jonathan Sharples
;NMF Technicians Paul Henderson/John Clarke/Tina Thomas/Paul Provost
;
```

```
;======================================================================
;                    D O W N L O O K E R . C M D
;                    doc: Tue Jun 15 11:46:07 2004
;                    dlm: Fri Jul  3 10:05:14 2020
;                    (c) 2004 A.M. Thurnherr
;                    uE-Info: 39 42 NIL 0 0 72 2 2 8 NIL ofnI
;======================================================================

; This is the default downlooker command file

; NOTES:
;   - this version requires firmware 16.30 or higher
;   - should contain only commands that change factory defaults
;   - assumes that WM15 (LADCP) mode is installed
;   - collect data in beam coordinates
;   - staggered single-ping ensembles every 1.3s/1.5s
;   - narrow bandwidth
;   - 25x 8m cells

; HISTORY:
;   Jan  7, 2011: - created for Firmware 16.30 or higher from old version
;             - increased pinging rate

; added file name prefix and comments
; this is the default for downlooker when paired with uplooker

CR1                     ; factory defaults
RN J275M          ; file name prefix
WM15              ; water mode 15 (LADCP)

TC2               ; ensembles per burst
LP1               ; pings per ensemble
TB 00:00:02.80          ; time per burst
TE 00:00:01.30          ; time per ensemble
TP 00:00.00       ; time between pings "staggered pinging with alternating
sampling intervals of 1.5 and 2.0 s works well"

LN25              ; number of depth cells
LS0800                  ; bin size [cm]
LF0               ; blank after transmit [cm] -- recommendation for WH300
is to set 0 and discard first bin, as traditional half-bin-length blank is
insufficient

LW1               ; narrow bandwidth LADCP mode
LV400             ; ambiguity velocity [cm/s] -- set to just over maximum
along-beam velocity (e.g. 1 m/s with heave compensation) ... ???

SM1               ; send sync pulses
SA011             ; send pulse before each ensemble
SB0               ; disable hardware-break detection on Channel B (ICN118)
SW5500                  ; wait .5500 s after sending sync pulse
SI0               ; # of ensembles to wait before sending sync pulse

EZ0011101         ; Sensor source:
                  ;     - manual speed of sound (EC)
                  ;     - manual depth of transducer (ED = 0 [dm])
                  ;     - measured heading (EH)
                  ;     - measured pitch (EP)
                  ;     - measured roll (ER)
                  ;     - manual salinity (ES = 35 [psu])
                  ;     - measured temperature (ET)
```

```
EX00100                 ; coordinate transformation:
                  ;     - radial beam coordinates (2 bits)
                  ;     - use pitch/roll (not used for beam coords?)
                  ;     - no 3-beam solutions
                  ;     - no bin mapping

CF11111                 ; Flow control:
                  ;     - automatic ensemble cycling (next ens when ready)
                  ;     - automatic ping cycling (ping when ready)
                  ;     - binary data output
                  ;     - enable serial output
                  ;     - enable data recorder

CD001000000       ;     - disable velocity serial output
                  ;     - disable correlation serial output
                  ;     - enable echo intensity serial output
                  ;     - disable percent good serial output
                  ;     - disable status serial output
                  ;     - reserved
                  ;     - reserved
                  ;     - reserved
                  ;     - reserved

CK                ; keep params as user defaults (across power failures)
CS                ; start pinging
```

Slave (uplooker)

```
;JC275 CarTRidge
;Jonathan Sharples
;NMF Technicians Paul Henderson/John Clarke/Tina Thomas/Paul Provost
;
;======================================================================
;                    U P L O O K E R . C M D
;                    doc: Tue Jun 15 11:46:07 2004
;                    dlm: Fri Jul  3 10:07:26 2020
;                    (c) 2004 A.M. Thurnherr
;                    uE-Info: 9 22 NIL 0 0 72 2 2 8 NIL ofnI
;======================================================================

; This is the default uplooker command file

; NOTES:
;   - this version requires firmware 16.30 or higher
;   - contains only commands that change factory defaults
;   - assumes that WM15 (LADCP) mode is installed
;   - collect data in beam coordinates
;   - single-ping ensembles; timing determined by [JC275_Master_Down.cmd]
;   - narrow bandwidth
;   - 25x 8m cells

; HISTORY:
;   Jan  7, 2011: - created for Firmware 16.30 or higher from old version
;                 - increased pinging rate

; added file name prefix and comments
; this is the default for uplooker when paired with downlooker

CR1                     ; factory defaults
RN J275S               ; file name prefix
```

```
WM15              ; water mode 15 (LADCP)

LP1               ; pings per ensemble
TP 00:00.00       ; time between pings
TE 00:00:00.00          ; time per ensemble

LN25              ; number of depth cells
LS0800                  ; bin size [cm]
LF0               ; blank after transmit [cm]

WB1               ; narrow bandwidth mode 1 (not sure if required)
LW1               ; narrow bandwidth LADCP mode
LV400             ; ambiguity velocity [cm/s]

SM2               ; receive sync pulses
SA011             ; wait for pulse before ensemble
SB0               ; disable hardware-break detection on Channel B (ICN118)

EZ0011101         ; Sensor source:
                  ;     - manual speed of sound (EC)
                  ;     - manual depth of transducer (ED = 0 [dm])
                  ;     - measured heading (EH)
                  ;     - measured pitch (EP)
                  ;     - measured roll (ER)
                  ;     - manual salinity (ES = 35 [psu])
                  ;     - measured temperature (ET)

EX00100                 ; coordinate transformation:
                  ;     - radial beam coordinates (2 bits)
                  ;     - use pitch/roll (not used for beam coords?)
                  ;     - no 3-beam solutions
                  ;     - no bin mapping

CF11101                 ; Flow control:
                  ;     - automatic ensemble cycling (next ens when ready)
                  ;     - automatic ping cycling (ping when ready)
                  ;     - binary data output
                  ;     - disable serial output
                  ;     - enable data recorder

;CD000000000            ;     - disable velocity serial output
                  ;     - disable correlation serial output
                  ;     - disable echo intensity serial output
                  ;     - disable percent good serial output
                  ;     - disable status serial output
                  ;     - reserved
                  ;     - reserved
                  ;     - reserved
                  ;     - reserved

CK                ; keep params as user defaults (across power failures)
CS                ; start pinging
```

Appendix 4 – VMP 2000 Setup Files

VMP 2000 s/n 291

```
; Standard configuration setup.cfg file for a downward profiling VMP.
; Change the vehicle type in the [instrument_info] section to rvmp for an
;  uprising profiler.
```

```
; Created by RSI, 2015-12-16
; Modified by Andrew Bourget,2018-04-13,for NOC.
; sensors shear and temperature have nominal values input in the setup
file.
; Modified with pressure transducer calibration coefficients 2018-04-13.
; Edited pressure coefficient to zero at RSI by subtracting 1.32 from
coeff. 0 2018-04-16
; Converted channel 64 from fast to slow in address matrix 2022-02-23

; Any line that starts with a semicolon, ";", is a comment and is ignored
by
;  software. Likewise, everything to the right of a semicolon is ignored.
;  Use this feature to leave notes and to indicate that you have made
changes
;  to this file. Indicate the date (YYYY-MM-DD), your name and a brief
;  description of your changes.

; The first section is the [root] section. It determines the data
;  acquisition parameters. It does not need to be declared explicitly.

rate        = 512    ; the sampling rate of "fast" channels
prefix      = JC275_A2_291_   ; the base name of your data files. A 3-digit
file number is
                               ; appended to this base name. The limit is 8
characters
                     ;  total for internally recording instruments.
disk        =        ; the directory for the data files. It must exist. The
directory
                               ; should be /data for internally recording
instruments. For
                               ; real-time instruments it is best to leave
this blank, so
                               ; that it defaults to the local directory.
recsize     = 1      ; the size of a record in seconds
man_com_rate= 5     ; the communication rate for real-time VMPs. This value
must
                     ; match the jumper settings of the RSTRANS in your
VMP.
                     ; It is not needed for internally recording
instruments.
no-fast      = 7     ; number of fast "columns" in the address matrix (see
below).
no-slow     = 2      ; number of slow "columns" in the address matrix.

; -----------------
;This section presents the address [matrix] of your instrument and
;  automatically ends the [root] section above. The first columns are
"slow"
;  channels as defined by the "no-slow" parameter in the [root] section.
;  The remainder are "fast" columns ("no-fast").
[matrix]
num_rows=8
row01   =   255   0     1     2     5     7     8     9     65
row02   =   32    40    1     2     5     7     8     9     65
row03   =   41    42    1     2     5     7     8     9     65
row04   =   4     6     1     2     5     7     8     9     65
row05   =   10    11    1     2     5     7     8     9     65
row06   =   12    64    1     2     5     7     8     9     65
row07   =   16    17    1     2     5     7     8     9     65
row08   =   18    19    1     2     5     7     8     9     65
```

```
; --------------------
;This section identifies your instrument. Only the vehicle is important.
[instrument_info]
vehicle = vmp      ; downward profiling
;vehicle= rvmp     ; upward profiling
model   = vmp-500_2000RT  ; The actual model. Used for trouble shooting.
sn      = 291     ; The serial numnber of the instrument. For trouble
shooting

; --------------------
; The next section is optional and can be expanded. Do not use the
parameter "id = ".
[cruise_info]
operator    = NOC
cruise      = JC275
ship        = James Cook

; --------------------
; Next come the [channel] sections. These are used to convert your data
;  into physical units, and to save them into a mat-file.
;  They also determine the name given to various signals
;  in your data file. Please, stick to the convention of
;  RSI because data visualization using the RSI Matlab Library of functions
;  assumes particular names. However, data will be converted into physical
;  units regardless of the name of the channels. If you change the names,
;  then data visualization and further processing is your responsibility.
;  A list of typical channel addresses (id) and their names and functions
;  is at the end of this file.

; Each channel section consists of a part that is unique to your
instrument.
;  It does not need to be changed. The second part is dependent on your
;  sensors (shear probes, FP07 thermistors, etc.) and must be updated
;  whenever you change a probe.
;
; The record average value is display for some channels with a real-time
;  instrument. Display can be forced or suppressed using
;  display = true, or display = false. Internally recording instruments
;  have no display. The units used for display can be specified with
;  units = [unit_symbols]. Keep it short for best display.

; The ground reference channel.
[channel]
id      = 0   ; the channel address, 0 to 254.  Listed in the [matrix]
section.
name    = Gnd ; the name it will have in the mat-file.
type    = gnd ; the algorithm used to convert raw data into physical units.
coef0   = 0   ; the coefficients required for conversion. None in this
case.

; --------------
; The piezo-vibration sensors
[channel]
id      = 1
name    = Ax
type    = accel
coef0=0
coef1=1
display = false

[channel]
```

```
id      = 2
name    = Ay
type    = accel
coef0=0
coef1=1
display = false

; -----------------
; The thermistor channels
; without pre-emphasis
[channel]
id          = 4
name        = T1
type        = therm
; instrument dependent parameters
adc_fs      = 4.096
adc_bits    = 16
a           = -11
b           = 0.99874
G           = 6
E_B         = 0.6824
; sensor dependent parameters
SN          = T1183
beta        = 3143.55
beta_2      = 2.5e5
T_0         = 289.301
cal_date    =
units       = [C]

; with pre-emphasis
[channel]
id          = 5
name        = T1_dT1
type        = therm
; instrument dependent parameter
diff_gain   = 0.927
adc_fs      = 4.096
adc_bits    = 16
a           = -11
b           = 0.99874
G           = 6
E_B         = 0.6824
SN          = T1183
beta        = 3143.55
beta_2      = 2.5e5
T_0         = 289.301

; without pre-emphasis
[channel]
id          = 6
name        = T2
type        = therm
; instrument dependent parameters
adc_fs      = 4.096
adc_bits    = 16
a           =-7.6
b           = 0.99818
G           = 6
E_B         = 0.68213
; sensor dependent parameters
SN          = T1574
```

```
beta        = 3143.55
beta_2      = 2.5e5
T_0         = 289.301
cal_date    =
units       = [C]

; with pre-emphasis
[channel]
id          = 7
name        = T2_dT2
type        = therm
diff_gain   = 0.906
adc_fs      = 4.096
adc_bits    = 16
a           = -11
b           = 0.99874
G           = 6
E_B         = 0.6824
SN          = T1574
beta        = 3143.55
beta_2      = 2.5e5
T_0         = 289.301

; -----------------
; The shear probe channels
[channel]
id          = 8
name        = sh1
type        = shear
; instrument dependent parameters
adc_fs      = 4.096
adc_bits    = 16
diff_gain   = 0.944
; sensor dependent parameters
sens        = 0.0727
SN          = M1090
cal_date    = 2022/10/13

[channel]
id          = 9
name        = sh2
type        = shear
; instrument dependent parameters
adc_fs      = 4.096
adc_bits    = 16
diff_gain   = 0.948
; sensor dependent parameters
sens        = 0.0661
SN          = M1412
cal_date    = 2022/04/07

; -----------------
; The pressure transducer
; without pre-emphasis
[channel]
id          = 10
name        = P
type        = poly
; instrument dependent parameters
coef0       = -7.58
coef1       = 0.12465
```

```
coef2       = 6.152e-9
cal_date    = 2018-04-13
units       = [dBar]

; with pre-emphasis
[channel]
id          = 11
name        = P_dP
type        = poly
; instrument dependent parameters
diff_gain   = 20.64
display=false

; pressure transducer voltage
[channel]
id      = 12
name    = PV
type    = poly
; instrument dependent parameters
coef0   = 4.096
coef1   = 1.25e-4
units   = [V]
display=false

[channel]
id_even=16
id_odd=17
name=SBT1
type=sbt
coef0=4.36216803e-3
coef1=6.39241236e-4
coef2=2.24866207e-5
coef3=2.11631346e-6
coef4=1000
coef5=24e6
coef6=128
SN=6309
date=2018-02-01
units=[^{\circ}C]

[channel]
id_even=18
id_odd=19
name=SBC1
type=sbc
coef0=-9.84390059e0
coef1=0
coef2=1.30544729e0
coef3=-4.31906053e-7
coef4=5.44530609e-5
coef5=24e6
coef6=128
SN=4644
date=2018-02-01
units=[mS cm^{-1}]

; -----------------
; Battery voltage or power supply voltage
[channel]
id          = 32
name        = V_Bat
```

```
type        = voltage
; instrument dependent parameters
G           = 0.1
adc_fs      = 4.096
adc_bits    = 16
units       = [V]

; -----------------
; The ADIS precision inclinometer with built in thermometer
[channel]
id      = 40
name    = Incl_X
type    = inclxy
; instrument dependent parameters
coef0   = 0
coef1   = 0.025
units   = [deg]

[channel]
id      = 41
name    = Incl_Y
type    = inclxy
; instrument dependent parameters
coef0   = 0
coef1   = -0.025
units   = [deg]

[channel]
id      = 42
name    = Incl_T
type    = inclt
; instrument dependent parameters
coef0   = 624
coef1   =-0.47
units   = [C]

; the micro-conductivity sensor. Remove if not installed
; first, without pre-emphasis
[channel]
; instrument dependent parameters
id          = 64
name        = C1
type        = ucond
a           =-0.766
b           = 113
adc_fs      = 4.096
adc_bits    = 16
; sensor dependent parameters
SN          = 202
K           = 1.03e-3 ; the cell constant
cal_date    =
units       = [mS/cm]

; with pre-emphasis
[channel]
; instrument dependent parameters
id          = 65
name        = C1_dC1
type        = ucond
diff_gain   = 0.3996
units       = [mS/cm]
```

```
a           =-0.766
b           = 113
adc_fs      = 4.096
adc_bits    = 16
; sensor dependent parameters
SN          = 123
K           = 1.03e-3 ; the cell constant



; -----------------
; This is a list of typical channels (addresses) and their signals
; Only some of these channels will be in any particular instrument
;  id    Name    - rate - Description
; -------------------------------------------------------------------
;  0     Gnd     - slow - Reference ground
;  1     Ax      - fast - horizontal acceleration in the direction of the
pressure port or ON/OFF magnet
;  2     Ay      - fast - horizontal acceleration orthogonal to the
direction of the pressure port
;  4     T1      - slow - Temperature from Thermistor 1 without pre-
emphasis
;  5     T1_dT1  - fast - Temperature from Thermistor 1 with pre-emphasis
;  6     T2      - slow - Temperature from Thermistor 2 without pre-
emphasis
;  7     T2_dT2  - fast - Temperature from Thermistor 2 with pre-emphasis
;  8     sh1     - fast - velocity derivative from shear probe 1
;  9     sh2     - fast - velocity derivative from shear probe 2
; 10     P       - slow - pressure signal without pre-emphasis
; 11     P_dP    - slow - pressure signal with pre-emphasis
; 12     PV      - slow - voltage on pressure transducer
; 16, 17 SBT     - slow - The even and odd addresses of the Sea-Bird SBE3
thermometer
; 18, 19 SBC     - slow - The even and odd addresses of the Sea-Bird SBE4
conductivity sensor
; 32     V_Bat   - slow - Battery or power supply voltage
; 40     Incl_X  - slow - Inclinometer, rotation around the x-axis
; 41     Incl_Y  - slow - Inclinometer, rotation around the y-axis
; 42     Incl_T  - slow - Inclinometer, its temperature
; 64     C1      - slow - micro-conductivity without pre-emphasis
; 65     C1_dC1  - fast - micro-conductivity with pre-emphasis
; 255    sp_char - slow - special Character that always returns 32752D or
7FF0H and
;                         is used to test the integrity of communication.

; End of setup configuration file.
```

Appendix 5 – VMP 6000 Setup File

VMP 6000 s/n 016

```
; Change the vehicle type in the [instrument_info] section to rvmp for an
uprising profiler.
; Created by RSI, 2015-12-17
; Modified by Dave Cronkrite, 2016-01-18, new setup file for odas5.0 use.
; 2020-09-21 updated with coefficients for new Micro-mag3 PCB by DC.
; Cruise setup 30th July 2022

; VMP SN 016
```

```
; Calibration  for system boards 15-11-2015
; Pressure transducer updated    05-01-2016
; Seabird temp SN 03-4634        07-10-2024
; Seabird cond SN 04-3240        14-10-2024
; shear 1      SN M1434        20-01-2016
; shear 2      SN M542           13-10-2022
; microT 1     SN T1576
; microT 2     SN T1584
; microC       SN C124
; release      HOPE


; The first section is the [root] section. It determines the data
;  acquisition parameters. It does not need to be declared explicitly.

rate         = 512    ; the sampling rate of "fast" channels
prefix       = 016_
                      ; the base name of your data files. A 3-digit file
number is
                  ; appended to this base name. The limit is 8 characters
                      ; total for internally recording instruments.
disk         = /data  ; the directory for the data files. It must exist. The
directory
                  ; should be /data for internally recording instruments.
For
                  ; real-time instruments it is best to leave this blank, so
                  ; that it defaults to the local directory.
recsize      = 1      ; the size of a record in seconds
man_com_rate= 3       ; the communication rate for real-time VMPs. This
value must
                      ; match the jumper settings of the RSTRANS in your
VMP.
                      ; It is not needed for internally recording
instruments.
no-fast      = 8      ; number of fast "columns" in the address matrix (see
below).
no-slow      = 3      ; number of slow "columns" in the address matrix.
;
max_time     = 11113     ;dive time in seconds
max_pressure= 4342       ;dB

; -----------------
;This section presents the address [matrix] of your instrument and
;  automaticaly ends the [root] section above. The first columns are "slow"
;  channels as defined by the "no-slow" parameter in the [root] section.
;  The remiander are "fast" columns ("no-fast").
[matrix]
num_rows=8
row01   =   255   0     80    1     2     5     7     8     9     64    65

row02   =   81    82    40    1     2     5     7     8     9     64    65
row03   =   41    42    32    1     2     5     7     8     9     64    65
row04   =   4     6     0     1     2     5     7     8     9     64    65
row05   =   10    11    0     1     2     5     7     8     9     64    65
row06   =   12    0     0     1     2     5     7     8     9     64    65
row07   =   16    17    0     1     2     5     7     8     9     64    65
row08   =   18    19    0     1     2     5     7     8     9     64    65


; --------------------
;This section identifies your instrument. Only the vehicle is important.
```

```
[instrument_info]
vehicle = vmp       ; downward profiling. Use either vmp or rvmp but not
both.
;vehicle= rvmp      ; upward profiling
model   = vmp-5500  ; The actual model. Used for trouble shooting.
sn      = 016       ; The serial number of the instrument. For trouble
shooting

; --------------------
; The next section is optional and can be expanded. Do not use the
parameter "id = ".
[cruise_info]
operator    = NOC NMF
project     = JC275
ship        = RRS James Cook
site        =
event     =
cast        = Test

; --------------------
; Next come the [channel] sections. These are used to convert your data
;  into physical units, and to save them into a mat-file.
;  They also determine the name given to various signals
;  in your data file. Please, stick to the convention of
;  RSI because data visualization using the RSI Matlab Library of functions
;  assumes particular names. However, data will be converted into physical
;  units regardless of the name of the channels. If you change the names,
;  then data visualization and further processing is your responsibility.
;  A list of typical channel addresses (id) and their names and functions
;  is at the end of this file.

; Each channel section consists of a part that is unique to your
instrument.
;  It does not need to be changed. The second part is dependent on your
;  sensors (shear probes, FP07 thermistors, etc.) and must be updated
;  whenever you change a probe.
;
; The record average value is display for some channels with a real-time
;  instrument. Display can be forced or suppressed using
;  display = true, or display = false. Internally recording instruments
;  have no display. The units used for display can be specified with
;  units = [unit_symbols]. Keep it short for best display.

; The ground reference channel.
[channel]
; instrument dependent parameters
id      = 0   ; the channel address, 0 to 254.  Listed in the [matrix]
section.
name    = Gnd ; the name it will have in the mat-file.
type    = gnd ; the algorithm used to convert raw data into physical units.
;coef0   = 0  ; the coefficients required for conversion. None in this
case.

; --------------
; The piezo-vibration sensors
[channel]
; instrument dependent parameters
id      = 1
name    = Ax
type    = piezo
```

```
[channel]
; instrument dependent parameters
id      = 2
name    = Ay
type    = piezo

; -----------------
; The thermistor channels
; without pre-emphasis
[channel]
; instrument dependent parameters
id           = 4
name         = T1
type         = therm
adc_fs       = 4.096
adc_bits     = 16
a            = -13
b            = 0.99997
G            = 6
E_B          = 0.68176
; sensor dependent parameters
SN           = T1576
beta_1       = 3143.55
beta_2       = 2.5e5
T_0          = 289.301
cal_date     =
units        = [C]

; with pre-emphasis
[channel]
; instrument dependent parameter
id           = 5
name         = T1_dT1
type         = therm
diff_gain    = 0.94
adc_fs       = 4.096
adc_bits     = 16
a            = -13
b            = 0.99997
G            = 6
E_B          = 0.68176
beta_1       = 3143.55
beta_2       = 2.5e5
T_0          = 289.301
cal_date     =
units        = [C]


; without pre-emphasis
[channel]
; instrument dependent parameters
id           = 6
name         = T2
type         = therm
adc_fs       = 4.096
adc_bits     = 16
a            =-16
b            = 0.99938
G            = 6
E_B          = 0.68183
; sensor dependent parameters
```

```
SN          = T1584
beta_1      = 3143.55
beta_2      = 2.5e5
T_0         = 289.301
cal_date    =
units       = [C]

; with pre-emphasis
[channel]
; instrument dependent parameters
id          = 7
name        = T2_dT2
type        = therm
diff_gain   = 0.94
adc_fs      = 4.096
adc_bits    = 16
a           =-16
b           = 0.99938
G           = 6
E_B         = 0.68183
beta_1      = 3143.55
beta_2      = 2.5e5
T_0         = 289.301
cal_date    =
units       = [C]

; -----------------
; The shear probe channels
[channel]
; instrument dependent parameters
id          = 8
name        = sh1
type        = shear
adc_fs      = 4.096
adc_bits    = 16
diff_gain   = 0.97
; sensor dependent parameters
sens        = 0.0912
SN          = M1434
cal_date    = 2016-01-20

[channel]
; instrument dependent parameters
id          = 9
name        = sh2
type        = shear
adc_fs      = 4.096
adc_bits    = 16
diff_gain   = 0.96
; sensor dependent parameters
sens        = 0.1171
SN          = M542
cal_date    = 2022-10-13

; -----------------
; The pressure transducder
; without pre-emphasis
[channel]
; instrument dependent parameters
id          = 10
name        = P
```

```
type        = poly
; sensor dependent parameters
coef0       = -19.1
coef1       = 0.32253
coef2       = -2.755e-7
cal_date    = 2016-01-05
units       = [dBar]

; with pre-emphasis
[channel]
; instrument dependent parameters
id          = 11
name        = P_dP
type        = poly
coef0       = -18.8
coef1       = 0.32245
coef2       = -2.713e-7
cal_date    = 2016-01-05
diff_gain   = 19.86

; pressure transducer voltage
[channel]
; instrument dependent parameters
id      = 12
name    = PV
type    = poly
coef0   = 4.096
coef1   = 1.25e-4
units   = [V]

; -----------------
; Sea-Bird SBE3 thermometer. Remove, if you are using a JAC CT, and
;  remember to update the [matrix] section.
[channel]
; instrument dependent parameters
id          = 16, 17 ; A two-channel signal. Separate channels with
a "," and/or a space.
name        = SBT1
type        = sbt
coef5       = 24e6 ; reference clock
coef6       = 128  ; periods
; sensor dependent parameters
coef0       = 4.348920e-03 ;SBE coef g
coef1       = 6.402200e-04 ;SBE coef h
coef2       = 2.206460e-05 ;SBE coef i
coef3       = 2.014324e-06 ;SBE coef j
coef4       = 1000         ;SBE coef f0
SN          = 3F-4634
cal_date    = 2024-10-07 ; date of calibration
units       = [C]

; Sea-Bird SBE4 conductivity cell. Remove, if you are using a JAC
CT, and
;  remember to update the [matrix] section.
[channel]
; instrument dependent parameters
```

```
id          = 18, 19
name        = SBC1
type        = sbc
coef5       = 24e6
coef6       = 128
; sensor dependent parameters
coef0       = -1.040691e+01;SBE coef g
coef1       = 0                 ;always zero
coef2       = 1.430299e+00 ;SBE coef h
coef3       = 2.189351e-03 ;SBE coef I
coef4       = -1.704114e-05;SBE coef j
SN          = 4C-3240
cal_date    = 2024-10-14 ; date of calibration
units       = [mS/cm]

; -----------------
; Battery voltage or power supply voltage
[channel]
; instrument dependent parameters
id          = 32
name        = V_Bat
type        = voltage
G           = 0.1
adc_fs      = 4.096
adc_bits    = 16
units       = [V]

; -----------------
; The ADIS precision inclinometer with built in thermometer
[channel]
; instrument dependent parameters
id      = 40
name    = Incl_Y
type    = inclxy
; sensor dependent parameters
coef0   = 0
coef1   = 0.025
units   = [deg]

[channel]
; instrument dependent parameters
id      = 41
name    = Incl_X
type    = inclxy
; sensor dependent parameters
coef0   = 0
coef1   = -0.025
units   = [deg]

[channel]
; instrument dependent parameters
id      = 42
name    = Incl_T
type    = inclt
; sensor dependent parameters
coef0   = 624
```

```
coef1   =-0.47
units   = [C]

; ------------------------
; the micro-conductivity sensor. Remove if not installed
; first, without pre-emphasis
[channel]
; instrument dependent parameters
id           = 64
name         = C1
type         = ucond
a            =-0.7654
b            = 113.5
adc_fs       = 4.096
adc_bits     = 16
; sensor dependent parameters
SN           = C124
K            = 1.03e-3 ; the cell constant
cal_date     =
units        = [mS/cm]

; with pre-emphasis
[channel]
; instrument dependent parameters
id           = 65
name         = C1_dC1
type         = ucond
a            =-0.7654
b            = 113.5
diff_gain    = 0.3965
adc_fs       = 4.096
adc_bits     = 16
K            = 1.03e-3 ; the cell constant
cal_date     =
;units        = [mS/cm]

; --------------------------
; micro-Mag, 3-axis Magentometer
; Remove if not installed
[channel]
; instrument dependent parameters
id           = 80
name         = Mz
type         = magn
; sensor dependent parameters
coef0        = -237
coef1        = 55.55
cal_date     = 2020-07-07
units        = [uT]  ; micro-Tesla

[channel]
; instrument dependent parameters
id           = 81
name         = My
type         = magn
; sensor dependent parameters
```

```
coef0       = 140.5
coef1       = -60.42
cal_date    = 2020-07-07
units       = [uT]

[channel]
; instrument dependent parameters
id          = 82
name        = Mx
type        = magn
; sensor dependent parameters
coef0       = 79.5
coef1       = -61.00
cal_date    = 2020-07-07
units       = [uT]

; ------------------
; This is a list of typical channels (addresses) and their signals
; Only some of these channels will be in any particular instrument
;  id    Name    - rate - Description
; --------------------------------------------------------------------
-
;  0     Gnd     - slow - Reference ground
;  1     Ax      - fast - horizontal acceleration in the direction
of the pressure port or ON/OFF magnet
;  2     Ay      - fast - horizontal acceleration orthogonal to the
direction of the pressure port
;  3     Az      - fast - vertical acceleration, positive up
;  4     T1      - slow - Temperature from Thermistor 1 without pre-
emphasis
;  5     T1_dT1  - fast - Temperature from Thermistor 1 with pre-
emphasis
;  6     T2      - slow - Temperature from Thermistor 2 without pre-
emphasis
;  7     T2_dT2  - fast - Temperature from Thermistor 2 with pre-
emphasis
;  8     sh1     - fast - velocity derivative from shear probe 1
;  9     sh2     - fast - velocity derivative from shear probe 2
; 10     P       - slow - pressure signal without pre-emphasis
; 11     P_dP    - slow - pressure signal with pre-emphasis
; 12     PV      - slow - voltage on pressure transducer
; 16, 17 SBT     - slow - The even and odd addresses of the Sea-Bird
SBE3 thermometer
; 18, 19 SBC     - slow - The even and odd addresses of the Sea-Bird
SBE4 conductivity sensor
; 32     V_Bat   - slow - Battery or power supply voltage
; 40     Incl_Y  - slow - Inclinometer, rotation around the y-axis
; 41     Incl_X  - slow - Inclinometer, rotation around the x-axis
; 42     Incl_T  - slow - Inclinometer, its temperature
; 64     C1      - fast - micro-conductivity without pre-emphasis
; 65     C1_dC1  - fast - micro-conductivity with pre-emphasis
; 80     Mz      - slow - vertical component of magnetic field from
magnetometer
; 81     My      - slow - horizontal component of magnetic field
from magnetometer
```

```
; 82     Mx      - slow - horizontal component of magnetic field
from magnetometer
; 255    sp_char - slow - special Character that always returns
32752D or 7FF0H and
;                         is used to test the integrity of
communication.

; End of setup configuration file.
```

NMF Moorings

Tina Thomas, Paul Provost

Deck Layout

Timeline of Events

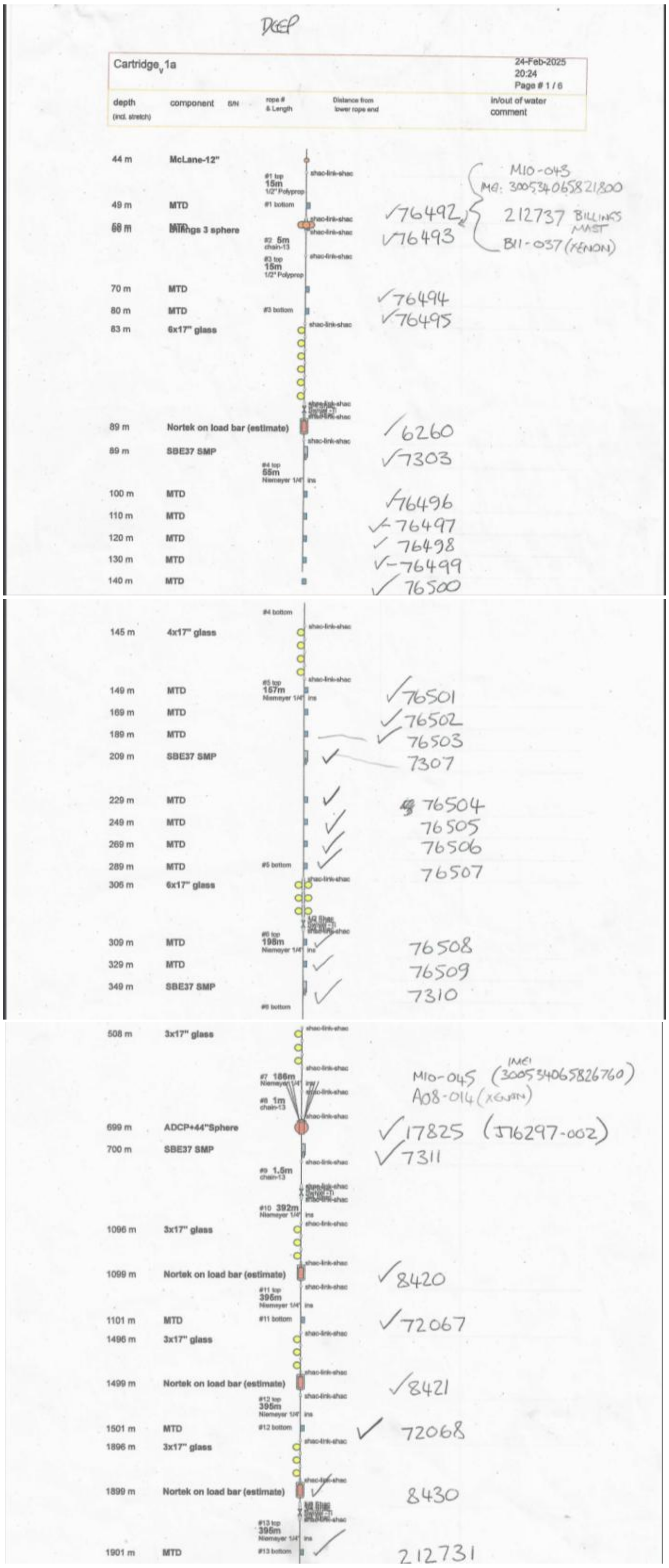
Deep mooring deployment: 25/02/2025 start: 13:55 end:18:27

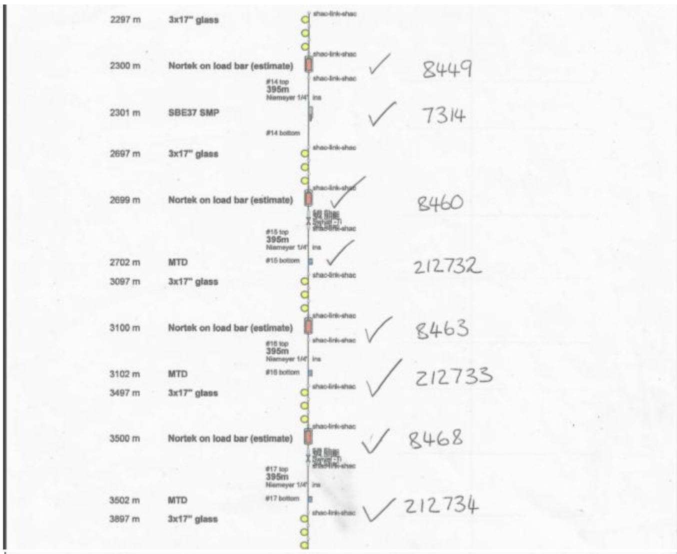
Ridge mooring deployment: 28/02/2025 start: 11:08 end: 14:17

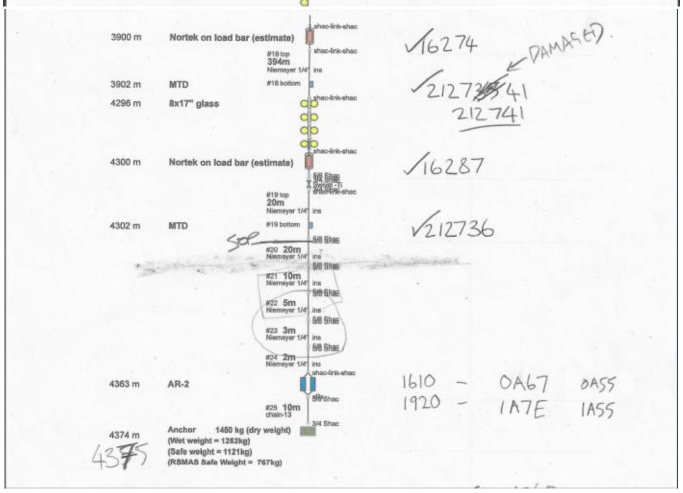
Deep mooring recovery: 18/03/2025 released: 09:28 hooked: 10:07 recovered: 12:59

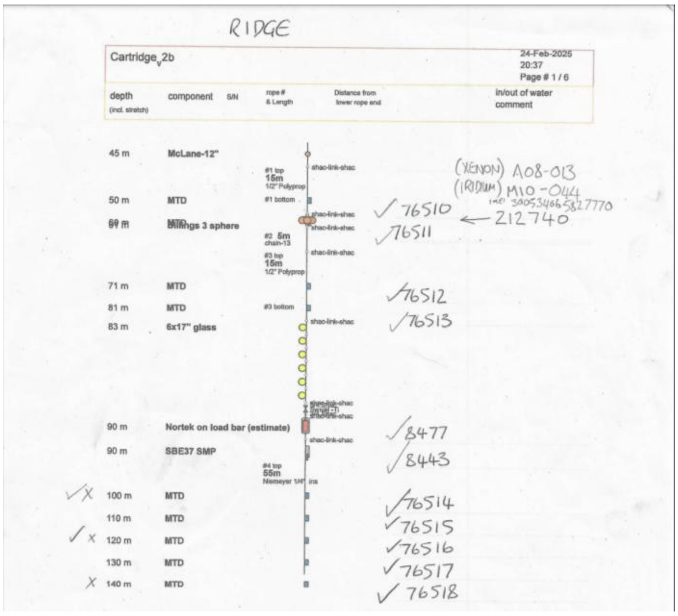
Ridge mooring recovery: released: 09:10 hooked: 09:44 recovered: 11:42

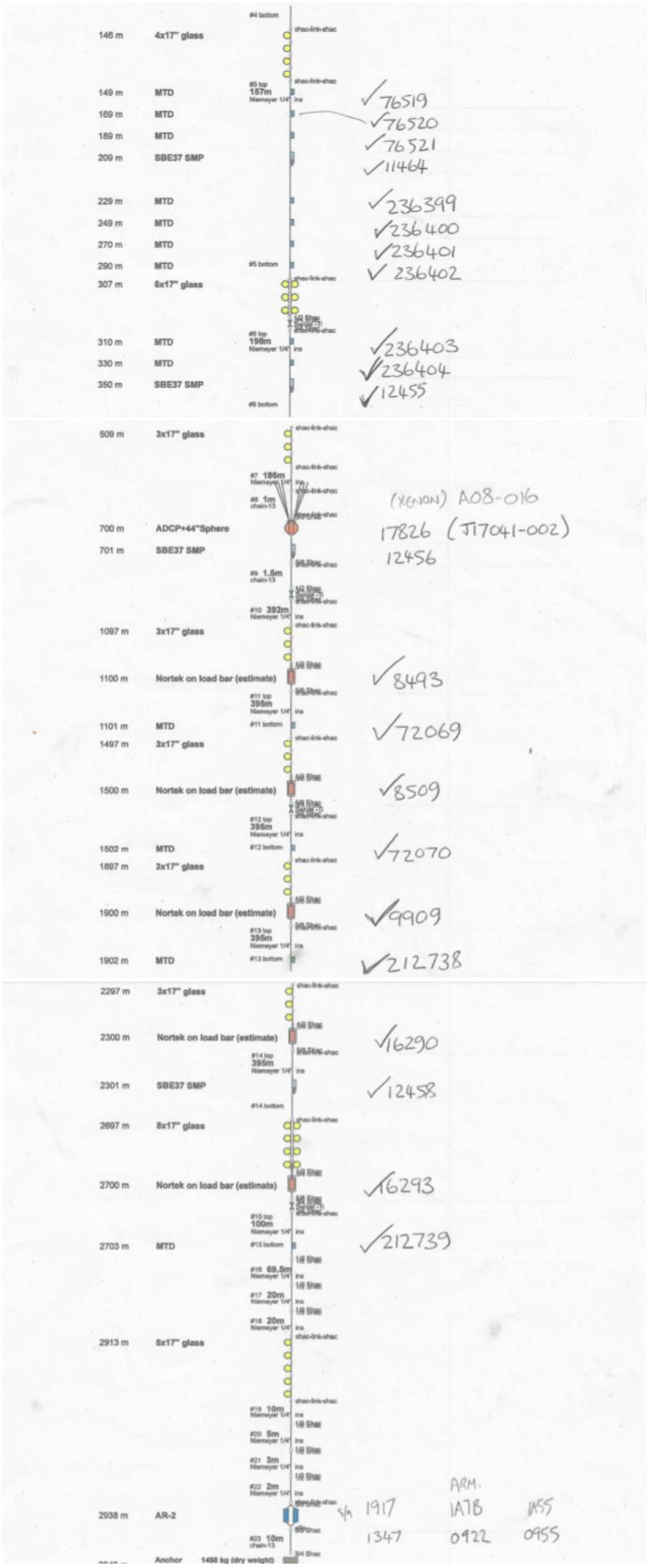
Mooring Diagrams




2297 m 3x17" glass
shac-link-shac
2300 m Nortek on load bar (estimate) ✓ 8449
#14 top 395m Niemeyer 1/4" ins
2301 m SBE37 SMP ✓ 7314
#14 bottom
2697 m 3x17" glass
2699 m Nortek on load bar (estimate) ✓ 8460
#15 top 395m Niemeyer 1/4" ins
2702 m MTD #15 bottom ✓ 212732
3097 m 3x17" glass
3100 m Nortek on load bar (estimate) ✓ 8463
#16 top 395m Niemeyer 1/4" ins
3102 m MTD #16 bottom ✓ 212733
3497 m 3x17" glass
3500 m Nortek on load bar (estimate) ✓ 8468
#17 top 395m Niemeyer 1/4" ins
3502 m MTD #17 bottom ✓ 212734
3897 m 3x17" glass


3900 m Nortek on load bar (estimate) ✓16274
#18 top 394m Niemeyer 1/4" ins
3902 m MTD #18 bottom ✓212741
DAMAGED
212741
4296 m 8x17" glass
4300 m Nortek on load bar (estimate) ✓16287
#19 top 20m Niemeyer 1/4" ins
4302 m MTD #19 bottom ✓212736
#20 20m Niemeyer 1/4"
#21 10m Niemeyer 1/4" ins
#22 5m Niemeyer 1/4" ins
#23 3m Niemeyer 1/4" ins
#24 2m Niemeyer 1/4" ins
5/8 Shac
4363 m AR-2 1610 – 0A67 0A55
1920 – 1A7E 1A55
#25 10m chain-13
3/4 Shac
4374 m Anchor 1450 kg (dry weight)
(Wet weight = 1262kg)
(Safe weight = 1121kg)
(RSMAS Safe Weight = 767kg)
4375


RIDGE
Cartridge_2b
24-Feb-2025
20:37
Page # 1 / 6
depth (incl. stretch) component S/N rope # & Length Distance from lower rope end in/out of water comment
45 m McLane-12"
(XENON) A08-013
(IRIDIUM) M10-044
#1 top 15m 1/2" Polyprop
50 m MTD #1 bottom ✓ 76510
69 m Billings 3 sphere 76511 ← 212740
#2 5m chain-13
#3 top 15m 1/2" Polyprop
71 m MTD ✓76512
81 m MTD #3 bottom ✓76513
83 m 6x17" glass
90 m Nortek on load bar (estimate) ✓8477
90 m SBE37 SMP ✓8443
#4 top 55m Niemeyer 1/4" ins
100 m MTD ✓76514
110 m MTD ✓76515
120 m MTD ✓76516
130 m MTD ✓76517
140 m MTD ✓ 76518



The ridge mooring had sporadic biological growth on the wire from 700 – 1100m.

Instrumentation

The instruments were set to record with the following parameters:

TRDI WHLR75kHz ADCP:

4 minute ensembles, 5 second pings, 24ppe, 16m bins.

Nortek Aquadopp single point RCM:

4 minute ensemble, 50 second averaging period.

SeaBird SBE37SMP moored CTD:

Recording 1 sample every minute

RBR Solo temperature logger:

Recording 1 sample every minute

Example setup files are shown below:

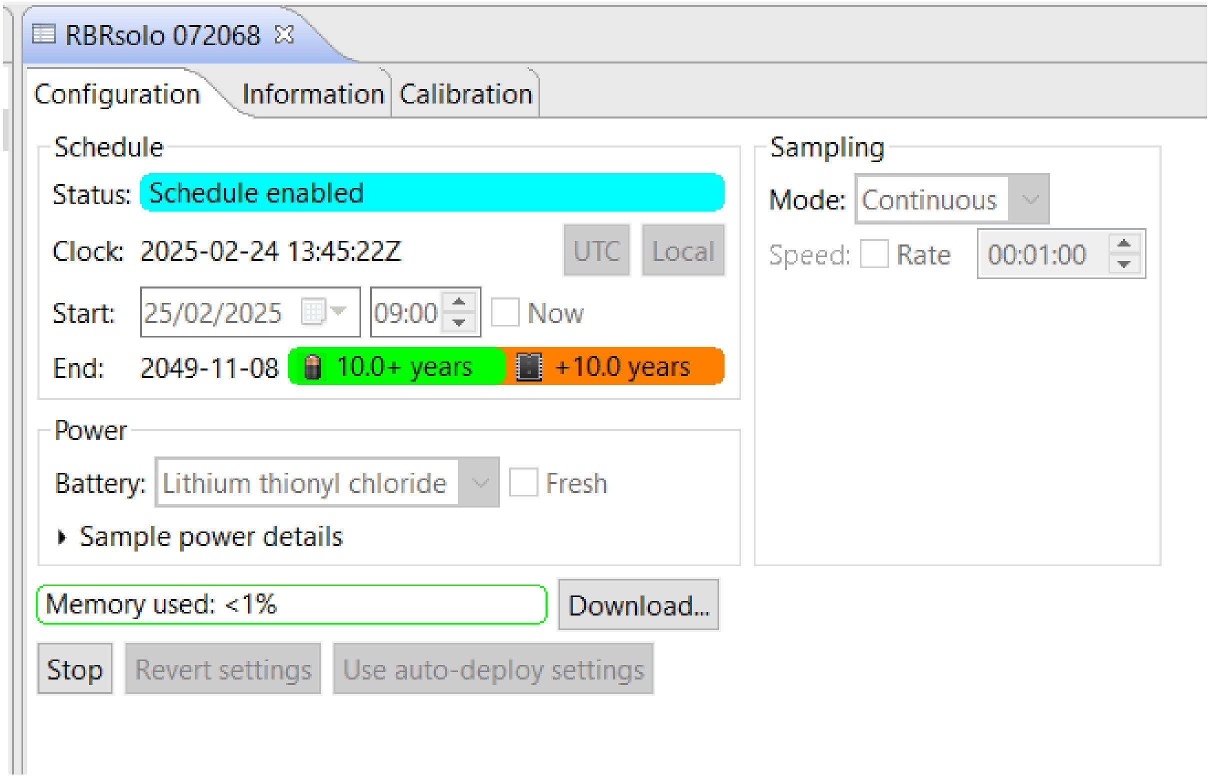
Nortek

```
============================================================
Deployment   : 90D
Current time : 24/02/2025 16:18:34
Start at     : 25/02/2025 09:00:00
Comment:

------------------------------------------------------------
Measurement interval  (s) : 240
Average interval      (s) : 50
Blanking distance     (m) : 0.50
Measurement load      (%) : 9
Power level               : HIGH
Diagnostics interval(min) : N/A
Diagnostics samples       : N/A
Compass upd. rate     (s) : 30
Coordinate System         : ENU
Speed of sound      (m/s) : MEASURED
Salinity            (ppt) : 35
Analog input 1            : NONE
Analog input 2            : NONE
Analog input power out    : DISABLED
Raw magnetometer out      : OFF
File wrapping             : OFF
TellTale                  : OFF
```

```
AcousticModem                  : OFF
Serial output                  : OFF
Baud rate                      : 9600
------------------------------------------------------------
Assumed duration   (days) : 30.0
Battery utilization     (%) : 56.0
Battery level           (V) : 13.8
Recorder size          (MB) : 9
Recorder free space    (MB) : 6.927
Memory required        (MB) : 0.4
Vertical vel. prec (cm/s) : 1.1
Horizon. vel. prec (cm/s) : 0.7
------------------------------------------------------------
Instrument ID                  : AQD 6260
Head ID                        : A6L 3858
Firmware version               : 3.37
------------------------------------------------------------
Aquadopp Deep Water Version 1.40.16
Copyright (C) Nortek AS
============================================================
```

RBR Solo



Microcat – SBE37

```
<Executed/>
ds
SBE37SM-RS232 v4.1  SERIAL NO. 12458  24 Feb 2025 15:10:19
vMain = 13.42, vLith =  2.81
samplenumber = 0, free = 559240
not logging, waiting to start at 25 Feb 2025 09:00:00
sample interval = 60 seconds
data format = converted engineering
transmit real-time = no
sync mode = no
pump installed = yes, minimum conductivity frequency = 3110.7
<Executed/>
```

ADCP

Deep (B)

```
>>>>>> Function starting 02/24/25 17:34:41 >>>>>>

[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>TS250224173444
>CZ

Powering Down

>>>>>> Function starting 02/24/25 17:34:53 >>>>>>

[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>CR1
[Parameters set to FACTORY defaults]
>DEPLOY?
Deployment Commands:
CF = 11111 --------------- Flow Ctrl (EnsCyc;PngCyc;Binry;Ser;Rec)
CK ----------------------- Keep Parameters as USER Defaults
CR # --------------------- Retrieve Parameters (0 = USER, 1 = FACTORY)
CS ----------------------- Start Deployment

EA = +00000 -------------- Heading Alignment (1/100 deg)
EB = +00000 -------------- Heading Bias (1/100 deg)
ED = 00000 --------------- Transducer Depth (0 - 65535 dm)
ES = 35 ------------------ Salinity (0-40 pp thousand)
EX = 11111 --------------- Coord Transform (Xform: Type,Tilts,3 Bm,Map)
EZ = 1111101 ------------- Sensor Source (C,D,H,P,R,S,T)

RE ----------------------- Recorder ErAsE
RN ----------------------- Set Deployment Name

TE = 01:00:00.00 --------- Time per Ensemble (hrs:min:sec.sec/100)
TF = **/**/**,**:**:** --- Time of First Ping (yr/mon/day,hour:min:sec)
TP = 01:20.00 ------------ Time per Ping (min:sec.sec/100)
```

```
TS = 25/02/24,17:34:55 --- Time Set (yr/mon/day,hour:min:sec)

WD = 111 100 000 --------- Data Out (Vel,Cor,Amp; PG,St,P0; P1,P2,P3)
WF = 0704 ---------------- Blank After Transmit (cm)
Press any key to continue

WN = 030 ----------------- Number of depth cells (1-128)
WP = 00045 --------------- Pings per Ensemble (0-16384)
WS = 1600 ---------------- Depth Cell Size (cm)
WV = 175 ----------------- Mode 1 Ambiguity Vel (cm/s radial)

>SYSTEM?
System Control, Data Recovery and Testing Commands:
AC ----------------------- Output Active Fluxgate & Tilt Calibration data
AF ----------------------- Field calibrate to remove hard/soft iron error
AR ----------------------- Restore factory fluxgate calibration data
AX ----------------------- Examine compass performance
AZ ----------------------- Zero pressure reading

CB = 411 ----------------- Serial Port Control (Baud; Par; Stop)
CP # --------------------- Polled Mode (0 = NORMAL, 1 = POLLED)
CZ  ---------------------- Power Down Instrument

FC ----------------------- Clear Fault Log
FD ----------------------- Display Fault Log

OL ----------------------- Display Features List

PA ----------------------- Pre-Deployment Tests
PC1 ---------------------- Beam Continuity
PC2 ---------------------- Sensor Data
PS0 ---------------------- System Configuration
PS3 ---------------------- Transformation Matrices

RR ----------------------- Recorder Directory
Press any key to continue

RF ----------------------- Recorder Space used/free (bytes)
RY ----------------------- Upload Recorder Files to Host

>TS?
TS 25/02/24,17:35:02 --- Time Set (yr/mon/day,hour:min:sec)
>PS0
  Instrument S/N:  17825
       Frequency:  76800 HZ
   Configuration:  4 BEAM, JANUS
     Match Layer:  10
      Beam Angle:  20 DEGREES
    Beam Pattern:  CONVEX
     Orientation:  UP
       Sensor(s):  HEADING  TILT 1  TILT 2  DEPTH  TEMPERATURE  PRESSURE
Pressure Sens Coefficients:
              c3 = +1.050317E-10
              c2 = -5.221865E-07
              c1 = +1.344550E+00
          Offset = +6.519860E+00
```

```
Temp Sens Offset:  0.04 degrees C

    CPU Firmware:  50.40 [0]
   Boot Code Ver:  Required:  1.16   Actual:  1.16
    DEMOD #1 Ver:  ad48, Type:  1f
    DEMOD #2 Ver:  ad48, Type:  1f
    PWRTIMG  Ver:  85d3, Type:   6

Board Serial Number Data:
   F2  00 00 06 B2 C4 74  09 TUN727-1005-06A
   8A  00 00 06 F6 07 6C  09 CPU727-2011-00E
   29  00 00 06 B2 DF AA  09 REC727-1004-06A
   47  00 00 06 F5 C6 BE  09 DSP727-2001-06H
   0D  00 00 06 83 A5 8D  09 HPI727-3007-00A
   27  00 00 06 F5 C4 F7  09 HPA727-3009-00B
>PA

PRE-DEPLOYMENT TESTS

CPU TESTS:
  RTC.....................................PASS
  RAM.....................................PASS
  ROM.....................................PASS
RECORDER TESTS:
  PC Card #0..............................DETECTED
    Card Detect...........................PASS
    Communication.........................PASS
    DOS Structure.........................PASS
    Sector Test (short)...................PASS
  PC Card #1..............................NOT DETECTED
DSP TESTS:
  Timing RAM..............................PASS
  Demod  RAM..............................PASS
  Demod  REG..............................PASS
  FIFOs...................................PASS
SYSTEM TESTS:
  XILINX Interrupts... IRQ3  IRQ3  IRQ3 ...PASS
  Wide Bandwidth.......................***FAIL***
  Narrow Bandwidth........................PASS
  RSSI Filter.............................PASS
  Transmit................................PASS
SENSOR TESTS:
  H/W Operation...........................PASS
>PC2

Press any key to quit sensor display ...

All Sensors are Internal Only.
Heading   Pitch    Roll   Up/Down    Attitude Temp   Ambient Temp
PRESSURE
151.40ø -43.51ø  44.69ø     Up          24.87øC        28.34øC         7.9
kPa
151.68ø -43.54ø  44.70ø     Up          24.87øC        28.33øC       -34.9
kPa
151.80ø -43.51ø  44.68ø     Up          24.88øC        28.35øC       -39.7
kPa
151.94ø -43.50ø  44.68ø     Up          24.86øC        28.35øC         9.7
```

```
kPa
151.79ø -43.52ø  44.68ø     Up          24.83øC        28.32øC        -52.6
kPa
151.67ø -43.52ø  44.70ø     Up          24.88øC        28.33øC         -5.9
kPa
151.61ø -43.52ø  44.68ø     Up          24.89øC        28.33øC         -6.9
kPa
151.40ø -43.53ø  44.69ø     Up          24.88øC        28.35øC        -23.3
kPa
151.04ø -43.53ø  44.68ø     Up          24.88øC        28.36øC          6.0
kPa
150.77ø -43.52ø  44.68ø     Up          24.88øC        28.34øC          7.3
kPa
150.40ø -43.53ø  44.68ø     Up          24.88øC        28.36øC         21.8
kPa
150.10ø -43.52ø  44.68ø     Up          24.87øC        28.34øC         -9.6
kPa
149.79ø -43.52ø  44.68ø     Up          24.88øC        28.32øC         14.9
kPa

>RS
RS = 000,245 ------------- REC SPACE USED (MB), FREE (MB)

>PC1


BEAM CONTINUITY TEST

When prompted to do so, vigorously rub the selected
beam's face.

If a beam does not PASS the test, send any character to
the ADCP to automatically select the next beam.

Collecting Statistical Data...
  23  27  23  27
  22  26  22  26
  22  26  22  25
  21  26  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  26
  21  27  22  26
  21  27  22  26
  21  27  22  26
  21  27  22  26
  21  27  22  26
  21  27  22  26
  21  27  22  26
  21  27  22  26
  21  27  22  26
```

```
  21  27  22  26
  21  27  22  26
  21  27  22  26
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  22  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25
  21  27  23  25

Rub Beam 1 = PASS
Rub Beam 2 = PASS
Rub Beam 3 = PASS
Rub Beam 4 = PASS

>CZ

Powering Down

>>>>>> Function starting 02/24/25 17:37:32 >>>>>>

[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
```

```
Teledyne RD Instruments (c) 1996-2010
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>AZ
Pressure Offset Updated in NVRAM.

>CZ

Powering Down

>>>>>> Function starting 02/24/25 17:37:40 >>>>>>

[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2010
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>RE ErAsE  erasing...
Recorder erased.

>CZ

Powering Down

>>>>>> Function starting 02/24/25 17:38:07 >>>>>>

[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2010
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>RR
Recorder Directory:
Volume serial number for device #0 is 206f-6241

  No files found.

  Bytes used on device #0 = 0
Total capacity   =  256352256 bytes
Total bytes used =          0 bytes in 0 files
Total bytes free =  256352256 bytes

>
[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>CR1
[Parameters set to FACTORY defaults]
>CQ255
>CF11101
>EA0
>EB0
>ED0
>ES35
>EX11111
>EZ1111101
>WA50
>WB1
>WD111100000
```

```
>WF704
>WN37
>WP24
>WS1600
>WV175
>TE00:04:00.00
>TP00:05.00
>TF25/02/25 09:00:00
>CK
[Parameters saved as USER defaults]
>The command CS is not allowed in this command file.  It has been ignored.
>The following commands are generated by this program:
>CF?
CF = 11101 --------------- Flow Ctrl (EnsCyc;PngCyc;Binry;Ser;Rec)
>CF11101
>RN Deep1
>cs
```

```
EZ1111101
WA50
WB1
WD111100000
WF704
WN37
WP24
WS1600
WV175
TE00:04:00.00
TP00:05.00
TF25/02/25 09:00:00
CK
CS
;
;Instrument          = Workhorse Long Ranger
;Frequency           = 76800
;Water Profile       = YES
;Bottom Track        = NO
;High Res. Modes     = NO
;High Rate Pinging   = NO
;Shallow Bottom Mode= NO
;Wave Gauge          = NO
;Lowered ADCP        = NO
;Ice Track           = NO
;Surface Track       = NO
;Beam angle          = 20
;Temperature         = 5.00
;Deployment hours    = 588.00
;Battery packs       = 4
;Automatic TP        = NO
;Memory size [MB]    = 256
;Saved Screen        = 2
;
;Consequences generated by PlanADCP version 2.06:
;First cell range    = 24.45 m
```

```
;Last cell range    = 600.45 m
;Max range          = 600.12 m
;Standard deviation = 1.54 cm/s
;Ensemble size      = 894 bytes
;Storage required   = 7.52 MB (7885080 bytes)
;Power usage        = 1778.26 Wh
;Battery usage      = 4.0
;
; WARNINGS AND CAUTIONS:
; Advanced settings have been changed.
```

Ridge (R)

```
>>>>>> Function starting 02/24/25 17:26:41 >>>>>>

[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>TS250224172644
>CZ

Powering Down

>>>>>> Function starting 02/24/25 17:26:57 >>>>>>

[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>CR1
[Parameters set to FACTORY defaults]
>DEPLOY?
Deployment Commands:
CF = 11111 --------------- Flow Ctrl (EnsCyc;PngCyc;Binry;Ser;Rec)
CK ----------------------- Keep Parameters as USER Defaults
CR # --------------------- Retrieve Parameters (0 = USER, 1 = FACTORY)
CS ----------------------- Start Deployment

EA = +00000 -------------- Heading Alignment (1/100 deg)
EB = +00000 -------------- Heading Bias (1/100 deg)
ED = 00000 --------------- Transducer Depth (0 - 65535 dm)
ES = 35 ------------------ Salinity (0-40 pp thousand)
EX = 11111 --------------- Coord Transform (Xform: Type,Tilts,3 Bm,Map)
EZ = 1111101 ------------- Sensor Source (C,D,H,P,R,S,T)

RE ----------------------- Recorder ErAsE
RN ----------------------- Set Deployment Name

TE = 01:00:00.00 --------- Time per Ensemble (hrs:min:sec.sec/100)
TF = **/**/**,**:**:** --- Time of First Ping (yr/mon/day,hour:min:sec)
TP = 01:20.00 ------------ Time per Ping (min:sec.sec/100)
TS = 25/02/24,17:26:59 --- Time Set (yr/mon/day,hour:min:sec)

WD = 111 100 000 --------- Data Out (Vel,Cor,Amp; PG,St,P0; P1,P2,P3)
WF = 0704 ---------------- Blank After Transmit (cm)
```

```
Press any key to continue

WN = 030 ----------------- Number of depth cells (1-128)
WP = 00045 --------------- Pings per Ensemble (0-16384)
WS = 1600 ---------------- Depth Cell Size (cm)
WV = 175 ----------------- Mode 1 Ambiguity Vel (cm/s radial)

>SYSTEM?
System Control, Data Recovery and Testing Commands:
AC ----------------------- Output Active Fluxgate & Tilt Calibration data
AF ----------------------- Field calibrate to remove hard/soft iron error
AR ----------------------- Restore factory fluxgate calibration data
AX ----------------------- Examine compass performance
AZ ----------------------- Zero pressure reading

CB = 411 ----------------- Serial Port Control (Baud; Par; Stop)
CP # --------------------- Polled Mode (0 = NORMAL, 1 = POLLED)
CZ  ---------------------- Power Down Instrument

FC ----------------------- Clear Fault Log
FD ----------------------- Display Fault Log

OL ----------------------- Display Features List

PA ----------------------- Pre-Deployment Tests
PC1 ---------------------- Beam Continuity
PC2 ---------------------- Sensor Data
PS0 ---------------------- System Configuration
PS3 ---------------------- Transformation Matrices

RR ----------------------- Recorder Directory
Press any key to continue

RF ----------------------- Recorder Space used/free (bytes)
RY ----------------------- Upload Recorder Files to Host

>TS?
TS 25/02/24,17:27:05 --- Time Set (yr/mon/day,hour:min:sec)
>PS0
  Instrument S/N:  17826
       Frequency:  76800 HZ
   Configuration:  4 BEAM, JANUS
     Match Layer:  10
      Beam Angle:  20 DEGREES
    Beam Pattern:  CONVEX
     Orientation:  UP
       Sensor(s):  HEADING  TILT 1  TILT 2  DEPTH  TEMPERATURE  PRESSURE
Pressure Sens Coefficients:
              c3 = +1.224143E-10
              c2 = -4.842744E-07
              c1 = +1.355325E+00
          Offset = +1.080875E+01

Temp Sens Offset:  0.06 degrees C

    CPU Firmware:  50.40 [0]
   Boot Code Ver:  Required:  1.16   Actual:  1.16
```

```
     DEMOD #1 Ver:  ad48, Type:  1f
     DEMOD #2 Ver:  ad48, Type:  1f
     PWRTIMG  Ver:  85d3, Type:   6

Board Serial Number Data:
   24  00 00 06 B3 10 A0  09 DSP727-2001-06H
   90  00 00 06 B2 AD D0  09 HPI727-3007-00A
   6B  00 00 06 F5 CF 2C  09 REC727-1004-06A
   79  00 00 06 B3 2D B2  09 TUN727-1005-06A
   06  00 00 06 F5 C1 26  09 HPA727-3009-00B
   F9  00 00 06 F5 E0 8F  09 CPU727-2011-00E
>PA

PRE-DEPLOYMENT TESTS

CPU TESTS:
  RTC......................................PASS
  RAM......................................PASS
  ROM......................................PASS
RECORDER TESTS:
  PC Card #0...............................DETECTED
    Card Detect............................PASS
    Communication..........................PASS
    DOS Structure..........................PASS
    Sector Test (short)....................PASS
  PC Card #1...............................NOT DETECTED
DSP TESTS:
  Timing RAM...............................PASS
  Demod  RAM...............................PASS
  Demod  REG...............................PASS
  FIFOs....................................PASS
SYSTEM TESTS:
  XILINX Interrupts... IRQ3  IRQ3  IRQ3 ...PASS
  Wide Bandwidth.........................***FAIL***
  Narrow Bandwidth.........................PASS
  RSSI Filter..............................PASS
  Transmit.................................PASS
SENSOR TESTS:
  H/W Operation..........................***FAIL***
>PC2

Press any key to quit sensor display ...

All Sensors are Internal Only.
Heading   Pitch    Roll   Up/Down    Attitude Temp   Ambient Temp
PRESSURE
179.86ø -42.70ø  25.92ø     Up          28.68øC        28.48øC       -26.6
kPa
181.51ø -42.67ø  22.47ø     Up          28.69øC        28.51øC       -35.8
kPa
182.56ø -42.64ø  19.84ø     Up          28.68øC        28.49øC        19.5
kPa

>RS
RS = 000,245 ------------- REC SPACE USED (MB), FREE (MB)

>PC1
```

BEAM CONTINUITY TEST

When prompted to do so, vigorously rub the selected beam's face.

If a beam does not PASS the test, send any character to the ADCP to automatically select the next beam.

```
Collecting Statistical Data...
  22  21  26  20
  22  22  25  20
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
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  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
```

```
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
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  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21
  21  22  25  21

Rub Beam 1 = PASS
Rub Beam 2 = PASS
Rub Beam 3 = PASS
Rub Beam 4 = PASS

>CZ

Powering Down

>>>>>> Function starting 02/24/25 17:29:06 >>>>>>

[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>AZ
Pressure Offset Updated in NVRAM.

>CZ

Powering Down

>>>>>> Function starting 02/24/25 17:29:15 >>>>>>

[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>RE ErAsE  erasing...
Recorder erased.

>CZ

Powering Down

>>>>>> Function starting 02/24/25 17:29:41 >>>>>>
```

```
[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>RR
Recorder Directory:
Volume serial number for device #0 is 206f-6241

  No files found.

  Bytes used on device #0 = 0
Total capacity   =  256352256 bytes
Total bytes used =          0 bytes in 0 files
Total bytes free =  256352256 bytes

>
[BREAK Wakeup A]
WorkHorse Broadband ADCP Version 50.40
Teledyne RD Instruments (c) 1996-2010
All Rights Reserved.
>CR1
[Parameters set to FACTORY defaults]
>CQ255
>CF11101
>EA0
>EB0
>ED0
>ES35
>EX11111
>EZ1111101
>WA50
>WB1
>WD111100000
>WF704
>WN37
>WP24
>WS1600
>WV175
>TE00:04:00.00
>TP00:05.00
>TF25/02/25 09:00:00
>CK
[Parameters saved as USER defaults]
>The command CS is not allowed in this command file.  It has been ignored.
>The following commands are generated by this program:
>CF?
CF = 11101 --------------- Flow Ctrl (EnsCyc;PngCyc;Binry;Ser;Rec)
>CF11101
>RN Ridge
>cs

CR1
CQ255
CF11101
EA0
EB0
ED0
```

```
ES35
EX11111
EZ1111101
WA50
WB1
WD111100000
WF704
WN37
WP24
WS1600
WV175
TE00:04:00.00
TP00:05.00
TF25/02/25 09:00:00
CK
CS
;
;Instrument          = Workhorse Long Ranger
;Frequency           = 76800
;Water Profile       = YES
;Bottom Track        = NO
;High Res. Modes     = NO
;High Rate Pinging   = NO
;Shallow Bottom Mode= NO
;Wave Gauge          = NO
;Lowered ADCP        = NO
;Ice Track           = NO
;Surface Track       = NO
;Beam angle          = 20
;Temperature         = 5.00
;Deployment hours    = 588.00
;Battery packs       = 4
;Automatic TP        = NO
;Memory size [MB]    = 256
;Saved Screen        = 2
;
;Consequences generated by PlanADCP version 2.06:
;First cell range    = 24.45 m
;Last cell range     = 600.45 m
;Max range           = 600.12 m
;Standard deviation = 1.54 cm/s
;Ensemble size       = 894 bytes
;Storage required    = 7.52 MB (7885080 bytes)
;Power usage         = 1778.26 Wh
;Battery usage       = 4.0
;
; WARNINGS AND CAUTIONS:
; Advanced settings have been changed.
```

Instrumentation recovered

All instruments returned data except the following instruments on the deep mooring:

RBR Solo s/n:

076493 – no data

076506 – all data @ -273 degrees C

076504 – no data

Microcat – SBE37 s/n:

7311 – low battery stopped

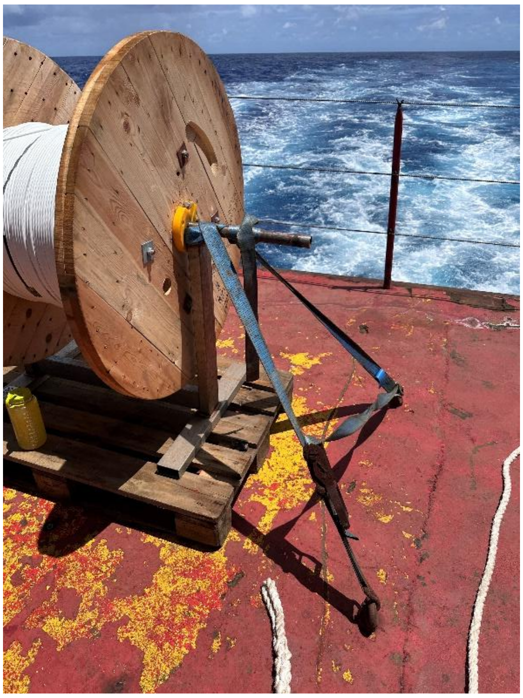
7303 - calibration coefficients were incorrect

Issues, tips, lessons learned

Picture of seabird on sphere



keeping the shaft stable




Make sure to pack

- Reeler shaft

Notes

Did not pack reeler shaft

Reused releases from cosmos s/n: 1610 & 1920

Used deck box s/n: 684 (same as cosmos)

Release s/n 323 labeled do no use – tested to 2000m worked, no documentation on IMS

Release s/n 907 did not fire on test cast to 2000m – noted on IMS work history

We pinged each mooring to see that they were on the bottom. The PI did not want to trilaterate.

Shopping list

- ☐ 28mm long handled spanner for adcp buoys
- ☐ 36mm long handled clicky spanner for deck bolts
- ☐ Boat hook

Handover notes

- Added COSMOS microcasts, Nortek, glass, buoys, anchor & anchor skip, wooden drum & stainless cradle, some beacons, releases, the container to Tina's Cartridge planlist
- Some beacons, the hardware cage, the block, were not on the ship on IMS
- Please read and edit glass inspection SOP and let me know how marking inspected glass with Velcro goes. Sorry I had told Billy prior to Cosmos and forgot by the time I that yall didn't know.
- There's a met office chain cage with a hippo bag for old recovered hardware that we used on Cartridge and there should be plenty of room for Congo recovered moorings.
- Reused releases from cosmos s/n: 1610 & 1920
- Used deck box s/n: 684 (same as cosmos)
- Release s/n 323 labeled do no use – tested to 2000m worked, no documentation on IMS
- Release s/n 907 did not fire on test cast to 2000m – noted on IMS work history
- Batteries and Velcro are in the moorings workshop container
- The 4 cages of glass in the hold from Cosmos has been inspected

MARS Gliders

Felipe Marques Dos Santos

Glider Mission Requirements

The JC275/Cartridge cruise initially required two Ocean Microstructure Gliders (OMG) deployments in two different areas, B and R, respectively, for about 30 days each. Throughout the mission, there was an opportunity to execute an additional OMG deployment to support the scientific goals of the cruise. This extra deployment was shorter, lasting about three days, and covered area X3. Figure 1 shows the reference points B (16°S, 19°W), R (16°S, 13°W) and X3 (16°S, 1°W).

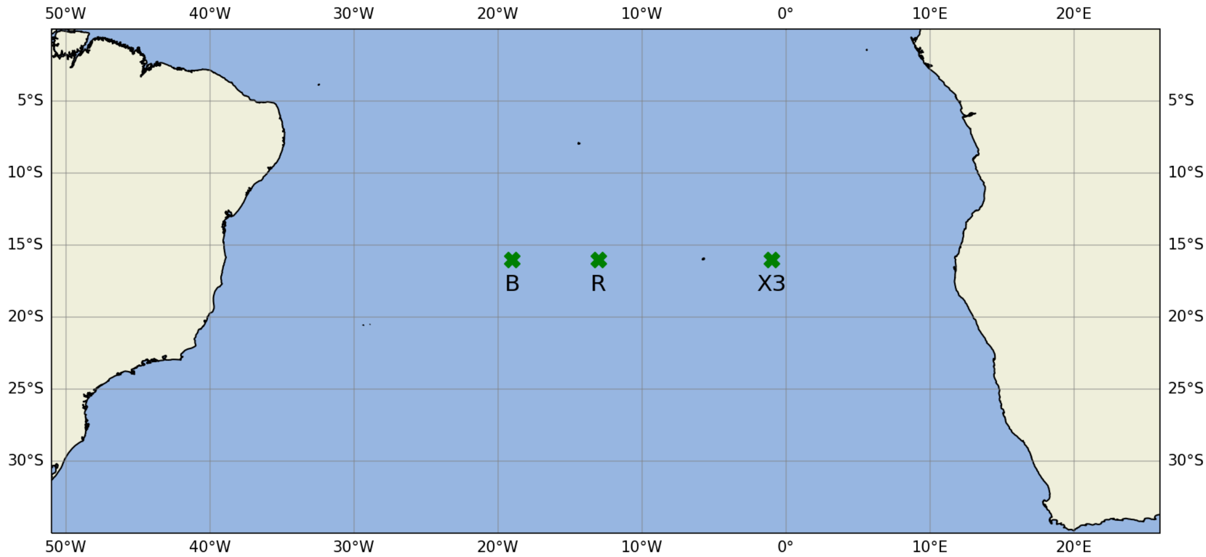


Figure 1: General map showing the glider deployment areas.

The requirements for the glider missions were the same for all three deployments:
Dives to 500 m depth; data collection using all sensors during all upcasts and downcasts.
Sensors: CTD, Wetlabs (FLBB2 / FLBBCD), Optode, and Microrider.

Glider Mission Summary

This section presents details of each glider mission, as well as the Microrider dive setup used on all of them.

The events/issues regarding the Microriders will be thoroughly investigated once the instruments return to the glider lab.

Area B

Unit_886 was prepared for the first deployment of the cruise. The glider performed well, as did all of its sensors. No events to report. Figure 2 shows the glider's GPS positions throughout the ~20 days of the mission. The glider remained within 15km of the reference point, with a considerable number of records within a 5 km range. The distance was increased during the mission to prevent the glider from getting too close to the ship.

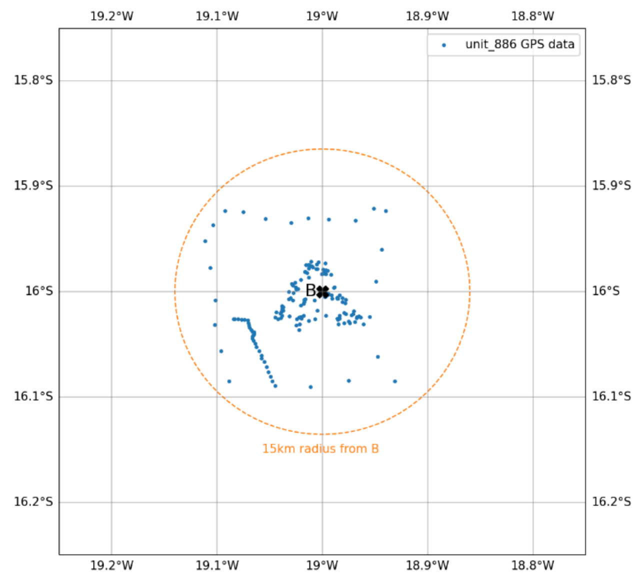


Figure 2: Glider GPS positions during the mission on area B (unit_886).

Key events:

- 26/02/2025 20:16 UTC: Glider deployed - initial dives
- 27/02/2025 10:40 UTC: Double dives to 500m (MR data acquisition setup)
- 17/03/2025 15:20 UTC: Changed to single dive to 100m (pre-recovery procedure)
- 18/03/2025 06:48 UTC: Glider recovered

Glider setup:

- Unit_886 - Slocum G3s
    - Pump G3 1000m 577
    - Batteries lithium-ion rechargeable
    - Thruster - none
    - Science Bay 1440
        - CTD: RBR sn 207225
        - Wetlabs: FLBBBB sn 6904
        - Optode: Aanderaa 4831F sn 120
        - Microrider: SN 105
            - T1: T2797
            - T2: T2798
            - S1: M821 (Z-oriented)
            - S2: M822 (Y-oriented)

Area R

Unit_887 was prepared for the second deployment of the cruise. The glider performed well, as did most of its sensors. In this case, it is essential to mention some issues associated with the Microrider.

During the near real-time channel stats analysis, it was observed that after a few days of operation, probe T1 broke, and in the last few days of the mission, probe T2 began to show increasing values on its pre-emphasis channel (T2_dT2_STD). Those events were discussed with Rockland's support team, and there are no significant concerns about data quality in this regard, as T2 remained healthy for most of the mission and could be utilised during the data processing phase. Regarding the last few days of data, T2 may still be suitable for use, as the T2_dT2_STD values were generally less than 500.

Figure 3 shows the glider's GPS positions throughout the ~20 days of the mission. The glider remained within 15km of the reference point, with a considerable number of records within a 5 km range. The distance was increased during the mission to prevent the glider from getting too close to the ship.

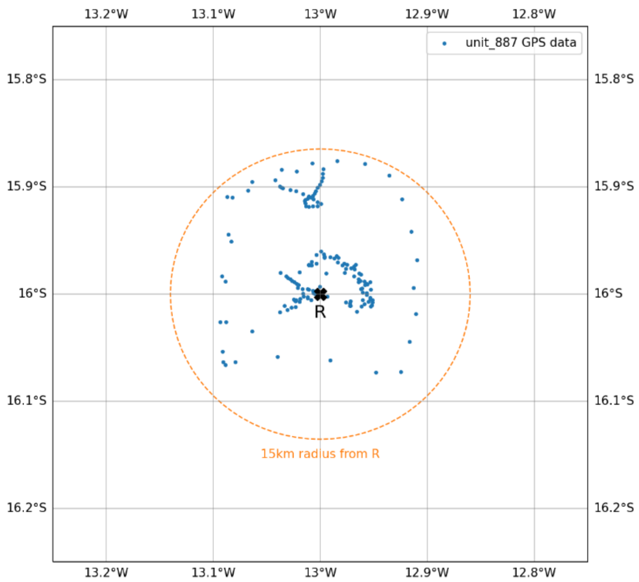


Figure 3: Glider GPS positions during the mission on area R (unit_887).

Key events:

- 28/02/2025 20:18 UTC: Glider deployed - initial dives
- 01/03/2025 13:00 UTC: Double dives to 500m (MR data acquisition setup)
- 06/03/2025 15:00 UTC: MR T1 probe broke
- 15/03/2025 21:00 UTC: MR T2 started showing increasing values on the T2_dT2_STD channel,
  which might be related to electronic noise.
- 19/03/2025 13:00 UTC: Changed to single dives to 100m (pre-recovery procedure)
- 20/03/2025 05:33 UTC: CTD profile ~1km away from the glider position.
  It should be comparable to those glider files/segments:
  01100255 / 01100256
- 20/03/2025 07:38 UTC: Glider recovered

Glider setup:

Unit_887 – Slocum G3s
Pump G3 1000m 576
Batteries lithium-ion rechargeable
Thruster - none
Science Bay 1395
CTD: RBR sn 204549
Wetlabs: FLBBCD sn 6408
Optode: Aanderaa 4831F sn 288
Microrider: SN 043
T1: T1642
T2: T837
S1: M1071 (Z-oriented)
S2: M1074 (Y-oriented)

Area X3

Unit_886 was prepared for an additional deployment, the last of the cruise. The glider performed well, as did most of its sensors. This mission also presented a few issues associated with the Microrider.

During the near real-time channel statistics analysis, it was observed that, after a few 500-meter dives, probe T2 began to show spike values on all of its channels (likely due to a crack on its glass tip). Also, a few hours before the glider recovery, the probes Sh1 and T1 showed increasing values on their STD channels (sh1_STD and T1_dT1_STD), which is probably associated with electronic noise. There may still be good data in this last section, as most of the values were within the acceptable ranges for those channels.

The glider was deployed 1 km away from X3, and the objective was to stay 1.5 km away from a reference point 7.5 km northeast of X3 (Figure 4).

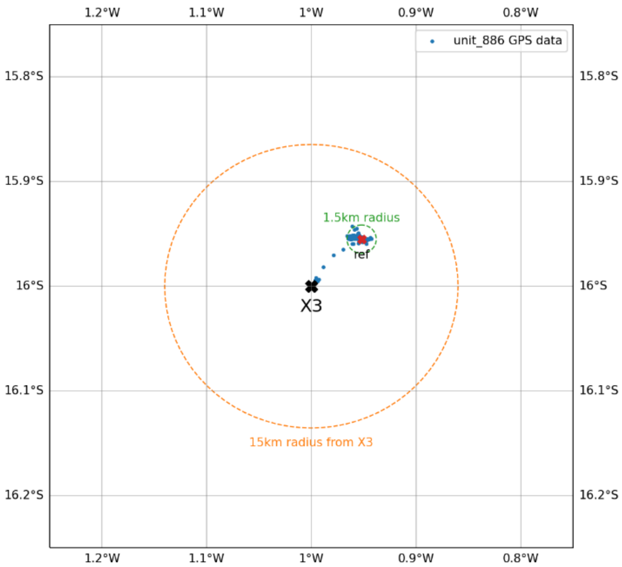


Figure 4: Glider GPS positions during the mission on area X3 (unit_886).

Key events:

- 23/3 06:45 UTC: Glider deployed - initial dives
- 23/3 13:45 UTC: MR T2 started to show spike values on all of its channels (degrading over time).
  Probably a crack on its glass tip.
- 23/3 15:05 UTC: Double dive to 500m (MR data acquisition setup)
- 25/3 14:00 UTC: Changed to single dive to 500m (pre-recovery procedure).
  MR sh1_STD channel showed a consistent step change in its values, mostly still in the acceptable range, but this might demand some care during processing.
- 25/3 21:00 UTC: Changed to single dive to 100m (pre-recovery procedure).
  MR T1 started showing higher T1_dT1 values (electronic noise).
- 25/3 23:00 UTC: MR T1_dT1_STD channel started to show increasing values.
- 26/3 04:00 UTC: CTD profile ~1km away from the glider position.
  It should be comparable to this glider file/segment: 02110000.
- 26/3 06:25 UTC: Glider recovered

Glider setup:
Unit_886 - Slocum G3s
Pump G3 1000m 577
Batteries lithium-ion rechargeable
Thruster - none
Science Bay 1440
CTD: RBR sn 207225
Wetlabs: FLBBBB sn 6904
Optode: Aanderaa 4831F sn 120
Microrider: SN 105
T1: T 1312
T2: T1643
S1: M1774 (Z-oriented)
S2: M1775 (Y-oriented)

OMG - Microrider dive setup

During a Microrider data acquisition mission, the dive setup should aim for a pitch angle of ~25 degrees and a vertical velocity of ~0.15 m/s while minimising glider noise and vibration. It is essential to mention that OMG missions should avoid using pumped CTDs, as this would also bring noise to the Microrider data. During the Cartridge/JC275 cruise, both gliders used unpumped RBR CTDs.

The first goal of the pilot is to determine the optimal battery position that will ensure the glider's pitch angles fall within the correct range during both downcast and upcast phases. Once found, those values are fixed, so the glider won't make any adjustments to them (i.e., not moving the battery during the profiles, resulting in less noise). The second step is to adjust the vertical velocity, which is achieved by setting the amount of drive/thrust (volume of oil) the glider will use during the profiles.

Finally, there is a limitation related to the Microrider/glider integration that makes it challenging to obtain Microrider data close to the surface. After a dive starts, the Microrider takes a few minutes to power up and start its data acquisition. At that point, the glider depth would be around ~6m. Additionally, at the end of the dive, the Microrider would stop data acquisition a bit earlier than the end of dive, which would represent a few meters gap from the surface. However, if the glider is set to perform multiple dives per segment (glider files), the Microrider data acquisition in between dives gets as close as possible to the surface (considering the glider capabilities, which would represent a depth of around ~2m). Figure 5 shows the double-dive setup used during the Cartridge/JC275 missions.

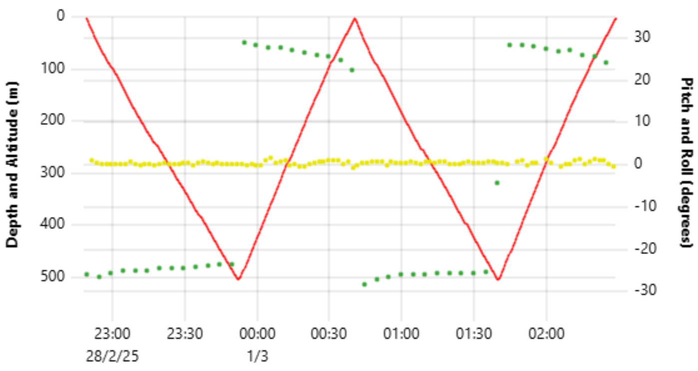


Figure 5: Microrider dive setup – double dive.

Final Dataset and Calibration Information

The final dataset will be provided by BODC, after they receive and process all the glider files and metadata.

Table 1 shows the BODC ID for each Cartridge deployment.

Table 1: BODC ID for each deployment.

Mission	Area	Glider	BODC ID
Cartridge	B	unit_886	672
Cartridge	R	unit_887	673
Cartridge	X3	unit_886	679

Those deployments can already be found on the BODC platforms webpage (near real-time data only, so far):

https://platforms.bodc.ac.uk/deployment-catalogue/

Shipboard CTD/LADCP measurements

(André Palóczy, Sophie Durston, and Filipe Pereira)

Physical and biological variables were measured in 53 casts using a SeaBird 9+ CTD. Primary conductivity (C), temperature(T), and dissolved oxygen (DO) sensors were located on the vane and secondary CT sensors were located on the SeaBird 9plus. An altimeter, a fluorometer, a transmissometer, a backscatter sensor, and two photosynthetically active radiation (PAR) sensors (uplooking and downlooking) were also present.

Water samples were taken using 24 Niskin bottles mounted on a stainless steel rosette frame. Figure 1 shows the geographical distribution of the casts across sites B (basin), R (Ridge) and the eddy stirring stations (*e.g.*, X1a, X1b, X3a).

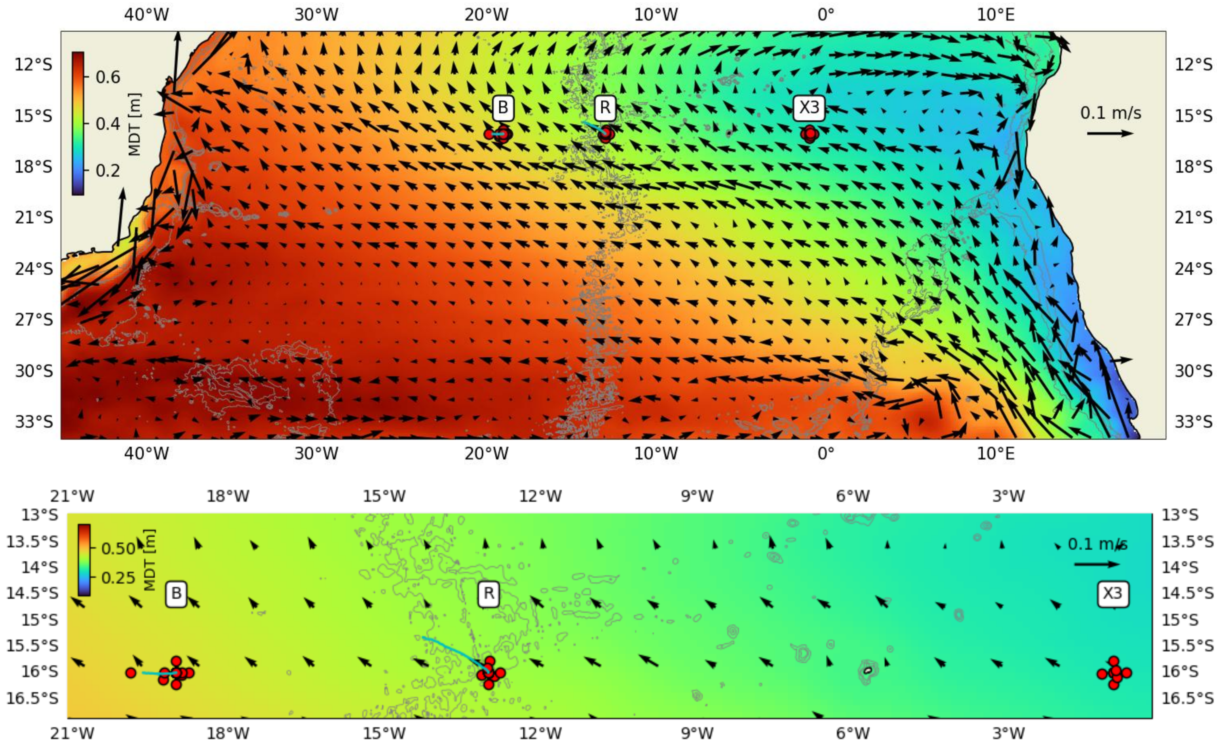


Figure 1: Upper panel: Location of all CarTRidge (JC275) CTD casts in the South Atlantic. The two main experiment sites are marked as "B" (Basin site) and "R" (ridge site), as well as the easternmost eddy flux diamond stations (X3). The color scale is a mean dynamic topography (CNES-CLS-2022) over the period 1993-2012, and associated absolute surface geostrophic velocity vectors. The two cyan lines are the tracks for the two wirewalkers (deployed at B and R). Lower panel: Zoom on B, R and X3.

After each CTD cast, data was output to the ship's shared science drive by the NMF team, and processing was done with NOC's Mexec software (https://github.com/NOC-OCP/ocp_hydro_matlab), which reproduces most of SeaBird's processing steps and enables manual editing options to remove spikes and bad scan ranges. The main automatic processing steps are as follows:

1) Align oxygen sensor relative to other sensors;
2) Correct for the conductivity cell's thermal inertia;
3) Average raw 24 Hz data to 1 Hz;

4) Bin-average in pressure bins;
5) Split profile in downcast and upcast.

Each CTD profile was processed and screened visually for bad data. Data quality was very high throughout the entire cruise, with spikes being almost always limited to the oxygen sensor during upcasts. Figure 2 shows all profiles from sites B and R (Figure 2).

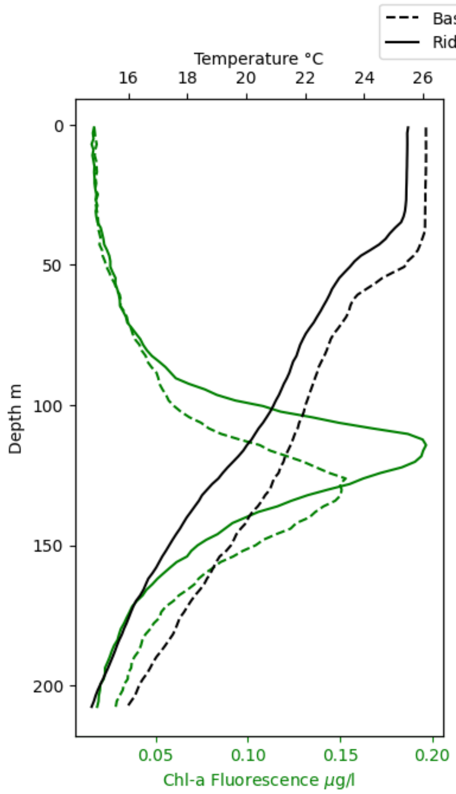


Figure 2: Average temperature and Chl-a fluorescence profiles for the Basin (dashed lines) and Ridge (solid lines) CTD deployments.

CTD casts were mostly in one of three categories (some also included sampling for particulate organic carbon and polonium) (Figure 3):

1) <u>Pre-dawn CTDs</u>: Done between 0300-0400 local time down to 250 m or 300 m. Their main purpose was to sample for phytoplankton and chemical variables with high resolution around the deep chlorophyll maximum.
2) <u>Eddy stirring CTDs</u>: Done in sets of four around a diamond pattern centered on B, R or X3 (Figure 1) down to 500 m, with high-resolution nutrient and dissolved organic carbon (DOC) in the pycnocline. They were collocated with Vertical Microstructure Profiler (VMP) turbulence profiles to derive estimates of lateral eddy stirring as a residual of the total diapycnal + isopycnal mixing (Polzin & Ferrari method).
3) <u>Full-depth CTDs</u>: Used primarily for sound speed calibrations of shipboard acoustic instruments.

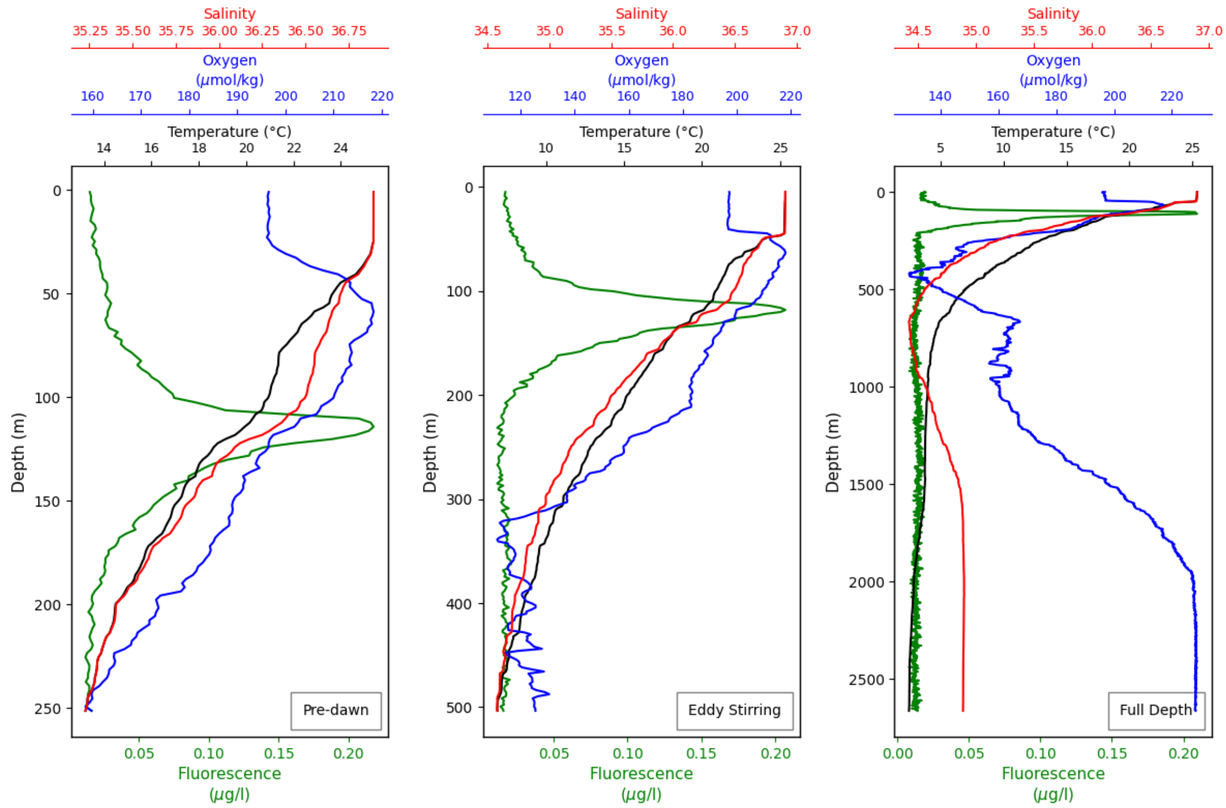


Figure 3: Temperature, salinity, oxygen, and fluorescence profiles measured during the pre-dawn (left), eddy stirring (centre), and full depth (right) CTD casts.

LADCP data

Two 300 Hz TRDI Workhorse LADCPs (uplooker and downlooker) were deployed on the stainless steel rosette frame. Data was processed using the LDEO IX LADCP processing software wrapped by Mexec scripts.

For every cast, data was processed in different sets by using only the uplooker (UL_GPS version), only the downlooker (DL_GPS version), both downlooker and uplooker (DLUL_GPS version), and both downlooker and downlooker with upper-ocean velocities constrained by the ship's 150 kHz ADCP. In full-depth stations where the bottom was within the downlooker's range, bottom track velocities were also used to constrain the LDEO IX software's velocity profile solutions (version DLUL_GPS_BT_SADCP). The ship's 75 kHz ADCP has longer range (~600 m) and is usually preferred as a constraint, but it had technical problems throughout most of the cruise, and therefore the 150 kHz (~300 m range) was used instead, since it was consistently available in every cast. Figure 4 shows an example of LADCP velocity profile from an eddy stirring (500 m deep) station. The near-surface agreement between the DLUL_GPS LADCP solutions (black lines) and the independent SADCP profiles (red dashed lines) gives some confidence in the LADCP velocity profile.

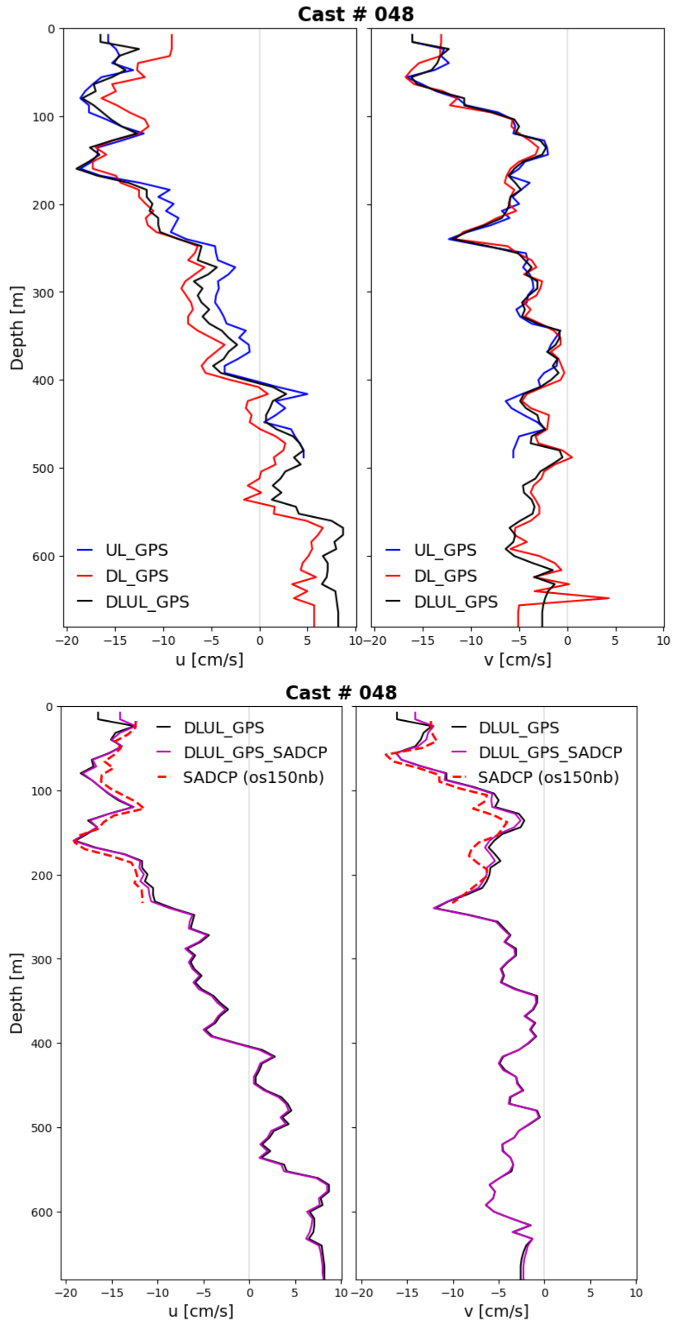


Figure 4: Examples of LADCP velocity profiles processed with different constraints. Left: Comparison between zonal (u) and meridional (v) velocity profiles from uplooker only (UL_GPS), downlooker only (DL_GPS), both uplooker and downlooker (DLUL_GPS). Right: Comparison between the LADCP profiles without shipboard ADCP (SADCP) constraints (DLUL_GPS) with LADCP profiles including SADCP constraints (DLUL_GPS_SADCP), and the SADCP profiles from the hull-mounted Ocean Surveyor 150 kHz in the top 250 m.

Calibration of conductivity, oxygen and chlorophyll fluorescence data

Water samples were collected using Niskin bottles mounted on the CTD-Rosette system and subsequently analyzed in the onboard chemical laboratory for dissolved oxygen (DO) and chlorophyll fluorescence. Salinity samples were analyzed using the Autosal Salinometer.
To calibrate sensor data, the corresponding .btl files generated by the *Seabird* software were used to match in-situ sensor measurements of DO (132 samples), chlorophyll fluorescence (240 samples), and practical salinity (117 samples) with the laboratory-measured values.

Regression analyses (Figure 5) were then performed to derive calibration curves for each parameter, which were applied to the CTD profiles to improve accuracy.

For both salinity and DO, a linear regression provided the best fit, with coefficients of determination (R^2) equal to 1.00, indicating excellent agreement, and Root Mean Square Error (RMSE) of 10.90 μM for DO and 0.0643 PSU for salinity. A small number of outliers were identified and excluded from the salinity calibration; these are highlighted in orange in Figure 3C. In the case of chlorophyll fluorescence, a cubic regression produced the best fit with an R^2 of 0.91 (RMSE = 0.187 mg m^{-3}) which was used for the calibration, although a quadratic fit also yielded a reasonably good fit with R^2 = 0.88 (RMSE = 0.157 mg m^{-3}).

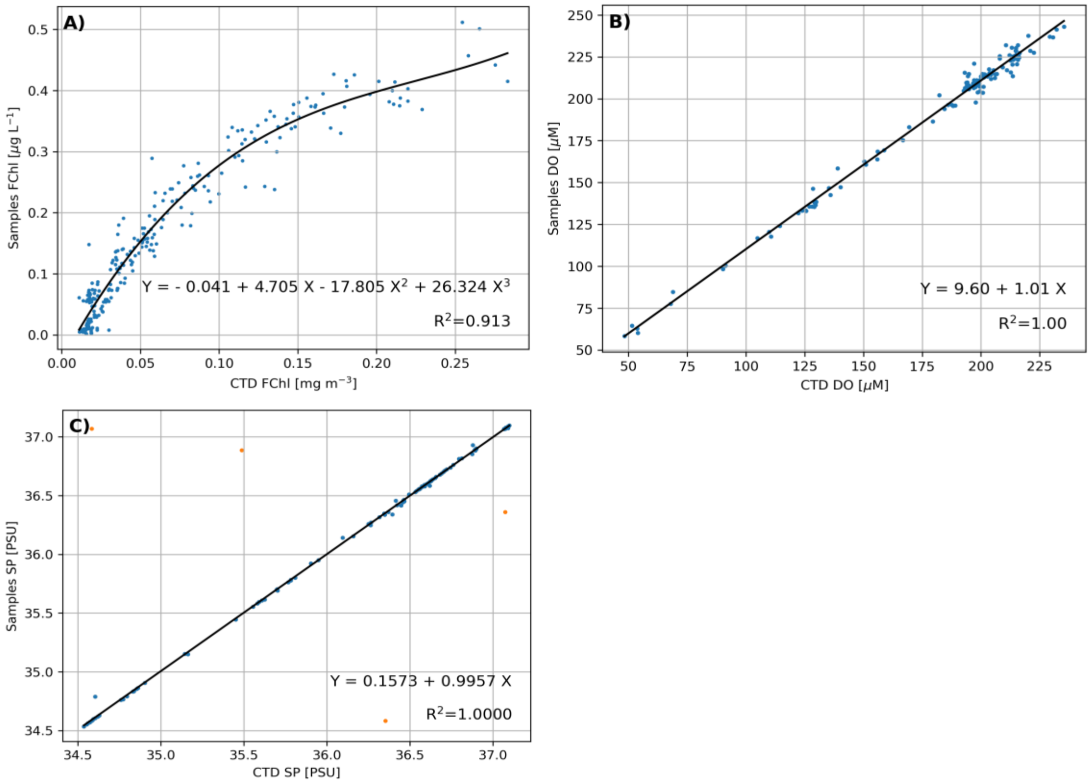


Figure 5: Least square fits for calibration of (A) Chlorophyll Fluorescence, (B) Dissolved Oxygen, and (C) Practical Salinity. Orange dots on panel C mark outliers not used in the fit.

Vessel Mounted Acoustic Doppler Current Profiler (vmADCP)

Sophie Durston

The RRS James Cook features two RDI OceanSurveyor vmADCPs operating at 75 kHz (os75nb) and 150 kHz (os150nb). During data aquisition, the UHDAS CODAS software was used for preliminary processing to ensure the instruments were running smoothly and the correct heading correction was applied during each leg. There are periods of missing data due to passing through restricted areas, such as through an EEZ (Figure 1). Data from os150nb was as expected throughout the cruise, however, os75nb had an issue with one of the instrument's beams. Beam 2 had a faulty connection which was detected initially as bad data and then during an inspection, of which it was disconnected for a proportion of the cruise to be fixed. However, due to the uncertainty that the fix had solved the beam issue entirely, beam 2 was removed from the full dataset for os75nb during the following post-process analysis.

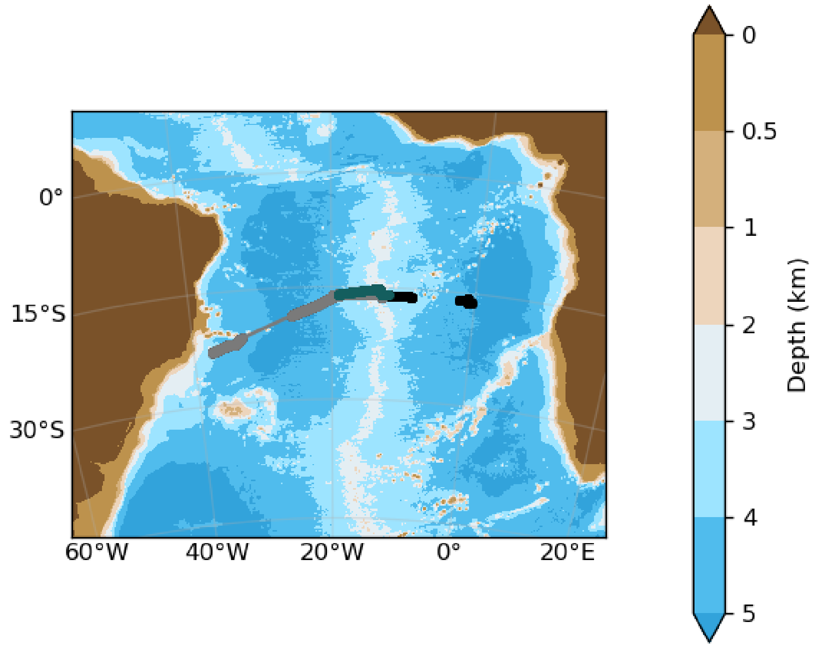


Figure 1. Overview of the vmADCP data aquisition locations across the South Atlantic Ocean. Gaps in data are due to the instruments being turned off when travelling through restricted areas, such as an EEZ. This figure is produced during the data processing steps detailed below to visually aid quality control.

Post-processing:

Data was synced from the ship's drive (/current_cruise/Shipboard_Systems/) to a working directory (/science_public/JC275/science/). CODAS was used to complete the post-processing, it was created to work with UHDAS/VmDAS data aquisition systems, as used on the James Cook. The CODAS software is written in Python 3.6+ and was installed onto a MacOS computer (https://currents.soest.hawaii.edu/docs/adcp_doc/codas_doc/index.html). These steps were repeated for both os150nb and os75nb. The output examples shown are from the processing of os150nb.

Step 1:

First, the cruise tracking and heading data were examined to look for gaps. The following command produced a figure that indicated gaps in heading values with a red plus sign. Good data was indicated with a green dot.

```
plot_nav.py nav/a_ukjc.gps
```

For this cruise, no corrections were needed.

Step 2:
Watertrack values were examined using:

```
tail -20  cal/watertrk/adcpcal.out
```

which produces the median, mean and standard deviation of both amplitude and phase values. Amplitudes need to be at 1 ± 0.3% while phase should be at 0 ± 0.05 deg. Bottom track was not examined for this cruise as the water depth was always more than 1000m deeper than the range of the sensors.

```
**watertrack**
-----------
Number of edited points:  81 out of  81

             median    mean     std
amplitude    1.0090  1.0082  0.0044
phase        0.0360  0.0335  0.2467
-----------
```

Results from the watertrack data suggested that a scale factor needs to be applied but the phase requires no corrections. This was completed after manual edits to the data.

Step 3:
Obviously bad data points can be removed manually using:

```
dataviewer.py -e
```

where individual points of visibly anomalous points can be edited out of data. This can then sometimes fix the calibration issues seen within Step 2, so it is necessary to complete before adding the required scale factors.

Therefore, once the editing is complete, the following command was used to recalculate the calibrations:

```
quick_adcp.py --steps2rerun navsteps:calib  --auto
```

Step 4:

Watertrack values were reassessed as the results might have changed due to the manual edits. Values had changed slightly but still require the application of a scale factor.

```
  **watertrack**
-----------
Number of edited points:  81 out of  81

                   median    mean     std
amplitude        1.0080   1.0083   0.0045
phase             0.0400   0.0331   0.2473
-----------
```

To get the amplitude values within the 0.03% range of 1, a scale factor of 1.008 was used within the following command:

```
quick_adcp.py --steps2rerun rotate:apply_edit:navsteps:calib --rotate_amplitude 1.008 --auto
```

to produce the following final calibration results:

```
  **watertrack**
-----------
Number of edited points:  81 out of  81

                   median    mean     std
amplitude        1.0000   1.0003   0.0045
phase            0.0400   0.0351   0.2494
-----------
```

Step 5:

Files were then extracted into a user-friendly format. Both NetCDF and Matlab files were created to ensure it was compatible with most coding languages.

To extract Matlab files:

```
plot_nav.py nav/a_km.gps
```

To extract NetCDF files:

```
adcp_nc.py adcpdb contour/os150nb os150nb_postproc os150nb --ship_name James Cook
```

Key areas of interest:

1. Velocities from the vmADCPs indicate that the ship sailed through an eddy soon after departing Brazil.
2. When the ship was stationary for sampling, inertial oscillations were observed providing a unique dataset.

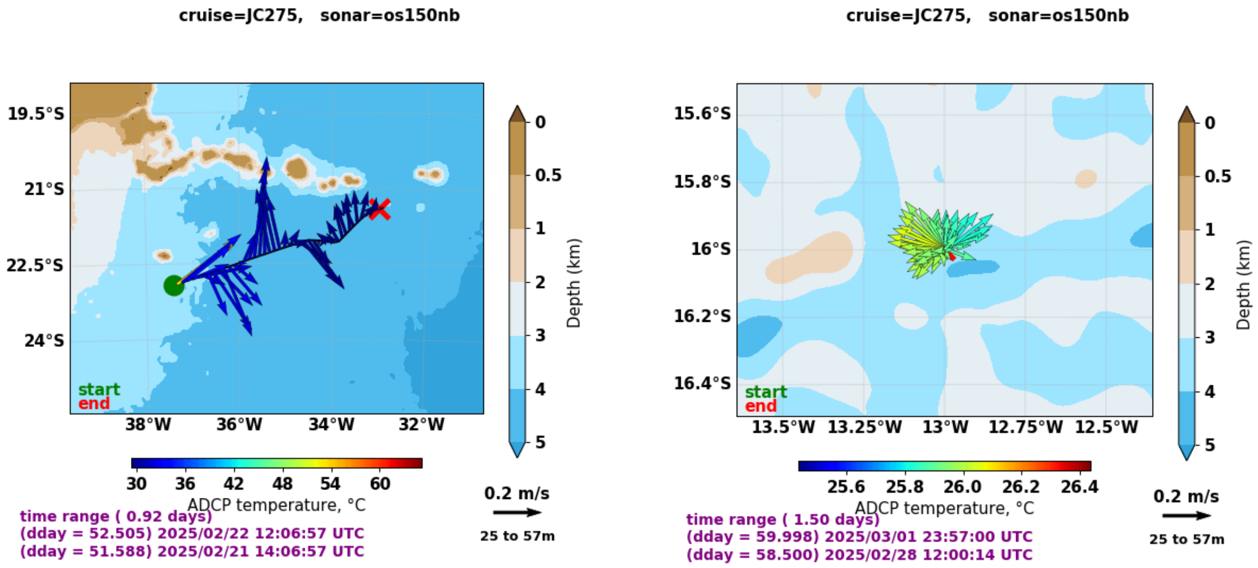


Figure 2. Panels produced within PyCODAS to indicate initial outputs of the eddy (left) and inertial oscillations (right) observed during post-processing.

Wirewalker underwater profiler deployments

Chris Balfour, Geoff Hargreaves

(all times are in GMT)

Measurement system scientific requirements

The 'Wirewalker' is a wave and buoyancy driven automated underwater profiling measurement system primarily utilised for oceanographic surveys. The two systems deployed during RRS James Cook research voyage JC275 were for the provision of high-resolution underwater measurements of chlorophyll-a concentration, conductivity, temperature and depth (CTD), PAR, backscatter and fDOM in the upper 300 metres of the sub-sea surface water column. Wave energy and the profiler system buoyancy were used to provide repeated underwater profiles from close to the sea surface to depth of 300 metres. Measurements from this system were configured to occur with the use of a drifting mooring. A vertically suspended sub surface steel mooring wire, sub-surface weight and couplings to the underside of a surface buoy formed the mooring arrangement. Two Wirewalker systems were deployed in drifting mooring configurations. An update on earlier design revision of the Wirewalker underwater profiler that included a contemporary scientific sensor suite was deployed at the South Atlantic Ocean basin survey station starting at 16S,19W. A newer design Wirewalker underwater profiler with a duplicate, modern scientific sensor suite was subsequently deployed at the mid-Atlantic Ocean underwater ridge survey location starting at 16S,13W. Each profiler was configured to continuously record the scientific measurements at a sample rate of 16Hz. The measurements from these sensor systems aimed to consolidate the various scientific survey techniques applied for the CarTRidge research program during JC275.

Sensors and mooring configuration

A surface expression in the form of an approximately 1 metre diameter buoy was used. Positional tracking systems mounted on the buoy monitored and recorded the location of the surface buoy and subsequently the attached underwater vertical profiling system. Beacons using the iridium satellite constellation with integrated GPS receivers formed the primary systems for tracking the mooring surface buoy positions remotely in near real time, at a nominal update rate of 30 minutes. Backup positional indications were provided by the Argos satellite constellation using self-powered marine mammal tracking tags fitted to the surface buoys. The surface buoy instrumentation included high-resolution GPS self-recording systems for tracking the buoy paths during the deployments, although these high spatial resolution data sets were not telemetered. Table 1 provides a list of the internally recording underwater profiler scientific sensor system basic specifications. The subsequent list in table 2 provides some details of the buoy mounted position indication and data recording systems. A functional diagram of the mooring arrangement is provided in figure 1. The key features of the underwater profiling system are in the labelled picture in figure 2. The primary components mounted to the surface buoy are indicated in figure 3. Table 3 lists each of the Wirewalker profiler sensor serial numbers.

Table. 1 – Wirewalker underwater profiler instrumentation

Item	Description
RBR Concerto3	An internally recording CTD with a fast response thermistor temperature sensor. Data is logged internally at 16Hz.
Li-Cor LI-192 PAR sensor (400nm to 700nm)	PAR sensor integrated to the CTD that is sampled and recorded at 16Hz.
RBR Tridente	Chlorophyll-a, backscatter and fDOM measurements from this sensor are sampled and recorded by the CTD at 16Hz.

Table. 2 – Wirewalker mooring surface buoy instrumentation

Item	Description
Novateck iBCN MMI-513-12000 GPS and Iridium beacon	An iridium satellite communications beacon with integrated GPS receiver and battery power source. A nominal position transmission update rate of 30 minutes was used.
Wildlife computers SPOT-257 marine mammal tag	A compact, battery powered scheduled transmitter using the Argos satellite constellation for backup surface buoy positional tracking, typically several times per day.
Carmanah M550 solar lantern	A solar powered buoy light for night time buoy position indication.
High resolution GPS recorder	A custom, compact battery powered GPS recording system. A nominal GPS fix update of several seconds was used.

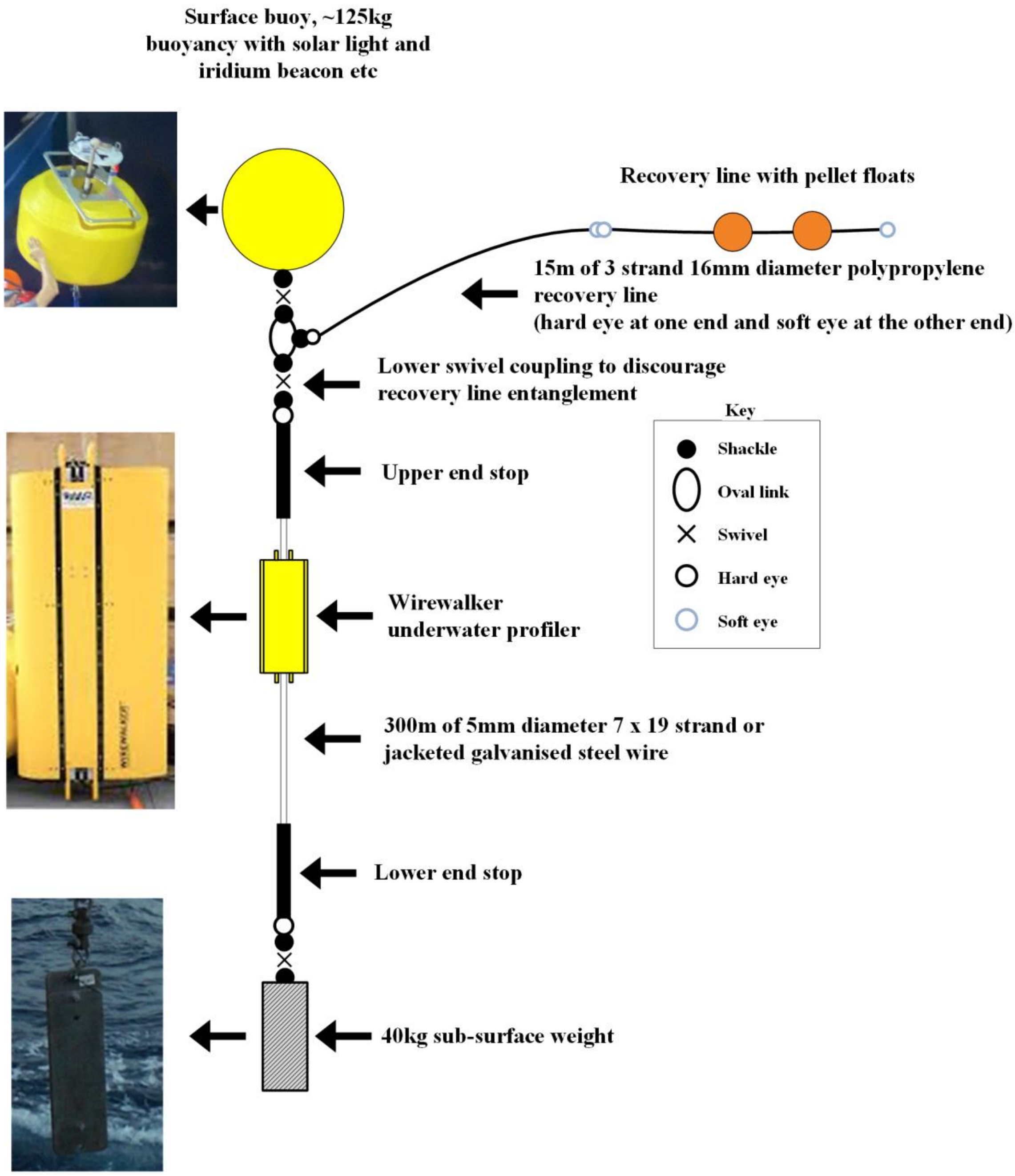


Figure 1 - Drifting mooring layout for the Wirewalker underwater profiling system

Table. 3 – Profiler instrument serial numbers

Profiler	Sensor suite
Legacy Wirewalker, Basin station (16S, 13W)	Concerto3 (C.T.D.PAR.TRIfast16): SN 235751 RBR Tridente bb.chl-a.fDOM SN 234375 Li-Cor LI-192 PAR sensor: UWQ11545
New Wirewalker, Ridge station (16S, 19W)	Concerto3 (C.T.D.PAR.TRIfast16): SN 214911 RBR Tridente bb.chl-a.fDOM SN 213951 Li-Cor LI-192 PAR sensor: UWQ10797

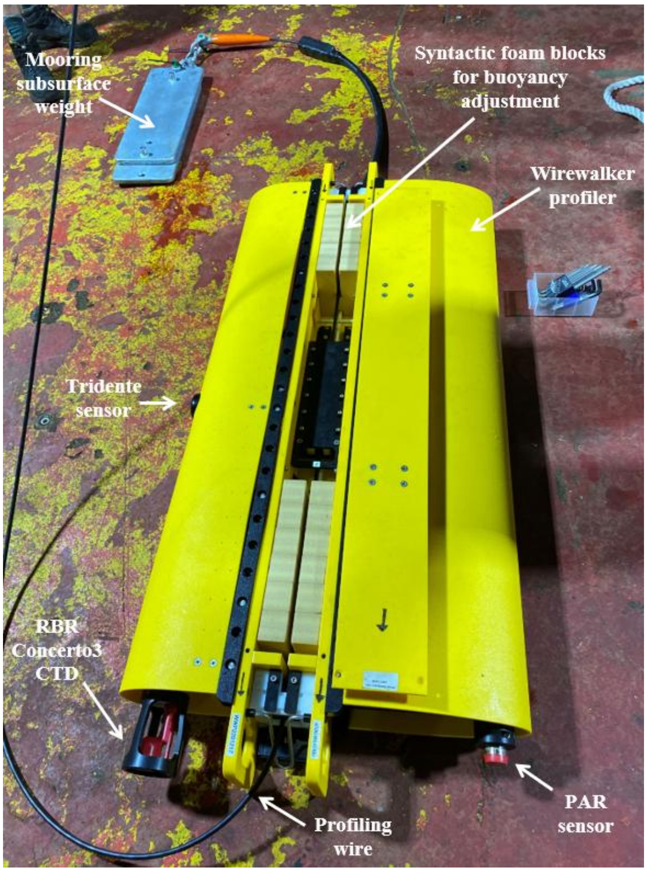


Figure 2 - Wirewalker underwater profiling system key features

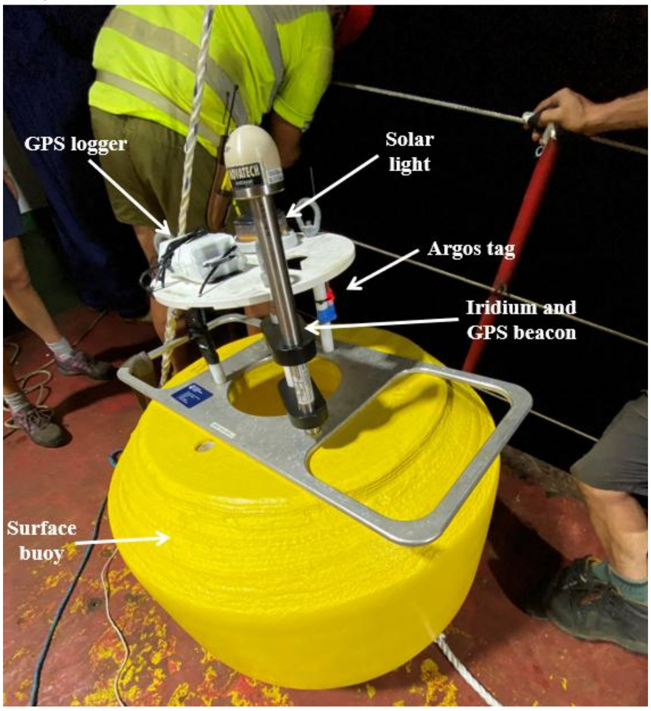
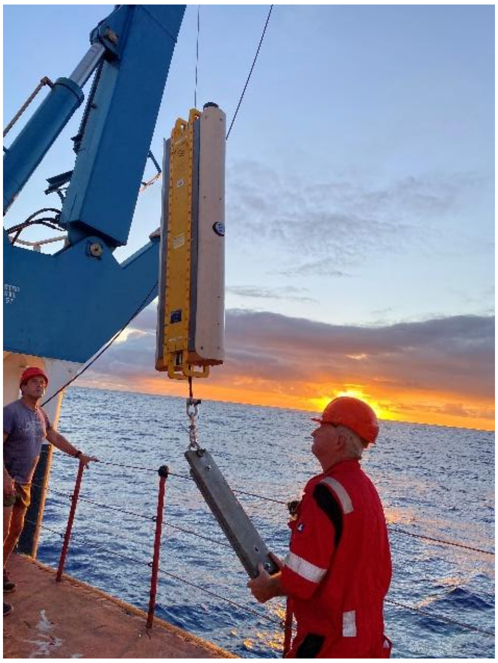


Figure 3 - Wirewalker mooring surface buoy key features

Deployment of the Wirewalkers and moorings

The legacy Wirewalker underwater profiler was deployed at the South Atlantic Ocean basin site, 16S, 19W at 19:57 on Wednesday 26th February 2025. The newer profiler was deployed at the southern mid-Atlantic Ocean ridge site at 20:00 on Friday 28th February 2025. Pictures of some of the deployment operations from RRS James Cook are in Figure 4.



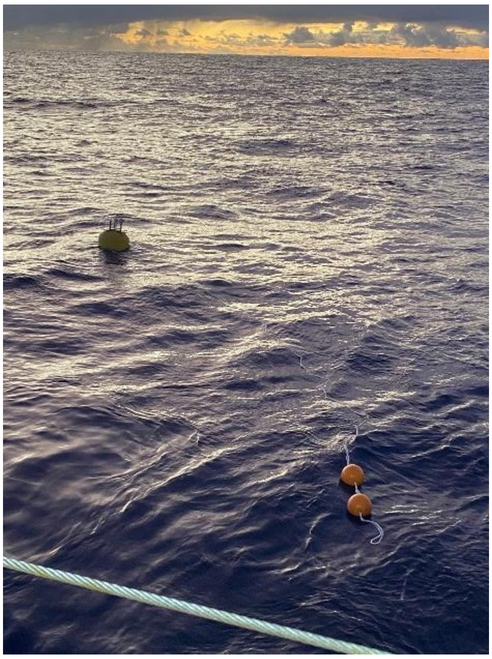


Figure 4 – Deployment of the legacy Wirewalker, mooring, surface buoy and recovery line

Mooring surface buoy positional tracks

The reported GPS positional tracks for the legacy and new Wirewalkers are illustrated in Figure 5 and Figure 6. The Wirewalker mooring surface buoy reported GPS positions via the iridium low earth orbit satellite constellation, at a predominantly 30-minute update rate.

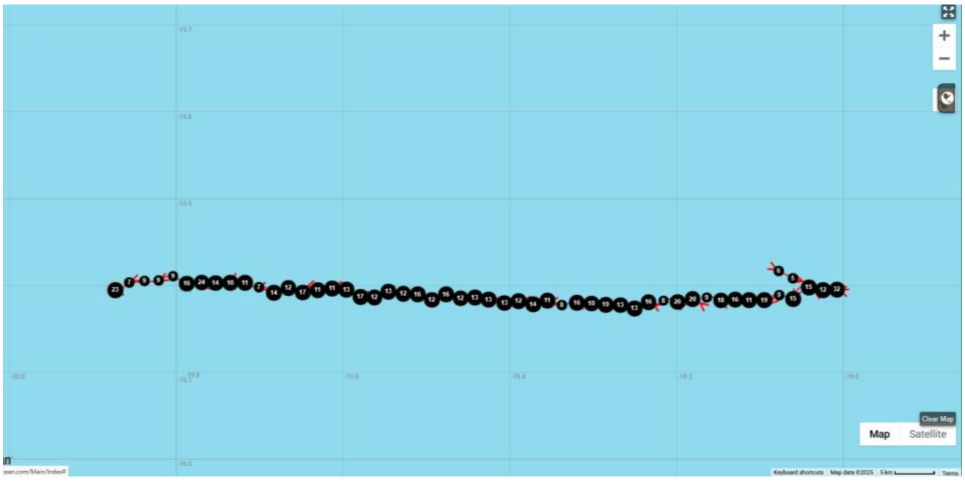


Figure 5 - Legacy Wirewalker mooring surface buoy track around the South Atlantic Ocean basin site from the deployment location at 16S, 19W
(Deployment from 19:57 on 26/02/25 to 16:00 on 14/03/25, The regularly updated recovery position estimate of a drift of circa 0.873W by Friday 14th March to 16.0S, 19.87W was of some assistance to cruise planning and the RRS James Cook navigation)

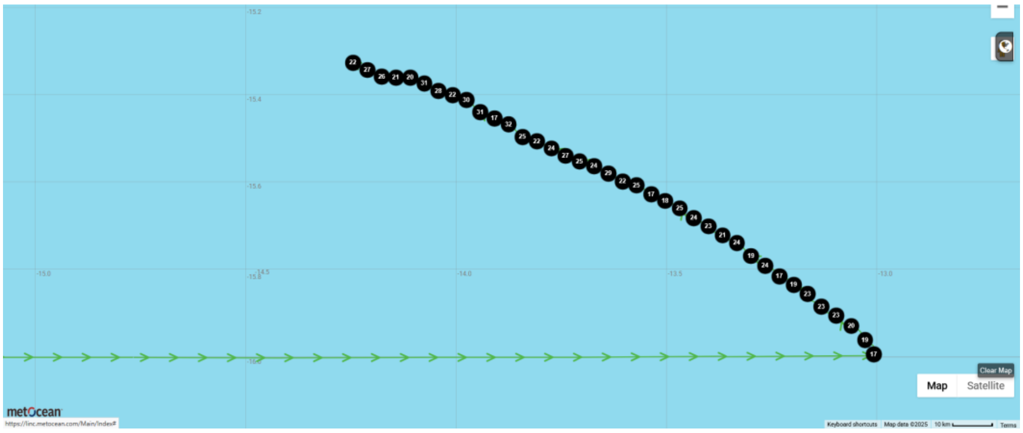


Figure 6 - Deployed new Wirewalker mooring surface buoy track around the South Atlantic Ocean basin site following the deployment at 16S, 13W
(Deployment from 08:00 on 28/02/25 to 12:52 on 19/03/25, The recovery position estimate of a drift of approximately 0.673N and circa 1.256W by 19/03/25 to 15.33S, 14.26W was of some assistance to cruise planning and the RRS James Cook navigation.)

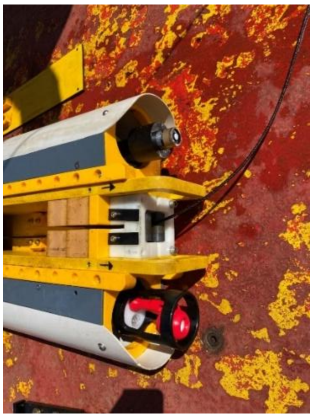
Wirewalker mooring recoveries

A selection of pictures of the Wirewalker mooring recovery operations are shown in figure 7 and figure 8. The recoveries were initiated using a grapnel from the aft starboard side of RRS JCR to snag the buoyant mooring recovery and pellet float line. The link below the surface buoy was stopped off on the stern of the ship. The mooring and Wirewalker were then carefully winched aboard.


a surface buoy and recovery line during hauling of the mooring onboard RRS James Cook


b surface buoy recovery

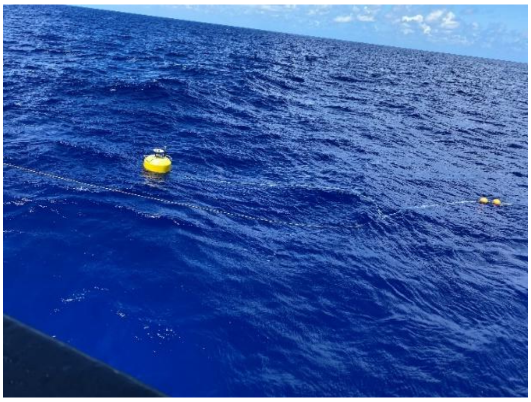
c recovery of the legacy Wirewalker underwater profiler



d no obvious fouling of the CTD and PAR sensors shortly after the recovery

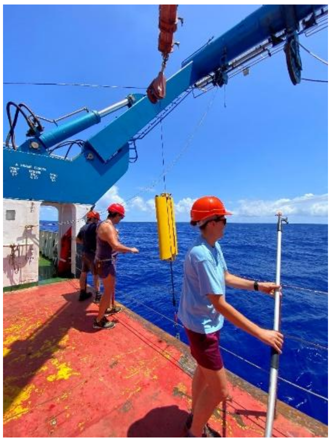
e no obvious fouling of the Tridente (Chlorophyll-a, backscatter and fDOM) sensors

Figure 7 – Recovery of the legacy Wirewalker and moorings

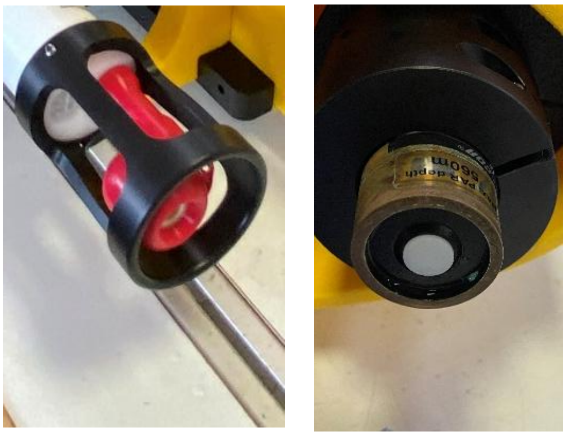


a surface buoy and recovery line during hauling of the new Wirewalker mooring onboard RRS James Cook

b new Wirewalker surface buoy recovery



c recovery of the new Wirewalker underwater profiler



d no obvious fouling of the CTD and PAR sensors shortly after the recovery

e no obvious fouling of the Tridente (Chlorophyll-a, backscatter and fDOM) sensors
Figure 8 – Recovery of the new Wirewalker and moorings

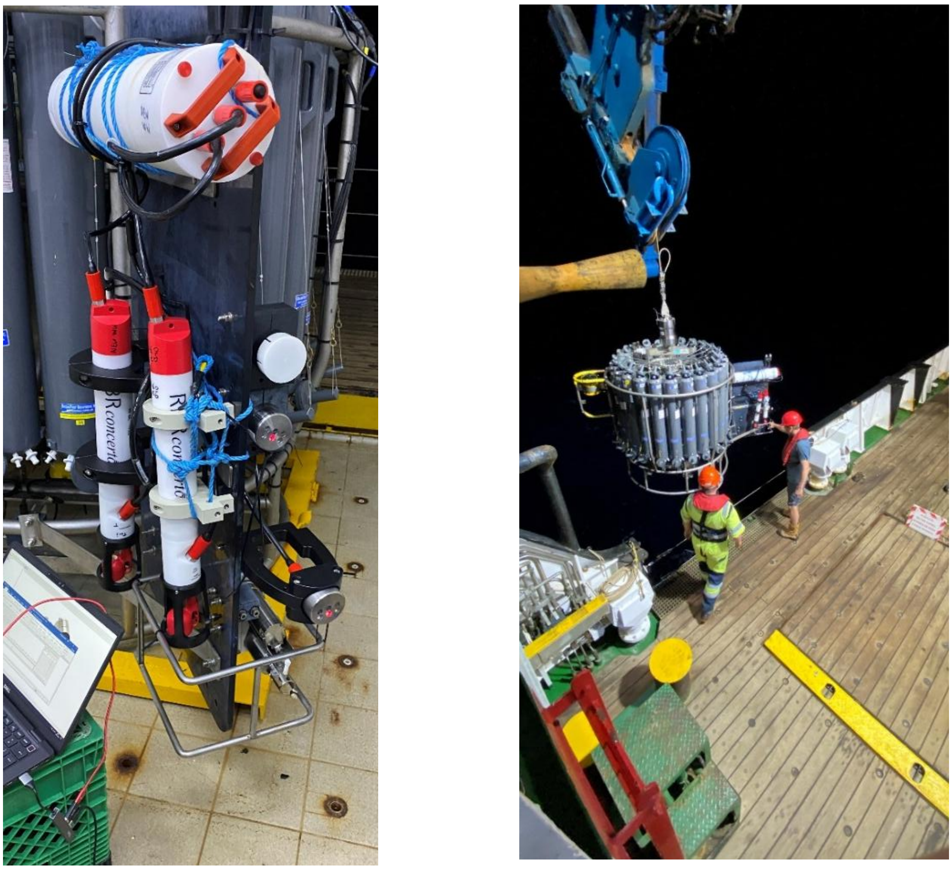
The recovery of the legacy Wirewalker was at a GPS location of 16° 0.198'S, 19° 52944'W at 16:00 on 14/03/25. The recovery of the new Wirewalker was at a GPS location of 15° 19.630'S, 14° 16.157'W at 12:52 on 19/03/25.

Instrumentation calibrations of the legacy Wirewalker, JC275 basin site 16S, 19W

Scheduling and limited daylight working hours dictated that in-situ Wirewalker sensor calibrations with the ship's CTD did not occur in the proximity of and shortly after the Wirewalker deployments. The legacy Wirewalker in-situ, pre-recovery sensor calibration with the ship's CTD occurred at a GPS location of 16° 0.180'S, 19° 52.639'W to a depth of 300m at 15:32 on 14/03/25. This was event 146 in the ship's log. Following this, the recovered legacy Wirewalker CTD, Tridente (Chlorophyll-a, backscatter and fDOM sensor) and PAR sensors were fastened to the ship's CTD and a parallel post-recovery measurement cast to 500m for the Wirewalker sensors occurred at a GPS location of 16° 0.000'S, 19° 0.000'W at 14:30 on 17/03/25 and was event 178 in the ship's log. Only cross calibration of the ship's CTD and the legacy Wirewalker CTD occurred during this sensor calibration exercise.

Instrumentation calibrations – Legacy and New Wirewalker, JC275 ridge site 16S, 13W

JC275 scheduling and research voyage programme time constraints dictated that a close proximity, pre-recovery CTD calibration cast did not occur before the new Wirewalker recovery at 19° 19.630'S, 14° 16.157'W at 12:52 on 19/03/25. Following the legacy and new Wirewalker recoveries, the Wirewalker CTD, Tridente (Chlorophyll-a, backscatter and fDOM sensor) and PAR sensors were fastened to the ship's CTD and a parallel post-recovery measurement cast to 500m for all of the Wirewalker sensors occurred at a GPS location of 15° 54.905'S, 13° 1.253'W at 05:33 on 20/03/25 and was event 187 in the ship's log. The Wirewalker sensors were configured to record data at 16Hz during the cross-calibration operations with the Wirewalker CTD conductivity cell and temperature sensors mounted as close as possible to the ship's CTD conductivity cell and temperature sensors. A selection of pictures of the post Wirewalker instrument recovery cross calibration with the ship's CTD carousel are provided in Figure 9.



a Both Wirewalker instruments and one RBR Fermata external power battery pack were strapped to the ship's CTD carousel

b Deployment of the ship's CTD to 500m with the Wirewalker sensors and battery pack attached on the CTD conductivity cell vane on the right hand side of the carousel

Figure 9 – Use of the RRS James Cook calibrated CTD carousel to 500m for post legacy and new Wirewalker instrument recovery reference calibrations

Scientific measurement data set summaries

During the deployments, measurement data was recorded by the RBR CTD with the Tridente and PAR sensors sampled by the CTD. This provided a unified data set for all the sensors that was aligned to a common CTD generated time reference. For both profilers, after some tethered buoyancy tests with 100m profiling wires, the typical up-cast buoyancy-controlled ascent rate from 300m to near the sea surface was trimmed to approximately 0.5m/s to 0.7m/s. This is within or just above the manufacturers preferred Wirewalker profiling ascent rate operating envelope of 0.3m/s to 0.5ms.

The legacy Wirewalker tended to be ballasted to operate inside the preferred operating envelope upper limit of 0.5m/s, with the legacy up-casts tending to be circa 0.45m/s to 0.5m/s. The new Wirewalker buoyancy driven ascent underwater from 300m depth to close to the sea surface was at an increased rate of 0.6m/s to 0.7m/s, although still considered acceptable for scientific data generation, cross calibration and subsequent analysis.

Table 4 – Legacy Wirewalker underwater profiler instrumentation data summary

<table>
<tr><td colspan="2">The legacy Wirewalker Deployment was at 19:57 on 26/02/25 until 16:00 on 14/03/35. A cyclic down and up underwater profile to and from 300m was completed typically every 20 minutes from the deployment start until approximately 03:00 on Monday 10th March, when a profiler stall occurred near the sea surface. This resulted in circa 11.5 days of scientific data generation via repeated underwater profiles.</td></tr>
<tr><th>Sensor</th><th>Summary of data return</th></tr>
<tr><td>RBR Concerto3 CTD
(SN235751)</td><td>A full data return sampled at 16Hz was achieved. The CTD clock was reset to 15:13 on Wednesday 26/02/25. The CTD clock was GMT+0 at 16:30 on 14th March 2025. No obvious conductivity, temperature and pressure sensor fouling occurred.</td></tr>
<tr><td>Tridente auxiliary sensor
(SN234375)</td><td>No significant instrument fouling observed and Chlorophyll-a, backscatter and fDOM measurements recorded successfully by the CTD at 16Hz.</td></tr>
<tr><td>PAR sensor
(UWQ11545)</td><td>No obvious fouling observed and a full measurement data set was recorded by the CTD at 16Hz.</td></tr>
</table>

Table 5 – New Wirewalker underwater profiler instrumentation data summary

<table>
<tr><td colspan="2">The new Wirewalker Deployment was from 20:00 on 28/02/25 to 12:52 on 19/05/25 2025 generating approximately 18.5 days of scientific data. A cyclic down and up underwater profile to and from 300m was completed approximately every 20 minutes. This Wirewalker attained a full deployment data return.</td></tr>
<tr><th>Sensor</th><th>Summary of data return</th></tr>
<tr><td>RBR Concerto3 CTD
(SN214911)</td><td>A full data return occurred that was sampled at 16Hz. The CTD clock was reset to 10:01:06 on 28/02/25. The CTD clock was GMT +0 at 14:44 on 19/03/25. No obvious conductivity, temperature and pressure sensor fouling occurred.</td></tr>
<tr><td>Tridente auxiliary sensor
(SN213951)</td><td>No significant instrument fouling observed, with Chlorophyll-a, backscatter and fDOM measurements recorded successfully by the CTD at 16Hz.</td></tr>
<tr><td>PAR sensor
(UWQ10797)</td><td>No obvious fouling observed and a full measurement data set was recorded by the CTD at 16Hz.</td></tr>
</table>

Surface buoy measurement data summary

A review of the performance of the buoy instrumentation for both moorings is provided in table 6 and table 7. In general, the instrumentation performed well and the GPS location of the Wirewalker mooring buoys was reported at typically 30-minute intervals via near real time data transfer for the duration of the deployment using the iridium low earth orbit satellite constellation. The Argos marine mammal backup position tag for the legacy Wirewalker operated correctly and normally reported several positional estimates per day. The Argos tag for the new Wirewalker surface buoy developed a fault and stopped reporting positional updates after two days into the deployment. The solar powered night time buoy lights operated correctly during the deployments after sunset on Wednesday 26/02/25 and Friday 28/02/25 and were still operational at the end of the deployments.

The high-resolution GPS data logger on both surface buoys operated sub-optimally and did not attain a full data return. The cause of this is under investigation as is the root cause of the problematic Argos backup positional tag fitted to the new Wirewalker mooring surface buoy.

Table 6 – Legacy Wirewalker mooring surface buoy instrumentation data summary

Deployment from 19:57 on 26/02/25 to 16:00 on 14/03/25, lasting approximately 15.5 days (11.5-day scientific data return due to a profiler stalling event)	
Sensor	**Summary of data return**
Metocean Iridium plus GPS beacon (IMEI: 301434061100220)	A full data return occurred with only occasional positional fix inaccuracies or missed GPS fixes. This is anticipated with a small beacon fitted to a mobile buoy on the sea surface.
High resolution GPS data recorder (SN0001)	An anomaly seemed to have occurred with the logging system resulting in a sub-optimal data return.
SPOT Argos tag	This tag provided backup positional fixes throughout the deployment.

Table 7 – New Wirewalker mooring surface buoy instrumentation data summary

Deployment from 20:00 on 28/02/25 to 12:52 on 19/03/25 ~18.5 days	
Sensor	**Summary of data return**
Metocean Iridium plus GPS beacon (IMEI: 300434067081670)	A full data return occurred with only occasional positional fix inaccuracies or missed GPS fixes. This is anticipated with a small beacon fitted to a mobile buoy on the sea surface.
High resolution GPS data recorder (SN0002)	An anomaly seemed to have occurred with the logging system resulting in a sub-optimal data return.
Spot Argos tag	Unfortunately, this tag failed and stopped providing positional fixes on Friday 28th February 2025 at approximately 2 days into the deployment.

Microstructure Profilers

Alex Forryan and Espe Broullón (University of Southampton)

Overview

Two microstructure profilers were used during JC275 (Cartridge), one tethered (VMP2000 SN291) and one free-falling (VMP6000 SN016) both manufactured by Rocklands Scientific International (Fig. 1). These types of instruments measured profiles of temperature and velocity microstructure (i.e. on the length scales of dissipation of turbulent flows, typically a few millimetres to tens of centimetres), from which the rates of dissipation of turbulent kinetic energy (ε) and temperature variance (χ) are estimated using methodology based on Oakey (1982). Finescale temperature, salinity and pressure are also measured with a Seabird CTD mounted on each instrument.

Figure 2. Instruments used to measure turbulence. VMP2000 SN291 (left), VMP6000 SN016 (centre) and FloatRider (right).

The aim of the Cartridge VMP operations was to observe mixing related to tidal flow and to attempt to constrain horizontal eddy fluxes in contrasting regimes on and off the mid-Atlantic ridge. To achieve this, four 13 hour continuous deployments to a depth of at least 500 m were planned using the tethered VMP, on and off ridge, at neap and spring tides. As a contrast an additional two 13 hour deployments were also conducted in the Angola basin east of the mid-Atlantic ridge. Three eddy-flux stations, consisting of a series of five profiles taken at each corner of a diamond centred on the position of the 13 hr stations (a total of 20 profiles), were also conducted using the tethered VMP. To provide context for the surface operations a series of full depth profiles using the VMP6000 were carried out combined with full depth CTD casts. A total of 274 tethered VMP2000 casts were carried out combined with 12 full depth VMP6000 casts.

In the frame of the microstructure observations, a turbulence float (FloatRider, Fig. 1) designed by NKE Instrumentation was also deployed at the Ridge station (Fig. 2). The FloatRider, provided with CTD (SBE41) and Dissolved Oxygen sensors, included a mounted MicroRider manufactured by Rockland Scientific International. The MicroRider consisted in two thermistors that allowed us to measure thermal variance (χ) and turbulent kinetic energy dissipation (ε). After launching the float (on the 2nd March), its mission consists in a repeating cycle of descent, submerged drift, ascent and data transmission. During these cycles, the float dynamically controls its buoyancy with a hydraulic system. This hydraulic system adjusts the density of the float causing it to descend, ascend or hover at a constant depth in the ocean. The user selects the depth at which the system drifts between descent and ascent profiles. New instructions can be sent to the float every time it is at surface.

The aim of the FloatRider mission within Cartridge cruise was to test the float performing profiles with different characteristics (maximum depths, parking depths, controlled time at surface, etc.). A total of 25 profiles were carried out. In the beginning, 9 profiles were conducted to 300 m; then (after 4th March) instructions were changed to let the FloatRider perform to 1600 m in a total of 15 profiles. In order to match the recovery time and the surface time of the float, the last profile was set to measure to 1000 m with a determined surface time (before 5pm on the 19th March, UTC).

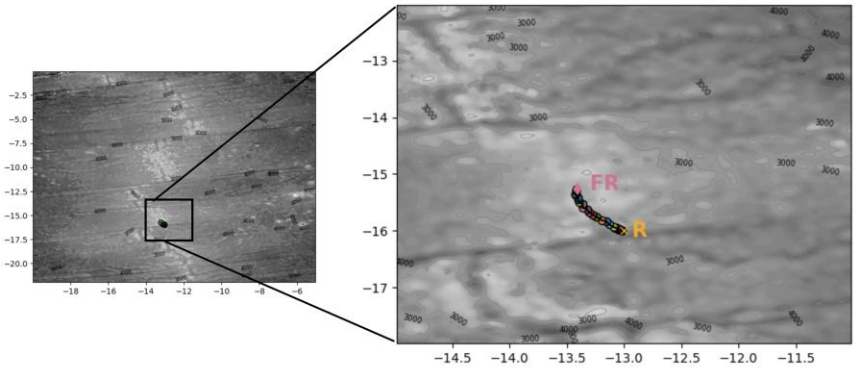


Figure 3. Location of the FloatRider profiles near the mid-Atlantic Ridge (R). R and FR indicate the deployment and recovery location.

Both deployment and recovery were carried out using a ship-mounted crane and a rope with a hook tied to its end.

Processing

All processing scripts used on this cruise were adaptations of those used in previous VMP cruises by the University of Southampton group. A summary of the processing steps is given below:

Function	Description
vmp_firstlook4	Produces a series of diagnostic plots for the raw un-calibrated VMP data (from XXX.P, produces XXX.mat) and calibrates data (XXX_cal.mat)
vmp_process_seabird4	Processes the VMP seabird data and applies various corrections (despike, filter, ...). Output is saved as a separate matlab file, XXX_dCTD.mat.
vmp_process_micro6	Processes the VMP microstructure shear, temperature and conductivity are calibrated by regressing against the processed VMP seabird temperature and conductivity. Output saved as a separate matlab file, XXX_micro.mat

Code for a preliminary processing of the FloatRider data was provided by Rockland Scientific and adapted by the University of Southampton team.

VMP 2000

Station	Date	Latitude (°S)	Longitude (°W)	Casts	Notes
R1	02/03/2025	16 0.0	12 59.9	33	On-ridge spring tide prefix :JC275_R1_291 No file recorded casts 10, 11 Shear 2 suspect cast 16 onwards.
X2a	04/03/2025	15 59.7	13 15.2	29	Eddy-flux around station R prefix JC275_X2a_291 Extended to 13 hr by popular demand. No file recorded cast 17 Shear 2 defective, replaced on cast 6
R2	05/03/2025	15 59.9	12 59.9	1	Max wire out prefix JC275_R1_291
X2b	06/03/2025	15 46.8	12 59.21	5	Eddy flux around station R prefix JC275_X2b_291
X2c	06/03/2025	16 13.5	12 59.9	5	Eddy flux around station R prefix JC275_X2c_291
X2d	06/03/2025	16 0.0	12 46.8	5	Eddy flux around station R prefix JC275_X2d_291
R3	08/03/2025	16 0.0	12 59.9	30	On-ridge neap tide prefix JC275_R3_291 Shear 2 replaced cast 2 Micro C replaced Bad buffers casts 5,9,14,16,17,25 fix_bad_buffers applied cast 25.
B1	10/03/2025	16 0.0	18 59.9	31	Basin neap tide prefix JC275_B1_291 No file recorded cast 17 file patched for processing cast 22
X1d	12/03/2025	16 0.0	18 46.0	5	Eddy flux around station B prefix JC275_X1d_291
X1b	12/03/2025	15 46.5	18 59.9	5	Eddy flux around station B prefix JC275_X1b_291
X1c	12/03/2025	16 13.3	19 0.0	5	Eddy flux around station B prefix JC275_X1c_291
X1a	14/03/2025	16 0.0	19 14.2	5	Eddy flux around station B prefix JC275_X1a_291
B2	16/03/2025	15 59.9	18 59.9	31	Basin spring tide prefix JC275_B2_291 No file recorded cast 13,28
A1	23/03/2025	15 39.7	0 59.3	30	Prefix JC275_A1_291 No file recorded cast 2,30 bad buffers cast 16 file patched for processing cast 23
X3a	24/03/2025	16 0.0	1 14.4	5	Eddy flux around station A prefix JC275_X3a_291
X3b	24/03/2025	15 46.6	1 0.0	5	Eddy flux around station A prefix JC275_X3b_291
X3c	24/03/2025	16 13.54	1 0.0	5	Eddy flux around station A prefix JC275_X3c_291
X3d	24/03/2025	16 0.0	0 45.6	5	Eddy flux around station A prefix JC275_X3d_291
A2	25/03/2025	16 0.0	0 59.9	31	Prefix JC275_A2_291 no file recorded cast 5,6,19,

VMP 6000

Station	Date	Latitude (°S)	Longitude (°W)	Notes
R	03/03/2025	15 59.9	12 59.9	File JC275_VMP6000_001
R	04/03/2025	15 59.9	13 0.0	File JC275_VMP6000_001 Shear 1 replaced
R	05/03/2025	15 59.9	12 59.9	File JC275_VMP6000_003 Shear 2 replaced File patched with correct shear 2 sensitivity
R	05/03/2025	15 59.8	13 0.4	File JC275_VMP6000_004 File patched with correct shear 2 sensitivity
R	07/03/2025	16 0.0	12 60.0	File JC275_VMP6000_005 File patched with correct shear 2 sensitivity
B	10/03/2025	16 0.3	18 59.9	File JC275_VMP6000_006 File patched with correct shear 2 sensitivity
B	11/03/2025	16 0.3	18 53.7	File JC275_VMP6000_007 File patched with correct shear 2 sensitivity
B	13/03/2025	15 59.9	18 59.8	File JC275_VMP6000_008
B	14/03/2025	15 59.9	19 0.0	File JC275_VMP6000_009
B	15/03/2025	16 0.0	18 59.9	File JC275_VMP6000_010
B	16/03/2025	16 0.0	18 53.5	File JC275_VMP6000_011
B	16/03/2025	16 0.0	18 53.5	File JC275_VMP6000_012

FloatRider

Profile	Time	Lon	Lat	File
1	2025-03-02T09:25:22	-13.017E	-15.999N	59f0_053_01_sbe41.mac.csv
2	2025-03-02T13:15:57	-13.022E	-15.992N	59f0_054_01_sbe41.mac.csv
3	2025-03-02T17:06:03	-13.032E	-15.984N	59f0_055_01_sbe41.mac.csv
4	2025-03-02T19:49:33	-13.046E	-15.978N	59f0_056_01_sbe41.mac.csv
5	2025-03-02T23:39:51	-13.054E	-15.969N	59f0_057_01_sbe41.mac.csv
6	2025-03-03T02:27:57	-13.053E	-15.961N	59f0_058_01_sbe41.mac.csv
7	2025-03-03T06:29:57	-13.065E	-15.949N	59f0_059_01_sbe41.mac.csv
8	2025-03-03T09:58:04	-13.081E	-15.940N	59f0_060_01_sbe41.mac.csv
9	2025-03-03T13:31:33	-13.088E	-15.933N	59f0_061_01_sbe41.mac.csv
10	2025-03-04T17:43:20	-13.132E	-15.886N	59f0_062_01_sbe41.mac.csv
11	2025-03-05T17:41:21	-13.152E	-15.836N	59f0_063_01_sbe41.mac.csv
12	2025-03-06T17:37:03	-13.194E	-15.814N	59f0_064_01_sbe41.mac.csv
13	2025-03-07T17:49:27	-13.239E	-15.754N	59f0_065_01_sbe41.mac.csv
14	2025-03-08T17:47:21	-13.270E	-15.719N	59f0_066_01_sbe41.mac.csv
15	2025-03-09T17:53:52	-13.307E	-15.666N	59f0_067_01_sbe41.mac.csv
16	2025-03-10T17:41:22	-13.319E	-15.629N	59f0_068_01_sbe41.mac.csv
17	2025-03-11T17:43:22	-13.358E	-15.589N	59f0_069_01_sbe41.mac.csv
18	2025-03-12T17:49:51	-13.359E	-15.531N	59f0_070_01_sbe41.mac.csv
19	2025-03-13T17:41:22	-13.395E	-15.488N	59f0_071_01_sbe41.mac.csv
20	2025-03-14T17:47:21	-13.398E	-15.437N	59f0_072_01_sbe41.mac.csv

21	2025-03-15T17:43:21	-13.405E	-15.414N	59f0_073_01_sbe41.mac.csv
22	2025-03-16T17:43:21	-13.423E	-15.363N	59f0_074_01_sbe41.mac.csv
23	2025-03-17T17:37:33	-13.422E	-15.341N	59f0_075_01_sbe41.mac.csv
24	2025-03-18T17:41:22	-13.417E	-15.294N	59f0_076_01_sbe41.mac.csv
25	2025-03-19T16:48:34	-13.415E	-15.263N	59f0_077_01_sbe41.mac.csv

Preliminary results

Underway, turbulence data has been pre-analysed to make sure that all the sensors were functioning correctly. The analysis of the high temporal resolution series of VMP allowed us to compare the different turbulent regimes across the sampled stations (B1, B2 (Brazilian basin), R1, R3 (ridge), A1, A2 (African basin)) (Fig. 3).

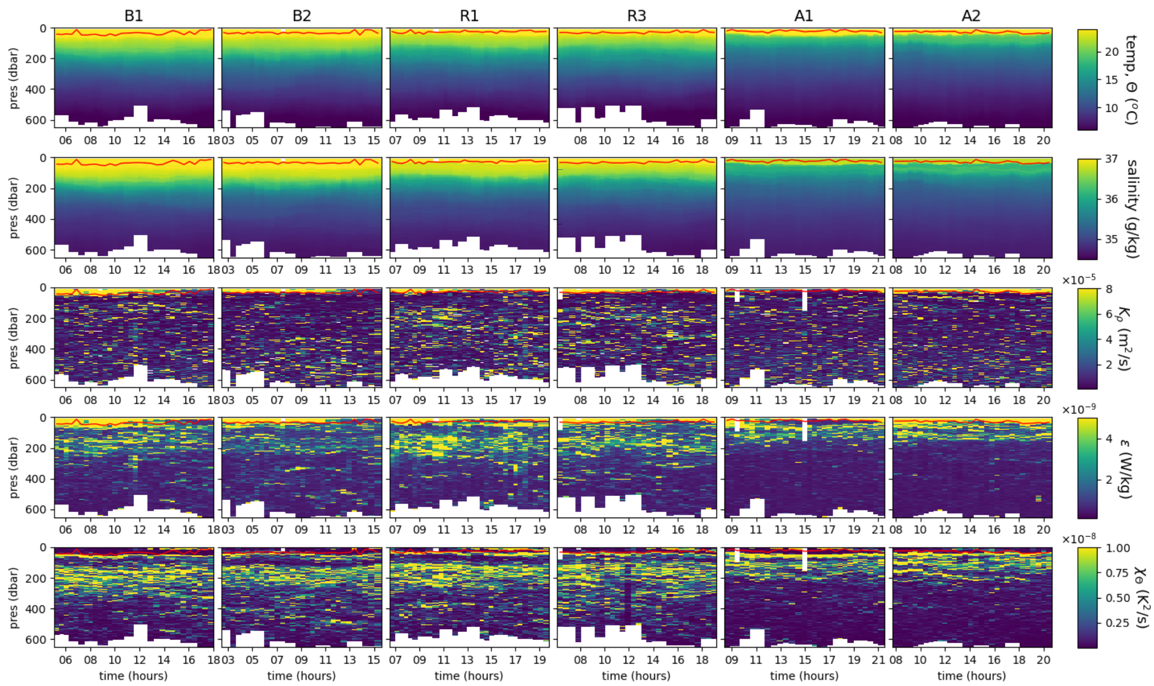


Figure 4. Time series of turbulence data measured with VMP2000 at Brazilian basin (B1, B2), ridge (R1, R3) and African basin (A1, A2). Variables sorted from the first row to the last: conservative temperature, absolute salinity, diapycnal diffusivity, turbulent kinetic energy and thermal variance dissipation rate.

Time series, as well as kernel density functions (Fig. 4), revealed differences between the different sites. These differences are more significant in the African basin stations, where mixing was the lowest, especially below 200 m.

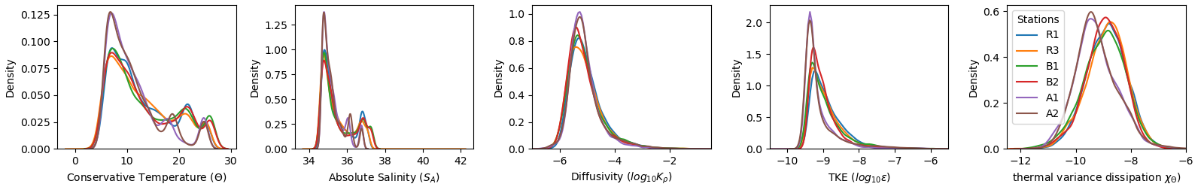


Figure 5. Kernel density functions for the variables in Figure 1, for each station.

Preliminary analysis of FloatRider data provided a longer time series of turbulence data at the Ridge site (Fig. 5).

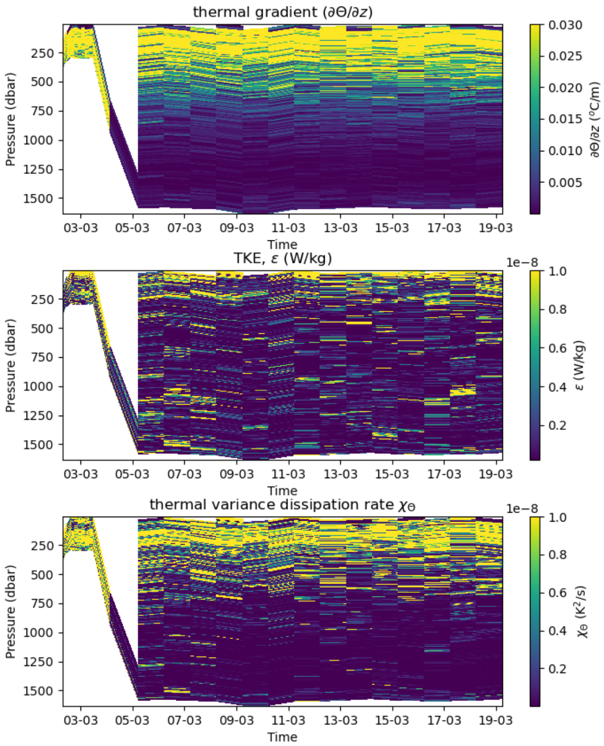


Figure 6. Turbulence float (FloatRider) time series of data. Variables from the top to the bottom: thermal gradient, turbulent kinetic energy and thermal variance dissipation rate.

Inorganic nutrients and DOC

Jonathan Sharples and Megan O'Hara

Inorganic nutrients

Samples for inorganic nutrients (nitrate, phosphate, silicate) were collected from all CTD profiles. Samples were stored in HDPE screw-top bottles and immediately frozen. The samples remained in the ship's freezers until docking in Southampton in late May 2025. Nutrient analysis is being carried out by Ed Mawji, National Oceanography Centre, Southampton.

Dissolved organic carbon (DOC)

1L samples were taken from 29 CTD casts for DOC analysis: CTD 5, 7, 9, 10, 12, 14-16, 18, 19, 22, 24, 25, 27-29, 33, 37, 39, 41, 43, 45-49 and 51-53. Once taken from the CTD each sample was passed through a pre-combusted glass microfiber filter of 47mm in diameter, pore size 0.7µm, using a vacuum pump. The collection chamber was filled and emptied three times with each sample (starting with the deepest sample) before on the 4th filtration the sub-sample was taken. Sub-samples were collected in vials which were pre-spiked with 5µl of 10% HCl, labelled, and placed in the fridge once collected. In total 488 sub-samples were stored for onshore processing. Between each CTD cast the glassware was stored in an acid bath of 10% HCl. All glassware was rinsed with distilled water and left to air dry before assembly (pictured below).

Plankton (phytoplankton and microzooplankton)

Ben Fisher, Alex Poulton (Heriot-Watt), Arianwen Herbert (University of Oxford), Frieda Schlegel (Marine Biological Association), Barbara Duckworth (MIT)

1. Sampling

The plankton work on JC275 concentrated on determining the biomass (pigment), community composition, vital rates (growth, mortality), photo-physiology, carbon and nitrogen uptake rates, transcriptomics, and response to nutrient and light availability of the microplankton (20-200 um), nanoplankton (2-20 um) and picoplankton (0.2-2 mm). Samples were collected from CTD casts before local dawn (~6-7 am) at 12 depth horizons over the upper 250-300 m, with sampling depths focused on 'light depths' relative to surface irradiance. Specifically, sampling focused on the following light depths as percentage of surface irradiance (depth ranges in parenthesis); 75% (7-9 m), 30% (27-37 m), 6% (64-86 m), 3% (80-107 m), 1.5% (96-128 m), 1% (105-140 m), 0.7% (113-151 m), 0.4% (126-168 m), 0.2% (142-189 m), 0.1% (158-210 m), 0.05% (173-231 m), 0.01% (210-280 m). Light depths were determined assuming that the Deep-Chlorophyll Maximum (DCM) occurred at the depth of 1% surface irradiance, and the estimated vertical attenuation coefficient used to back-calculate the different light depths. Generally, 75% and 30% light depths were within the upper mixed layer, and the 1.5% and 0.7% bounded the upper and lower sections of the DCM. Depths where the different measurements were collected are given in Table 1 below.

Table X1. Parameter depths.

Depths	Parameters	Notes
All 12 depths	Total chlorophyll-a, Flow Cytometry, Nitrogen Isotopes	c.f. Nutrients
Upper 8 depths (75-0.4%)	Size-fractionated chlorophyll-a, LabSTAF, FlowCam	
Surface (75%), DCM (1%) and lower DCM (0.7%)	Carbon and nitrogen uptake	
DCM (1%)	Dilution Experiments	
Surface (75%), Mixed layer (30%), upper thermocline (6%), DCM (1%), sub-DCM (0.7%), lower DCM (0.2, 0.1%), deep (0.01%).	Scanning Electron Microscopy, Coccolithophore Genetics	
Surface (75%), upper thermocline (6%), upper DCM (1.5%), DCM (1%), sub-DCM (0.4%)	Metabarcoding Transcriptomics	

2. Chlorophyll – Total and Size-Fractionated

Arianwen Herbert (University of Oxford), Barbara Duckworth (MIT), Frieda Schlegel (Marine Biological Association), Ben Fisher, Alex Poulton (Heriot-Watt)

Total and size-fractionated chlorophyll-a were measured by filtering 250 mL of seawater through Whatman GF/F filters or polycarbonate filters, respectively. For size-fractionated chlorophyll, the seawater was sequentially filtered through a tower system with 47 mm diameter polycarbonate filters of pore sizes 20 µm, 5 µm, 2 µm and 0.2 µm. Each filter was placed in a 20 mL glass vial, the GF/F filters sample-side up and the polycarbonate filters folded in half, sample-side inward. 6 mL of HPLC grade 90% acetone was added and the vials were then placed in a 4 °C dark fridge. 18 to 24 hours later, chlorophyll-a florescence was measured with a Turner Designs Trilogy fluorometer set up with a non-acidification module (after Welschmeyer, 1994) which was calibrated against a pure chlorophyll-a extract prior to the cruise. At the start of each set of measurements, a blank 90% acetone sample and a solid standard were used to check for instrument drift.

3. Active Chlorophyll Fluorescence

Ben Fisher, Alex Poulton (Heriot-Watt)

Single Turnover Active Fluorometry of Enclosed Samples (STAFES)
Single Turnover Active Fluorometry (STAF) is a non-destructive and rapid technique to determine the physiological status of phytoplankton. STAF can be used to measure a suite of parameters pertaining to the photosynthetic physiology of the entire phytoplankton community, including an estimate of the photosystem II photochemical efficiency (Fv/Fm), a proxy of the overall photosynthetic 'health' of the community, and E_K, which indicates the light level to which the phytoplankton community is adapted. The instruments can provide a range of other photosynthetic variables which can be used to derive photosynthetic electron transport rates using a 'Fluorescence Light Curve' (FLC) sampling protocol. The STAFES technique measures in real time and at high sensitivity.

Instruments summary:
Three LabSTAF instruments were used during JC275:

Serial number	Location on ship	Use
19-0105-003	CT lab	Continuous FLC (Surface temperature with flow through UW seawater ~27 °C)
19-0105-004	CT lab	Discrete FLC (Surface temperature with flow through UW seawater ~27 °C)
20-0787-003	CT lab	Discrete FLC (Chilled to DCM temperature ~20 °C)

Calibration:
All instruments were calibrated prior to the cruise, calibration files are available on the JC275 shared drive (\JC275\science\Team Plankton\02 Active Chlorophyll Fluorescence\calibration).

Software:
Instruments were run on RunSTAF v9.2.6. The software version used is available on the JC275 shared drive (JC275\science\Team Plankton\02 Active Chlorophyll Fluorescence \STAFES \RunSTAF v9.2.6).

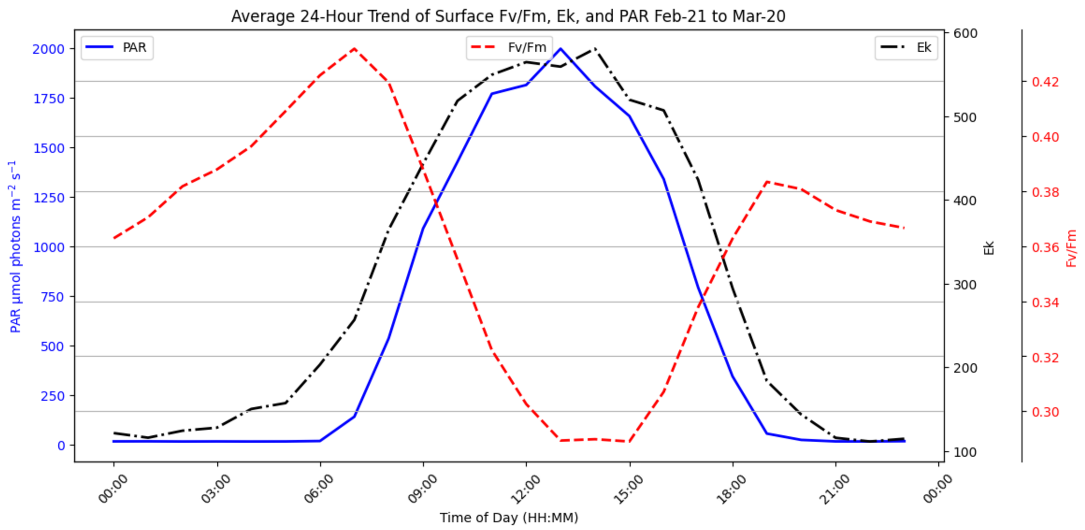
Continuous FLC measurements:
Instrument 19-0105-003 was used to run continuous fluorescence light curves (FLC) using the same protocol throughout the cruise. The instrument was run in AutoFLC mode, with dynamic FLC and AutoHigh activated which results in the light levels of light steps automatically adjusting during each FLC. The FLC protocol included a low light time of 200s at 20 umol quanta m^{-2} s^{-1} and a dark step of 40s, 10 light levels of 80s each and a final dark step of 60s. A dual waveband measurement (DWM) was automatically run prior to each FLC. Photochemical excitation profiles (PEP) were also run prior to FLCs. The value of Seq/Saq (number of acquisitions to be averaged) was set to 32. Blanks were run with 0.2 µm filtered seawater followed by MQ water every few days. Raw data files can be found at (JC275\science\Team Plankton\02 Active Chlorophyll Fluorescence\02 JC275 Data_STAFES).

Discrete FLC measurements:

Instruments 19-0105-004 and 20-0787-003 was used to run fluorescence light curves (FLC) on discrete samples from CTD casts, nutrient addition experiments ('ExL') and zooplankton grazing dilution experiments ('ExD'). For each pre-dawn CTD cast, samples were taken from the upper 6 depths of the CTD cast (75%-0.7% light transmission) for LabSTAF analysis. The upper 3 depths were run on 19-0105-004, which was set to surface water temperature using a flow-through temperature exchange from the ship's underway water. The lower 3 depths were run on 20-0787-003 which was calibrated daily to the temperature of the DCM using a Fisherbrand Isotemp II recirculating chiller unit. Samples from the 'ExD' experiments, originally sampled from the DCM, were run on 20-0787-003 while 'ExL' were run primarily on 19-0105-004. Occasionally, surface water samples were run in tandem on both discrete instruments by changing the chiller temperature to match the surface water temperature and adjusting the "high E" value on 20-0787-003 to 2000. A similar FLC setup to the continuous FLC protocol used on both discrete instruments was used (10 light steps and 1 dark step, DWM and PEP). Raw files can be found at (JC275\science\Team Plankton\02 Active Chlorophyll Fluorescence\02 JC275 Data_STAFES) under separate folders for each instrument.

Preliminary Data:

Underway Fv/Fm and E_K data from the LabSTAF showed a strong relationship with light (PAR, averaged from the Ship's Starboard and Port PAR sensors). E_K, reflecting light adaptation of phytoplankton, has a strong positive correlation with PAR while Fv/Fm showed an inverse relationship to both E_K and PAR. The time-period shown reflects the transit on to station B and time spend between stations B and R.



FastOcean FRRf measurements:

In addition to the STAFES measurements, single turnover active chlorophyll fluorescence measurements were also made using a Chelsea Technologies Group (CTG) FastOceanTM fluorometer on sub-samples from the nutrient addition experiments (see Section on nutrient addition experiments 'ExL').

The instrument (SN 15-0093-002) was set up with a saturating sequence of 100 flashlets (at 2µs pitch) and a relaxation sequence of 20 flashlets (at 60 µs pitch), with 110 sequence repeats at a sequence interval of 100ms. Data was downloaded and analysed with 'FastPro8' software to derive fluorescence parameters (see above). Following each sample run, a blank was run on the instrument first with 0.2 µm filtered seawater followed by MilliQ. Raw data is available on the ships drive at the location (JC275\science\Team Plankton\02 Active Chlorophyll Fluorescence\03 JC275 Data_FRR_MkIII). Processed data are available on the ships drive within the data files for the nutrient addition experiments at location (JC275\science\Team Plankton\06 Nutrient Addition Experiments (ExL)).

4. Plankton community composition: Flow Cytometry and Flow Cam

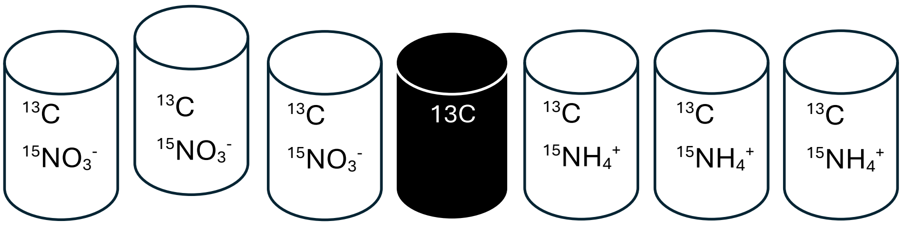
Ben Fisher, Alex Poulton (Heriot-Watt), Arianwen Herbert (University of Oxford)

Seawater samples were collected directly from the CTD Niskin bottles for analysis of plankton community composition, from either 12 depths (Flow Cytometry) or 8 depths (Flow Cam). Flow cytometry samples were collected in 15 mL Falcon tubes, transferred to the laboratory and duplicate 1.8 mL sub-samples preserved in 25% Glutaraldehyde (36 uL, <0.1% final conc., v/v), fixed in a fridge (4oC) for 4 hours and then frozen at -80°C until further analysis at the University of Oxford. Flow Cytometry will determine the cell abundance of picoplankton (*Prochlorococcus*, *Synechococcus*, picoeukaryotes) and nanoplankton (nanoeukaryotes) (see e.g., Tarran et al., 2006). Seawater samples (100 mL or 250 mL) were preserved with either acidic Lugol's solution (4% final conc., v/v) or 25% Glutaraldehyde (0.5% final conc., v/v) in glass bottles for subsequent analysis with a Flow Cam 8100 in Heriot-Watt University. These seawater samples (50-100 mL) will be settled in Hydro-Bios (Uttermöhl) settling chambers for 24-48 hrs, the supernatant removed, and the remaining volume (~1.5 mL) diluted with supernatant and injected in the Flow Cam 8100. Samples will be run using a 10x objective to visualise particles between 4 and 100 um, and images analysed initially using Visual Spreadsheet 6 software before uploading to EcoTaxa2 for taxonomic analysis.

5. Carbon and Nitrogen Uptake Experiments (ExS)

Ben Fisher (Heriot-Watt)

A series of nutrient uptake experiments were conducted at Sites B, R and X3 to measure acquisition rates of NO_3^-, NH_4^+ and $NaHCO_3$ by phytoplankton communities at the surface (75% PAR), deep chlorophyll maximum (DCM) (1% PAR) and Sub-DCM (0.7% PAR). For each experiment, 7 x 2L bottles were filled per depth from a pre-dawn CTD a few hours prior to commencing the incubation. For each depth, one bottle was dark (amber plastic bottle), while the other 6 were clear polycarbonate. The dark bottle acted as a control for ^{13}C uptake, allowing for the subtraction of any non-photosynthetically driven ^{13}C uptake from the light treatments. The layout of the bottles for each of the three depths in an experiment was:



Isotopic additions were performed hourly from sunrise (6 am), starting with the surface bottles, followed by the DCM (7 am) and Sub-DCM (8am). While awaiting isotopic addition, bottles were maintained at ambient (DCM) temperature and ambient light conditions in an MIR-254-PE cooled incubator.

Stocks of isotope spikes for $^{15}NO_3^-$, $^{15}NH_4^+$ and $NaH^{13}CO_3$ were prepared at the start of the cruise by dissolution of $K^{15}NO_3$ and $^{15}NH_4Cl$ (>98%) in MilliQ to a concentration of 50 μmol L^{-1}. $NaH^{13}CO_3$ was dissolved to a concentration of 0.294 mol L^{-1} in a combination of MilliQ and NaOH to maintain an alkaline solution, preventing outgassing. Nutrient addition experiments typically aim to create an isotopic addition of <10% relative to the ambient nutrient concentration. Since nutrients were not determined onboard, we took a cautious approach of using minimal NO_3^- and NH_4+ additions of 5nM in this oligotrophic environment. Some experiments were conducted using higher $^{15}NO_3^-$ spike concentrations in the DCM and Sub-DCM to reflect increases in potential NO_3^- concentrations through the nitracline. To determine the % enrichment, extra 125ml nutrient samples were taken at each of the sampled depths for nanomolar [NH_4^+], these samples were filtered using a 0.2µm AcroPak and frozen at -20°C. Following the isotopic spiking, surface bottles were incubated for 6 hours in seawater flow-through deck incubators (covered with LEE misty blue light filters), while DCM and Sub-DCM bottles were placed in the cooled incubator for 6 hours, with light levels adjusted to 1% of surface PAR. At the end of the incubation period, the total volume of each bottle was filtered on to ashed 25mm GF/F filters (400°C, 6 hours). A few drops of 1% HCl were added to remove particulate inorganic carbon, and the filters were dried at 50°C for transport back to the UK. The filters will subsequently be analysed by isotope ratio mass spectrometry to calculate uptake rates of NO_3^-, NH_4+ and carbon.

Table of nutrient uptake experiments conducted during JC275 and the experimental conditions.

Experiment ID	Date	Station	[$^{15}NO_3^-$ (Surf)]	[$^{15}NO_3^-$ (DCM)]	[$^{15}NO_3^-$ (Sub-DCM)]	[$^{15}NH4^+$]	[$NaH^{13}CO_3$]
ExS1	26/2/25	B	5 nM	5 nM	5 nM	5 nM	155 uM
ExS2	28/2/25	R	5 nM	5 nM	5 nM	5 nM	155 uM
ExS3	1/3/25	R	5 nM	5 nM	5 nM	5 nM	155 uM
ExS4	2/3/25	R	5 nM	5 nM	5 nM	5 nM	155 uM
ExS5	5/3/25	R	5 nM	5 nM	5 nM	5 nM	155 uM
ExS6	6/3/25	R	5 nM	5 nM	5 nM	5 nM	155 uM
ExS7	7/3/25	R	5 nM	5 nM	5 nM	5 nM	155 uM
ExS8	10/3/25	B	5 nM	5 nM	5 nM	5 nM	155 uM
ExS9	11/3/25	B	5 nM	5 nM	5 nM	5 nM	155 uM
ExS10	12/3/25	B	5 nM	5 nM	5 nM	5 nM	155 uM
ExS11	13/3/25	B	5 nM	5 nM	25 nM	5 nM	155 uM
ExS12	15/3/25	B	5 nM	5 nM	5 nM	5 nM	155 uM
ExS13	17/3/25	B	5 nM	10 nM	25 nM	5 nM	155 uM
ExS14	18/3/25	B	5 nM	10 nM	25 nM	5 nM	155 uM
ExS15	20/3/25	R	5 nM	5 nM	25 nM	5 nM	155 uM
ExS16	23/3/25	X3	5 nM	10 nM	25 nM	5 nM	155 uM
ExS17	25/3/25	X3	5 nM	10 nM	25 nM	5 nM	155 uM

6. Dilution experiments for microplankton growth and microzooplankton grazing rates

Alex Poulton (Heriot-Watt)

Methodology

Dilution experiments (Landry, 1995) were set-up to determine the rates of phytoplankton growth and microzooplankton predation. This involves 24-hour parallel incubations of whole seawater (WSW) and dilutions of ~33% WSW with 67% filtered seawater (DSW) through 0.8/0.2 um cartridge filters. Water was collected directly from the Deep-Chlorophyll Maximum Niskin bottle, and filtered and diluted immediately. Firstly, 373 mL of seawater was added to six 1.1 L Nalgene bottles, 3 amber bottles for time zero DSW measurements and 3 opaque bottles for incubations. An 0.8/0.2 um AcroPak in-line filter was then fitted to the sampling tube from the Niskin bottle and filtered seawater was added to six 1.1 L bottles to top them up. After this, nine bottles were filled directly from the Niskin bottle with WSW, 3 amber bottles for time zero WSW

measurements and 6 opaque bottles for incubation. All filling of clear bottles was done under low light using rubble sacs to avoid exposure to ambient light.
After filling, the 9 bottles (3 DSW, 6 WSW) were transferred to a darkened laboratory and the DSW and 3 of the WSW bottles incubated in a temperature controlled PHCB incubator (DCM temperature, 20.4°C ± 0.5°C). The remaining 3 WSW had nutrients added (1 uM Nitrate, 1 uM Ammonia, 0.125 uM Phosphate; and for later experiments (see Table 1) 2 nM dissolved Iron) following trace-metal handling techniques. After nutrient addition and mixing, the 3 WSW+N (nutrients) bottles were incubated in parallel to the DSW and WSW bottles. Light levels experienced in the DCM were replicated using LED light panels and LEE light filters (~15 and 35 umol m-2 s-1), with a 12:12-hr Light:dark cycle, and equivalent to either 0.6 mol m-2 d-1 or 1.5 mol E m-2 d-1 (see Table 1).

Table X1. Dilution experiments (ExD) on JC275. Details included are: experiment number, CTD number, site and date of collection, alongside notes on deviations in methods between experiments.

ExD	CTD #	Site	Dates	Notes
ExD01	C002	B	26/02-27/02/2025	
ExD02	C003	R	28/02-01/03/2025	
ExD03	C006	R	02/03-03/03/2025	
ExD04	C011	R	05/03-06/03/2025	Run for 24 and 48 hrs
ExD05	C017	R	07/03-08/03/2025	Run for 24 and 48 hrs
ExD06	C020	R	08/03-09/03/2025	
ExD07	C021	B	10/03-11/03/2025	
ExD08	C023	B	11/03-12/03/2025	
ExD09	C036	B	13/03-14/03/2025	
ExD10	C036	B	15/03-16/03/2025	Iron (+Fe) added to nutrient mix
ExD011	C040	B	17/03-18/03/2025	+Fe; elevated light (35 umol m-2 s-1)
ExD012	C042	B	18/03-19/03/2025	+Fe; elevated light (35 umol m-2 s-1)
ExD013	C043	Near R	20/03-21/03/2025	+Fe; elevated light (35 umol m-2 s-1)
ExD014		A (X3)	23/03-24/03/2025	
ExD015		A (X3)	25/03-26/03/2025	

Incubations lasted 24-hr (dawn to dawn) and were terminated by collection of sub-samples from all bottles for chlorophyll-a (250 mL), flow cytometry (4 mL), FlowCam (100 mL or 250 mL) and LabSTAF (20 mL). Time-zero measurements for all these parameters were collected from the 6 amber Nalgene bottles at the start of the incubation. Chlorophyll-a concentration was determined by seawater filtration onto Whatman GF/F filters, extraction in 6-mL 90% acetone (HPLC grade) for 20-24 hrs and determination of the fluorescence of the extract using a Turner Trilogy fluorometer. Duplicate samples (1.8 mL) for flow cytometry were collected in 2 mL cryovials, preserved with 36 uL 25% Glutaraldehyde (<0.1% final concentration, v/v), fixed for 4 hours at 4oC and then frozen at -80oC prior to analysis. Preserved seawater samples (100 mL or 250 mL) were collected in glass Schott bottles and preserved with either acidic Lugol's solution (4% v/v) or 25% Glutaraldehyde (0.5% v/v) for later analysis by Flow Cam. Small volume samples (~20 mL) were analysed in a LabSTAF (see cruise report section) from one time-zero bottle and after incubation from one WSW and one WSW+N (nutrients) bottles for photo-physiology.

Next Steps
Daily growth rates (d^{-1}) of the different plankton parameters collected (Chlorophyll-*a*, phytoplankton groups counted by flow cytometry and Flow Cam) will be compared between WSW, WSW+N and DSW to determine whether DCM communities were nutrient limited (WSW

vs WSW+N) using paired t-tests (Sigma-Stat). Differences between growth rates determined from DSW and WSW will allow determination of mortality rates for the different plankton parameters to be determined (after Mayers et al., 2024). Photo-physiological parameters measured by the LabSTAF will be compared between the start of the incubation (time zero) and its end (T24) to monitor for changes in photo-physiology during the incubations.

References

Landry MR, Kirshtein J, Constantinou J (1995) A refined dilution technique for measuring the community grazing impact of microzooplankton, with experimental tests in the central equatorial Pacific. Marine Ecology Progress Series 120, 53–63.

Mayers KMJ, Sandnes Skaar K, Mugu S, Harvey EL, Larsen A (2024) Mortality partitioning between viral lysis and microzooplankton grazing in successive phytoplankton blooms using dilution and molecular methods. Aquatic Microbial Ecology 90, 141-156.

7. Coccolithophore community (SEM and genetics)

Frieda Schlegel (University of Southampton/ Marine Biological Association)

Seawater was collected from the CTD (mainly pre-dawn) to answer questions about the community structure and abundance of coccolithophores at the different stations (B, R and X3) in the south Atlantic (Table 1). Special focus is placed on the vertical community composition consistently sampling eight depths for 18S metabarcoding and scanning electron microscopy (SEM).

Table 1. Information on the JC275 sampling locations for 18S metabarcoding and SEM filtering for coccolithophore community composition.

Date	Station	CTD ID	Latitude (S)	Longitude (W)	Niskin bottles	Nominal depths (m)
26/02/2025	B	C002	15.59.99	19.00.01	1,4,6,10,14,20,21,24	250,188,169,135,125,76,33,8
18/02/2025	R	C003	15.59.99	13.00.00	1,4,6,10,14,20,21,24	250,188,169,135,125,76,33,8
01/03/2025	R	C004	15.59.99	12.59.98	1,4,6,10,14,20,21,24	244,183,165,124,114,75,32,8
02/03/2025	R	C006	15.59.99	12.59.98	1,4,5,9,13, 19, 20, 24	250,188,169,135,125,76,33,8
05/03/2025	R	C011	15.59.98	12.59.99	1,4,5,9,13, 19, 20, 24	230,173,155,124,110,70,30,7
06/03/2025	R	C013	15.59.79	13.00.30	1,4,5,9,13, 19, 20, 24	210,158,142,113,105,64,27,7
07/03/2025	R	C017	16.00.01	13.00.00	1,4,5,9,13, 19, 20, 24	230,173,155,124,110,70,30,7
08/03/2025	R	C020	16.00.00	13.00.00	1,4,5,9,13, 19, 20, 24	234,176,158,126,117,72,31,7
10/03/2025	B	C021	16.00.00	19.00.00	1,4,5,9,13, 19, 20, 24	236,177,159,127,118,72,31,7
11/03/2025	B	C023	16.00.00	19.00.00	1,4,5,9,13, 19, 20, 24	250,192,173,138,128,78,34,8
12/03/2025	B	C026	15.59.99	19.00.02	1,4,5,9,13, 19, 20, 24	250,213,192,153,142,87,37,9
13/03/2025	B	C030	15.59.99	18.59.99	1,4,5,9,13, 19, 24	270,203,182,146,135,83,8
15/03/2025	B	C036	15.59.99	18.59.99	1,4,5,9,13, 19, 20, 24	300,222,200,160,148,91,39,9
17/03/2025	B	C040	16.00.00	19.00.00	1,4,5,9,13, 19, 20, 24	280,210,189,151,132,82,37,9
18/03/2025	B	C042	16.00.00	18.59.99	1,4,5,9,13, 19, 20, 24	242,182,163,131,128,74,22,8

23/03/2025	X3 (A)	C044	16.00.00	01.00.00	1,4,5,9,13, 19, 20, 24	132,99,89,71,66,40,17,4
25/03/2025	X3 (A)	C050	16.00.00	01.00.01	1,4,5,9,13, 19, 20, 24	260,195,130,85,65,14,8,6

Water was sampled into acid-rinsed blacked out carboys, which were triple rinsed with sample water before collecting four litres for metabarcoding and two litres for SEM. The genetic samples were vacuum filtered under low pressure onto 47mm, 0.8um polycarbonate filters. These samples were stored in cryotubes with 1ml RNA*later* (Invitrogen) at -80 °C. The workstation, gloves and forceps were regularly cleaned with 70% ethanol. Two litres - or less if the filters clogged - were vacuum filtered onto 25mm, 0.8um polycarbonate filters for SEM. The filters were rinsed with pH-adjusted Mili-Q to remove salt residue and placed in petri-slides (Millipore) into the oven over night (~14h) at 50°C. The petri-slides are left slightly ajar to remove moisture but not enough to cause contamination of the filter.

Once the samples return to the UK, the aim is to produce morphospecies counts (SEM) and metabarcoding reads that can be compared and correlated with one another to gain insights into the coccolithophore species present in the vertical profiles of the three stations both morphologically and genetically. For 18S metabarcoding, the plan is to analyse the ribosomal 18S V4 region using specific haptophyte primers, likely 528Flong and PRYM01+7 (Egge et al., 2013) and compare it to both published genetic data for environmental haptophyte samples, as well as specifically add to the generally sparce genetic data for this group in the south Atlantic. The SEM samples will be mounted on a stub and gold-coated before transferring to the microscope. For each filter approximately 225 fields of view, depending on the volume filtered, along a pre-determined transect will be imaged at a set magnification (Charampopoulou et al., 2011; Daniels et al., 2012). This will be followed by the enumeration of coccospheres and identification to the smallest possible taxonomic unit.

References

Egge, E. *et al.* 454 Pyrosequencing to Describe Microbial Eukaryotic Community Composition, Diversity and Relative Abundance: A Test for Marine Haptophytes. *PLoS ONE* **8**, e74371 (2013).
Charalampopoulou, A., Poulton, A., Tyrrell, T. & Lucas, M. Irradiance and pH affect coccolithophore community composition on a transect between the North Sea and the Arctic Ocean. *Mar. Ecol. Prog. Ser.* **431**, 25–43 (2011).
Daniels, C. J., Tyrrell, T., Poulton, A. J. & Pettit, L. The influence of lithogenic material on particulate inorganic carbon measurements of coccolithophores in the Bay of Biscay. *Limnology & Oceanography* **57**, 145–153 (2012).

8. Picoeukaryote genetics (CTD)

Arianwen Herbert (University of Oxford)

The objective of sampling CTD casts for genetics (Table 4) onboard CarTRidge JC275 was to understand the response of the microbial community to changes in light, nutrient and mixing regimes.

Seawater was collected in 0.5% HCl-rinsed blacked-out carboys from pre-dawn CTDs. 10 L seawater was filtered for RNA/transcriptomics analysis, 5 L for DNA/metabarcoding. Carboys were triple rinsed with sample water from Niskins before filling. The time from CTD O/W to all carboys filled was <1hr (typically 35-45 minutes). Carboys were then transferred immediately to the laboratory and filtering started immediately.

Samples were filtered through opaque plastic tubing directly onto 0.22 µm Sterivex filters using a 6-line peristaltic pump, at a rate of ~150 mL/min. Before filters were loaded, lines were flushed with 0.5% HCl, Milli-Q and a small amount of sample to minimise cross-contamination. Everything was handled with gloved hands cleaned regularly with 70% ethanol. Once full, samples were transferred immediately to liquid nitrogen and then to the -80°C freezer for long-term storage.

Table 4. Samples taken for genetic analysis onboard JC275.

Date	CTD ID	Niskin bottles	Irradiances (% EO)	Nominal depths (m)
01/03/25	004	7, 11, 15, 19, 22	0.4, 1, 1.5, 6, surface	146, 114, 104, 75, 8
02/03/25	006	6, 10, 14, 18, 21	0.4, 1, 1.5, 6, surface	150, 125, 114, 76, 8
05/03/25	011	6, 10, 14, 18, 21	0.4, 1, 1.5, 6, surface	138, 110, 100, 70, 7
06/03/25	013	6, 10, 14, 18, 21	0.4, 1, 1.5, 6, surface	126, 105, 96, 64, 7
07/03/25	017	6, 10, 14, 18, 21	0.4, 1, 1.5, 6, surface	138, 110, 97, 70, 7
08/03/25	020	6, 10, 14, 18, 21	0.4, 1, 1.5, 6, surface	140, 117, 107, 72, 7
10/03/25	021	6, 10, 14, 18, 21	0.4, 1, 1.5, 6, surface	142, 118, 108, 72, 7
11/03/25	023	6, 10, 14, 18, 21	0.4, 1, 1.5, 6, surface	154, 128, 117, 78, 8
13/03/25	030	6, 10, 14, 18, 21	0.4, 1, 1.5, 6, surface	162, 135, 123, 83, 8
15/03/25	036	6, 10, 14, 18, 21	0.4, 1, 1.5, 6, surface	178, 148, 135, 91, 9
17/03/25	040	6, 10, 14, 18, 21	0.4, 1, 1.5, 6, surface	168, 132, 120, 82, 9
18/03/25	042	6, 10, 14, 18, 21	0.4, 1, 1.5, 6, surface	145, 128, 110, 74, 8
23/03/25	044	6, 10, 14, 18, 21	0.4, 1, 1.5, 6, surface	79, 66, 60, 40, 4
25/03/25	050	6, 10, 14, 18, 21	3, 10, 15, 60, 80	99, 65, 54, 14, 6

9. Nutrient Addition Incubation Experiments (ExL)

Arianwen Herbert (University of Oxford), Alex Poulton (Heriot-Watt), Frieda Schlegel (Marine Biological Association), Ben Fisher (Heriot-Watt), Barbara Duckworth (MIT)

Experiment set-up

Three multifactorial nutrient addition (nutrient amendment) experiments (Table 5) were conducted over the course of JC275 to investigate how different macronutrients and trace elements (Phosphate, Nitrate+Ammonia and Iron) influenced phytoplankton physiology, growth, community structure and macro-nutrient drawdown. Experiments were run following methods previously employed in the sub-polar north Atlantic (Moore et al., 2006; Ryan-Keogh et al., 2013). Experiments (ExL) were run over a period of 120 hours, subsampling at 48 hours, to assess changes in community physiology, structure and nutrient drawdown in response to changing nutrients.

Precautions were taken to avoid contamination of bottles, seawater and nutrient spikes. Incubation bottles were previously cleaned with Decon and 1M HCl, rinsed with Milli-Q and stored with 0.024 M HCl prior to sailing. Iron (Fe) spikes were prepared from high purity salts. Seawater was collected using a trace metal clean tow-fish through acid cleaned tubing whilst moving at 10-12 knots. Bottle filling, spiking and subsampling were performed in a Class-100 clean air container.

Water was collected directly into 4.5L Nalgene™ polycarbonate bottles. Bottles were filled in a random order, 50% at a time, with triplicate samples for initial (T_0) measurements collected at the beginning, middle and end. The process of filling half-way and then full-way in a random order ensured relatively homogeneous water collection, representative of the surface conditions encountered during the sampling period. The time between start and end of sampling was always <1 hour, corresponding to distance travelled during collection being <12km.

Nutrient amendment

Nutrient stocks used: Nitrate (10mM KNO_3), Ammonia (10mM NH_4Cl), Phosphate (1mM $NaHPO_4$), Iron (20 µM FeCl). Stocks were trace-metal clean and made up such that nutrients could be added at 100 µL per 1 L seawater (ie 440 µL for each 4.4 L bottle), except phosphate which was added at 125 µL per litre seawater. Spikes were added to a final concentration of 2 uM nitrogen (1 uM nitrate, 1 uM of ammonia), 0.125 uM phosphate, and 2 nM iron.

Once spiked, bottles were closed and fastened and sealed with parafilm, before being placed in the on-deck incubator with 'misty blue' light filters. Following each experiment, bottles were rinsed with milli-Q, acid washed and stored containing a small amount of 1% HCl ready for the next round of incubations.

The 4.4L acid-cleaned polycarbonate bottles were labelled as follows: 1-3 controls (no nutrients added), 4-6 N addition, 7-9 P addition, 10-12 Fe addition, 13-15 N+P addition, 16-18 N+Fe addition, 19-21 P+Fe addition, 22-24 N+P+Fe addition. The sampling regime was as follows:

- *T0:* 10L transcriptomics, 5L metabarcoding, chlorophyll, flow cytometry, FRRF, STAFES, nutrients, SEM. Three sets of subsamples were collected: at the start, once all bottles were half-filled, and at the end
- *T48:* all 24 bottles were sampled for chlorophyll, FRRF, STAFES, flow cytometry
- *T120:* all 24 bottles were sampled for transcriptomics and metabarcoding (3.3L, onto a single 0.22 µm Sterivex filter), chlorophyll, FRRF, STAFES, flow cytometry, nutrients, SEM

Table 5. Average T0 Location, start and end dates of nutrient addition experiments.

Expt ID	**Latitude (oN)**	**Longitude (oW)**	**Sampling method**	**Start date**	**End date**
ExL01			Trace clean fish	03/03/25	08/03/25
ExL02			Trace clean fish	11/03/25	16/03/25
ExL03			Trace clean fish	20/03/25	25/03/25

Moore, C. M., Mills, M. M., Milne, A., Langlois, R., Achterberg, E. P., Lochte, K., Geider, R. J., & La Roche, J. (2006). Iron limits primary productivity during spring bloom development in the central North Atlantic. *Global Change Biology*, *12*(4), 626-634. https://doi.org/https://doi.org/10.1111/j.1365-2486.2006.01122.x

Ryan-Keogh, T. J., Macey, A. I., Nielsdóttir, M. C., Lucas, M. I., Steigenberger, S. S., Stinchcombe, M. C., Achterberg, E. P., Bibby, T. S., & Moore, C. M. (2013). Spatial and temporal development of phytoplankton iron stress in relation to bloom dynamics in the high-latitude North Atlantic Ocean. *Limnology and Oceanography*, *58*(2), 533-545. https://doi.org/10.4319/lo.2013.58.2.0533

Particles (zooplankton, marine snow, Polonium)

Marika Takeuchi, Will Major, Louwin Anand, Unai Abascal

1. Red Camera Frame

Objectives

Sinking particles play a crucial role in transporting carbon from the upper ocean to the deep sea, where it remains sequestered for long periods. The size, shape, and composition of these particles are key factors influencing their sinking speed. Accurately measuring these properties is essential for understanding the role of particles—particularly large phytoplankton and zooplankton—in carbon flux. During this cruise, we collected in-situ images of particles over both the ridge and basin to investigate how nutrient supply drives differences in particle dynamics, hence contributing the carbon fluxes.

Methods

Deployment

We mounted optical imaging sensors (Underwater Vision Profiler 5 (UVP5) and LISST-HOLO2), an optical backscattering sensor (ECO Triplet), and a compact CTD (RBR Concerto) on a steel frame to collect in-situ particle images, backscatter data, and hydrographic measurements simultaneously. The frame also carried a memory device (cumHub) for data storage from the ECO Triplet and RBR Concerto.

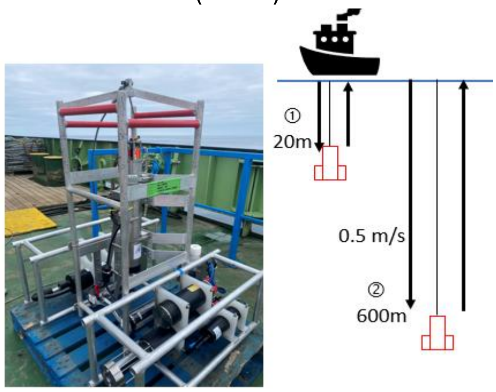


Figure 7 Image of the ceamera frame and schematic image of deployment

The camera frame was deployed to 600 m over the starboard side using a Romica winch. Since the UVP5 was programmed to activate based on pressure, the frame was first lowered to 20 m, held for 60 seconds, and then brought back to the surface (~4 m) before being deployed to 600 m (Figure 1). The wire speed was maintained at 0.5 m/s during both the downcast and upcast.

Instrument description

UVP5

The Underwater Vision Profiler 5 (UVP5, Hydroptic) captures grayscale images (pixel size = 94 µm) at a sampling rate of 20 Hz, with a field of view measuring 22 cm × 18 cm (sample volume~ 1.12 L/s). It is powered by an internal battery that supports up to 7 hours of data acquisition. All images are stored in the internal memory. The system automatically detects and crops in-focus particles (vignettes), saving them for further analysis.

LISST-Holo2

The LISST-Holo2 (Sequoia Scientific, Inc.) captures holographic images (holograms) at a sampling rate of 10 Hz, with a field of view of 5.2 mm × 7.2 mm and a sample volume of approximately 1.86 cm^3. With a pixel size of 4.5 µm, the system can resolve particles larger than 25 µm.

Holograms are generated as interference patterns created when laser light diffracts upon encountering particles. These patterns require post-processing to digitally reconstruct them into visually recognizable images. The digital reconstruction will be conducted by Dr. Thangavel Thevar at the University of Aberdeen after the cruise.

Onboard quality control was performed after each deployment, including metadata generation, removal of unnecessary images (e.g., those collected out of water), and brightness adjustments.

ECOTRIPLET3

The Environmental Characterization Optics (ECO) Triplet Fluorometer and Backscattering Sensor measures backscatter at two wavelengths (532 nm and 700 nm) and chlorophyll fluorescence. During this cruise, we deployed two ECO Triplet sensors (s/n 1663 and s/n 7930) for intercalibration.

The ECO Triplet is powered by an internal battery, and data was stored either in its internal memory or the CamHUB system. Due to cable limitations, s/n 1663 was not connected to CamHUB and its data was stored in internal memory, while s/n 7930 data was stored directly in CamHUB. Since EcoTriplet does not carry the pressure sensor, post processing to obtain the depth from RBR concerto was performed after each deployment.

RBR concerto

RBR concerto measures multiple biological and physical variables (pressure, temperature, conductivity, turbidity and fluorescence). RBR concerto was powered up by an external power supply and the data was stored in CamHUB.

Results

A total of 20 deployments were conducted: 9 over the ridge, 9 over the basin, and 2 at the X3 site (Table 1 in appendix). Of these, we successfully deployed UVP5 in 18 cases, LISST-HOLO2 in 19 cases, ECO Triplet (s/n 1663) in 18 cases, and both ECO Triplet (s/n 7930) and RBR Concerto in all 20 deployments. Details of the unsuccessful deployments are provided in a later section. Across all deployments, particle area (averaged per image) distribution data from UVP5 indicated a higher abundance of larger particles at the ridge site compared to the basin site (Figure 2). Both particle abundance and size exhibited a maximum layer just below the mixed layer at both locations. This layer was thicker at the ridge site, with larger particles extending to greater depths (Figure 3). Detailed results from each deployment are presented in the appendix.

Table 6Deployment details

RCF number	Event	Station	Date	Time (UCT)	Latitude			Longitude			Profile depth (m)	Echo depth (m)	Wind speed (knts)	Sea state
1	11	Test	27/02/25	10:33:00	15	59.99	S	19	0.01	W	230	3758	16.9	4
2	32	R	01/03/25	09:39:00	15	59.99	S	12	59.98	W	600	2529	18.7	5
3	38	R	02/03/25	01:05:00	15	59.59	S	12	59.59	W	600	2549	14.5	4
4	47	R	03/03/25	08:09:00	15	59.98	S	23	59.98	W	600	2541	10.8	3
5	56	R	04/03/25	01:00:00	16	0	S	13	0	W	600	2639	12.7	4
6	66	R	05/03/25	07:27:00	15	59.98	S	12	59.99	W	600	2541	13.7	4
7	78	R	06/03/25	01:03:00	15	59.67	S	13	0.4	W	600	2756	11.3	4
8	89	R	07/03/25	08:25:00	16	0	S	12	58.99	W	600	2558	13	4
9	99	R	08/03/25	01:00:00	15	59.99	S	12	59.99	W	600	2612	22.1	5
10	110	B	11/03/25	07:50:00	16	0	S	19	0	W	600	NA	17.6	4
11	119	B	12/03/25	02:26:00	15	59.97	S	19	0	W	600	3803	13	4
12	134	B	13/03/25	08:48:00	15	59.9	S	18	59.79	W	600	3878	16	5
13	142	B	14/03/25	00:54:00	15	59.99	S	18	59.99	W	600	3748	10.5	4
14	154	B	15/03/25	08:12:00	16	0	S	19	0	W	600	3749	8.6	3
15	164	B	16/03/25	00:56:00	15	59.99	S	18	59.99	W	600	3840	10.6	4
16	170	B	16/03/25	23:14:00	16	0.72	S	18	53.48	W	600 300	4480	10	3
17	175	B	17/03/25	08:06:00	16	0	S	19	0	W	600	3709	8	2
18	180	B	18/03/2025	00:54	16	0	S	19	0	W	600	3808	13	4
19	198	X3	23/03/2025	23:55	16	0	S	1	0	W	600	5175	13	3
20	213	X3	26/03/2025	00:13	15	59.99	S	1	0	W	600	5095	16.8	4

	UVP5		LISST HOLO2		ECO triplet 1633 (old)		ECO triplet 7930		RBR	
RCF number	Deployment	Data	Deployment	Data	Deployment	Data	Deployment	Data	Deployment	Data
1	Y	HDR20250226102903	Y	LH20250226102903	Y	~~ECO1663_20250226102903.raw~~	Y	ECO7930_20250226102903.CSV	Y	RBR20250226102903.CSV
2	Y	HDR20250301094036	Y	LH20250301094036	Y	ECO1663_20250301094036.raw	Y	ECO7930_20250301094036.CSV	Y	RBR20250301094036.CSV
3	Y	HDR20250302010449	Y	LH20250302010449	Y	~~ECO1663_20250302010449.raw~~	Y	ECO7930_20250302010449.CSV	Y	RBR20250302010449.CSV
4	Y	HDR20250303081034	Y	LH20250303081034	Y	ECO1663_20250303081034.raw	Y	ECO7930_20250303081034.CSV	Y	RBR20250303081034.CSV
5	Y	HDR20250304010242	Y	LH20250304010242	Y	ECO1663_20250304010242.raw	Y	ECO7930_20250304010242.CSV	Y	RBR20250304010242.CSV
6	Y	HDR20250305082906	Y	NA	Y	ECO1663_20250305082906.raw	Y	ECO7930_20250305082906.CSV	Y	RBR20250305082906.CSV
7	Y	HDR20250306010521	Y	LH20250306010521	Y	ECO1663_20250306010521.raw	Y	ECO7930_20250306010521.CSV	Y	RBR20250306010521.CSV
8	Y	HDR20250307082722	Y	LH20250307082722	Y	ECO1663_20250307082722.raw	Y	ECO7930_20250307082722.CSV	Y	RBR20250307082722.CSV
9	Y	HDR20250308010053	Y	LH20250308010053	Y	NA	Y	ECO7930_20250308010053.CSV	Y	RBR20250308010053.CSV
10	Y	HDR20250311075005	Y	LH20250311075005	Y	ECO1663_20250311075005.raw	Y	ECO7930_20250311075005.CSV	Y	RBR20250311075005.CSV
11	Y	HDR20250312022856	Y	LH20250312022856	Y	ECO1663_20250226102903.raw	Y	ECO7930_20250312022856.CSV	Y	RBR20250312022856.CSV
12	Y	HDR20250313085015	Y	LH20250313085015	Y	ECO1663_20250313085015.raw	Y	ECO7930_20250313085015.CSV	Y	RBR20250313085015.CSV
13	Y	HDR20250314004717	Y	LH20250314004717	Y	ECO1663_20250314004717.raw	Y	ECO7930_20250314005717.CSV	Y	RBR20250314004717.CSV
14	Y	HDR20250315081328	Y	LH20250315081328	Y	ECO1663_20250315081328.raw	Y	ECO7930_20250315081328.CSV	Y	RBR20250315081328.CSV
15	Y	HDR20250316005925	Y	LH20250316005925	Y	ECO1663_20250316005925.raw	Y	ECO7930_20250316005925.CSV	Y	RBR20250316005925.CSV
16	N	NA	Y	LH20250316231441	Y	ECO1663_20250316232441.raw	Y	ECO7930_20250316231441.CSV	Y	RBR20250316231441.CSV
17	Y	HDR20250317080703	Y	LH20250317080703	Y	ECO1663_20250317080703.raw	Y	ECO7930_20250317080703.CSV	Y	RBR20250317080703.CSV
18	Y	HDR20250318014038	Y	LH20250318014038	Y	ECO1663_20250318014038.raw	Y	ECO7930_20250318014038.CSV	Y	RBR20250318014038.CSV
19	Y	HDR20250323234550	Y	LH20250323234550	Y	ECO1663_20250323234550.RAW	Y	ECO7930_20250323234550.CSV	Y	RBR20250323234550.CSV
20	Y	HDR20250326001238	Y	LH20250326001238	Y	ECO1663_20250326001238.raw	Y	ECO7930_20250326001238.CSV	Y	RBR20250326001238.CSV

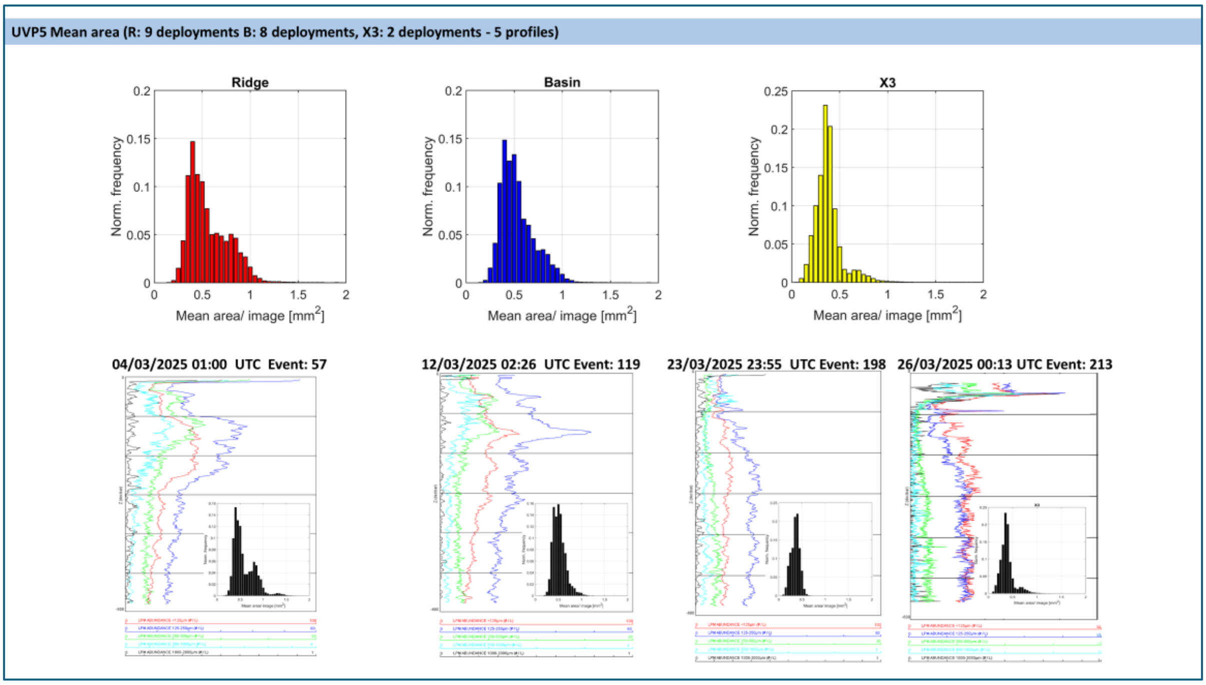


Figure2 Upper panels: Particle average area distribution. Lower panels: Example of individual vertical profile from each site (event 57: ridge, event 119: basin, event 198 and 213: x3).

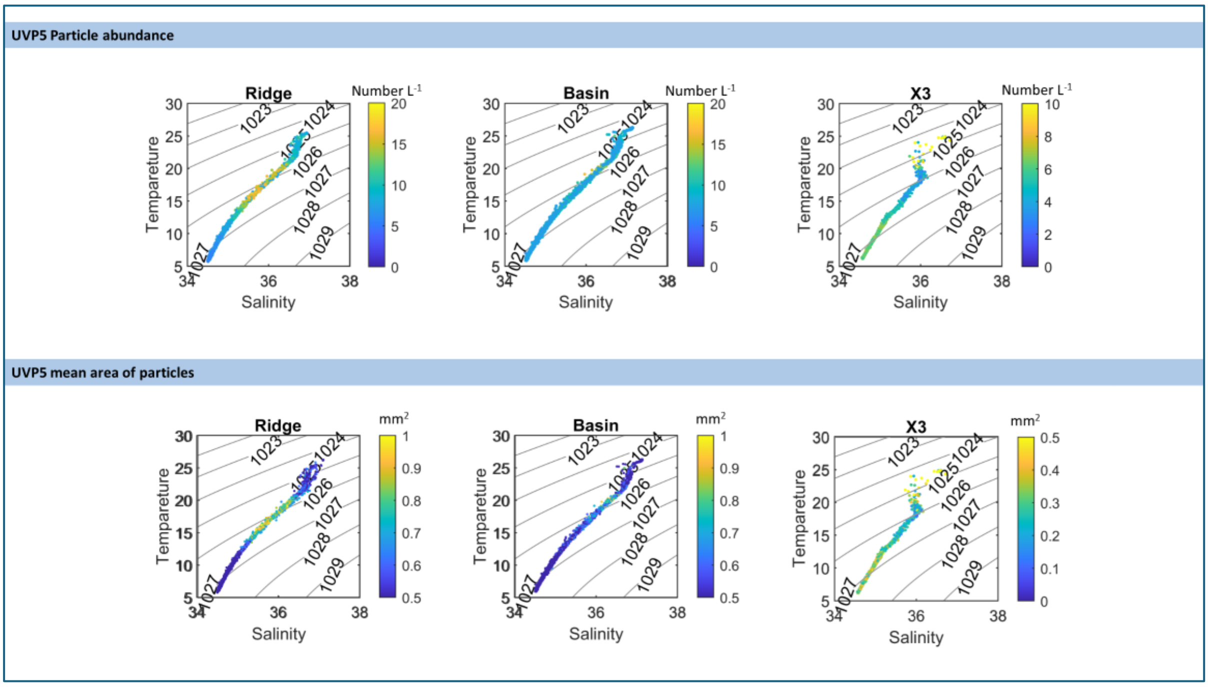


Figure 8TS diagram with particle abundance (upper panels) and mean area of particles (lower panels)

Troubles during the deployment

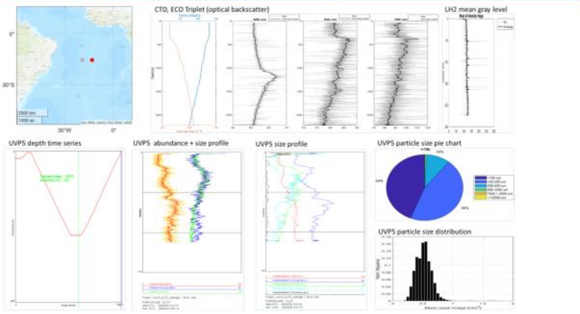
UVP5: One failed deployment (Event 78) successfully collected images; however, the binary data containing particle properties and depth information was not generated. Particle properties can still be extracted from individual images, and depth information can be retrieved from the RBR Concerto based on the timestamp of each data. The failure to generate binary data was likely due to an incomplete download process. To determine whether the binary data was generated but not downloaded, accessing the internal memory is required. If the issue was due to a download failure, the binary data could have been retrieved directly from the memory device; however, the memory was cleared before this could be verified.

Another failure occurred before deployment during Event 180 due to a communication issue. The laptop failed to wake up the camera, displaying an error message indicating that no power supply was recognized while the external power supply was connected. Consequently, the UVP5 did not activate, and no data was collected, however, the communication resumed without issue after the deployment. A further investigation is required to diagnose the issues. The LISST-HOLO2: it failed to wake up during Event 66, and no data was collected. This issue occurred because the system incorrectly detected that the vent, which is opened during battery charging, was still open. Since the system does not activate while the system recognise the vent is open, confirming the vent status on the interface before deployment is necessary to prevent this issue in the future.

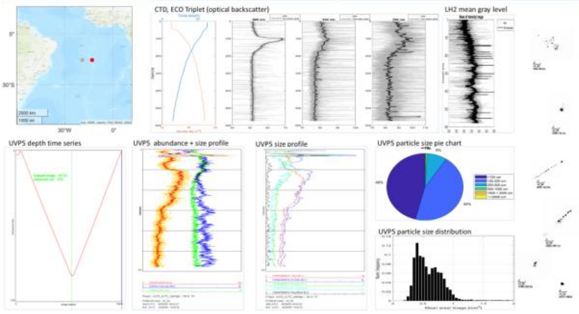
EcoTriplet : Data for event 11 and 38 were corrupt and it is difficult to diagnose the issues which caused the corruption.

Appendix

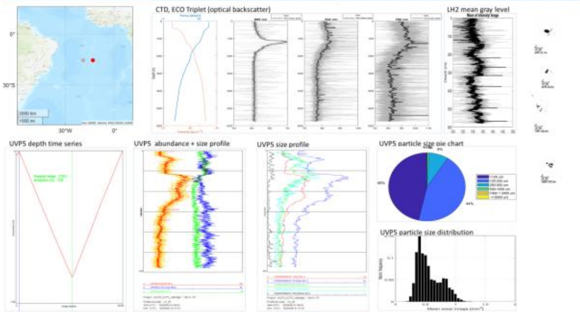
26/02/2025 10:33 UTC | Station: R | Event: 11 | Latitude: 15°59.99 S | Longitude: 12°59.98 W



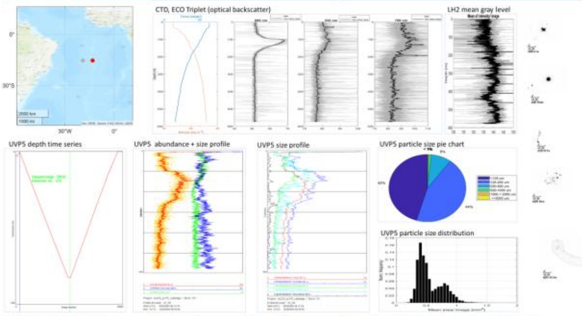
01/03/2025 09:39 UTC | Station: R | Event: 32 | Latitude: 15°59.99 S | Longitude: 12°59.98 W



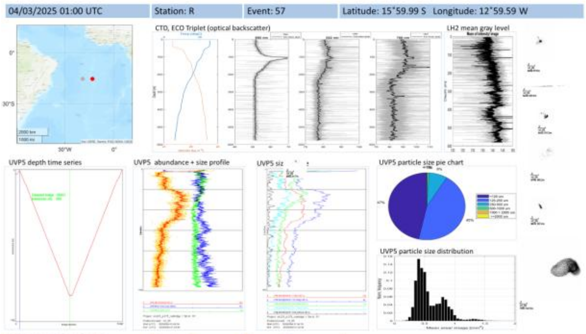
02/03/2025 01:05 UTC | Station: R | Event: 38 | Latitude: 15°59.99 S | Longitude: 12°59.59 W



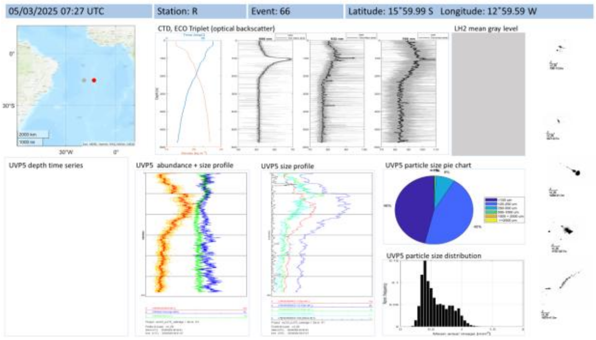
03/03/2025 08:09 UTC | Station: R | Event: 47 | Latitude: 15°59.99 S | Longitude: 12°59.59 W



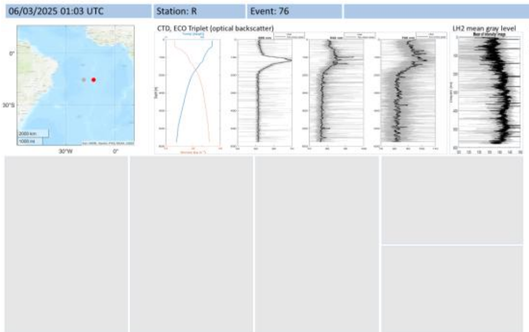
04/03/2025 01:00 UTC | Station: R | Event: 57 | Latitude: 15°59.99 S | Longitude: 12°59.59 W



05/03/2025 07:27 UTC | Station: R | Event: 66 | Latitude: 15°59.99 S | Longitude: 12°59.59 W

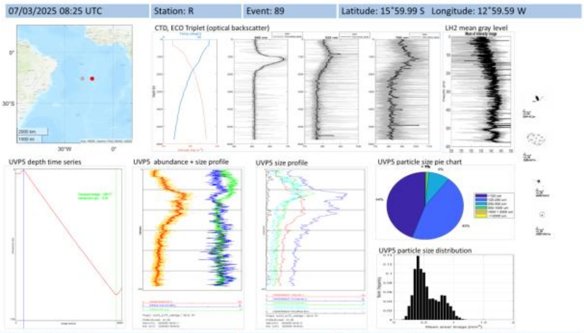


06/03/2025 01:03 UTC | Station: R | Event: 76

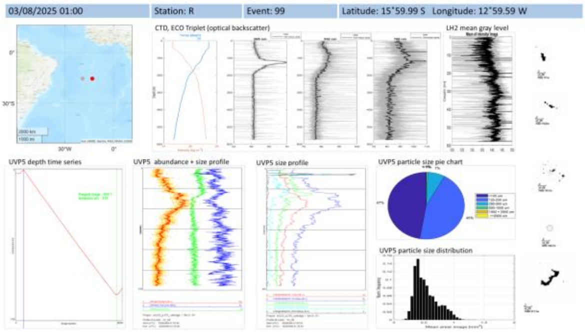


- Comment
- UVP 5 manual stop – binary data was not generated.

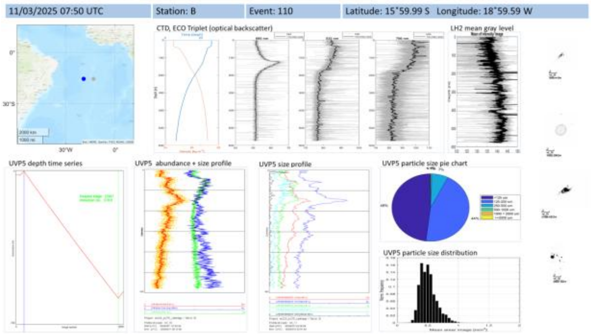
07/03/2025 08:25 UTC | Station: R | Event: 89 | Latitude: 15°59.99 S | Longitude: 12°59.59 W

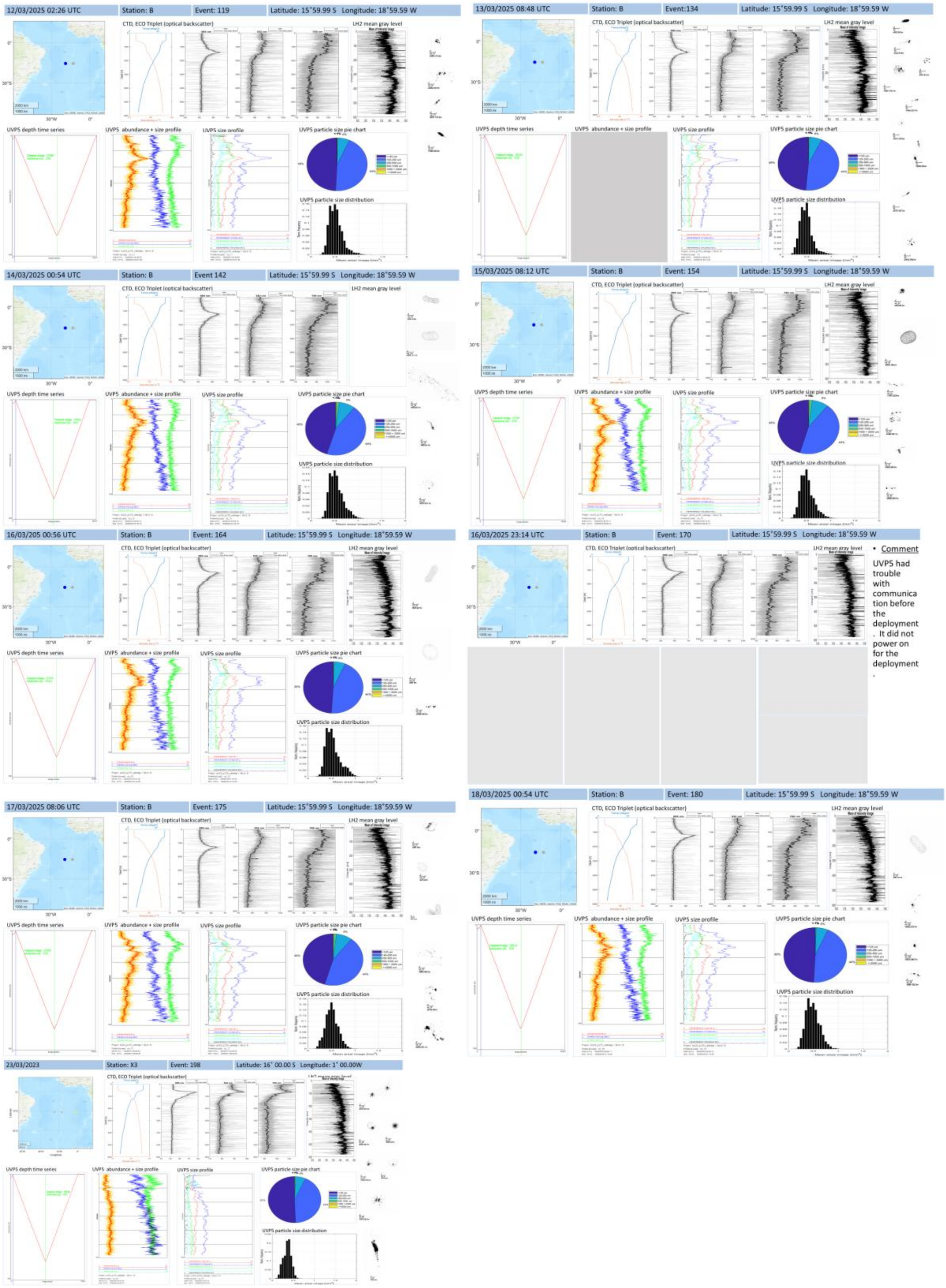


03/08/2025 01:00 | Station: R | Event: 99 | Latitude: 15°59.99 S | Longitude: 12°59.59 W



11/03/2025 07:50 UTC | Station: B | Event: 110 | Latitude: 15°59.99 S | Longitude: 18°59.59 W





2. Underway plankton imaging

Objective

Plankton communities can vary significantly from coastal to pelagic waters in response to physical and chemical processes. Continuously monitoring the plankton community during the cruise provides valuable insight into their spatial distribution, seasonal dynamics, and interactions with environmental factors, helping to better understand their role in oceanic ecosystems and biogeochemical cycles. We ran an experiment to continuously collect plankton images from the underway water using a high-resolution imaging system.

Method

Instrument setup

The underway water tap was connected to the bottom of a bucket using a ~50 cm length hose, allowing water to flow in from the bottom and overflow from the top. This setup helped create water circulation and keep refreshing the water in the bucket. An optical imaging sensor (CPICS) was positioned vertically in the bucket, continuously capturing images (Figure 1).

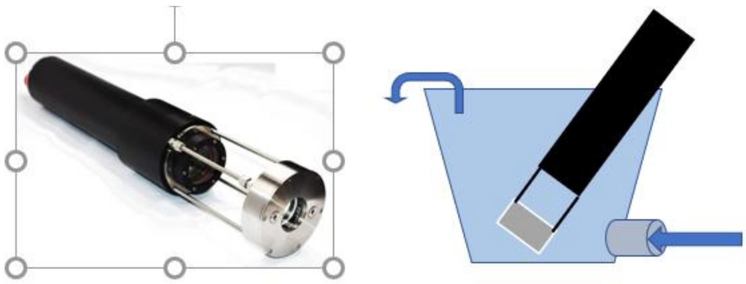


Figure 9 Schematic figure of experimental setup

Instrument description

The Continuous Plankton Imaging and Classification system (Coastal Ocean Vision) captures RGB images at 10 Hz with a sample volume of 330 mm^3 and a field of view of 15 × 11 mm. It automatically detects and crops in-focus particles (regions of interest, ROI) and saves the cropped images. All images are stored in the internal memory. For continuous monitoring, we used an external power supply, though an internal battery is also available.

Results

We successfully captured plankton images from the underway water system (Figure 2); however, modifications to the setup are needed to improve image quality and quantity. During the initial phase of the experiment (March 1–8), no particles were detected, likely due to excessive water flow speed, which prevented proper recognition. Particles started being detected once the flow speed was reduced and maintaining the same flow rate was required. Although more images were detected at the basin site, this is reflecting the flow rate issues – flow rate was too high on the ridge and limited the number of images to be captured, while the flow rate was adjusted to lower on the basin and allowed to take more images.

Additionally, tiny air bubbles occasionally entered the system, filling the regions of interest (ROI) with bubbles and affecting image quality. Lastly, the instrument must remain fully submerged to prevent overheating. For future deployments, positioning the sensor away from the water inlet to reduce bubble interference and submerging it horizontally would be ideal.

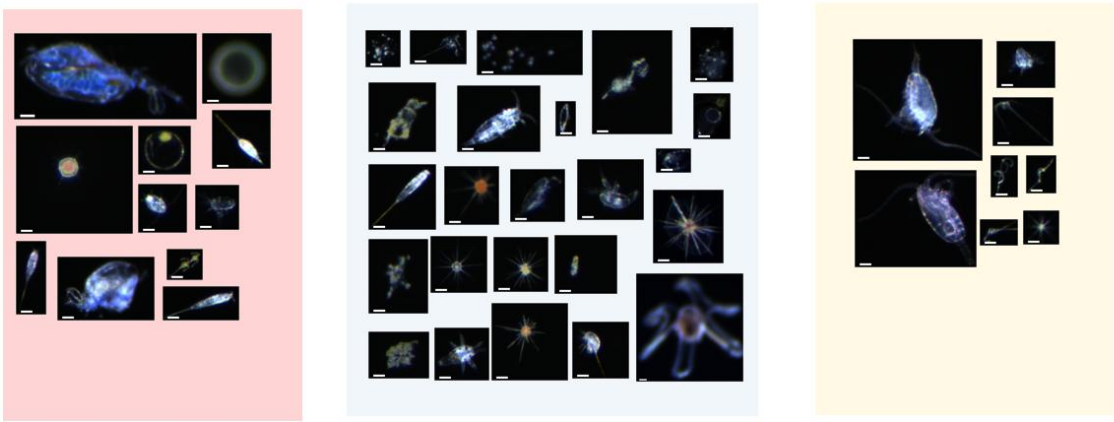


Figure 10Images collected by CPICS. Red: Ridge, Blue: Basin, Yellow: X3. The scale bar indicates 100 micrometres

3. Gravitational flux of organic matter

Overview

We deployed Marine Snow Catchers (MSCs) to measure sinking particle flux profiles at stations R and B. The aim was to determine whether a difference is present between carbon flux through the mesopelagic ocean on and off the mid-Atlantic Ridge. Three different MSCs were deployed during the cruise: two were of an old design, referred to as Silver and Red, and the third was an updated version of a prototype MSC deployed for the first time in its current configuration, known as Umi. There was a total of 29 successful MSC deployments across 4 days at each of R and B. The data collected will provide stocks and fluxes for particulate organic carbon (POC), particulate inorganic carbon (PIC), biogenic silica (BSi) and chlorophyll (Chl) following the completion of laboratory analyses. MSC samples were not collected at station X3 due to time constraints and issues with deployments.

POC samples were taken from deployments of the CTD-rosette for to provide a comparison against MSC POC samples, give POC sample blanks to account for dissolved organic carbon adsorption (Cetinic et al., 2011), and enable the calibration of glider backscatter into high-resolution POC (Briggs et al., 2020). Gliders were deployed at stations R, B and X3 with calibration CTD casts completed at stations R and X3. At station B, the glider was in close proximity of the ship during deployments so backscatter-to-POC calibration should still be possible. Providing the backscatter data from the glider is good, high-resolution flux estimates can fill the gap at station X3 for POC flux where no MSC data are available.

Marine Snow Catcher deployments

Deployment strategy

The aim of our deployments was to exclusively capture particles that had been exported from the productive zone in the mid-Atlantic gyre. Three depths were targeted: below the base of the euphotic zone (EZB+10) to give export; 100-metres below the euphotic zone base (EZB+100) to give attenuation of export; 500 metres depth to give further attenuation and to provide a comparison close to the extent of Red Camera Frame (RCF) deployments. We attempted to record measurements for each of the three depth horizons every deployment day. Typically, Umi (the prototype MSC) was deployed to the three depth horizons (EZD+10, EZD+100, 500 m) with a paired deployment of an old MSC alternating between EZD+10 or EZD+100. We aimed to deliver ample data for the overall aim as well as providing a comparison between old and new MSC types.

SeaStar TD-Tilt sensors were attached to MSCs to accurately record depth and the angle of the lid or tray of Umi. Generally, the Romica winch wire proved to be an inaccurate measure of depth resulting in shallower sampling relative to the target depth. For depths ~200 m, ~300 m and 500 m, an extra 2 m, 4 m and 10 m of wire was paid out, respectively. Angle data from TD-Tilt sensors proved very useful in determining whether Umi had fired at the correct depth.

Deployment procedure

MSCs were deployed from the starboard side using a Romica winch. Once at depth, a messenger (double weight for new MSCs) was sent down the wire to fire the MSC. The MSC was returned to deck, secured, and a 5L time zero (Tzero) sample was taken. The MSCs were then allowed to settle for 2 hours to allow for the particles to sink down into the base. To standardize measurements across the old and new MSCs the sampling strategy was changed slightly. A 5L suspended sample was taken from the middle tap of the snowcatchers as only one of the old snowcatchers had a top tap. The slow sinking fraction was then sampled (5L) from the lower tap on all MSCs (which are at the same height above the tray +/- 1cm) instead of the previously method of siphoning from the base. The MSCs were then drained by opening the middle tap fully and half opening the bottom tap. As the MSC drained (~20 minutes) the bottom tap was gradually opened more but kept at a medium flow. Once the MSCs were drained the tops were lifted off the old MSCs using the crane and with the support from two members of the crew. The base was unclipped for the new MSCs and excess water above the tray was siphoned off. The lid was put on the tray and carefully moved to the lab where it was decanted into a carboy using a funnel. Carboys were kept in the dark at 4 °C until filtered. MSCs were hosed down with fresh water after deployments and the new MSCs mechanisms were rinsed with MilliQ.

Deployment issues

As if often the case with MSCs, several issues were encountered during the cruise that affected deployments.

1. On 01/03/2025, during our first day of deployments at station R, a wave made contact with the top of Umi during recovery and forced the lid open, compromising our sample from depth. This meant that Umi was unusable for the first two deployment days (01/03/2025 and 03/03/2025) while a fix was found. MechTech Richie kindly made a latch for the top of the MSC that was spring-loaded by a bungee cord (see Image 1). Umi was back in action by 07/03/2025 and our initial plan to deploy Umi to target depths with one paired deployment alongside an old MSC was reinstated from that point onwards.
2. On 01/03/2025, prior to the final MSC deployment of the day, the base of Silver split slightly. Duct tape was applied temporarily for the deployment so that we could glue it back together properly the next day when we had more time. However, while trying to put back together the next day, the base split in two entirely. Attempts to glue it back together were unsuccessful, and Silver was mostly retired permanently. With both Umi and Silver out of action during 03/03/2025, Red was deployed to all three target depths that day.
3. TD tilt sensors enabled us to collect accurate depth data for 27 of the 29 successful MSC deployments. Their initial intended purpose was to record the depth that the lid and base of Umi closed, as previous cruises had had several issues with misfires. After Umi was out of action for the first two deployment days, the TD-Tilt sensors were put on Silver and Red. When Umi returned to action, it was found that one of the threaded bars that the TD-Tilt attaches was no longer there, and no 4mm threaded bars were on the ship to replace it. Therefore, we could not record the depth of Umi's lid and base closing simultaneously. We measured the depth of the lid closing until 13/03/2025 when it was placed on the base.

4. There were four reasons why MSCs did not collect samples:
    i. For Umi, the trigger mechanism at the top occasionally comes loose through repeated force of the messenger making contact (see Image 2). If Umi remains in this configuration, we recommend checking the bolt is tight at least once a day.
    ii. The winch wire had got caught on the trigger mechanism so the messenger did not made good contact. We recommend checking the winch wire is not caught on Umi's trigger mechanism pre-deployment.
    iii. Umi's base did not close despite the lid firing. It appears that the rod that attaches to the base got stuck. We rinsed the spring with MilliQ water and didn't seem to encounter the problem again. However, there appears to be three misfires of Umi during the cruise based on Chlorophyll data, and this issue is the most likely reason as to why.
    iv. A common issue with Red is that the base leaks if the clamps that attach the column to the base are not tight enough.

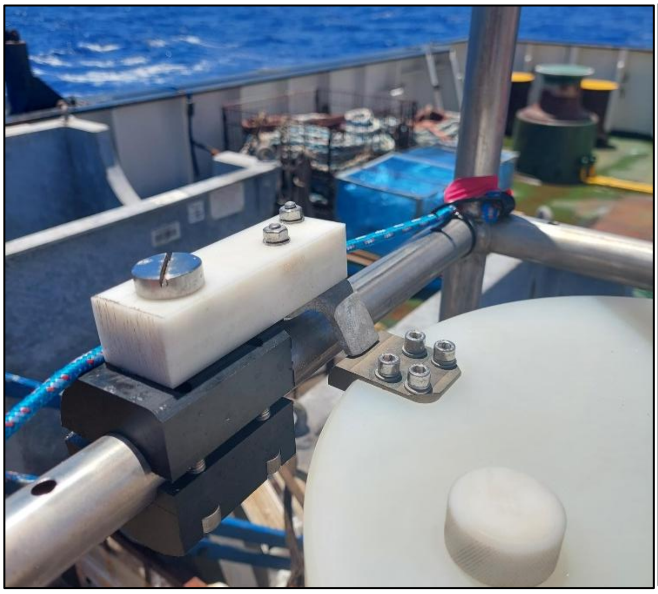



Image 1 (left): a new latch for the lid of Umi to ensure it stays closed once fired.
Image 2 (right): the bolt atop Umi that comes loose after being repeatedly triggered is circled in yellow.

Sample preparation

Particulate organic carbon/nitrogen

Samples were filtered onto pre-combusted glass fibre filters (GF/F; nominal pore size 0.7 μm, 25 mm diameter, Whatman). To pre-combust filters, they were placed in a muffle furnace for a 24-hour oven cycle reaching 450°C prior to the cruise. They were stored in foil wrappers with ~25 filters in each wrapper, then stored in sealable bags. For the Tzero, Top and Base fractions, 1000 mL of seawater was filtered, while 250 mL was filtered for Tray fraction. Replicates were taken for POC/N labelled as POC1 and POC2; only POC1 will be analysed unless issues occur in shipping or analysis. The filters were rinsed with MilliQ water and were not allowed to dry to avoid cell lysis (following Chavez et al., 2021). On occasions where filters did run dry, it should be noted by the individual filtering on the log sheet. Filters were stored individually in a petrislide and placed in a drying oven at 50°C for 24 hours. Samples were then bagged in individual event numbers, separated into POC1 and POC2.

During the cruise, 6 pre-combusted and unused filters were placed in the oven for 24 hours and stored to ensure the filters had not been contaminated. Triple volume (2000 mL, 1000 mL and

500 mL) filtration was undertaken using CTD water to determine POC/N blanks (Cetinic et al., 2012).

Particulate inorganic carbon
Seawater samples were filtered onto polycarbonate filters (0.4 µm pore size, 25 mm, Whatman) and gently rinsed with pH-adjusted MilliQ water (~pH 8.5; 180 µL 25% ammonium in 1L MilliQ). For Tzero, Top and Base fractions, 500 mL of seawater was filtered, and between 100-150 mL was filtered for the Tray sample, depending on the availability of the sample. Sample availability varied because of the size of the MSC tray and from the efficacy of the transfer of Tray sample into a carbuoy. Filters were placed into 15 mL blue-capped Falcon tubes and dried overnight at 50 °C for laboratory analysis onshore. Samples will be sent to the University of Maine for analysis.

Biogenic silica
Samples were filtered onto polycarbonate filters (0.4 µm pore size, 25 mm, Whatman). For the Tzero, Top and Base fractions, 500 mL of seawater sample was filtered, while 100-150 mL was filtered for the Tray sample, depending on the availability of sample. Sample availability varied because of the size of the MSC tray and from the efficacy of the transfer of Tray sample into a carbuoy. Filters were placed into 15 mL blue-capped Falcon tubes and dried overnight at 50 °C. Samples will be analysed by colleagues at National Oceanography Centre, Southampton.

Chlorophyll-a
Seawater samples were filtered onto GF/F filters (nominal pore-size 0.7 µm, 25 mm diameter, Whatman), placed into glass vials filled with 6 mL acetone (90%) for pigments to extract for 18-24 hours. Fluorescence was analysed on board by Alex Poulton's team and more a more detailed description of the methodology can be found in the biology section of this cruise.

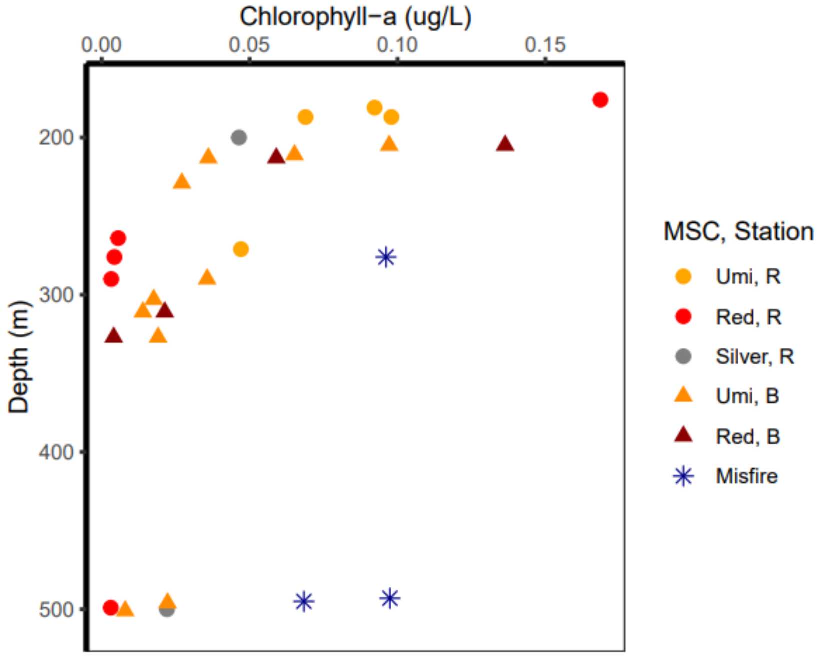


Figure 11: Tzero chlorophyll-a from all successful MSC deployments, coloured by MSC name with shape denoting station R or B. Misfires were identified by comparing these data with CTD fluorescence sensor data. The two highest chlorophyll-a values are also elevated relative to sensor fluorescence, likely caused by a known issue with Red that it does not flush efficiently during descent.

CTD particulate organic carbon sampling

Water samples from Niskin bottles were filtered at sites R, B and X3 for later POC analysis. The same collection and filtration method used to sample POC from the MSCs was used to measure POC from the CTD, except larger volumes were filtered (typically 2000 mL). Samples were collected so that we have a comparison with MSC POC values, as well as providing blanks for DOC adsorption onto combusted GFF-filters following the method in Cetinic et al. (2011) by filtering triplicate volumes of the same sample (2000 mL, 1000 mL and 500mL). Depths where triplicate volumes were taken to measure DOC adsorption matched the depths that MSCs were deployed. Further, POC samples from glider calibration CTD casts will be used to convert backscatter into high-resolution POC (Giering et al., 2023).

References

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Table 1: MSC deployment log for JC275

e	Station	Event #	MSC #	Lat	Long	MSC ID	Wire depth (m)	Depth record (m)	Time fired (UTC)	Tzero sample time	Misfire	Echo depth (m)	SST (degC)	Wind (knots)	Sea state	Notes / Comments/Weather
26/02/2025	test	12	1	-16.01083	-19.000556	Umi	30	48	14:16	14:21	N	x	x	x	x	Top tap not used - avoid throughout cruise and sample Tzero and Top fraction fro
26/02/2025	test	13	2	-16.01083	-19.000556	Silver	31	x	14:38	14:47	N	x	x	x	x	back-up winch used so wire depth is not accurate
01/03/2025	R	31	3	-16.01083	-13.010833	Umi	200	x	x	x	Y	x	x	x	x	Closed during wire attachment; lid forced open by a wave during recovery so reco
01/03/2025	R	33	4	-16.01083	-13.010833	Red	290	x	x	x	Y	x	x	x	x	2 messengers sent as no vibration felt on first, leaky base.
01/03/2025	R	34	5	-16.01083	-13.010833	Silver	200	x	11:44	11:53	N	2471	25.47	13.5	4	Rust in tray
01/03/2025	R	35	6	-16.01083	-13.010833	Red	290	x	12:22	12:35	N	2323	25.48	16.4	4	Replaced o-ring and applied small amount of silicon grease; lowered cyclinder o
01/03/2025	R	36	7	-16.01083	-13.010833	Silver	500	485	15:53	16:12	N	2520	25.65	10.1	4	
03/03/2025	R	46	8	-16.01083	-13.010833	Red	180	176	07:36	07:50	N	2611	25.43	9.9	3	
03/03/2025	R	48	9	-16.01083	-13.010833	Red	270	x	x	x	Y	x	x	x	x	leaky base - misfire
03/03/2025	R	49	10	-16.01083	-13.010833	Red	270	264	11:19	11:31	N	2793	25.47	17	5	
03/03/2025	R	51	11	-16.01083	-13.010833	Red	510	x	x	x	Y	x	x	x	x	leaky base - misfire
03/03/2025	R	52	12	-16.01083	-13.010833	Red	510	499	15:02	15:22	N	2635	25.51	15.2	4	
05/03/2025	R	64	13	-16.01083	-13.010833	Umi	190	187	07:20	07:32	N	2628	25.43	13.2	4	Richie made a latch for the top; did not siphon base before placing the lid over tra
05/03/2025	R	65	14	-16.01083	-13.010833	Red	190	187	08:00	08:11	N	2628	25.43	13.2	4	SAMPLES NOT STORED - tray sample lost during filtering
05/03/2025	R	67	15	-16.01083	-13.010833	Umi	280	271	10:47	11:03	N	2619	25.4	18.6	5	
05/03/2025	R	69	16	-16.01083	-13.010833	Umi	510	494	13:42	x	N	2583	25.49	11.6	4	hydraulics cut out during ascent, MSC at 87m for 1.5 hours; no Tzero; Sampled a
07/03/2025	R	88	17	-16.01083	-13.010833	Umi	280	275	07:11	07:27	N	2524	25.39	14.2	4	EZD 173m; add 114m to EZD to get EZD+100m
07/03/2025	R	89	18	-16.01083	-13.010833	Red	280	277	07:48	08:05	N	2496	25.39	9.5	4	
07/03/2025	R	90	19	-16.01083	-13.010833	Umi	510	493	10:46	11:08	N	2467	24.4	13.5	4	fired on deck again - attach wire then set up Umi
07/03/2025	R	92	20	-16.01083	-13.010833	Umi	185	x	x	x	Y	x	x	x	x	did not fire - messenger doesn't work without a bit of welly!
07/03/2025	R	93	21	-16.01083	-13.010833	Umi	185	181	13:54	14:04	N	2599	25.4	13.5	4	
11/03/2025	B	109	22	-15.99999	-18.999997	Umi	206	204	07:02	07:15	N	3707	26.03	13.3	4	08:02 local sample time
11/03/2025	B	109	23	-15.99999	-18.999997	Red	206	206	07:31	07:46	N	3701	26.03	18	5	MSC not recorded in event log
11/03/2025	B	111	24	-16	-18.999993	Umi	510	496	10:25	10:50	N	3707	26.04	13.7	4	08:31 local sampling time
11/03/2025	B	113	25	-16.00001	-18.999994	Umi	296	290	13:26	13:37	N	3701	26.1	19	4	
13/03/2025	B	130	26	-15.99846	-18.996547	Umi	310	x	x	x	Y	x	x	x	x	EZD 203m; base didn't close - misfire; adjusted bar on connecting arm - shorten
13/03/2025	B	131	27	-15.99847	-18.996538	Umi	215	x	x	x	Y	x	x	x	x	Sent to 215m as opposed to 310m (EZD+10 instead of EZD+100) because of the
13/03/2025	B	132	28	-15.99847	-18.99655	Umi	215	213	08:01	08:14	N	3771	26.12	16.1	4	Local sample time 09:01; red carbuoys used
13/03/2025	B	133	29	-15.99847	-18.99654	Red	215	213	08:30	08:42	N	3774	26.11	9	4	Umi carbuoys used
13/03/2025	B	135	30	-15.99947	-18.997417	Umi	510	x	x	x	Y	x	x	x	x	misfire - trigger at the top of the MSC was loose - start checking at the beginning
13/03/2025	B	136	31	-15.99948	-18.997414	Umi	310	303	12:14	12:27	N	3724	26.18	16	4	local sample time 13:14
15/03/2025	B	152	32	-16	-19.000003	Umi	330	327	07:07	07:20	N	3749	26.21	12	4	EZD = 222m; Unai ran all POCs from top base, tray
15/03/2025	B	153	33	-16	-19.000004	Red	330	327	07:45	08:00	N	3760	26.17	11	3	Unai ran top base, tray POCs
15/03/2025	B	155	34	-15.99998	-19.000015	Umi	510	501	10:35	10:55	N	3745	26.17	10	3	
15/03/2025	B	156	35	-16	-18.999987	Umi	235	x	x	x	Y	x	x	x	x	misfire - not enough force on messenger
15/03/2025	B	157	36	-15.99999	-18.999992	Umi	235	x	x	x	Y	x	x	x	x	misfire - trigger mechanism loose again
15/03/2025	B	158	37	-16	-18.99999	Umi	235	229	14:02	14:14	N	3722	26.44	9.8	3	
17/03/2025	B	173	38	-16	-19.000007	Umi	315	310	07:08	07:23	N	3710	26.34	6.8	2	EZD = 210m; very thin film of oil on the surface of the tray sample
17/03/2025	B	174	39	-16	-19.000005	Red	315	312	07:46	08:01	N	3712	26.26	5.7	2	LTS - 08:46
17/03/2025	B	176	40	-15.99999	-19.000006	Umi	510	495	10:37	10:55	N	3710	26.28	6.5	3	reduced gap between latch and lid (the latch that Richie made to keep the top cl
17/03/2025	B	177	41	-15.99999	-19.000004	Umi	220	211	13:21	13:31	N	3711	26.32	10.2	3	MSC recalled too early after sending messenger - closed after recovery began at
23/03/2025	X3	x	x	x	x	Red	x	x	x	x	Y	x	x	x	x	Leaky base - misfire; not enough time to send again
23/03/2025	X3	x	x	x	x	Umi	x	x	x	x	Y	x	x	x	x	Wire not in line with trigger - did not fire; not enough time to send again

Table 2: MSC filtering log for JC275

Date	Station	Event	MSC #	MSC	Wire Depth (m)	Recorded Depth (m)	Fraction (Tzero, Sus, SS, FS)	POC 1 vol. (ml)	POC 2 vol. (ml)	PIC vol. (ml)	bSi vol. (ml)	Chl vol. (ml)	Chl vial #	Notes / Comments
26/02/2025	test	12	1		30	48	Tzero	1000	1000	x	x	250	64	site to test MSCs and trial filtering with Louwin
26/02/2025	test	13	2		31	unknown	Tzero	1000	1000	x	x	250	65	site to test MSCs and trial filtering with Louwin
26/02/2025	test	12	1		30	48	Top	1000	1000	x	x	250	66	site to test MSCs and trial filtering with Louwin
26/02/2025	test	12	1		30	48	Base	1000	1000	x	x	250	67	site to test MSCs and trial filtering with Louwin
26/02/2025	test	12	1		30	48	Tray	250	250	x	x	100	68	site to test MSCs and trial filtering with Louwin
26/02/2025	test	13	2		31	x	Top	1000	1000	x	x	250	69	site to test MSCs and trial filtering with Louwin
26/02/2025	test	13	2		31	x	Base	1000	1000	x	x	250	70	site to test MSCs and trial filtering with Louwin
26/02/2025	test	13	2		31	x	Tray	250	250	x	x	100	71	site to test MSCs and trial filtering with Louwin
01/03/2025	R	34	5		200	x	Tzero	1000	1000	500	500	250	220	PIC and BSi filters folded rather than stuck to side of tube
01/03/2025	R	34	5		200	x	Top	1000	1000	500	500	250	221	PIC and BSi filters folded rather than stuck to side of tube
01/03/2025	R	34	5		200	x	Base	1000	1000	500	500	250	222	PIC and BSi filters folded rather than stuck to side of tube
01/03/2025	R	34	5		200	x	Tray	250	250	100	100	100	223	PIC and BSi filters folded rather than stuck to side of tube
01/03/2025	R	35	6		290	x	Tzero	1000	1000	500	500	250	224	
01/03/2025	R	35	6		290	x	Top	1000	1000	500	500	250	225	
01/03/2025	R	35	6		290	x	Base	1000	1000	500	500	250	226	
01/03/2025	R	35	6		290	x	Tray	250	250	100	100	100	227	
01/03/2025	R	x	x		x	x	x	dry blank 1	dry blank 2	x	x	x	x	combusted filter dry blanks 1 and 2 placed in oven for 24 h
01/03/2025	R	36	7		500	485	Tzero	1000	1000	500	500	250	228	
01/03/2025	R	36	7		500	485	Top	1000	1000	500	500	250	229	
01/03/2025	R	36	7		500	485	Base	1000	1000	500	500	250	230	
01/03/2025	R	36	7		500	485	Tray	250	250	100	100	100	231	
03/03/2025	R	46	8		180	176	Tzero	1000	1000	500	500	250	89	
03/03/2025	R	46	8		180	176	Top	1000	1000	500	500	250	90	
03/03/2025	R	46	8		180	176	Base	1000	1000	500	500	250	91	
03/03/2025	R	46	8		180	176	Tray	250	250	100	100	100	92	
03/03/2025	R	48	10		270	264	Tzero	1000	1000	500	500	250	94	
03/03/2025	R	48	10		270	264	Top	1000	1000	500	500	250	95	
03/03/2025	R	48	10		270	264	Base	1000	1000	500	500	250	96	
03/03/2025	R	48	10		270	264	Tray	250	250	100	100	100	97	
03/03/2025	R	52	12		510	499	Tzero	1000	1000	500	500	250	98	
03/03/2025	R	52	12		510	499	Top	1000	1000	500	500	250	99	
03/03/2025	R	52	12		510	499	Base	1000	1000	500	500	250	100	
03/03/2025	R	52	12		510	499	Tray	250	250	100	100	100	1	
05/03/2025	R	64	13		190	187	Tzero	1000	1000	500	500	250	176	
05/03/2025	R	64	13		190	187	Top	1000	1000	500	500	250	178	
05/03/2025	R	64	13		190	187	Base	1000	1000	500	500	250	179	
05/03/2025	R	64	13		190	187	Tray	250	250	100	100	100	180	
05/03/2025	R	67	15		280	271	Tzero	1000	1000	500	500	250	183	
05/03/2025	R	67	15		280	271	Top	1000	1000	500	500	250	184	
05/03/2025	R	67	15		280	271	Base	1000	1000	500	500	250	185	
05/03/2025	R	67	15		280	271	Tray	250	250	100	100	100	186	
05/03/2025	R	69	16		510	494	Tzero	x	x	x	x	x	x	Did not recover until 1.5 hours after firing, no Tzero
05/03/2025	R	69	16		510	494	Top	1000	1000	x	x	x	x	Only filtered POC, no Tzero. Use Niskin POC as Tzero
05/03/2025	R	69	16		510	494	Base	1000	1000	x	x	x	x	Only filtered POC, no Tzero. Use Niskin POC as Tzero
05/03/2025	R	69	16		510	494	Tray	250	250	x	x	x	x	Only filtered POC, no Tzero. Use Niskin POC as Tzero
07/03/2025	R	88	17		280	275	Tzero	1000	1000	500	500	250	49	re labelled as MSC16 and were relabelled during storage (a
07/03/2025	R	88	17		280	275	Top	1000	1000	500	500	250	51	re labelled as MSC16 and were relabelled during storage (a
07/03/2025	R	88	17		280	275	Base	1000	1000	500	500	250	53	re labelled as MSC16 and were relabelled during storage (a
07/03/2025	R	88	17		280	275	Tray	250	250	100	100	100	54	re labelled as MSC16 and were relabelled during storage (a
07/03/2025	R	89	18		280	277	Tzero	1000	1000	500	500	250	50	re labelled as MSC16 and were relabelled during storage (a
07/03/2025	R	89	18		280	277	Top	1000	1000	500	500	250	55	st on POC filters - no cover on filtration bottles prior to runn
07/03/2025	R	89	18		280	277	Base	1000	1000	500	500	250	56	st on POC filters - no cover on filtration bottles prior to runn
07/03/2025	R	89	18		280	277	Tray	250	250	100	100	100	57	st on POC filters - no cover on filtration bottles prior to runn
07/03/2025	R	90	19		510	493	Tzero	1000	1000	500	500	250	58	
07/03/2025	R	90	19		510	493	Top	1000	1000	500	500	250	59	
07/03/2025	R	90	19		510	493	Base	1000	1000	500	500	250	60	
07/03/2025	R	90	19		510	493	Tray	250	250	100	100	100	61	
07/03/2025	R	93	21		185	181	Tzero	1000	1000	500	500	250	62	
07/03/2025	R	93	21		185	181	Top	1000	1000	500	500	250	63	
07/03/2025	R	93	21		185	181	Base	1000	1000	500	500	250	64	
07/03/2025	R	93	21		185	181	Tray	250	250	100	100	100	65	
11/03/2025	B	109	22	Umi	206	204	Tzero	1000	1000	500	500	250	20	
11/03/2025	B	109	23	Red	206	206	Tzero	1000	1000	500	500	250	21	event log did not register MSC23
11/03/2025	B	109	22	Umi	206	204	Top	1000	1000	500	500	250	31	
11/03/2025	B	109	22	Umi	206	204	Base	1000	1000	500	500	250	32	
11/03/2025	B	109	22	Umi	206	204	Tray	250	250	150	150	150	33	event log did not register MSC23
11/03/2025	B	109	23	Red	206	206	Top	1000	1000	500	500	250	34	C and BSi were running; event log did not register MSC23;
11/03/2025	B	109	23	Red	206	206	Base	1000	x	500	500	250	35	OC2 dropped and not rerun; event log did not register MSC2
11/03/2025	B	109	23	Red	206	206	Tray	250	250	100	100	100	36	
11/03/2025	B	111	24	Umi	510	496	Tzero	1000	1000	500	500	250	37	
11/03/2025	B	111	24	Umi	510	496	Top	1000	1000	500	500	250	38	
11/03/2025	B	111	24	Umi	510	496	Base	1000	1000	500	500	250	39	PIC and Bsi may have been left to run dry for ~10 minutes
11/03/2025	B	111	24	Umi	510	496	Tray	250	250	150	150	150	40	PIC and Bsi left to run dry for ~10 minutes
11/03/2025	B	113	25	Umi	296	290	Tzero	1000	1000	500	500	250	41	
11/03/2025	B	113	25	Umi	296	290	Top	1000	1000	500	500	250	42	
11/03/2025	B	113	25	Umi	296	290	Base	1000	1000	500	500	250	43	
11/03/2025	B	113	25	Umi	296	290	Tray	250	250	150	150	150	44	
13/03/2025	B	132	28	Umi	215	213	Tzero	1000	1000	500	500	250	167	
13/03/2025	B	133	29	Red	215	213	Tzero	1000	1000	500	500	250	168	
13/03/2025	B	132	28	Umi	215	213	Top	1000	1000	500	500	250	169	red/umi carbuoys switched
13/03/2025	B	132	28	Umi	215	213	Base	1000	1000	500	500	250	170	red/umi carbuoys switched
13/03/2025	B	132	28	Umi	215	213	Tray	250	250	150	150	150	171	red/umi carbuoys switched
13/03/2025	B	133	29	Red	215	213	Top	1000	1000	500	500	250	172	red/umi carbuoys switched
13/03/2025	B	133	29	Red	215	213	Base	1000	1000	500	500	250	173	red/umi carbuoys switched
13/03/2025	B	133	29	Red	215	213	Tray	250	250	100	100	100	174	red/umi carbuoys switched
13/03/2025	B	136	31	Umi	310	303	Tzero	1000	1000	500	500	250	175	
13/03/2025	B	136	31	Umi	310	303	Top	1000	1000	500	500	250	176	
13/03/2025	B	136	31	Umi	310	303	Base	1000	1000	500	500	250	177	PIC filtered quickly - re-ran due to fold in the filter
13/03/2025	B	136	31	Umi	310	303	Tray	250	250	150	150	150	178	
15/03/2025	B	152	32	Umi	330	227	Tzero	1000	1000	500	500	250	246	
15/03/2025	B	153	33	Red	330	227	Tzero	1000	1000	500	500	250	247	
15/03/2025	B	152	32	Umi	330	227	Top	1000	1000	500	500	250	248	
15/03/2025	B	152	32	Umi	330	227	Base	1000	1000	500	500	250	249	
15/03/2025	B	152	32	Umi	330	227	Tray	250	250	150	150	150	250	
15/03/2025	B	153	33	Red	330	227	Top	1000	1000	500	500	250	1	
15/03/2025	B	153	33	Red	330	227	Base	1000	1000	500	500	250	2	
15/03/2025	B	153	33	Red	330	227	Tray	250	250	150	150	150	3	
15/03/2025	B	155	34	Umi	510	501	Tzero	1000	1000	500	500	250	4	
15/03/2025	B	155	34	Umi	510	501	Top	1000	1000	500	500	250	5	
15/03/2025	B	155	34	Umi	510	501	Base	1000	1000	500	500	250	6	
15/03/2025	B	155	34	Umi	510	501	Tray	250	250	150	150	150	7	
15/03/2025	B	158	37	Umi	235	229	Tzero	1000	1000	500	500	250	8	
15/03/2025	B	158	37	Umi	235	229	Top	1000	1000	500	500	250	9	
15/03/2025	B	158	37	Umi	235	229	Base	1000	1000	500	500	250	10	
15/03/2025	B	158	37	Umi	235	229	Tray	250	250	150	150	150	11	
17/03/2025	B	173	38	Umi	315	312	Tzero	1000	1000	500	500	250	95	
17/03/2025	B	174	39	Red	315	312	Tzero	1000	1000	500	500	250	96	
17/03/2025	B	173	38	Umi	315	312	Top	1000	1000	500	500	250	97	
17/03/2025	B	173	38	Umi	315	312	Base	1000	1000	500	500	250	98	
17/03/2025	B	173	38	Umi	315	312	Tray	250	250	150	150	150	99	
17/03/2025	B	174	39	Red	315	312	Top	1000	1000	500	500	250	100	
17/03/2025	B	174	39	Red	315	312	Base	1000	1000	500	500	250	101	
17/03/2025	B	174	39	Red	315	312	Tray	250	250	150	150	150	102	POC2 dropped after drying - could not rerun
17/03/2025	B	176	40	Umi	510	495	Tzero	1000	1000	500	500	250	103	
17/03/2025	B	176	40	Umi	510	495	Top	1000	1000	500	500	250	104	
17/03/2025	B	176	40	Umi	510	495	Base	1000	1000	500	500	250	105	
17/03/2025	B	176	40	Umi	510	495	Tray	250	250	150	150	150	106	
17/03/2025	B	177	41	Umi	220	211	Tzero	1000	1000	500	500	250	107	Conservative estimate of depth fired - likely closer to 220m
17/03/2025	B	177	41	Umi	220	211	Top	1000	1000	500	500	250	108	Conservative estimate of depth fired - likely closer to 220m
17/03/2025	B	177	41	Umi	220	211	Base	1000	1000	500	500	250	109	Conservative estimate of depth fired - likely closer to 220m
17/03/2025	B	177	41	Umi	220	211	Tray	250	250	150	150	150	110	Conservative estimate of depth fired - likely closer to 220m

Table 3: CTD Niskin water samples filtered for POC.

Date	Station	Latitude	Longitude	Event	CTD #	Cast Depth	Bottom Depth	Time I/W	Niskin #	Feature	Depth (m)	POC 1 vol. (mL)	POC 2 vol. (mL)	POC3 vol. (mL)	Notes / Comments
01/03/2025	R	-15.9999	-12.9998	36	CTD005	500	2500	16:56	1		500	2000	1000	500	uoys left out for 1.5 hours before filtering; hoses on floor of wetlab between
01/03/2025	R	-15.9999	-12.9998	36	CTD005	500	2500	16:56	3	EZD + 100	290	2000			Very tired; carbuoys left out for 1.5 hours before filtering; hoses on floor of wetlab between
01/03/2025	R	-15.9999	-12.9998	36	CTD005	500	2500	16:56	9	EZD + 10	200	2000			Very tired; carbuoys left out for 1.5 hours before filtering; hoses on floor of wetlab between
01/03/2025	R	-15.9999	-12.9998	36	CTD005	500	2500	16:56	12	DCM	135	2000	1000	500	uoys left out for 1.5 hours before filtering; hoses on floor of wetlab between
01/03/2025	R	-15.9999	-12.9998	36	CTD005	500	2500	16:56	13		75	2000			Very tired; carbuoys left out for 1.5 hours before filtering; hoses on floor of wetlab between
03/03/2025	R	-15.9997	-12.9998	53	CTD009		2500	16:25	8		750	3000			
03/03/2025	R	-15.9997	-12.9998	53	CTD009		2500	16:25	9		500	2000	1000	500	
03/03/2025	R	-15.9997	-12.9998	53	CTD009		2500	16:25	13	EZD+100	264	2000	1000	500	
03/03/2025	R	-15.9997	-12.9998	53	CTD009		2500	16:25	16	EZD+10	175	2000	1000	500	
03/03/2025	R	-15.9997	-12.9998	53	CTD009		2500	16:25	20	DCM	110	1000			
05/03/2025	R	-15.9998	-13	70	CTD012	500	2500	14:22	4	EZD + 100	280	2000	1000	500	
05/03/2025	R	-15.9998	-13	70	CTD012	500	2500	14:22	6	EZD + 10	190	2000	1000	500	
05/03/2025	R	-15.9998	-13	70	CTD012	500	2500	14:22	13	DCM	115	2000			
05/03/2025	R	-15.9998	-13	70	CTD012	500	2500	14:22	16		20	2000			
05/03/2025	R	-15.9998	-13	70	CTD012	500	2500	14:22	18	Surface	5	2000	1000	500	
11/03/2025	B	-16	-18.999991	114	CTD024	500	3711	15:43	1		500	2000	1000	500	
11/03/2025	B	-16	-18.999991	114	CTD024	500	3711	15:43	4		290	2000	1000	500	
11/03/2025	B	-16	-18.999991	114	CTD024	500	3711	15:43	6		205	2000	1000	500	
11/03/2025	B	-16	-18.999991	114	CTD024	500	3711	15:43	13		130	2000			
13/03/2025	B	-15.9995	-18.997424	137	CTD031	500	3740	14:30	1		500	2000			
13/03/2025	B	-15.9995	-18.997424	137	CTD031	500	3740	14:30	4		310	2000	1000	500	
13/03/2025	B	-15.9995	-18.997424	137	CTD031	500	3740	14:30	7		205	2000	1000	500	
13/03/2025	B	-15.9995	-18.997424	137	CTD031	500	3740	14:30	11		162	1000			
13/03/2025	B	-15.9995	-18.997424	137	CTD031	500	3740	14:30	15		133	1000			
13/03/2025	B	-15.9995	-18.997424	137	CTD031	500	3740	14:30	20		10	1000			
15/03/2025	B	-15.9995	-18.997424	159	CTD037	500	3740	14:30	1		510	2000	1000	500	
15/03/2025	B	-15.9995	-18.997424	159	CTD037	500	3740	14:30	4	EZD+100	322	2000	1000	500	
15/03/2025	B	-15.9995	-18.997424	159	CTD037	500	3740	14:30	7	EZD+10	232	2000			Could not filter 500 so didn't filter 1000 either
15/03/2025	B	-15.9995	-18.997424	159	CTD037	500	3740	14:30	10		180	1000			
15/03/2025	B	-15.9995	-18.997424	159	CTD037	500	3740	14:30	16	DCM	125	1000			
15/03/2025	B	-15.9995	-18.997424	159	CTD037	500	3740	14:30	18		90	1000			
15/03/2025	B	-15.9995	-18.997424	159	CTD037	500	3740	14:30	22		10	1000			
17/03/2025	B	-16	-19.000004	178	CTD041	500	3740	14:49	1		500	2000	1000	500	Pump not connected for the first 10 minutes; POC1 ran dry
17/03/2025	B	-16	-19.000004	178	CTD041	500	3740	14:49	5	EZD+100	310	2000	1000	500	Pump not connected for first 10 minutes; POC1 ran dry
17/03/2025	B	-16	-19.000004	178	CTD041	500	3740	14:49	7	EZD+10	220	2000	1000	500	
17/03/2025	B	-16	-19.000004	178	CTD041	500	3740	14:49	9		168	1000			
17/03/2025	B	-16	-19.000004	178	CTD041	500	3740	14:49	12		140	1000			
17/03/2025	B	-16	-19.000004	178	CTD041	500	3740	14:49	14		130	1000			
17/03/2025	B	-16	-19.000004	178	CTD041	500	3740	14:49	22		10	1000			
20/03/2025	R	-15.9151	-13.02088	187	CTD043	500	2252	05:33	1		500	2000			Glider calibration cast
20/03/2025	R	-15.9151	-13.02088	187	CTD043	500	2252	05:33	4		400	2000			
20/03/2025	R	-15.9151	-13.02088	187	CTD043	500	2252	05:33	5		350	2000			
20/03/2025	R	-15.9151	-13.02088	187	CTD043	500	2252	05:33	6		300	2000			
20/03/2025	R	-15.9151	-13.02088	187	CTD043	500	2252	05:33	7		250	2000			Bottle also labelled as N5 from previous deployment – fairly sure it is correct but worth double checking
20/03/2025	R	-15.9151	-13.02088	187	CTD043	500	2252	05:33	9		200	2000			
20/03/2025	R	-15.9151	-13.02088	187	CTD043	500	2252	05:33	11		150	2000			
20/03/2025	R	-15.9151	-13.02088	187	CTD043	500	2252	05:33	16	DCM	122	2000			
20/03/2025	R	-15.9151	-13.02088	187	CTD043	500	2252	05:33	17		100	2000			
20/03/2025	R	-15.9151	-13.02088	187	CTD043	500	2252	05:33	18		80	2000			
20/03/2025	R	-15.9151	-13.02088	187	CTD043	500	2252	05:33	20		40	2000			
20/03/2025	R	-15.9151	-13.02088	187	CTD043	500	2252	05:33	21		10	2000			
23/03/2025	X3	-16	-0.999964	193	CTD045	500	5152	05:06	1		500	2000			
23/03/2025	X3	-16	-0.999964	193	CTD045	500	5152	05:06	9		200	2000			
23/03/2025	X3	-16	-0.999964	193	CTD045	500	5152	05:06	13		100	2000			
23/03/2025	X3	-16	-0.999964	193	CTD045	500	5152	05:06	12		125	2000			
23/03/2025	X3	-16	-0.999964	193	CTD045	500	5152	05:06	17		60	2000			
23/03/2025	X3	-16	-0.999964	193	CTD045	500	5152	05:06	22		20	2000			
26/03/2025	X3	-15.9518	-0.949561	215	CTD053	500	5150	03:59	1		500	2000			Dropped filter onto petrslide – hopefully okay
26/03/2025	X3	-15.9518	-0.949561	215	CTD053	500	5150	03:59	3		400	2000			
26/03/2025	X3	-15.9518	-0.949561	215	CTD053	500	5150	03:59	4		350	2000			
26/03/2025	X3	-15.9518	-0.949561	215	CTD053	500	5150	03:59	6		300	2000			
26/03/2025	X3	-15.9518	-0.949561	215	CTD053	500	5150	03:59	8		250	2000			
26/03/2025	X3	-15.9518	-0.949561	215	CTD053	500	5150	03:59	10		200	2000			
26/03/2025	X3	-15.9518	-0.949561	215	CTD053	500	5150	03:59	12		150	2000			Ran dry for <15 seconds
26/03/2025	X3	-15.9518	-0.949561	215	CTD053	500	5150	03:59	13		125	2000			
26/03/2025	X3	-15.9518	-0.949561	215	CTD053	500	5150	03:59	14		100	2000			
26/03/2025	X3	-15.9518	-0.949561	215	CTD053	500	5150	03:59	15		80	2000			
26/03/2025	X3	-15.9518	-0.949561	215	CTD053	500	5150	03:59	16	DCM	71	2000			
26/03/2025	X3	-15.9518	-0.949561	215	CTD053	500	5150	03:59	18		30	2000			

4. Bongo net

Objectives

Zooplankton play a key role in particle dynamics through feeding and remineralization processes. For example, large marine snow particles can be fragmented by feeding, and fecal pellets, which typically have a high sinking speed, may increase the density and sinking rate of marine snow when incorporated. The mesozooplankton population is hypothesized to be higher over the ridge compared to the basin. To investigate this, we deployed a bongo net to collect zooplankton samples alongside the camera frame.

Methods

Deployment:

We used 100 µm and 300 µm mesh sizes and deployed the bongo nets vertically to a depth of 300 m. A weight was attached to the bottom end of the bongo net (Figure 1) to stabilize the net during descent. The nets were deployed over the starboard side using the Romica winch, with a wire speed of 0.5 m/s for both descent and ascent.

Once the net reached the surface, it was held alongside the ship, and the inside was rinsed with seawater to collect organisms attached to the net into the codend. After bringing the net back onto the deck, we rinsed around the codend to ensure that most of the organisms were collected.

Figure 12Deployment of bongo net

Preservation:

Samples from 100 cod end was preserved in the lugol and samples from 300 cod end was preserved in formaldehyde. The details of preservation processes are described in Figure 2 and 3.

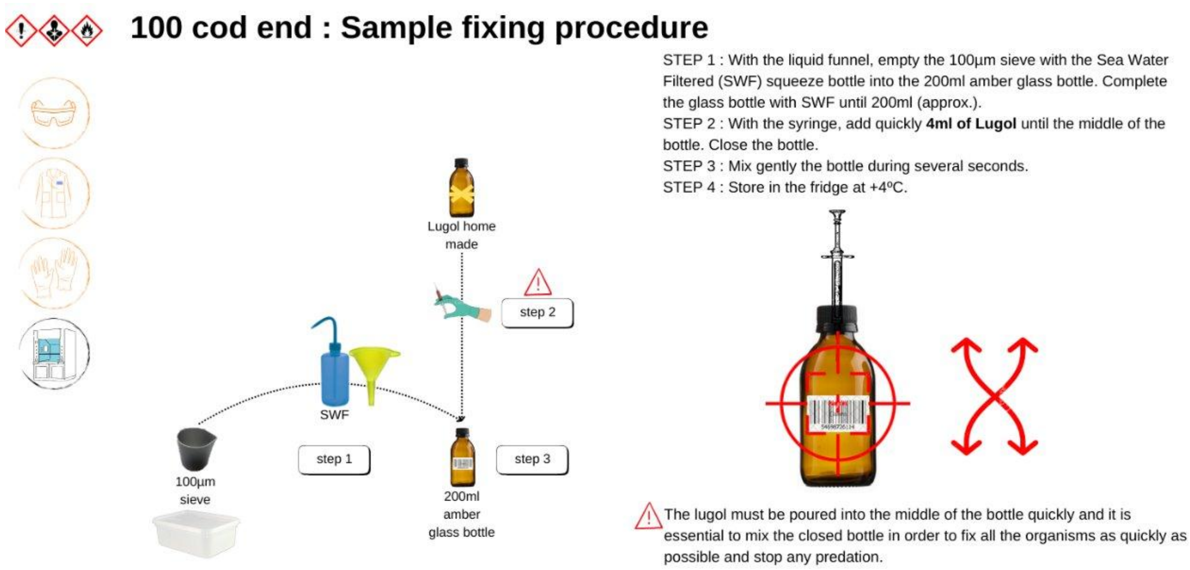

Figure 13Preservation method for 100 cod end samples

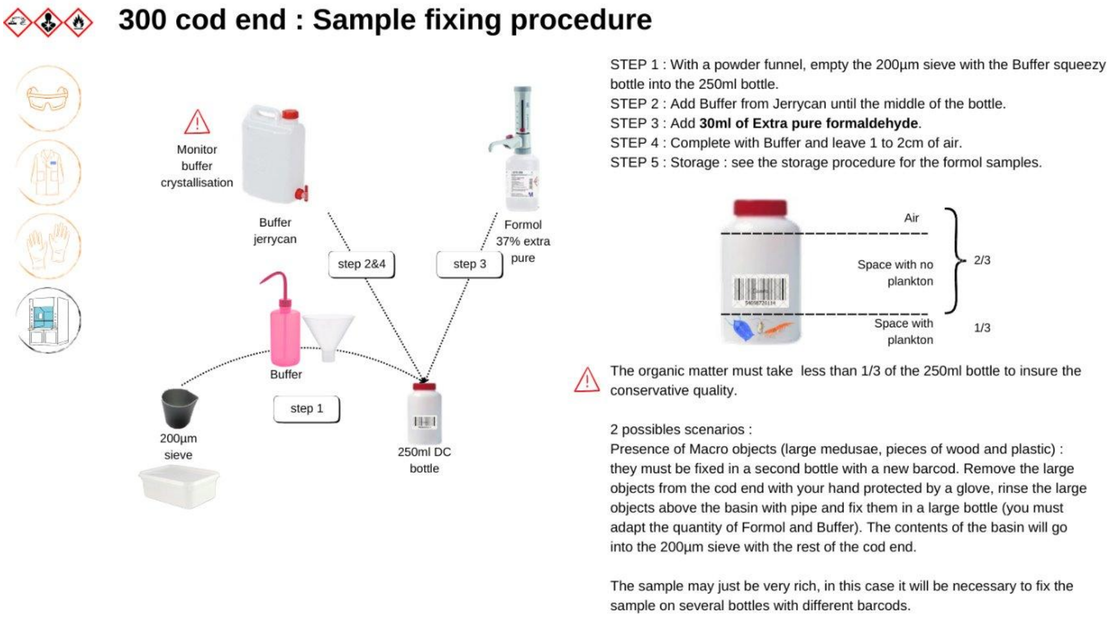

Figure 14Preservation method for 300 cod end samples

Results

We initially planned to deploy the bongo net both during the day and at night; however, this became unrealistic due to the schedules of other samplings during the day time. As a result, we focused on night time deployments when zooplankton are known to migrate to the surface. In total, 12 successful deployments were made (Table 1). Notably, some large organisms, such as krill, were observed (Figure 4). Although we sieved the buffer three times using a 20 µm sieve, we noticed sedimentation in the buffer. To address this, the buffer was sieved twice more after Event 91.

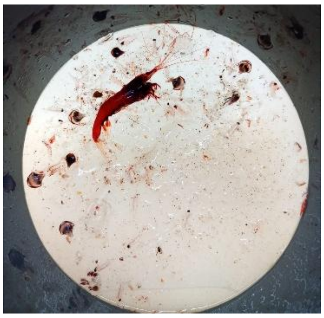

Figure 15 Sample from X3

Table 7Deployment details

	Event	Station	Date	Time (UTC)	Net type	Depth inte	Wire length	Speed	Angle	Longitude			Latitude			Volume Start	Volume End	100um	300um	Comment
1	39	R	02/03/2025	02:07	100/300 vertical	200	200	0.5	1	15	59.59	S	12	59.59	W	807	1474	CAR000000040	CAR000000044	Water pressure to rinse the net was weak.
2	50	R	03/03/2025	11:53	100/300 vertical	200	200	0.5	1	15	59.98	S	12	59.98	W	1480	2111	CAR000000046	CAR000000045	
3	57	R	04/03/2025	01:55	100/300 vertical	300	200	0.5	1	16	0	S	13	0	W	2116	3064	CAR000000042	CAR000000039	
4	68	R	05/03/2025	12:05	100/300 vertical	300	200	0.5	NA	15	59.98	S	12	59.98	W	3065	4061	CAR000000041	CAR000000043	
5	78	R	06/03/2025	02:26	100/300 vertical	300	200	0.5	2	15	59.66	S	13	0.5	W	4067	5042	CAR000000069	CAR000000070	VMP recovery before bongo net.
6	91	R	07/03/2025	12:00	100/300 vertical	300	200	0.5	2	16	0	S	12	59.99	W	5144	6383	CAR000000057	CAR000000068	
7	100	R	08/03/2025	01:52	100/300 vertical	300	200	0.5	2	15	59.99	S	12	59.99	W	6398	7545	CAR000000065	CAR000000063	Added too much SWF to 100 um samples. Split samples into two bottles.
8	112	B	11/03/2025	11:55	100/300 vertical	300	200	0.5	2	16	0	S	19	0	W	7617	8714	CAR000000064	CAR000000050	
9	120	B	12/03/2025	03:17	100/300 vertical	300	200	0.5	2	15	59.99	S	19	0	W	8735	9815	CAR000000061	CAR000000062	
10	143	B	14/03/2025	01:47	100/300 vertical	300	200	0.5	1	15	59.99	S	18	59.99	W	9821	10813	CAR000000060	CAR000000067	FULL MOOOOOON
11	165	B	16/03/2025	01:50	100/300 vertical	300	200	0.5	1	15	59.99	S	18	59.99	W	10832	11912	CAR000000066	CAR000000059	
12	169	B	16/03/2025	22:03	100/300 vertical	300	200	0.5	1	16	0	S	18	53.47	W	11944	130140	CAR000000054	CAR000000055	

5. ^{210}Po-^{210}Pb profiles

Scientific motivation

^{210}Pb (T1/2 = 22.3 yr) and its daughter ^{210}Po (T1/2 = 138.4 d) are natural particle reactive radioisotopes that can be used as tracers of particle cycling in the upper ocean. Both radioisotopes have a strong affinity for particles, but whereas ^{210}Pb is only adsorbed on particle surfaces, ^{210}Po is also bioaccumulated, being incorporated into the cytoplasm of some species of phytoplankton and bacteria; its partitioning is similar to that of protein and sulphur within the cell. For this reason ^{210}Po is more efficiently removed from surface waters than ^{210}Pb via sinking particles. When there is biological activity and sinking of organic matter, the disequilibrium between the two radionuclides occurs when is measurable.

This disequilibrium ^{210}Po-^{210}Pb, that appears because ^{210}Po is scavenged attached to the sinking particles, allows to calculate downward ^{210}Po fluxes using the continuity equation coupled with the radioactive decay equations. The calculate ^{210}Po flux is used to calculate POC fluxes using the ratio POC/^{210}Po in sinking particles as a conversion factor. Additionally, ^{210}Po flux can be used to calculate the average velocity of the sinking particles. ^{210}Po flux can be calculated from the average sinking velocity of the flux, multiplied by the total concentration of ^{210}Po in the particulate fraction. Therefore, if ^{210}Po particulate fraction can be obtained from the particles collected, the flux can be obtained from the total water fraction, so sinking velocities could be calculated.

POC fluxes ^{210}Po derived are a robust alternative to be used instead of POC flux ^{234}Th derived. ^{210}Po fluxes obtained from to ^{210}Pb and ^{210}Po disequilibrium differ from the ^{234}Th fluxes calculated from ^{234}Th-^{238}U disequilibrium in several ways: First, ^{234}Th is attached to the surface of the particles, on the contrary ^{210}Po is also assimilated by the organic matter. Study timescales are also different, going from several days (^{234}Th) to months (^{210}Po) due to the different half-lives of ^{234}Th (24 d) and ^{210}Po (138.4 d).

Carbon export fluxes from ^{210}Po-^{210}Pb disequilibrium

During JC275, ^{210}Po downward fluxes will be calculated to assess the strength of downward export of particulate carbon. The disequilibrium ^{210}Po-^{210}Pb will be measured in water depth profiles, collected from the CTD and used to calculate ^{210}Po fluxes. Subsequently POC/^{210}Po ratios measured in sinking particles (collected using SAPS) will be used to obtain POC fluxes from ^{210}Po fluxes and POC/^{210}Po ratio.

Average sinking velocities

The measurement of radioactive ^{210}Po-^{210}Pb pair in the water column also provides a robust method to calculate the depth variation of the average velocities of the sinking particles through the water column, following similar calculations as for the estimtion of ^{210}Po fluxes,. This will allow us to estimate the average velocities of particles contributing to the flux, which is also a necessary parameter for biogeochemical and ocean carbon cycle models.

The objectives of this work will be:

- To obtain an assessment of the strength of downward carbon export and evaluate flux attenuation. Using the calculated POC fluxes from ^{210}Po-^{210}Pb disequilibrium, together with also POC/^{210}Pb ratios in sinking particles.
- To compare POC fluxes using POC/^{210}Po ratios from SAPS. The objective is to use both particle collection methods to obtain complementary information about the biogeochemical behavior of ^{210}Po and POC flux attenuation.
- To calculate particle sinking velocities (ASV) variation with depth in the sampled profiles. The final aim is to use this parameter to analyse the attenuation of the particle flux through the twilight zone, e.g measuring the contribution of slow sinking particles to the flux and how this contribution changes with depth. Additionally, this a necessary parameter for biogeochemical and ocean carbon cycle models, so it will be used to

improve the scarce database of sinking particles velocities in the ocean.
- to estimate export efficiency, defined as the ratio POC flux at the base of the Euphotic zone (Ez) to NPP, and transfer efficiency, defined as the ratio POC flux in Ez + 100 to POC flux in Ez. Using POC fluxes and satellite NPP.
- To estimate b attenuation coefficient from Martin's power law fitting of POC and ^{210}Po fluxes
- Combine ASV, export efficiency, transfer efficiency and b to parameterize attenuation and ***remineralization depths***.

Methodology and sampling strategy

Sampling collection strategy:

One CTD was deployed per station to couple ^{210}Po-^{210}Pb water depth profiles with the particles obtained from the Stand Alone Pumping System (SAPS).
^{210}Po and ^{210}Pb in the particulate fraction obtained form the SAPS have to be measured, together with ^{210}Po in the total water fraction. The ratio ^{210}Po/POC in sinking particles, can be then calculated and ^{210}Po export fluxes will be converted into POC fluxes and sinking velocities calculated.

For this reason it is necessary to collect sinking particles to measure ^{210}Po. The sinking particles were collected from the Stand-Alone Pumping Systems (SAPS). In each station the SAPS has been pumping for 2 hours. After that time the filters inside the SAPS has been collected.

Po Sampling methodology and sampling treatment on board

Samples for ^{210}Po and ^{210}Pb analysis were collected from 20-L Niskin bottles mounted on the stainless steel CTD rosette. 9 profiles were taken in stations new B, R, B and X3. 5 L water samples were collected from up to 12 depths between 5-500 m (see Table 1). Four duplicate samples were taken in three profiles (Station R3 – CTD 012, Station B2 – CTD 031 and Station B4 – CTD 041).

From each depth, 5 L of water were collected in acid-cleaned (solution: 500 mL MilliQ + 500 mL HNO3 65% + 10 mL H2O2) and MilliQ-rinsed carboys that were pre-rinsed with the sample. The 5-L line was marked on the carboys, so the volume measurements are not super precise. Samples were immediately acidified (10 mL HNO3) and vigorously shaken. All carboys were then spiked with 100 µL 209Po tracer from 0,20 Bq/ml disolution. After waiting more than 6 hours for the sample to homogenise, 1.25 g $FeSO_4$ and 2.5 g $K_2S_2O_5$ were added. The samples were again vigorously shaken. Then about 15 mL NH_4OH was added to neutralize the solution (to a final pH of 8.5). The solution was shaken vigorously, and the pH checked. Samples were allowed to precipitate and settle for at least 24 h. After settling, as much supernatant as possible was removed by carefully siphoning. The precipitate was transferred into 1-L HDPE bottles and left to settle for at least another 24 h. Again, the supernatant was carefully siphoned off, and the precipitate transferred into 250-mL HDPE bottles. For sample transfer, carboys/bottles were rinsed with MilliQ water.
The radiochemical analysis of these samples will be carried out at the laboratories of the Universidad de Sevilla, Spain.

SAPS Sampling methodology and sampling treatment on board

After SAPS recovering the head are taken and filtered ridding of the remained seawater. After that, the 53um and 1 um filters are removed. Afterwards, each filter has been split into 4 quarters, 2 quarters for two measurements of POC and 2 for ^{210}Po. After cut filters were introduced in 250-mL HDPE bottles containing around 100-mL of filtered seawater.

Samples were shaken and stored for about 4 hours. POC samples were filtered using precombusted 25 mm GFF and for ^{210}Po 25 mm non-combusted GFF. The filters were placed in a labeled plastic filter case and dried in the oven.

Samples analysis of these samples will be carried out at the Universidad de Sevilla.

Station new B		Station R						Station B								Station X3	
25-feb-25		01-mar-25		05-mar-25		15-mar-25		11-mar-25		13-mar-25		15-mar-25		17-mar-25		23-mar-25	
New B	**CTD01**	**St R1**	**CTD05**	**St R3**	**CTD12**	**St R4**	**CTD18**	**St B1**	**CTD24**	**St B2**	**CTD31**	**St B3**	**CTD37**	**St B4**	**CTD41**	**Station X3**	**CTD45**
Depth	Niskin	Depth	Niskin	Depth	Niskin	Depth	Niskin	Depth	Niskin	Depth	Niskin	Depth	Niskin	Depth	Niskin	Depth	Niskin
10	15	5	14	5	18	5	24	5	19	5	24	5	24	5	24	5	24
75	14	10	13	20	16	10	23	10	18	10	20	10	22	10	22	20	21
115	11	75	12	81	15	75	12	85	16	95	17	90	18	85	18	60	16
125	9	105	11	115	13	115	11	120	15	133	15	115	17	120	16	100	13
150	7	120*	10	125*	11	125*	9	140*	11	145*	13	125	16	140*	12	125	12
175	5	135	9	138	10	136	8	150	10	155	12	135*	13	152	11	150	11
280	3	200	7	150	9	155	7	155	9	162	11	172	12	168	9	175	10
350	1	210	6	170	8	185*	6	175	8	182	10	200	9	189	8	200	9
		230	5	190*	6	200	5	205*	6	205*	7	232*	7	220*	7	250	7
		290*	3	280*	4	275*	4	290*	4	310*	4	322*	4	310*	5	300	6
		350	2	350	3	350	3	350	3	350	3	350	3	350	3	350	4
		500*	1	500*	1	500*	1	500*	1	500*	1	500*	1	500*	1	500	1

Details of the collected profiles. * marks depth with corresponding SAPS deployment.