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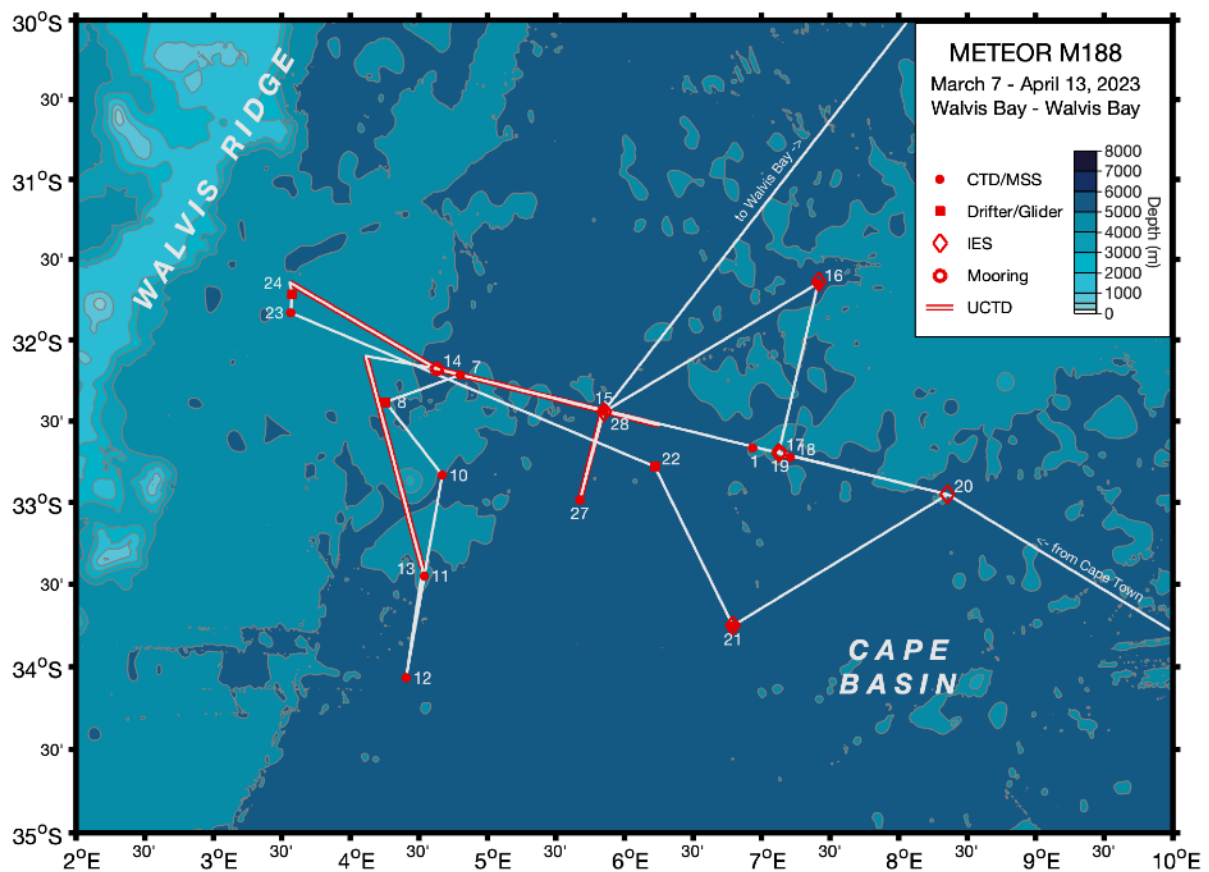
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RV METEOR
Cruise M188
Short Cruise Report

Walvis Bay - Walvis Bay
March 7 - April 13, 2023

Chief Scientist: Christian Mertens
Captain: Rainer Hammacher



Objectives

Energetic inconsistencies in present climate models feature errors of the same magnitude as the energy imbalance of Earth's climate system due to anthropogenic greenhouse gas emissions. This leads to biases that limit the models ability to predict climate relevant physical processes. The collaborative research centre TRR181 'Energy Transfers in Atmosphere and Ocean' aims to address these shortcomings by deepening the physical understanding of energy transfers between the dynamical regimes, i.e. geostrophic motions, gravity waves, and turbulence. The METEOR Expedition M188 SONETT II to the southeast Atlantic is an integrative effort that brings together observational projects within the TRR181 to combine different process studies to synoptically observe the different energy compartments.

In the study area near the Walvis Ridge energy is converted from barotropic to baroclinic tides, eddies emanating from the Agulhas retroflection pass through affecting eddy-internal wave interaction, and the formation of fronts and filaments. The observational programme includes the study of mixed-layer processes, mesoscale and submesoscale circulation, horizontal mixing processes, internal waves, and energy dissipation. It is complemented by a modelling project where a general circulation ocean model is set up with a telescoping grid for the observed region to evaluate the consistency of the observations as well as validate the models against the observations.

The three principal dynamical regimes of the atmosphere and the ocean can be classified as small-scale turbulence, internal gravity waves and geostrophic flows at large space and time scales. Together with external forcing and exchanges with internal energy, the energy transfers among these three principal dynamical regimes constitute the global energy cycle. The conversion of kinetic energy to internal energy by molecular friction in boundary layers or the interior takes place at the dissipative scales relevant for the small-scale turbulent regime, i.e. below centimeters in the interior ocean. The turbulent kinetic energy in turn is fed by dissipative processes acting on larger scales, such as the dissipation of gravity waves by shear or convective instability. Going to larger scales, internal gravity waves can interact with and be generated by the geostrophically balanced submeso-, meso- to large-scale circulation, e.g. by flow over topography or direct loss of geostrophic balance and wave emission.

The work programme consisted of repeated full-depth CTD/LADCP casts and microstructure (MSS) measurements in the upper ocean carried out for periods of 30 to 36 hours to capture semidiurnal and inertial signals. Two long-term moorings and five bottom-mounted inverted echo sounders (PIES) that were deployed in April 2021 on R/V SONNE cruise SO283 were recovered. Both moorings were in a depth of about 5000 m and equipped with current meters, ADCPs, and temperature/salinity recorders. Deployment and recovery of ocean gliders equipped with microstructure sensors measuring shear and temperature while profiling the upper 100 m and 1000 m of the water column. The gliders were sampling continuously for an about 10-day period. Current-following surface drifters that provide Lagrangian trajectories and near surface temperature measurements were deployed. The drifters are designed to be tracked for about 2 years. A hierarchical drifter deployment strategy was used to cover different scales of initial separations between the drifters, thus resolving the small-scale dispersion regime. The drifters were deployed in packages called knots. Each knot consisted of triplets of drifters. Shipboard ADCPs and an underway CTD (UCTD) were used to provide velocity and stratification information for the upper water column. The data will be used to measure submesoscale currents and internal wave shear and strain.

Narrative

RV METEOR left the port of Walvis Bay, Namibia, on Tuesday, March 7 2023, at 10:20 LT heading to our first working area in the eastern South Atlantic. The scientific party was formed by 18 scientists from the Universities of Bremen and Hamburg, and the Helmholtz Centres Hereon in Geesthacht and GEOMAR in Kiel. We unloaded our containers and started setting up the instruments and labs. Underway measurements (shipboard ADCPs, thermosalinograph, wave radar) were started in the evening of March 9, 18:00 LT, after leaving the EEZ of Namibia, followed by a short test of the CTD/Rosette (to 1000 m) at 19:00 LT, which went well.

The research program began on Friday, March 10, around noon with a CTD/LADCP time series station 10 nm away from the mooring ET4, that had been deployed during RV SONNE cruise SO283 in April 2021. After only a few hours, we had to interrupt the station work at 21:00 LT, due to a medical emergency on Tristan da Cunha, a volcanic island at the Mid-Atlantic Ridge. It has no airstrip, the only way to reach and leave Tristan is by boat, actually it is considered to be the most remote inhabited archipelago in the world. Since METEOR was the only ship around able to help, we left our research area towards Tristan. We arrived on Tuesday afternoon, March 14, and waited near the island's only settlement, Edinburgh of the Seven Seas, since the harbour is too small for larger vessels. Being in the north of the island, we were well protected from the high swell from southern directions. The seriously ill patient, his wife, a doctor and a nurse were taken to the ship by raft and then brought on board. After about two hours, we could leave the island in the direction of Cape Town. Sadly, the patient passed away on the late evening of Thursday, March 17. Despite intensive medical care by the ship's doctor and the accompanying team of Tristan da Cunha, and assistance from crew members and scientific participants, he could not be stabilized. The METEOR arrived in the port of Cape Town in the early morning of Monday, March 20. The authorities were very cooperative, so that we could leave in the afternoon of the same day, to return to the research area. Underway data was recorded for this period only outside the respective exclusive economic zones.

The scientific work resumed on March 21 at 13:30 LT with a deployment of surface drifters. A total of 10.5 working days were lost due to this unforeseen medical evacuation. The work program had to be rearranged accordingly, now concentrating fully on the SONETT I area. The planned work in the SONETT II area had to be cancelled to avoid further loss of time on long transits. Another limitation was the failure of the bow thruster due to an explosion of a capacitor on Friday, March 24, during a CTD time series station. The bow thruster could no longer be used for the remaining cruise. However, the impacts on station work were relatively minor thanks to the calm weather. The time series station was finished in the morning of March 25, and the ship moved to the center of an anticyclonic eddy, where we started the deployment of two Slocum Gliders, a shallow version profiling in the upper 100 m and a deeper version with 1000 m depth range. The deployment was finished at 14:00 LT. Right after that, 11 surface drifters were deployed in the same area. These included 5 SVP drifters (Surface Velocity Profile) and 6 smaller drifters custom-build at Hereon, Geesthacht.

In the evening of March 25 we started a transect of three CTD time series stations in southward direction across the anticyclonic eddy. The duration of the stations was between 31 and 37 hours. The third station was completed in the morning of March 30 and was already outside the eddy. After a short transit to the north, we then made an underway-CTD transect toward the center of the eddy. This transect was completed in the morning of March 31 near the mooring ET3. The mooring was released at 08:00 LT in calm weather conditions and the top float sighted shortly afterwards. The recovery of the

mooring took about 4 hours and was completed at 13:30 LT. Next, three bottom mounted inverted echo sounders (IES) were recovered between the evening of March 31 and the evening of April 1. The IES has a burn-wire release that takes 15-20 minutes to drop the anchor, after which it rises to the surface with a velocity of about one meter per second. All IESs started burning the wire immediately after release. The ascent of the devices was tracked acoustically. The work program was then continued with a CTD time series station near mooring ET4. At the end of this station we recovered the mooring in the morning of April 3. The weather conditions were still favorable and the top float again sighted shortly after release. The recovery was finished at 13:20 LT. The remaining two IESs were recovered thereafter, one in the evening of April 3 and the last in the morning of April 4. In the afternoon of the same day, we deployed the remaining 28 surface drifters in a square with 10 km side length. Evenly spaced, with ship and inflatable boat, 8 triplets were deployed along the edges of the square and four more drifters right in the middle.

According to the weather forecast, the coming day, Wednesday April 5, was to be the last day on which the weather would be calm enough for the gliders to be easily recovered by dinghy. Another such window was not foreseeable until the end of our stay in the working area. Therefore, we made a longer transit back to the center of the anticyclonic eddy, where the gliders had been deployed on March 25. We reached a position early the morning that was about 5 nm from the anticipated position for the glider recovery. First, we started with a time series station of microstructure measurements near the surface to observe the diurnal variation of turbulence in and below the surface mixed layer. The two gliders were then recovered easily in the afternoon and the microstructure time series was then continued into the late evening. Both gliders performed well and had collected data throughout their missions.

On the night of April 6, we began an underway CTD transect that extended from the center of the eddy to its outer edge, ending at 09:04 LT on April 7, having covered a distance of 147 nm with 127 casts. The weather had deteriorated in the meantime, so that we could not continue our work as planned with a CTD time series station. A CTD station that had been started had to be aborted after a short time because the cable got under the ship due to the lack of a bow thruster. We therefore continued the work with another underway CTD transect. In the evening, the weather had calmed down enough to proceed with the next CTD time series station. This station lasted until April 8, 20:17 LT. The work program then ended after a final time series station, started on the night of April 9, at 10:45 LT on April 10. The end of the scientific measurements on Easter Monday was celebrated in the evening with a barbecue on deck, a nice conclusion for the successful work of the past weeks. After three days of transit RV METEOR arrived at the port of Walvis Bay at 09:20 LT on Thursday, April 13.

Acknowledgements

We thank Captain Rainer Hammacher and the entire crew of the METEOR for the friendly and cooperative atmosphere and their professional technical assistance, which immensely contributed to the success of the expedition. The German Research Fleet Coordination Centre (Universität Hamburg), Klaus Bohn (LPL Projects + Logistics GmbH), and Barbara Kozák (University of Bremen) provided logistical and administrative support. The scientific work conducted during this cruise was funded by the German research Foundation (DFG) in the TRR 181 Energy Transfers in Atmosphere and Ocean.

List of participants

1. MERTENS, Christian	Chief Scientist	IUP
2. METHALE PUTHUKKOTTU, Subeesh	Moorings	IUP/MARUM
3. STAKE, Jürgen	Moorings	IUP
4. MEIRITZ, Luisa	Moorings	GEOMAR
5. LAGE, Mariana	Gliders	HEREON
6. BOATWRIGHT, Victoria	Gliders	HEREON
7. OELERICH, Ria	Gliders	IUP/MARUM
8. BREUNING, Emelie	Drifters	IFM
9. WELSCH, Andreas	UCTD	IFM
10. BRACAMONTES RAMIREZ, Joel	Microstructure	IUP/MARUM
11. LEIMANN, Ilmar	SADCP, Wave radar	IUP/MARUM
12. DENNERT, Peter	CTD, Salinometer	IUP/MARUM
13. EPKE, Moritz	CTD, Drifter	MPIM
14. KOURKOURAIDOU, Zoi	CTD	MPIM
15. ASCHENBECK, Lara	CTD	IUP
16. DUONG, Buu Lik	CTD	IUP
17. ROSENAU, Silvano	CTD	IFM
18. ENNEPER, Che	CTD	IFM
19. SUTTER, Patrick	Meteorology	DWD
20. OTTE, Frank	Meteorology	DWD

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List of stations

Station	Date / Time UTC	Device	Latitude	Longitude	Depth (m)	Comment
M188_1-1	2023/03/10 10:28	CTD	32° 39.997' S	006° 56.080' E	5121	
M188_1-2	2023/03/10 13:44	CTD	32° 40.009' S	006° 56.026' E	5118	
M188_1-3	2023/03/10 18:05	MSS	32° 40.061' S	006° 55.971' E	5117	
M188_1-4	2023/03/10 18:42	MSS	32° 40.522' S	006° 55.546' E	5088	Cast aborted
M188_2-1	2023/03/21 11:51	Drifter	36° 20.170' S	014° 59.801' E		
M188_2-2	2023/03/21 12:06	Drifter	36° 20.505' S	014° 59.475' E		
M188_3-1	2023/03/21 12:51	Drifter	36° 18.473' S	014° 57.409' E		
M188_3-2	2023/03/21 13:04	Drifter	36° 18.838' S	014° 57.210' E		
M188_4-1	2023/03/21 15:43	Drifter	36° 01.787' S	014° 32.341' E		
M188_4-2	2023/03/21 16:02	Drifter	36° 02.249' S	014° 32.015' E		
M188_5-1	2023/03/21 16:54	Drifter	36° 00.173' S	014° 29.987' E		
M188_5-2	2023/03/21 17:16	Drifter	36° 00.661' S	014° 29.642' E		
M188_6-1	2023/03/23 07:07	Drifter	32° 43.489' S	007° 12.412' E		
M188_7-1	2023/03/23 21:15	CTD	32° 12.949' S	004° 48.156' E	5081	
M188_7-2	2023/03/24 00:39	CTD	32° 12.989' S	004° 48.102' E	5073	
M188_7-3	2023/03/24 04:36	CTD	32° 12.831' S	004° 48.220' E	5096	
M188_7-4	2023/03/24 08:38	CTD	32° 12.889' S	004° 47.819' E	5023	
M188_7-5	2023/03/24 12:20	MSS	32° 12.722' S	004° 48.501' E	5123	
M188_7-6	2023/03/24 12:46	MSS	32° 12.849' S	004° 48.673' E	5141	
M188_7-7	2023/03/24 13:03	MSS	32° 12.964' S	004° 48.830' E	5147	
M188_7-8	2023/03/24 14:01	CTD	32° 12.917' S	004° 48.100' E	5074	
M188_7-9	2023/03/24 16:55	CTD	32° 12.805' S	004° 48.182' E	5088	
M188_7-10	2023/03/24 21:45	CTD	32° 12.784' S	004° 48.076' E	5077	
M188_7-11	2023/03/25 00:01	CTD	32° 12.895' S	004° 48.141' E	5076	
M188_8-1	2023/03/25 07:00	Glider	32° 23.021' S	004° 15.434' E	4882	
M188_8-2	2023/03/25 08:28	Glider	32° 23.154' S	004° 16.776' E	4900	
M188_9-1	2023/03/25 13:17	Drifter	32° 23.075' S	004° 16.227' E	4891	
M188_10-1	2023/03/25 17:42	CTD	32° 49.927' S	004° 40.233' E	4951	
M188_10-2	2023/03/25 21:27	CTD	32° 49.622' S	004° 41.678' E	4977	
M188_10-3	2023/03/25 23:00	CTD	32° 49.447' S	004° 41.671' E	4975	
M188_10-4	2023/03/26 02:58	CTD	32° 50.025' S	004° 40.215' E	4950	
M188_10-5	2023/03/26 04:36	CTD	32° 49.983' S	004° 40.532' E	4953	
M188_10-6	2023/03/26 08:11	MSS	32° 49.989' S	004° 40.319' E	4949	
M188_10-7	2023/03/26 10:06	CTD	32° 49.944' S	004° 40.262' E	4949	
M188_10-8	2023/03/26 13:46	CTD	32° 49.949' S	004° 40.289' E	4950	
M188_10-9	2023/03/26 16:57	MSS	32° 49.460' S	004° 40.553' E	4969	
M188_10-10	2023/03/26 17:19	MSS	32° 49.025' S	004° 40.617' E	4979	
M188_10-11	2023/03/26 17:42	MSS	32° 48.616' S	004° 40.588' E	4963	
M188_10-12	2023/03/26 18:48	CTD	32° 49.870' S	004° 40.221' E	4952	
M188_10-13	2023/03/26 22:27	CTD	32° 49.970' S	004° 40.275' E	4949	
M188_10-14	2023/03/27 00:03	CTD	32° 49.952' S	004° 40.195' E	4951	
M188_11-1	2023/03/27 07:32	CTD	33° 26.991' S	004° 32.396' E	5018	
M188_11-2	2023/03/27 11:10	MSS	33° 26.807' S	004° 32.285' E	5016	
M188_11-3	2023/03/27 11:32	MSS	33° 26.752' S	004° 32.092' E	5014	
M188_11-4	2023/03/27 11:55	MSS	33° 26.727' S	004° 31.840' E	5011	
M188_11-5	2023/03/27 12:12	MSS	33° 26.723' S	004° 31.618' E	5006	
M188_11-6	2023/03/27 13:08	CTD	33° 26.980' S	004° 32.421' E	5016	
M188_11-7	2023/03/27 16:53	CTD	33° 26.919' S	004° 32.539' E	5017	
M188_11-8	2023/03/27 18:30	CTD	33° 26.976' S	004° 32.437' E	5016	
M188_11-9	2023/03/27 22:33	CTD	33° 27.091' S	004° 32.300' E	5016	
M188_11-10	2023/03/28 00:10	CTD	33° 27.075' S	004° 32.316' E	5018	
M188_11-11	2023/03/28 04:10	CTD	33° 27.198' S	004° 32.588' E	5017	
M188_11-12	2023/03/28 05:46	CTD	33° 27.057' S	004° 32.455' E	5017	

M188_11-13	2023/03/28 10:21	MSS	33° 26.983' S	004° 32.407' E	5016	
M188_11-14	2023/03/28 10:36	MSS	33° 27.102' S	004° 32.108' E	5013	
M188_11-15	2023/03/28 10:52	MSS	33° 27.192' S	004° 31.852' E	5007	
M188_11-16	2023/03/28 11:42	CTD	33° 27.067' S	004° 32.349' E	5020	
M188_11-17	2023/03/28 15:44	CTD	33° 27.709' S	004° 32.201' E	5007	
M188_11-18	2023/03/28 17:13	CTD	33° 26.369' S	004° 32.470' E	5009	
M188_12-1	2023/03/29 00:50	CTD	34° 03.993' S	004° 24.443' E	5118	
M188_12-2	2023/03/29 05:02	CTD	34° 05.060' S	004° 24.491' E	5122	
M188_12-3	2023/03/29 07:55	CTD	34° 07.532' S	004° 23.607' E	5112	
M188_12-4	2023/03/29 12:20	CTD	34° 04.302' S	004° 24.401' E	5118	
M188_12-5	2023/03/29 14:52	CTD	34° 02.662' S	004° 24.651' E	5149	
M188_12-6	2023/03/29 19:27	CTD	34° 03.749' S	004° 24.617' E	5121	
M188_12-7	2023/03/29 23:18	CTD	34° 04.063' S	004° 24.429' E	5117	
M188_12-8	2023/03/30 00:51	CTD	34° 03.064' S	004° 23.727' E	5133	
M188_12-9	2023/03/30 04:14	CTD	34° 02.114' S	004° 24.327' E	5141	
M188_13-1	2023/03/30 11:26	UCTD	33° 24.310' S	004° 31.542' E	4987	Profile start
M188_13-1	2023/03/31 03:28	UCTD	32° 05.905' S	004° 06.776' E	4789	Profile end
M188_14-1	2023/03/31 06:04	Mooring	32° 10.680' S	004° 37.791' E		
M188_15-1	2023/03/31 17:14	CTD	32° 26.351' S	005° 51.060' E	5068	
M188_15-2	2023/03/31 21:19	IES	32° 26.586' S	005° 51.027' E		
M188_16-1	2023/04/01 05:09	CTD	31° 38.978' S	007° 24.557' E	5078	
M188_16-2	2023/04/01 07:22	IES	31° 38.390' S	007° 24.903' E		
M188_17-1	2023/04/01 15:02	IES	32° 41.814' S	007° 07.505' E		
M188_18-1	2023/04/01 17:51	CTD	32° 43.474' S	007° 12.658' E		
M188_18-2	2023/04/01 21:29	CTD	32° 44.144' S	007° 13.383' E	5034	
M188_18-3	2023/04/01 22:58	CTD	32° 43.635' S	007° 12.935' E	5010	
M188_18-4	2023/04/02 02:51	CTD	32° 43.401' S	007° 12.677' E	5003	
M188_18-5	2023/04/02 04:25	CTD	32° 43.334' S	007° 12.779' E	5010	
M188_18-6	2023/04/02 08:11	MSS	32° 43.851' S	007° 12.932' E	5009	
M188_18-7	2023/04/02 08:35	MSS	32° 44.003' S	007° 13.195' E	5026	
M188_18-8	2023/04/02 08:57	MSS	32° 44.238' S	007° 13.372' E	5030	
M188_18-9	2023/04/02 09:58	CTD	32° 43.463' S	007° 12.827' E	5000	
M188_18-10	2023/04/02 13:49	CTD	32° 43.503' S	007° 12.695' E	5006	
M188_18-11	2023/04/02 15:16	CTD	32° 43.436' S	007° 12.774' E	5004	
M188_18-12	2023/04/02 18:47	CTD	32° 43.657' S	007° 12.841' E	5004	
M188_18-13	2023/04/02 20:17	CTD	32° 43.694' S	007° 13.110' E	5035	
M188_18-14	2023/04/02 23:51	CTD	32° 43.500' S	007° 12.510' E	5003	
M188_18-15	2023/04/03 01:25	CTD	32° 43.552' S	007° 12.606' E	5000	
M188_19-1	2023/04/03 05:56	Mooring	32° 41.686' S	007° 08.075' E		
M188_20-1	2023/04/03 17:08	IES	32° 57.045' S	008° 21.461' E		
M188_21-1	2023/04/04 02:42	CTD	33° 45.076' S	006° 47.437' E	5297	
M188_21-2	2023/04/04 05:12	IES	33° 44.914' S	006° 47.368' E		
M188_22-1	2023/04/04 14:48	Drifter	32° 46.793' S	006° 13.233' E		
M188_23-1	2023/04/05 03:06	CTD	31° 49.910' S	003° 33.910' E	4724	
M188_23-2	2023/04/05 04:26	MSS	31° 49.541' S	003° 33.245' E	4712	
M188_23-3	2023/04/05 04:46	MSS	31° 49.711' S	003° 32.832' E	4728	
M188_23-4	2023/04/05 05:07	MSS	31° 49.819' S	003° 32.393' E	4744	
M188_23-5	2023/04/05 05:28	MSS	31° 49.912' S	003° 31.958' E	4761	
M188_23-6	2023/04/05 06:22	MSS	31° 50.113' S	003° 30.688' E	4818	
M188_23-7	2023/04/05 06:28	MSS	31° 50.140' S	003° 30.531' E	4827	
M188_23-8	2023/04/05 07:40	CTD	31° 49.948' S	003° 33.835' E	4716	
M188_23-9	2023/04/05 09:28	MSS	31° 49.664' S	003° 32.464' E	4742	
M188_23-10	2023/04/05 09:29	MSS	31° 49.665' S	003° 32.455' E	4741	
M188_23-11	2023/04/05 09:45	MSS	31° 49.693' S	003° 32.193' E	4750	
M188_23-12	2023/04/05 09:45	MSS	31° 49.694' S	003° 32.189' E	4753	
M188_23-13	2023/04/05 10:03	MSS	31° 49.723' S	003° 31.955' E	4766	
M188_23-14	2023/04/05 10:17	MSS	31° 49.756' S	003° 31.713' E	4774	
M188_23-15	2023/04/05 12:15	Glider	31° 42.975' S	003° 34.444' E	4737	

M188_23-16	2023/04/05 12:15	Glider	31° 38.203' S	003° 39.123' E	4866	
M188_23-17	2023/04/05 13:35	MSS	31° 38.172' S	003° 38.994' E	4884	
M188_23-18	2023/04/05 13:55	MSS	31° 38.258' S	003° 38.651' E	4903	
M188_23-19	2023/04/05 14:16	MSS	31° 38.338' S	003° 38.284' E	4915	
M188_23-20	2023/04/05 14:35	MSS	31° 38.457' S	003° 37.993' E	4922	
M188_23-21	2023/04/05 14:56	MSS	31° 38.588' S	003° 37.686' E	4931	
M188_23-22	2023/04/05 15:16	MSS	31° 38.662' S	003° 37.432' E	4932	
M188_23-23	2023/04/05 16:02	CTD	31° 38.702' S	003° 37.055' E	4926	
M188_23-24	2023/04/05 17:28	MSS	31° 38.344' S	003° 36.718' E	4934	
M188_23-25	2023/04/05 17:46	MSS	31° 38.392' S	003° 36.502' E	4931	
M188_23-26	2023/04/05 18:03	MSS	31° 38.456' S	003° 36.358' E	4921	
M188_23-27	2023/04/05 18:24	MSS	31° 38.572' S	003° 36.223' E	4904	
M188_23-28	2023/04/05 19:01	MSS	31° 38.790' S	003° 36.056' E	4879	
M188_23-29	2023/04/05 19:01	MSS	31° 38.792' S	003° 36.055' E	4892	
M188_23-30	2023/04/05 19:46	CTD	31° 38.964' S	003° 35.947' E	4862	
M188_23-31	2023/04/05 21:13	MSS	31° 39.146' S	003° 35.893' E	4857	
M188_23-32	2023/04/05 21:30	MSS	31° 39.183' S	003° 35.893' E	4856	
M188_23-33	2023/04/05 21:51	MSS	31° 39.134' S	003° 35.634' E	4823	
M188_23-34	2023/04/05 22:07	MSS	31° 39.140' S	003° 35.188' E	4817	
M188_23-35	2023/04/05 22:20	MSS	31° 39.174' S	003° 34.768' E	4805	
M188_23-36	2023/04/05 22:38	MSS	31° 39.213' S	003° 34.299' E	4779	
M188_23-37	2023/04/05 22:54	MSS	31° 39.256' S	003° 33.896' E	4799	
M188_24-1	2023/04/05 23:30	UCTD	31° 38.606' S	003° 33.453' E	4875	Profile start
M188_24-1	2023/04/07 07:04	UCTD	32° 31.464' S	006° 15.092' E	5083	Profile end
M188_25-1	2023/04/07 09:13	CTD	32° 26.324' S	005° 50.689' E	5119	Cast aborted
M188_26-1	2023/04/07 10:00	UCTD	32° 27.305' S	005° 50.034' E	5234	Profile start
M188_26-1	2023/04/07 16:55	UCTD	32° 59.083' S	005° 40.517' E	5241	Profile end
M188_27-1	2023/04/07 17:08	CTD	32° 59.083' S	005° 40.517' E	5241	Cast aborted
M188_27-2	2023/04/07 19:51	CTD	32° 59.482' S	005° 40.206' E	5254	
M188_27-3	2023/04/07 23:54	CTD	33° 00.192' S	005° 40.225' E	5257	
M188_27-4	2023/04/08 01:25	CTD	33° 00.248' S	005° 40.257' E	5256	
M188_27-5	2023/04/08 06:06	CTD	33° 00.607' S	005° 40.220' E	5255	
M188_27-6	2023/04/08 07:44	CTD	33° 00.917' S	005° 40.476' E	5249	
M188_27-7	2023/04/08 11:14	MSS	33° 01.831' S	005° 41.244' E	5225	
M188_27-8	2023/04/08 11:31	MSS	33° 02.136' S	005° 41.185' E	5224	
M188_27-9	2023/04/08 11:47	MSS	33° 02.386' S	005° 41.075' E	5223	
M188_27-10	2023/04/08 12:03	MSS	33° 02.643' S	005° 40.956' E	5219	
M188_27-11	2023/04/08 13:23	CTD	32° 58.990' S	005° 40.483' E	5240	
M188_27-12	2023/04/08 16:48	CTD	32° 59.111' S	005° 40.914' E	5238	
M188_27-13	2023/04/08 18:17	CTD	32° 59.245' S	005° 40.706' E	5242	
M188_28-1	2023/04/09 00:39	CTD	32° 26.292' S	005° 50.989' E	5080	
M188_28-2	2023/04/09 04:56	CTD	32° 26.574' S	005° 51.241' E	5064	
M188_28-3	2023/04/09 06:33	CTD	32° 26.750' S	005° 51.046' E	5101	
M188_28-4	2023/04/09 09:53	MSS	32° 27.526' S	005° 50.999' E	5119	
M188_28-5	2023/04/09 10:11	MSS	32° 27.866' S	005° 50.928' E	5127	
M188_28-6	2023/04/09 10:28	MSS	32° 28.111' S	005° 50.867' E	5133	
M188_28-7	2023/04/09 11:23	CTD	32° 26.299' S	005° 50.915' E	5083	
M188_28-8	2023/04/09 15:22	CTD	32° 26.477' S	005° 50.906' E	5099	
M188_28-9	2023/04/09 16:35	CTD	32° 26.440' S	005° 50.906' E	5107	
M188_28-10	2023/04/09 19:57	CTD	32° 26.479' S	005° 50.725' E	5120	
M188_28-11	2023/04/09 21:28	CTD	32° 26.538' S	005° 50.804' E	5115	
M188_28-12	2023/04/10 00:49	CTD	32° 26.517' S	005° 50.846' E	5111	
M188_28-13	2023/04/10 02:20	CTD	32° 26.421' S	005° 50.873' E	5095	
M188_28-14	2023/04/10 05:30	CTD	32° 26.439' S	005° 51.006' E	5079	