

PD Dr. Holger Auel
Universität Bremen (FB 02)
BreMarE - Bremen Marine Ecology
Postfach 330 440
D-28334 Bremen

Tel.: +49 421 218-63040
Fax: +49 421 218-63055
email: hael@uni-bremen.de

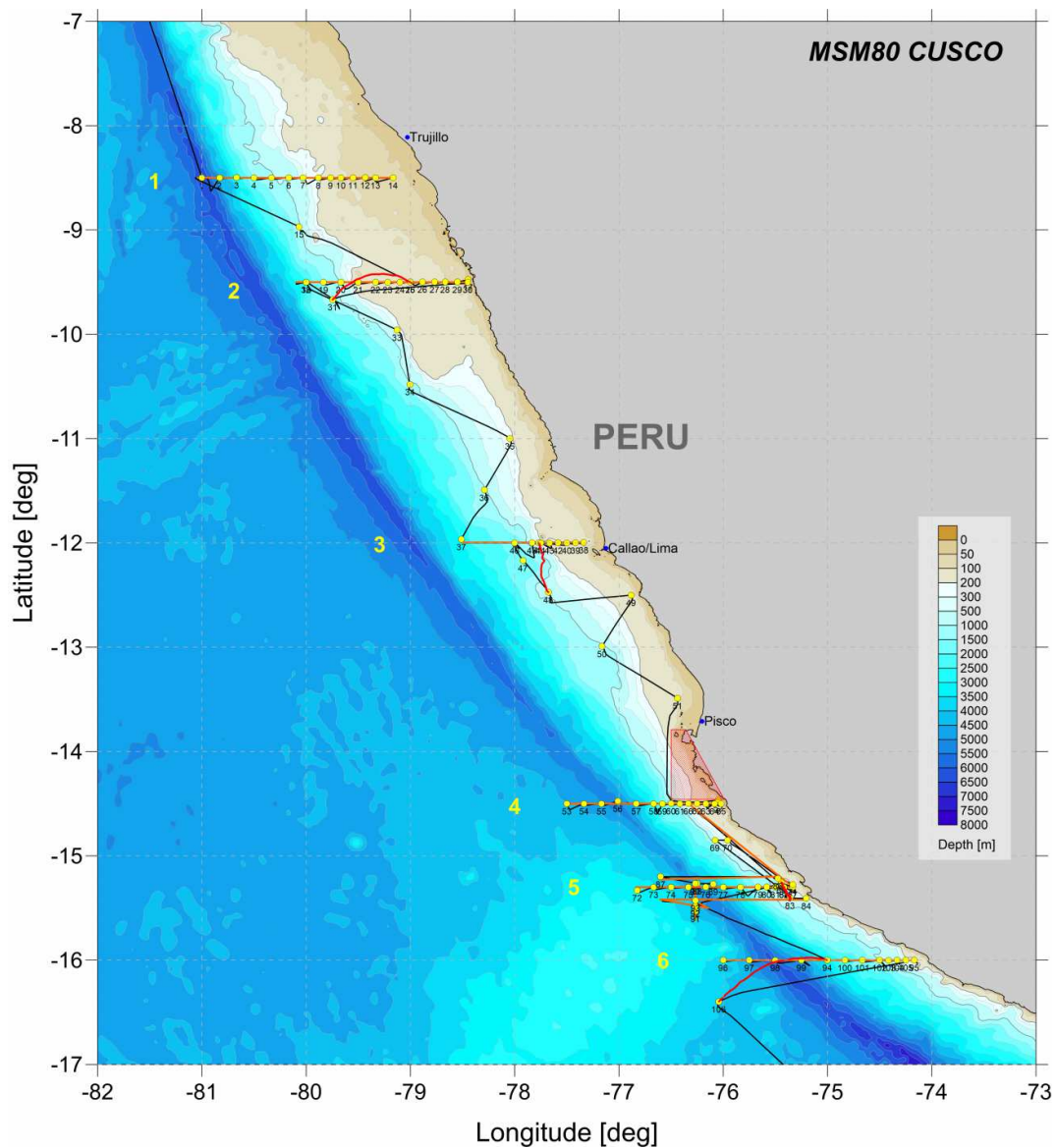
Short Cruise Report FS Maria S. Merian: MSM80

Bahia Las Minas (Panama) - Valparaiso (Chile)

20.12.2018 - 31.01.2019

Chief Scientist: Holger Auel

Captain: Björn Maaß



Objectives

In the framework of the BMBF-funded joint research project CUSCO - "Coastal Upwelling System in a Changing Ocean", during the cruise MSM80, productivity and trophic interactions were studied in the Humboldt Current Upwelling System off Peru in order to elucidate the reasons for the extremely high fisheries yield compared to other coastal upwelling regions and to answer the question how the system will respond to global climate change.

Eastern Boundary Upwelling Systems (EBUS) are among the most productive marine ecosystems, providing 7% of total marine primary production and 20% of global marine fish landings, but accounting for <2% of the ocean area. Although the four major EBUS have similar upwelling intensities and similar primary productivity per unit area, the Humboldt Upwelling System (HUS) provides eight to ten times higher fisheries yields per unit area than the other systems. To elucidate the reasons for this extremely high productivity at upper trophic levels and how the mechanisms will respond to global climate change is the overarching objective of the BMBF-funded joint research project CUSCO - "Coastal Upwelling System in a Changing Ocean - Trophic Transfer Efficiency of the Humboldt Current Upwelling System off Peru". The CUSCO research cruise MSM80 was its first fieldwork campaign. Biological and physical oceanographers cooperated with marine ecologists, biogeochemists, and fisheries scientists in order to trace carbon and energy fluxes through the marine food web and to study how different upwelling intensities affect overall trophic transfer efficiency (TTE).

Major aim of the cruise was to establish which processes and mechanisms determine TTE and, hence, affect food-web structure, community composition and trophic pathways, and to study potential regional differences within the Peruvian upwelling system related to differences in upwelling intensity and water mass distribution. Major trophic pathways were quantified by covering the following topics:

- (i) Phytoplankton composition and primary production under different upwelling regimes.
- (ii) Length of the food chain between primary producers and harvested species via trophic biomarkers (stable isotopes, fatty acids).
- (iii) Role of filter feeders (e.g. krill). Since filter feeders efficiently consume a wide range of prey sizes, they form less complex food webs with a higher overall TTE.
- (iv) Gelatinous zooplankton, since they are often "dead ends" of the food chain and predators and competitors for small pelagic fish.
- (v) Abundance, distribution and prey spectra of pelagic and mesopelagic fishes.
- (vi) Effects of physical-biological boundaries (meso-scale eddies, upwelling filaments, margins of the oxygen minimum zone) on zooplankton dynamics.

Narrative

On 20th December 2018, an interdisciplinary and international research team including 19 scientists with four different nationalities from three German universities and two marine research institutions boarded R/V Maria S. Merian in Bahia Las Minas, Panama, for the start of the MSM80 expedition. Two days later, two scientists from the Peruvian fisheries research institute IMARPE joined the cruise.

During the first few days on board, we unpacked our expedition equipment from the freight containers, assembled measuring devices and plankton nets, and established ourselves in the labs. We benefited from the fact that the ship was still moored in port on the first day and after that anchored on roads off the Caribbean coast of Panama with very calm conditions.

In the late afternoon of 23.12.2018 we entered the locks on the Caribbean side of the Panama Canal. The passage through the canal took eight hours, until we finally reached the Pacific Ocean at midnight. On the evening of Christmas Day we crossed the equator.

On 27.12.2018 at 2 p.m. we reached our study area in the coastal upwelling system of the Humboldt Current off Peru and started with station work at 8°30'S 081°00'W. Standard stations always began with CTD/rosette casts for physical measurements of water temperature, salinity, oxygen concentration, light intensity and turbulence in relation to water depth. We also collected water samples from different depths in order to study inorganic nutrients, suspended matter, particulate organic carbon, nitrogen and phosphorus (POC, PON, POP), biogenic silica (BSi) as well as phytoplankton abundance and composition (using flow cytometry, microscopy, HPLC pigment analysis). Water samples were incubated on board for determination of primary production and nitrogen fixation.

After that, we deployed different kinds of nets to catch zooplankton. This included a stratified vertical haul with a HydroBios Multinet Midi in order to catch mesozooplankton, two successive double-oblique tows with another HydroBios Multinet Midi in order to catch fish larvae and gelatinous zooplankton and the deployment of an Isaacs Kidd Midwater Trawl (IKMT, 10 m² mouth opening) for larger macrozooplankton and micronekton. At the deepest offshore stations, a 1 m² Double-MOCNESS was deployed with 18 separate nets to provide high vertical resolution. Specimens of zooplankton key species were used for respiration measurements on board to establish their individual energy demands (Winkler titration, optode respirometry). For the quantitative determination of dietary spectra, specimens were sorted from the catches and deep-frozen at -80°C for trophic biomarker analysis (fatty acids and stable isotopes). Predator-prey relationships and food-web structure of the pelagic ecosystem were studied by stable isotope ratios of nitrogen and carbon ($\delta^{15}\text{N}$, $\delta^{13}\text{C}$). This approach provides information on the dietary source and trophic levels in order to trace energy flows through the pelagic food web and to establish trophic transfer efficiencies for major predator-prey interactions.

During the following days, we sampled a total of 14 stations, along a section at 8°30'S towards the Peruvian coast. In between standard stations, the physical oceanographers often added short stations with microstructure profiles only in order to increase the spatial resolution of the hydrographic measurements. The final station on this transect was completed at 65 m water depth in sighting distance to the coast. Thereafter, we deployed the ScanFish, a towed undulating CTD, and returned along the entire section at 8°30'S back to the first station and completed our first transect after about 2.5 days in the study area.

A second section perpendicular to the Peruvian coast was sampled at 9°30'S. This time, we first deployed the ScanFish and steamed along the transect in order to assess the water mass distribution and upwelling activity. Thereafter, we sampled a total of 13 stations along the transect with CTD/rosette, optical profilers, microstructure profiler and different plankton nets. In spite of the relatively short distance between the first section at 8°30'S and the second at 9°30'S, the high temporal and spatial variability was responsible for strong differences in water mass structure. Surprisingly, phytoplankton concentration was rather low close to the coast, where stronger phytoplankton growth was to be expected during periods of active upwelling. On this section, we also deployed a surface drifter for the first time during this cruise. This device is drifting with the surface currents, independent from the vessel, and provides hydrographic data on changes in the upper 50 m of the water column in high temporal resolution. After three days, the drifter was

recovered successfully on 03.01.2019. Thereafter, we headed south and steamed to a series of stations alternating between 200 m water depth on the shelf and 1.000 m bottom depth above the continental rise in order to identify large-scale differences in the upwelling pattern along the Peruvian coastline.

In the evening of 05.01.2019 we reached 12°S, where we sampled along a third transect perpendicular to the coast, since this is also one of the regular monitoring lines of our Peruvian partners from the national fisheries research institute IMARPE. At 07:20 p.m. we deployed the ScanFish again and towed it for 12 hours along the transect from a position at 2.800 m bottom depth to close to the coast in front of the Peruvian capital Lima and its port Callao. Station work along the 12°S section also included a full-day 24 h-station at 12°S 78°W in order to study diel vertical migrations (DVM) by zooplankton (mainly krill) and mesopelagic fish.

On 07 January, immediately before the 24 hours-station, five out of seven of our regular sampling gears showed malfunctions, all at the same station. Thanks to the efforts of the technicians on board, in particular, the members of the scientific-technical service (WTD), all technical problems could be solved within a few hours and gears were repaired in time for the 24 h-station. The 24 h-station Stn. 46 was located over the continental rise at 1.600 m water depth. Four times during the day, we deployed the CTD and a multiple opening/closing net, both at daylight and during darkness. In addition, we developed a special sampling scheme for the hours of sunset and sunrise. Exactly half an hour before sunset, the krill species *Euphausia mucronata* began to migrate from its daytime distribution at 300 m depth to the sea surface, where it spent the night. The interdisciplinary co-operation of biologists, biogeochemists and physical oceanographers on board allowed us to gather a comprehensive data set to study DVM of krill in the Humboldt Current and its effects on the carbon flux to the deep sea.

Between 11.01. and 14.01.2019 we sampled along the fourth section at 14°30'S with a similar sampling strategy. During the fifth week of the expedition, we focussed on small- to meso-scale processes and differences in water mass distribution and upwelling intensity. For that purpose, we deployed the ScanFish along three sections, which were separated by only a few miles in geographic latitude at 15°12'S, 15°18'S and 15°25'S and extended from the coast far into the open ocean. The spatial analysis of the data revealed certain areas with colder, less saline or warmer, saltier water, respectively. There were also differences in biological parameters. Almost 70 miles off the coast, we found a spot with a typical coastal zooplankton community, dominated by small copepod species. At another location, also far away from the coast, we encountered an intense algal bloom of dinoflagellates and small diatoms, which one would usually expect closer to shore in a coastal upwelling region, but not 65 miles offshore above 5.000 m water depth. The section at 15°18'S also included another 24 h-station over the continental rise, Stn. 80 on 17. to 18.01.2019.

On 21st January 2019, we completed the sampling campaign for small- to mesoscale processes and gradients in water mass distribution and upwelling intensity. During the remaining days in the study area from 22. till 26.01.2019, sampling concentrated on the southernmost section at 16°S. Routine sampling included steaming to a position about one third of the total section length away from the coast to deploy the drifter as the first procedure in order to allow the drifter the maximum time in the water and the longest measurement period. Thereafter, we moved to the easternmost station, closest to the coast, and deployed the ScanFish. With the ScanFish in tow, we steamed about 120 nm westwards along the entire section from the station closest to the coast to the one most distant from the coastline. Along that track, water depth increased from 120 m to more than 5.000 m. On our way back to the coast, we took water samples in regular intervals, conducted hydrographic measurements and sampled zooplankton with different nets. The entire scientific programme for this section required about three days. At the end, we still had to recover the drifter.

During its four deployments, the drifter always headed in a different direction. At the last deployment, it moved westwards relatively fast with almost one nautical mile per hour. Therefore, we had to steam again for ca. 100 nm at the end of the cruise to pick up the drifter. We completed the final station work of the expedition MSM80 at the drifter's position on 26.01.2019 at 02:00 a.m.

On 30th January 2019, we reached Valparaiso in Chile, from where most of the cruise participants flew back to Germany. The research cruise MSM80 was very successful. We sampled 106 stations, far more than originally planned.

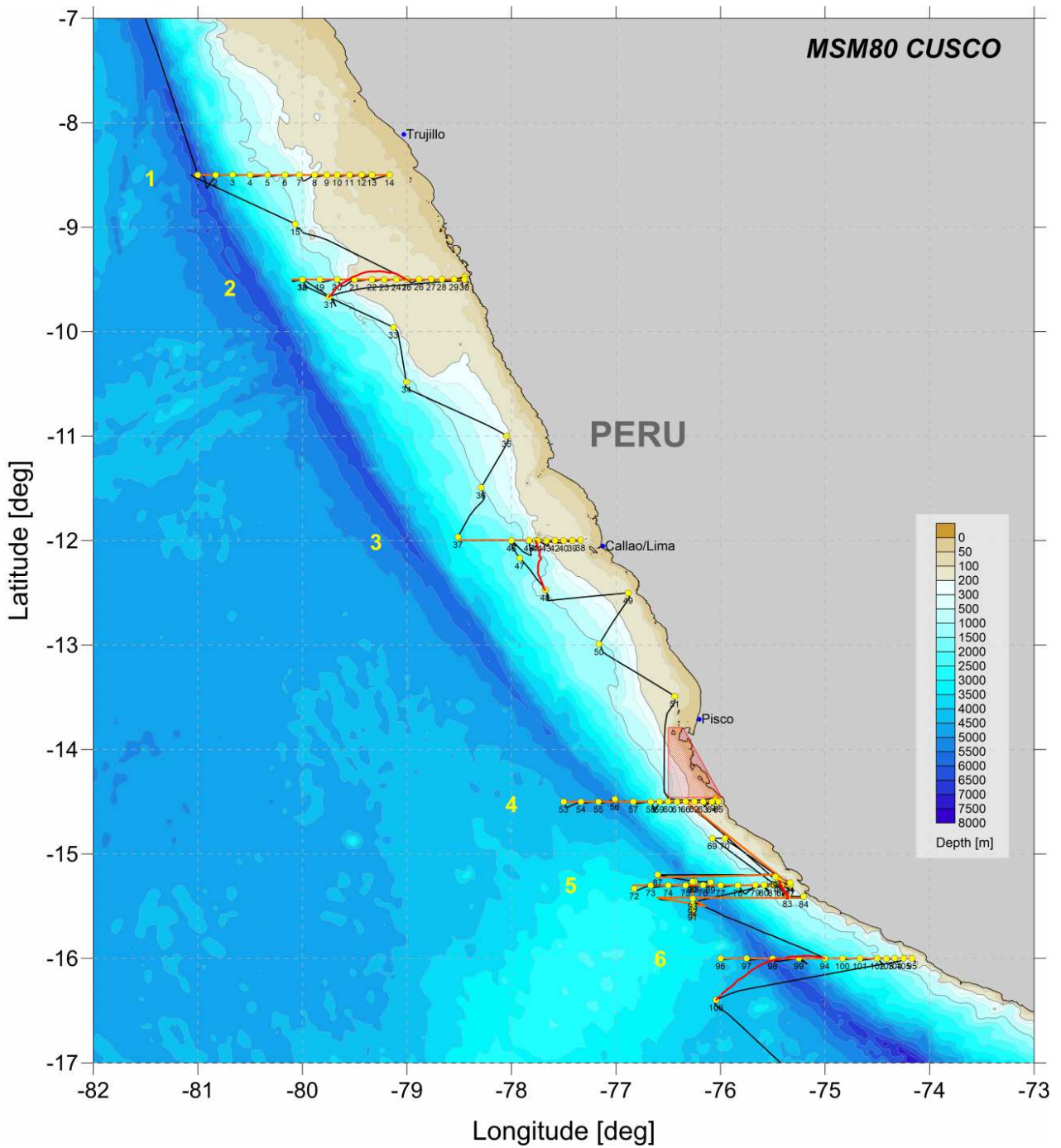


Fig. 1: Station map and cruise track of MSM80 from 20th Dec. 2018 to 31th Jan. 2019. Yellow dots and black labels indicate the positions and names of CTD/MSS stations. The orange lines depict the ScanFish transects. The red lines indicate the deployments and pathways of the drifting surface mooring. The thin black line is the ship track (provided by IOW team).

Acknowledgements

We are very grateful to Capitain Björn Maaß and the entire crew of R/V Maria S. Merian for their excellent, very professional, creative and extremely friendly support during the research cruise MSM80. Their tireless efforts were essential for the scientific success of the expedition. Scientists' participation and cruise logistics, including i.a. container transports, shipment of frozen samples and the participation of Peruvian colleagues from the partner institution IMARPE, were funded by the German Federal Ministry for Education and Research (BMBF) in the framework of the joint research project CUSCO - Coastal Upwelling System in a Changing Ocean as part of the MARE:N programme for coastal, marine and polar research and the FONA³ strategy for research for sustainability (03F0813C).

List of Participants

No.	Name	Discipline	Institute
1	AUEL, Holger	Fahrtleiter / <i>Chief Scientist</i>	UniHB-BreMarE
2	HAGEN, Wilhelm	Zooplankton ecophysiology	UniHB-BreMarE
3	SCHUKAT, Anna	Zooplankton ecology / Multinet	UniHB-BreMarE
4	MASSING, Jana	Food web analysis / Multinet	UniHB-BreMarE
5	AUCH, Dominik	Gelatinous zooplankton	UniHH-IMF
6	JANSSEN, Silke	MOCNESS, IKMT, Multinet oblique	UniHH-IMF
7	KURBJUWEIT, Stefanie	Ichthyoplankton	UniHH-IMF
8	MARTIN, Bettina	MOCNESS, IKMT, Multinet oblique	UniHH-IMF
9	WELKER, Annelie	Ichthyoplankton	UniHH-IMF
10	HEENE, Toralf	CTD, ACS, MSS, SCF, Drifter	IOW
11	BEIER, Sebastian	CTD, ACS, MSS, SCF, Drifter	IOW
12	MOHRHOLZ, Volker	Physical Oceanography	IOW
13	FERNÁNDEZ MÉNDEZ, Maria del Mar	Phytoplankton	GEOMAR
14	KIKO, Rainer	UVP	Uni Kiel
15	KITTU, Leila	Nitrogen fixation	GEOMAR
16	MEYERHÖFER, Michael	Phytoplankton	GEOMAR
17	ORTIZ, Joaquin	Biogeochemistry	GEOMAR
18	PAUL, Allanah Joy	Nitrogen fixation	GEOMAR
19	QELAJ, Kastriot	Biogeochemistry	GEOMAR
20	PINEDO ARTEAGA, Elda Luz	Zooplankton	IMARPE, Peru
21	CORREA ACOSTA, Jonathan Angello	Ichthyoplankton	IMARPE, Peru

Institutes

UniHB - BreMarE

Universität Bremen (FB 02)
Bremen Marine Ecology
Leobener Str. NW2
28359 Bremen / Deutschland
www.uni-bremen.de

GEOMAR

Helmholtz-Zentrum für Ozeanforschung Kiel
Wischhofstr. 1-3
24148 Kiel / Deutschland
www.geomar.de

UniHH - IMF

Universität Hamburg
Institut für marine Ökosystem- und Fischereiwissenschaften
Große Elbstraße 133
22767 Hamburg / Deutschland
www.biologie.uni-hamburg.de/einrichtungen/imf.html

Uni Kiel

Christian-Albrechts-Universität zu Kiel
Christian-Albrechts-Platz 4
24118 Kiel / Deutschland
www.uni-kiel.de

IOW

Leibniz-Institut für Ostseeforschung Warnemünde
Seestraße 15
18119 Rostock / Deutschland
www.io-warnemuende.de

IMARPE

Instituto del Mar del Peru
Esquina Gamarra and General Valle S / N
Chucuito Callao / Peru
www.imarpe.gob.pe

Station List

CTD: Sensor for conductivity, temperature and depth in combination with rosette water sampler and UVP underwater vision profiler; ACS: Optical profiler AC-S; MSS: Microstructure profiler; MSN: Hydro-Bios MultiNet Midi multiple opening and closing net; NET-IKMT: Isaacs Kidd Midwater Trawl; MOCNESS: double 1 m² Multiple Opening/Closing Net & Environmental Sensing System; SCF: ScanFish towed undulating CTD; DRIFT: Surface drifter

Station No.	Date Time [UTC]	Gear	Latitude [°S]	Longitude [°W]	Water Depth [m]	Remarks
MSM80_1-1	27.12.2018 19:19	CTD	08° 29.975' S	080° 59.999' W	6233.3	
MSM80_1-2	27.12.2018 20:06	ACS	08° 29.972' S	080° 59.990' W	6242.8	
MSM80_1-3	27.12.2018 20:50	MSS	08° 30.176' S	080° 59.859' W	6231.1	
MSM80_1-4	27.12.2018 22:13	ACS	08° 30.681' S	080° 59.704' W	6255.6	
MSM80_1-5	27.12.2018 22:42	MSN	08° 30.650' S	080° 59.609' W	6270.5	
MSM80_1-6	27.12.2018 23:39	MSN	08° 30.471' S	080° 59.266' W	6303.2	
MSM80_1-7	28.12.2018 00:43	MSN	08° 30.189' S	080° 58.526' W	6296.9	
MSM80_1-8	28.12.2018 01:17	MSN	08° 30.116' S	080° 57.827' W	6092.4	
MSM80_1-9	28.12.2018 02:38	NET-IKMT	08° 31.429' S	080° 56.341' W	5820.2	
MSM80_1-10	28.12.2018 05:28	MOCNESS	08° 35.337' S	080° 55.310' W	6077.0	
MSM80_2-1	28.12.2018 07:49	MSS	08° 29.965' S	080° 49.901' W	4327.6	
MSM80_3-1	28.12.2018 10:04	MSS	08° 29.883' S	080° 40.013' W	2770.9	
MSM80_4-1	28.12.2018 12:47	CTD	08° 29.989' S	080° 29.999' W	1326.0	
MSM80_4-2	28.12.2018 13:32	ACS	08° 29.989' S	080° 29.999' W	1325.6	
MSM80_4-3	28.12.2018 13:43	MSS	08° 30.016' S	080° 29.979' W	1329.8	
MSM80_4-4	28.12.2018 14:10	MSS	08° 30.358' S	080° 29.774' W	1330.0	
MSM80_4-5	28.12.2018 14:34	MSS	08° 30.739' S	080° 29.687' W	1328.8	
MSM80_4-6	28.12.2018 15:41	MSN	08° 31.038' S	080° 29.504' W	1342.3	
MSM80_4-7	28.12.2018 16:40	MSN	08° 31.179' S	080° 28.888' W	1304.3	
MSM80_5-1	28.12.2018 17:55	MSS	08° 29.989' S	080° 20.008' W	1138.5	
MSM80_6-1	28.12.2018 20:06	MSS	08° 30.003' S	080° 09.999' W	776.2	
MSM80_7-1	28.12.2018 22:15	CTD	08° 29.948' S	080° 01.863' W	357.1	
MSM80_7-2	28.12.2018 22:47	ACS	08° 29.947' S	080° 01.862' W	356.8	
MSM80_7-3	28.12.2018 22:57	MSS	08° 29.966' S	080° 01.860' W	357.7	
MSM80_7-4	28.12.2018 23:13	MSN	08° 29.984' S	080° 01.853' W	357.6	
MSM80_7-5	28.12.2018 23:55	MSN	08° 30.185' S	080° 01.553' W	347.0	
MSM80_7-6	29.12.2018 00:30	MSN	08° 30.627' S	080° 00.819' W	321.2	
MSM80_7-7	29.12.2018 00:46	MSS	08° 30.765' S	080° 00.567' W	312.4	
MSM80_7-8	29.12.2018 02:29	NET-IKMT	08° 33.077' S	079° 59.905' W	317.2	
MSM80_8-1	29.12.2018 03:53	MSS	08° 30.072' S	079° 52.973' W	202.8	
MSM80_9-1	29.12.2018 05:35	MSS	08° 30.011' S	079° 46.019' W	143.4	
MSM80_10-1	29.12.2018 07:20	CTD	08° 29.993' S	079° 40.034' W	102.2	
MSM80_10-2	29.12.2018 07:47	ACS	08° 29.992' S	079° 40.033' W	101.1	
MSM80_10-3	29.12.2018 07:58	MSS	08° 30.005' S	079° 40.009' W	100.4	
MSM80_10-4	29.12.2018 09:14	MSN	08° 30.530' S	079° 39.755' W	100.3	
MSM80_10-5	29.12.2018 09:32	MSN	08° 30.712' S	079° 39.536' W	98.8	
MSM80_10-6	29.12.2018 10:06	MSN	08° 31.051' S	079° 39.089' W	99.3	
MSM80_11-1	29.12.2018 10:58	MSS	08° 29.961' S	079° 33.044' W	89.8	
MSM80_12-1	29.12.2018 12:47	MSS	08° 29.875' S	079° 26.055' W	85.5	
MSM80_13-1	29.12.2018 14:51	CTD	08° 30.002' S	079° 20.106' W	77.0	
MSM80_13-2	29.12.2018 15:11	ACS	08° 30.002' S	079° 20.105' W	77.2	
MSM80_13-3	29.12.2018 15:18	MSS	08° 30.023' S	079° 20.117' W	76.9	
MSM80_13-4	29.12.2018 16:28	MSN	08° 32.191' S	079° 20.283' W	79.0	
MSM80_13-5	29.12.2018 16:44	MSN	08° 32.214' S	079° 20.202' W	80.8	
MSM80_13-6	29.12.2018 17:00	MSN	08° 31.878' S	079° 20.106' W	78.9	

MSM80_13-7	29.12.2018 17:30	NET-IKMT	08° 32.134' S	079° 19.922' W	79.1	
MSM80_14-1	29.12.2018 18:54	CTD	08° 29.980' S	079° 10.021' W	66.6	
MSM80_14-2	29.12.2018 19:14	ACS	08° 29.981' S	079° 10.021' W	65.3	
MSM80_14-3	29.12.2018 19:21	MSS	08° 29.989' S	079° 10.019' W	64.9	
MSM80_14-4	29.12.2018 20:29	MSN	08° 30.583' S	079° 09.818' W	63.9	
MSM80_14-5	29.12.2018 20:47	MSN	08° 30.642' S	079° 09.617' W		
MSM80_14-6	29.12.2018 21:12	MSN	08° 30.710' S	079° 09.316' W	64.2	
MSM80_14-7	29.12.2018 22:33	SCF	08° 30.030' S	079° 10.066' W	65.0	Start of Profile
MSM80_14-7	30.12.2018 17:03	SCF	08° 29.952' S	081° 02.517' W	5972.2	End of Profile
MSM80_15-1	30.12.2018 23:46	CTD	08° 58.148' S	080° 04.053' W	1030.8	
MSM80_15-2	31.12.2018 00:14	ACS	08° 58.147' S	080° 04.052' W	1030.7	
MSM80_15-3	31.12.2018 00:54	CTD	08° 58.148' S	080° 04.053' W	1030.9	
MSM80_15-4	31.12.2018 01:32	MSS	08° 58.218' S	080° 04.026' W	1027.5	
MSM80_15-5	31.12.2018 03:36	MSN	09° 00.397' S	080° 03.270' W	1016.3	
MSM80_15-6	31.12.2018 04:30	MSN	09° 00.489' S	080° 02.966' W	977.8	
MSM80_15-7	31.12.2018 05:00	MSN	09° 00.451' S	080° 02.197' W		
MSM80_15-8	31.12.2018 06:12	NET-IKMT	09° 01.750' S	080° 00.768' W	799.2	
MSM80_16-1	31.12.2018 13:34	CTD	09° 29.968' S	079° 00.062' W	136.3	
MSM80_16-2	31.12.2018 14:03	ACS	09° 29.967' S	079° 00.062' W	136.0	
MSM80_16-3	31.12.2018 14:14	MSS	09° 30.052' S	079° 00.023' W	135.9	
MSM80_16-4	31.12.2018 15:33	MSN	09° 30.898' S	078° 59.460' W	135.5	
MSM80_16-5	31.12.2018 16:11	DRIFT	09° 30.454' S	078° 59.295' W	134.9	Deployment
MSM80_16-5	03.01.2019 17:34	DRIFT	09° 40.048' S	079° 44.784' W	1199.6	Recovery
MSM80_17-1	31.12.2018 19:38	SCF	09° 30.029' S	078° 27.404' W	82.1	Start of Profile
MSM80_17-1	01.01.2019 11:50	SCF	09° 29.999' S	080° 05.839' W	2994.8	End of Profile
MSM80_18-1	01.01.2019 13:30	CTD	09° 29.990' S	080° 00.018' W	2424.1	
MSM80_18-2	01.01.2019 14:15	ACS	09° 29.991' S	080° 00.018' W	2424.7	
MSM80_18-3	01.01.2019 14:27	MSS	09° 30.043' S	080° 00.020' W	2409.3	
MSM80_18-4	01.01.2019 15:58	MSN	09° 30.808' S	080° 00.022' W	2406.4	
MSM80_18-5	01.01.2019 17:12	MSN	09° 30.808' S	080° 00.022' W	2407.0	
MSM80_18-6	01.01.2019 18:11	MSN	09° 30.884' S	079° 59.703' W	2575.3	
MSM80_18-7	01.01.2019 19:44	NET-IKMT	09° 33.329' S	079° 58.444' W	2209.8	
MSM80_19-1	01.01.2019 23:16	MSS	09° 30.024' S	079° 50.068' W	1454.2	
MSM80_20-1	02.01.2019 02:04	CTD	09° 29.993' S	079° 40.097' W	891.6	
MSM80_20-2	02.01.2019 02:48	ACS	09° 29.993' S	079° 40.096' W	892.1	
MSM80_20-3	02.01.2019 02:57	MSS	09° 30.042' S	079° 40.076' W	889.4	
MSM80_20-4	02.01.2019 04:45	MSN	09° 31.490' S	079° 39.741' W	835.2	
MSM80_20-5	02.01.2019 05:29	MSN	09° 31.555' S	079° 39.549' W	2781.7	
MSM80_20-6	02.01.2019 06:00	MSN	09° 31.770' S	079° 38.934' W	2338.0	
MSM80_20-7	02.01.2019 07:08	NET-IKMT	09° 33.144' S	079° 37.879' W	611.4	
MSM80_21-1	02.01.2019 09:01	MSS	09° 30.031' S	079° 30.065' W	302.5	
MSM80_22-1	02.01.2019 11:14	CTD	09° 29.993' S	079° 20.036' W	151.8	
MSM80_22-2	02.01.2019 11:43	ACS	09° 29.994' S	079° 20.034' W	152.3	
MSM80_22-3	02.01.2019 11:53	MSS	09° 30.025' S	079° 20.014' W	151.7	
MSM80_22-4	02.01.2019 13:07	MSN	09° 31.066' S	079° 19.264' W	151.9	
MSM80_22-5	02.01.2019 13:29	MSN	09° 31.097' S	079° 19.083' W	155.1	
MSM80_23-1	02.01.2019 14:33	MSS	09° 30.042' S	079° 13.069' W	153.9	
MSM80_24-1	02.01.2019 16:27	MSS	09° 30.031' S	079° 06.023' W	141.1	
MSM80_25-1	02.01.2019 18:24	CTD	09° 29.968' S	079° 00.069' W	137.5	
MSM80_25-2	02.01.2019 18:50	ACS	09° 29.968' S	079° 00.070' W	136.9	
MSM80_25-3	02.01.2019 18:58	MSS	09° 29.984' S	079° 00.066' W	137.8	
MSM80_25-4	02.01.2019 20:13	MSN	09° 30.674' S	078° 59.449' W	134.2	
MSM80_25-5	02.01.2019 20:38	MSN	09° 30.899' S	078° 59.150' W	135.3	
MSM80_25-6	02.01.2019 21:09	MSN	09° 31.207' S	078° 58.513' W	135.9	
MSM80_25-7	02.01.2019 21:47	NET-IKMT	09° 31.877' S	078° 57.964' W	137.8	
MSM80_26-1	02.01.2019 22:45	MSS	09° 29.853' S	078° 53.094' W	131.3	
MSM80_27-1	03.01.2019 00:25	MSS	09° 29.898' S	078° 46.067' W	130.7	

MSM80_28-1	03.01.2019 02:21	CTD	09° 29.952' S	078° 40.025' W	108.0	
MSM80_28-2	03.01.2019 02:48	ACS	09° 29.951' S	078° 40.024' W	106.8	
MSM80_28-3	03.01.2019 02:57	MSS	09° 29.990' S	078° 40.003' W	106.6	
MSM80_28-4	03.01.2019 04:24	MSN	09° 30.757' S	078° 39.652' W	109.8	
MSM80_28-5	03.01.2019 04:44	MSN	09° 30.772' S	078° 39.503' W	108.9	
MSM80_29-1	03.01.2019 05:43	MSS	09° 29.968' S	078° 33.032' W	96.3	
MSM80_30-1	03.01.2019 07:46	CTD	09° 29.984' S	078° 27.001' W	80.1	deployed as Jo-Jo
MSM80_30-2	03.01.2019 08:16	ACS	09° 29.984' S	078° 27.001' W	77.7	
MSM80_30-3	03.01.2019 08:27	MSS	09° 30.014' S	078° 26.966' W	79.8	
MSM80_30-4	03.01.2019 09:39	MSN	09° 30.481' S	078° 26.750' W	80.4	
MSM80_30-5	03.01.2019 09:58	MSN	09° 30.573' S	078° 26.549' W	78.4	
MSM80_30-6	03.01.2019 10:24	MSN	09° 30.747' S	078° 26.326' W	76.3	
MSM80_31-1	03.01.2019 18:12	CTD	09° 40.065' S	079° 44.780' W	1199.8	
MSM80_31-2	03.01.2019 19:00	ACS	09° 40.064' S	079° 44.778' W	1200.4	
MSM80_31-3	03.01.2019 19:09	MSS	09° 40.092' S	079° 44.758' W	1200.2	
MSM80_31-4	03.01.2019 20:58	MSN	09° 40.308' S	079° 44.060' W	1177.7	
MSM80_31-5	03.01.2019 21:47	MSN	09° 40.422' S	079° 43.886' W	1174.8	
MSM80_31-6	03.01.2019 22:14	MSN	09° 40.644' S	079° 43.590' W	1181.9	
MSM80_31-7	03.01.2019 23:59	NET-IKMT	09° 43.345' S	079° 42.076' W	1264.0	
MSM80_32-1	04.01.2019 04:09	CTD	09° 30.002' S	080° 00.035' W	2411.3	
MSM80_32-2	04.01.2019 05:56	MOCNESS	09° 32.088' S	079° 59.025' W	2301.1	
MSM80_33-1	04.01.2019 12:25	CTD	09° 57.561' S	079° 07.768' W	235.7	
MSM80_33-2	04.01.2019 12:50	ACS	09° 57.560' S	079° 07.767' W	236.0	
MSM80_33-3	04.01.2019 13:04	MSS	09° 57.644' S	079° 07.722' W	236.9	
MSM80_33-4	04.01.2019 14:19	MSN	09° 58.516' S	079° 07.257' W	239.6	
MSM80_33-5	04.01.2019 14:42	MSN	09° 58.653' S	079° 06.977' W	231.5	
MSM80_33-6	04.01.2019 15:07	MSN	09° 58.866' S	079° 06.447' W	221.7	
MSM80_33-7	04.01.2019 15:49	NET-IKMT	09° 59.591' S	079° 05.607' W	206.4	
MSM80_34-1	04.01.2019 19:20	CTD	10° 28.837' S	079° 00.188' W	998.6	
MSM80_34-2	04.01.2019 19:55	ACS	10° 28.856' S	079° 00.088' W	1001.7	
MSM80_34-3	04.01.2019 20:06	MSS	10° 28.923' S	079° 00.085' W	1010.2	
MSM80_34-4	04.01.2019 22:04	MSN	10° 29.688' S	079° 00.682' W	1098.1	
MSM80_34-5	04.01.2019 22:55	MSN	10° 29.383' S	079° 00.508' W	1061.0	
MSM80_34-6	04.01.2019 23:24	MSN	10° 28.725' S	079° 00.129' W	996.8	
MSM80_34-7	05.01.2019 00:44	NET-IKMT	10° 29.951' S	079° 00.350' W	1097.3	
MSM80_35-1	05.01.2019 07:46	CTD	11° 00.002' S	078° 02.732' W	208.6	
MSM80_35-2	05.01.2019 08:04	ACS	11° 00.001' S	078° 02.731' W	209.5	
MSM80_35-3	05.01.2019 08:14	MSS	11° 00.048' S	078° 02.722' W	212.2	
MSM80_35-4	05.01.2019 09:29	MSN	11° 00.871' S	078° 02.668' W	213.0	
MSM80_35-5	05.01.2019 09:53	MSN	11° 01.066' S	078° 02.526' W	216.1	
MSM80_35-6	05.01.2019 10:24	MSN	11° 01.605' S	078° 02.122' W	210.2	
MSM80_35-7	05.01.2019 11:00	NET-IKMT	11° 02.299' S	078° 01.871' W	209.7	
MSM80_36-1	05.01.2019 14:25	CTD	11° 29.611' S	078° 17.454' W	1023.0	
MSM80_36-2	05.01.2019 15:04	ACS	11° 29.616' S	078° 17.454' W	1024.6	
MSM80_36-3	05.01.2019 15:23	MSS	11° 29.740' S	078° 17.425' W	1041.4	
MSM80_36-4	05.01.2019 17:09	MSN	11° 30.630' S	078° 17.121' W	1060.3	
MSM80_36-5	05.01.2019 17:59	MSN	11° 30.909' S	078° 16.988' W	1118.8	
MSM80_36-6	05.01.2019 18:29	MSN	11° 31.630' S	078° 16.639' W	1090.5	
MSM80_36-7	05.01.2019 20:08	NET-IKMT	11° 34.365' S	078° 16.058' W	1160.4	
MSM80_37-1	06.01.2019 00:21	SCF	11° 59.754' S	078° 30.086' W	2842.7	Start of Profile
MSM80_37-1	06.01.2019 11:55	SCF	11° 59.696' S	077° 20.096' W	107.9	End of Profile
MSM80_38-1	06.01.2019 13:16	CTD	11° 59.780' S	077° 20.267' W	104.9	
MSM80_38-2	06.01.2019 13:07	NET-Apstein	11° 59.780' S	077° 20.266' W	105.9	
MSM80_38-3	06.01.2019 13:40	ACS	11° 59.780' S	077° 20.267' W	105.7	
MSM80_38-4	06.01.2019 13:50	MSS	11° 59.797' S	077° 20.263' W	108.2	
MSM80_38-5	06.01.2019 15:14	MSN	11° 59.656' S	077° 20.783' W	109.4	
MSM80_38-6	06.01.2019 15:35	MSN	11° 59.936' S	077° 20.660' W	107.6	

MSM80_38-7	06.01.2019 16:02	MSN	12° 00.485' S	077° 20.463' W	106.6	
MSM80_39-1	06.01.2019 16:57	MSS	11° 59.964' S	077° 25.070' W	120.4	
MSM80_40-1	06.01.2019 18:54	CTD	12° 00.006' S	077° 29.996' W	138.5	
MSM80_40-2	06.01.2019 18:46	NET-Apstein	12° 00.006' S	077° 29.994' W	139.8	
MSM80_40-3	06.01.2019 19:17	ACS	12° 00.006' S	077° 29.995' W	138.1	
MSM80_40-4	06.01.2019 19:25	MSS	12° 00.025' S	077° 29.989' W	138.6	
MSM80_40-5	06.01.2019 20:38	MSN	12° 00.824' S	077° 29.958' W	139.6	
MSM80_40-6	06.01.2019 21:01	MSN	12° 01.179' S	077° 29.765' W	141.2	
MSM80_41-1	06.01.2019 22:55	DRIFT	11° 59.907' S	077° 46.254' W	245.0	Deployment
MSM80_41-1	09.01.2019 11:00	DRIFT	12° 28.432' S	077° 40.615' W	811.3	Recovery
MSM80_41-2	06.01.2019 23:16	CTD	11° 59.823' S	077° 46.171' W	239.4	
MSM80_41-3	06.01.2019 23:49	ACS	11° 59.824' S	077° 46.169' W	239.6	
MSM80_42-1	07.01.2019 01:03	MSS	11° 59.969' S	077° 35.040' W	156.6	
MSM80_43-1	07.01.2019 03:01	CTD	11° 59.990' S	077° 39.976' W	179.2	
MSM80_43-2	07.01.2019 02:52	NET-Apstein	11° 59.991' S	077° 39.976' W	176.8	
MSM80_43-3	07.01.2019 03:24	ACS	11° 59.987' S	077° 39.971' W	179.0	
MSM80_43-4	07.01.2019 03:36	MSS	12° 00.009' S	077° 39.943' W	180.2	
MSM80_43-5	07.01.2019 04:47	MSN	12° 01.103' S	077° 39.385' W	176.6	
MSM80_43-6	07.01.2019 05:10	MSN	12° 01.408' S	077° 39.277' W	179.3	
MSM80_43-7	07.01.2019 05:40	MSN	12° 02.006' S	077° 38.938' W	179.2	
MSM80_43-8	07.01.2019 06:28	NET-IKMT	12° 02.904' S	077° 38.864' W	180.1	
MSM80_44-1	07.01.2019 07:37	MSS	12° 00.023' S	077° 44.994' W	171.6	
MSM80_45-1	07.01.2019 09:31	CTD	11° 59.968' S	077° 50.016' W	464.0	
MSM80_45-2	07.01.2019 09:27	NET-Apstein	11° 59.969' S	077° 50.015' W	467.0	
MSM80_45-3	07.01.2019 10:00	ACS	11° 59.969' S	077° 50.016' W	469.6	
MSM80_45-4	07.01.2019 10:09	MSS	11° 59.983' S	077° 50.010' W	461.1	
MSM80_45-5	07.01.2019 11:10	MSN	12° 00.588' S	077° 49.693' W	588.2	
MSM80_45-6	07.01.2019 11:48	MSN	12° 00.850' S	077° 49.632' W	644.8	
MSM80_45-7	07.01.2019 12:17	MSN	12° 01.503' S	077° 49.510' W	662.2	
MSM80_45-8	07.01.2019 12:34	MSS	12° 01.842' S	077° 49.465' W	749.3	
MSM80_45-9	07.01.2019 15:02	NET-IKMT	12° 05.898' S	077° 49.102' W	1137.4	
MSM80_45-10	07.01.2019 16:35	ACS	12° 08.579' S	077° 48.649' W	1390.3	
MSM80_45-11	07.01.2019 16:28	NET-Apstein	12° 08.578' S	077° 48.649' W	1394.6	
MSM80_46-1	07.01.2019 18:35	CTD	11° 59.988' S	078° 00.000' W	1607.3	
MSM80_46-2	07.01.2019 19:10	ACS	11° 59.988' S	078° 00.000' W	1607.3	
MSM80_46-3	07.01.2019 19:18	MSS	12° 00.029' S	078° 00.004' W	1614.3	
MSM80_46-4	07.01.2019 22:44	MOCNESS	12° 00.300' S	077° 59.906' W	1625.6	
MSM80_46-5	08.01.2019 01:35	CTD	11° 59.952' S	077° 59.989' W	1606.0	
MSM80_46-6	08.01.2019 02:26	MSN	11° 59.951' S	077° 59.990' W	1607.7	
MSM80_46-7	08.01.2019 02:50	MSS	12° 00.016' S	077° 59.973' W	1607.4	
MSM80_46-8	08.01.2019 04:01	MOCNESS	12° 01.373' S	077° 59.895' W	1762.1	
MSM80_46-9	08.01.2019 04:54	MSN	12° 02.654' S	077° 59.457' W	1747.4	
MSM80_46-10	08.01.2019 07:28	CTD	11° 59.985' S	078° 00.022' W	1612.0	
MSM80_46-11	08.01.2019 08:15	MSN	11° 59.998' S	078° 00.019' W	1612.0	
MSM80_46-12	08.01.2019 08:51	ACS	11° 59.998' S	078° 00.019' W	1611.9	
MSM80_46-13	08.01.2019 09:43	CTD	11° 59.998' S	078° 00.019' W	1612.0	deployed as Jo-Jo
MSM80_46-14	08.01.2019 14:03	CTD	12° 00.001' S	078° 00.029' W	1613.0	
MSM80_46-15	08.01.2019 14:45	MSN	12° 00.002' S	078° 00.029' W	1610.9	
MSM80_46-16	08.01.2019 16:02	MSN	12° 01.022' S	077° 59.202' W	1692.6	
MSM80_46-17	08.01.2019 17:17	MSN	12° 02.632' S	077° 57.923' W	1580.6	
MSM80_46-18	08.01.2019 18:41	ACS	12° 00.001' S	078° 00.044' W	1617.1	
MSM80_46-19	08.01.2019 19:15	CTD	12° 00.001' S	078° 00.045' W	1617.1	
MSM80_46-20	08.01.2019 20:24	MSN	12° 00.000' S	078° 00.043' W	1617.4	
MSM80_46-21	08.01.2019 22:12	MOCNESS	12° 02.330' S	077° 59.879' W	1755.9	
MSM80_46-22	09.01.2019 00:08	CTD	12° 00.005' S	078° 00.032' W	1618.4	
MSM80_46-23	09.01.2019 00:41	ACS	12° 00.004' S	078° 00.031' W	1616.2	
MSM80_46-24	09.01.2019 00:45	MSS	12° 00.018' S	078° 00.033' W	1617.3	

MSM80_46-25	09.01.2019 02:25	MSN	12° 02.097' S	078° 00.452' W	1800.8	
MSM80_47-1	09.01.2019 04:48	MSN	12° 10.147' S	077° 55.230' W	1885.3	
MSM80_48-1	09.01.2019 11:33	CTD	12° 28.435' S	077° 40.577' W	810.9	
MSM80_48-2	09.01.2019 12:11	ACS	12° 28.437' S	077° 40.435' W	811.6	
MSM80_48-3	09.01.2019 12:19	MSS	12° 28.448' S	077° 40.413' W	812.4	
MSM80_48-4	09.01.2019 14:07	MSN	12° 29.811' S	077° 40.065' W	829.4	
MSM80_48-5	09.01.2019 14:45	MSN	12° 29.986' S	077° 39.868' W	834.2	
MSM80_48-6	09.01.2019 15:11	MSN	12° 30.395' S	077° 39.481' W	850.2	
MSM80_48-7	09.01.2019 16:37	NET-IKMT	12° 32.990' S	077° 39.256' W	926.5	
MSM80_49-1	09.01.2019 22:04	CTD	12° 30.031' S	076° 52.988' W	104.2	
MSM80_49-2	09.01.2019 22:27	ACS	12° 30.030' S	076° 52.986' W	105.3	
MSM80_49-3	09.01.2019 22:35	MSS	12° 30.050' S	076° 52.979' W	105.7	
MSM80_49-4	09.01.2019 23:40	MSN	12° 30.999' S	076° 52.801' W	108.3	
MSM80_49-5	10.01.2019 00:08	MSN	12° 31.372' S	076° 52.524' W	108.6	
MSM80_49-6	10.01.2019 00:42	NET-IKMT	12° 31.973' S	076° 52.271' W	112.4	
MSM80_50-1	10.01.2019 04:23	CTD	12° 59.542' S	077° 09.740' W	1021.1	
MSM80_50-2	10.01.2019 05:04	ACS	12° 59.543' S	077° 09.741' W	1024.8	
MSM80_50-3	10.01.2019 05:13	MSS	12° 59.561' S	077° 09.733' W	1022.1	
MSM80_50-4	10.01.2019 06:59	MSN	13° 00.291' S	077° 09.331' W	1010.3	
MSM80_50-5	10.01.2019 07:49	MSN	13° 00.521' S	077° 09.132' W	1031.8	
MSM80_50-6	10.01.2019 08:24	MSN	13° 00.909' S	077° 08.709' W	1065.6	
MSM80_50-7	10.01.2019 09:50	NET-IKMT	13° 02.593' S	077° 08.074' W	1121.2	
MSM80_51-1	10.01.2019 15:28	CTD	13° 29.365' S	076° 26.263' W	101.9	
MSM80_51-2	10.01.2019 15:53	ACS	13° 29.365' S	076° 26.262' W	102.8	
MSM80_51-3	10.01.2019 16:16	CTD	13° 29.366' S	076° 26.262' W	102.1	
MSM80_51-4	10.01.2019 16:35	MSS	13° 29.450' S	076° 26.300' W	102.6	
MSM80_51-5	10.01.2019 17:41	MSN	13° 30.856' S	076° 26.348' W	103.4	
MSM80_51-6	10.01.2019 18:06	MSN	13° 31.284' S	076° 26.276' W	104.5	
MSM80_51-7	10.01.2019 18:35	MSN	13° 31.911' S	076° 26.137' W	101.7	
MSM80_51-8	10.01.2019 19:10	NET-IKMT	13° 32.677' S	076° 26.281' W	104.3	
MSM80_52-1	11.01.2019 03:04	SCF	14° 29.986' S	076° 01.894' W	105.6	Start of Profile
MSM80_52-1	11.01.2019 17:31	SCF	14° 30.002' S	077° 30.545' W	4549.2	End of Profile
MSM80_53-1	11.01.2019 19:10	CTD	14° 29.987' S	077° 30.026' W	4563.6	
MSM80_53-2	11.01.2019 20:08	ACS	14° 29.985' S	077° 30.024' W	4561.7	
MSM80_53-3	11.01.2019 20:15	MSS	14° 29.996' S	077° 30.019' W	4556.4	
MSM80_53-4	11.01.2019 22:37	MSN	14° 30.820' S	077° 29.901' W	4538.4	
MSM80_53-5	11.01.2019 23:57	MSN	14° 30.935' S	077° 29.778' W	4565.0	
MSM80_53-6	12.01.2019 01:12	NET-IKMT	14° 32.275' S	077° 29.019' W	4447.7	
MSM80_54-1	12.01.2019 03:14	MSS	14° 29.974' S	077° 20.092' W	4669.0	
MSM80_55-1	12.01.2019 05:35	MSS	14° 30.019' S	077° 10.020' W	5027.9	
MSM80_56-1	12.01.2019 07:50	MSS	14° 28.510' S	077° 00.661' W	4990.5	
MSM80_56-2	12.01.2019 09:31	CTD	14° 29.772' S	077° 00.127' W	4942.7	deployed as Jo-Jo
MSM80_56-3	12.01.2019 12:48	ACS	14° 29.773' S	077° 00.127' W	5989.3	
MSM80_56-4	12.01.2019 13:35	CTD	14° 29.773' S	077° 00.127' W	0.0	
MSM80_56-5	12.01.2019 14:50	MSN	14° 29.773' S	077° 00.126' W	4960.1	
MSM80_56-6	12.01.2019 15:42	MSN	14° 29.989' S	076° 59.940' W	4946.3	
MSM80_57-1	12.01.2019 16:57	MSS	14° 29.999' S	076° 50.063' W	4071.5	
MSM80_58-1	12.01.2019 19:32	CTD	14° 29.977' S	076° 40.032' W	2651.1	
MSM80_58-2	12.01.2019 20:16	ACS	14° 29.977' S	076° 40.031' W	2650.6	
MSM80_58-3	12.01.2019 20:26	MSS	14° 30.001' S	076° 40.022' W	2639.7	
MSM80_58-4	12.01.2019 22:10	MSN	14° 30.821' S	076° 39.812' W	2599.3	
MSM80_58-5	12.01.2019 22:59	MSN	14° 31.046' S	076° 39.654' W	2608.7	
MSM80_58-6	12.01.2019 23:31	MSN	14° 31.629' S	076° 39.240' W	3896.1	
MSM80_58-7	13.01.2019 01:05	NET-IKMT	14° 34.024' S	076° 38.539' W	2609.3	
MSM80_59-1	13.01.2019 03:07	MSS	14° 30.009' S	076° 35.041' W	1764.0	
MSM80_60-1	13.01.2019 05:19	CTD	14° 29.927' S	076° 30.038' W	1418.5	
MSM80_60-2	13.01.2019 06:02	ACS	14° 29.927' S	076° 30.039' W	1423.4	

MSM80_60-3	13.01.2019 06:09	MSS	14° 29.943' S	076° 30.029' W	1419.2	
MSM80_60-4	13.01.2019 07:55	MSN	14° 30.957' S	076° 29.617' W	1522.8	
MSM80_61-1	13.01.2019 09:09	MSS	14° 29.984' S	076° 24.992' W	467.5	
MSM80_62-1	13.01.2019 11:13	MSS	14° 29.871' S	076° 15.078' W	145.7	
MSM80_63-1	13.01.2019 13:06	CTD	14° 29.971' S	076° 10.019' W	131.2	
MSM80_63-2	13.01.2019 13:21	ACS	14° 29.972' S	076° 10.019' W	132.1	
MSM80_63-3	13.01.2019 13:43	MSS	14° 30.026' S	076° 10.034' W	129.9	
MSM80_63-4	13.01.2019 14:58	MSN	14° 31.369' S	076° 09.933' W	126.9	
MSM80_63-5	13.01.2019 15:14	MSN	14° 31.465' S	076° 09.870' W	126.5	
MSM80_63-6	13.01.2019 15:33	MSN	14° 31.766' S	076° 09.669' W	129.7	
MSM80_63-7	13.01.2019 16:01	NET-IKMT	14° 32.378' S	076° 09.435' W	129.3	
MSM80_64-1	13.01.2019 16:54	MSS	14° 29.985' S	076° 04.994' W	124.6	
MSM80_65-1	13.01.2019 18:38	CTD	14° 29.976' S	076° 01.119' W	96.2	
MSM80_65-2	13.01.2019 18:36	NET-Apstein	14° 29.976' S	076° 01.119' W	94.3	
MSM80_65-3	13.01.2019 19:00	ACS	14° 29.976' S	076° 01.119' W	98.8	
MSM80_65-4	13.01.2019 19:08	MSS	14° 29.994' S	076° 01.113' W	97.2	
MSM80_65-5	13.01.2019 20:19	MSN	14° 30.786' S	076° 00.887' W	97.6	
MSM80_65-6	13.01.2019 20:37	MSN	14° 30.991' S	076° 00.717' W	92.7	
MSM80_66-1	13.01.2019 22:48	CTD	14° 29.958' S	076° 20.022' W	222.4	
MSM80_66-2	13.01.2019 23:19	ACS	14° 29.957' S	076° 20.022' W	228.5	
MSM80_66-3	13.01.2019 23:26	MSS	14° 29.973' S	076° 20.015' W	223.4	
MSM80_66-4	14.01.2019 00:41	MSN	14° 31.025' S	076° 19.586' W	206.3	
MSM80_66-5	14.01.2019 01:04	MSN	14° 31.231' S	076° 19.429' W	201.6	
MSM80_66-6	14.01.2019 02:01	SCF	14° 30.283' S	076° 19.663' W	218.3	Start of Profile
MSM80_66-6	14.01.2019 14:36	SCF	15° 18.099' S	075° 19.700' W	123.2	End of Profile
MSM80_67-1	14.01.2019 15:41	CTD	15° 17.918' S	075° 20.015' W	133.2	
MSM80_67-2	14.01.2019 16:09	ACS	15° 17.918' S	075° 20.015' W	132.6	
MSM80_67-3	14.01.2019 16:21	MSS	15° 17.948' S	075° 19.987' W	130.8	
MSM80_67-4	14.01.2019 17:39	MSN	15° 19.123' S	075° 19.613' W	134.2	
MSM80_67-5	14.01.2019 18:01	MSN	15° 19.449' S	075° 19.408' W	136.4	
MSM80_67-6	14.01.2019 18:28	MSN	15° 19.949' S	075° 18.990' W	135.9	
MSM80_67-7	14.01.2019 19:09	NET-IKMT	15° 20.820' S	075° 18.631' W	138.1	
MSM80_68-1	14.01.2019 20:38	DRIFT	15° 17.953' S	075° 25.030' W	526.7	Deployment
MSM80_68-1	20.01.2019 03:54	DRIFT	15° 15.219' S	075° 26.519' W	233.9	Recovery
MSM80_68-2	14.01.2019 21:16	CTD	15° 17.808' S	075° 25.068' W	515.3	
MSM80_68-3	14.01.2019 21:53	ACS	15° 17.808' S	075° 25.067' W	517.3	
MSM80_68-4	14.01.2019 22:10	MSS	15° 18.276' S	075° 24.796' W	535.7	
MSM80_68-5	14.01.2019 23:46	MSN	15° 19.462' S	075° 23.999' W	478.5	
MSM80_68-6	15.01.2019 00:40	NET-IKMT	15° 20.293' S	075° 23.827' W	444.9	
MSM80_68-7	15.01.2019 01:24	MSN	15° 21.193' S	075° 23.554' W	417.2	
MSM80_68-8	15.01.2019 01:47	MSN	15° 21.588' S	075° 23.374' W	400.8	
MSM80_69-1	15.01.2019 06:40	CTD	14° 51.008' S	076° 04.706' W	412.2	
MSM80_69-2	15.01.2019 07:05	ACS	14° 51.008' S	076° 04.705' W	414.7	
MSM80_69-3	15.01.2019 10:25	MSS	14° 51.007' S	076° 01.087' W	276.6	
MSM80_70-1	15.01.2019 13:00	CTD	14° 51.027' S	075° 57.508' W	202.5	
MSM80_70-2	15.01.2019 13:27	ACS	14° 51.027' S	075° 57.508' W	200.4	
MSM80_70-3	15.01.2019 13:42	MSN	14° 51.028' S	075° 57.508' W	201.4	
MSM80_70-4	15.01.2019 14:07	MSN	14° 51.159' S	075° 57.269' W	199.1	
MSM80_70-5	15.01.2019 14:45	MSN	14° 51.503' S	075° 56.782' W	194.5	
MSM80_70-6	15.01.2019 15:34	NET-IKMT	14° 52.326' S	075° 56.057' W	198.2	
MSM80_71-1	15.01.2019 20:42	SCF	15° 18.015' S	075° 20.012' W	133.0	Start of Profile
MSM80_71-1	16.01.2019 11:14	SCF	15° 17.997' S	076° 50.086' W	3381.9	End of Profile
MSM80_72-1	16.01.2019 11:46	MSS	15° 19.813' S	076° 49.481' W	3197.7	
MSM80_73-1	16.01.2019 14:14	MSS	15° 17.979' S	076° 40.031' W	3507.3	
MSM80_74-1	16.01.2019 17:11	CTD	15° 18.017' S	076° 30.039' W	3837.5	
MSM80_74-2	16.01.2019 17:59	ACS	15° 18.017' S	076° 30.039' W	3830.2	
MSM80_74-3	16.01.2019 18:07	MSS	15° 18.026' S	076° 30.029' W	3840.0	

MSM80_74-4	16.01.2019 19:58	MSN	15° 18.747' S	076° 29.612' W	3802.5	
MSM80_75-1	16.01.2019 21:39	MSS	15° 17.998' S	076° 20.015' W	5060.8	
MSM80_76-1	16.01.2019 23:44	MSS	15° 17.922' S	076° 10.060' W	4124.1	
MSM80_77-1	17.01.2019 01:46	MSS	15° 18.068' S	075° 59.987' W	3260.9	
MSM80_78-1	17.01.2019 04:14	CTD	15° 17.984' S	075° 50.045' W	2301.1	
MSM80_78-2	17.01.2019 04:59	ACS	15° 17.987' S	075° 50.046' W	2297.1	
MSM80_78-3	17.01.2019 05:07	MSS	15° 18.000' S	075° 50.038' W	2297.6	
MSM80_78-4	17.01.2019 07:03	MSN	15° 19.107' S	075° 49.481' W	2324.3	
MSM80_78-5	17.01.2019 07:54	MSN	15° 19.246' S	075° 49.181' W	3898.8	
MSM80_78-6	17.01.2019 09:30	MOCNESS	15° 21.355' S	075° 47.378' W	2347.8	
MSM80_79-1	17.01.2019 11:33	MSS	15° 17.900' S	075° 39.998' W	1404.2	
MSM80_80-1	17.01.2019 13:45	CTD	15° 17.966' S	075° 35.013' W	1168.9	
MSM80_80-2	17.01.2019 14:19	ACS	15° 17.966' S	075° 35.013' W	1170.2	
MSM80_80-3	17.01.2019 15:32	MOCNESS	15° 19.219' S	075° 34.151' W	1148.7	
MSM80_80-4	17.01.2019 16:59	MSS	15° 17.811' S	075° 35.048' W	1165.5	
MSM80_80-5	17.01.2019 19:22	CTD	15° 17.990' S	075° 34.996' W	1171.0	
MSM80_80-6	17.01.2019 20:23	MSN	15° 17.983' S	075° 34.985' W	1165.8	
MSM80_80-7	17.01.2019 20:56	MSS	15° 17.988' S	075° 34.971' W	1171.7	
MSM80_80-8	17.01.2019 22:35	MOCNESS	15° 18.969' S	075° 34.450' W	1165.5	
MSM80_80-9	18.01.2019 01:54	CTD	15° 18.462' S	075° 35.086' W	1185.6	
MSM80_80-10	18.01.2019 02:43	MSN	15° 18.435' S	075° 35.040' W	1185.2	
MSM80_80-11	18.01.2019 04:53	MOCNESS	15° 19.709' S	075° 34.364' W	1201.4	
MSM80_80-12	18.01.2019 07:19	CTD	15° 17.977' S	075° 35.014' W	1173.4	
MSM80_80-13	18.01.2019 08:16	MSN	15° 17.968' S	075° 35.003' W	1168.8	
MSM80_80-14	18.01.2019 09:25	CTD	15° 17.982' S	075° 35.005' W	1167.2	deployed as Jo-Jo
MSM80_80-15	18.01.2019 12:46	ACS	15° 17.692' S	075° 34.646' W	1139.3	
MSM80_80-16	18.01.2019 13:26	CTD	15° 17.651' S	075° 34.596' W	1134.4	
MSM80_80-17	18.01.2019 14:21	MSN	15° 17.628' S	075° 34.567' W	1131.4	
MSM80_80-18	18.01.2019 15:10	CTD	15° 17.627' S	075° 34.562' W	1131.1	
MSM80_80-19	18.01.2019 15:32	ACS	15° 17.627' S	075° 34.561' W	1134.9	
MSM80_80-20	18.01.2019 15:42	MSS	15° 17.643' S	075° 34.550' W	1131.2	
MSM80_81-1	18.01.2019 17:55	MSS	15° 17.984' S	075° 29.990' W		
MSM80_82-1	18.01.2019 20:06	CTD	15° 17.974' S	075° 25.006' W	547.0	
MSM80_82-2	18.01.2019 20:36	ACS	15° 17.975' S	075° 25.007' W	532.8	
MSM80_83-1	18.01.2019 21:55	CTD	15° 24.239' S	075° 21.555' W	156.1	
MSM80_83-2	18.01.2019 22:24	ACS	15° 24.239' S	075° 21.555' W	161.5	
MSM80_83-3	18.01.2019 22:42	MSN	15° 24.238' S	075° 21.555' W	156.2	
MSM80_83-4	18.01.2019 22:55	MSS	15° 24.223' S	075° 21.569' W	155.6	
MSM80_83-5	19.01.2019 00:15	MSN	15° 22.266' S	075° 22.724' W	282.2	
MSM80_83-6	19.01.2019 00:44	MSN	15° 22.129' S	075° 22.666' W	274.6	
MSM80_83-7	19.01.2019 02:01	NET-IKMT	15° 23.899' S	075° 23.563' W	467.0	
MSM80_84-1	19.01.2019 04:18	SCF	15° 25.284' S	075° 12.449' W	129.8	Start of Profile
MSM80_84-1	19.01.2019 23:30	SCF	15° 27.581' S	076° 13.242' W	4905.5	End of Profile
MSM80_85-1	20.01.2019 04:17	CTD	15° 15.223' S	075° 26.524' W	234.1	
MSM80_85-2	20.01.2019 04:44	ACS	15° 15.215' S	075° 26.517' W	233.6	
MSM80_85-3	20.01.2019 04:52	MSS	15° 15.238' S	075° 26.514' W	236.2	
MSM80_86-1	20.01.2019 06:59	SCF	15° 12.001' S	075° 30.072' W	142.7	Start of Profile
MSM80_86-1	20.01.2019 17:40	SCF	15° 11.997' S	076° 36.060' W	3915.9	End of Profile
MSM80_87-1	20.01.2019 18:58	CTD	15° 11.983' S	076° 36.005' W	3925.2	
MSM80_87-2	20.01.2019 19:32	ACS	15° 11.983' S	076° 36.004' W	4166.5	
MSM80_88-1	20.01.2019 21:59	CTD	15° 15.942' S	076° 15.013' W	4262.4	
MSM80_88-2	20.01.2019 22:34	ACS	15° 15.942' S	076° 15.013' W	4259.4	
MSM80_89-1	21.01.2019 00:05	CTD	15° 16.249' S	076° 05.716' W	4001.7	
MSM80_89-2	21.01.2019 01:01	ACS	15° 16.254' S	076° 05.996' W	3991.5	
MSM80_89-3	21.01.2019 01:33	MSS	15° 17.120' S	076° 05.800' W	4165.1	
MSM80_89-4	21.01.2019 03:03	MSN	15° 15.986' S	076° 06.006' W	3988.6	
MSM80_89-5	21.01.2019 03:39	MOCNESS	15° 15.997' S	076° 06.468' W	3975.0	

MSM80_90-1	21.01.2019 08:44	CTD	15° 15.990' S	076° 16.091' W	4290.6	
MSM80_90-2	21.01.2019 09:36	ACS	15° 15.990' S	076° 16.091' W	4312.3	
MSM80_90-3	21.01.2019 09:45	MSS	15° 15.997' S	076° 16.087' W	4307.6	
MSM80_90-4	21.01.2019 10:52	MSN	15° 17.026' S	076° 15.596' W	4490.3	
MSM80_90-5	21.01.2019 11:31	SCF	15° 15.995' S	076° 15.973' W	4292.5	Start of Profile
MSM80_90-5	21.01.2019 14:48	SCF	15° 35.385' S	076° 15.979' W	3992.9	End of Profile
MSM80_91-1	21.01.2019 16:19	CTD	15° 31.830' S	076° 16.035' W	4035.6	
MSM80_91-2	21.01.2019 17:05	ACS	15° 31.830' S	076° 16.035' W	4022.5	
MSM80_91-3	21.01.2019 17:12	MSS	15° 31.847' S	076° 16.017' W	4024.9	
MSM80_92-1	21.01.2019 19:21	CTD	15° 28.798' S	076° 16.023' W	4393.6	
MSM80_92-2	21.01.2019 19:58	ACS	15° 28.799' S	076° 16.023' W	4406.8	
MSM80_92-3	21.01.2019 20:08	MSS	15° 28.846' S	076° 15.969' W	4392.7	
MSM80_93-1	21.01.2019 22:02	CTD	15° 25.709' S	076° 15.966' W	4651.8	
MSM80_93-2	21.01.2019 22:45	ACS	15° 25.709' S	076° 15.966' W	4614.4	
MSM80_93-3	21.01.2019 22:53	MSS	15° 25.726' S	076° 15.957' W	4617.1	
MSM80_94-1	22.01.2019 07:37	ACS	15° 59.990' S	075° 00.050' W	2815.0	
MSM80_94-2	22.01.2019 07:45	MSS	16° 00.003' S	075° 00.033' W	2820.1	
MSM80_94-3	22.01.2019 09:20	CTD	16° 00.347' S	074° 59.759' W	2876.0	deployed as Jo-Jo
MSM80_94-4	22.01.2019 12:34	DRIFT	16° 00.007' S	075° 00.133' W	2862.1	Deployment
MSM80_94-4	25.01.2019 22:43	DRIFT	16° 23.870' S	076° 02.553' W	3712.8	Recovery
MSM80_94-5	22.01.2019 13:18	MSN	15° 59.986' S	075° 00.122' W	2849.5	
MSM80_94-6	22.01.2019 14:24	CTD	15° 59.987' S	075° 00.121' W	2850.0	
MSM80_95-1	22.01.2019 19:37	CTD	16° 00.001' S	074° 09.998' W	122.9	
MSM80_95-2	22.01.2019 19:59	ACS	16° 00.001' S	074° 09.999' W	115.4	
MSM80_95-3	22.01.2019 20:07	MSS	16° 00.029' S	074° 09.979' W	114.7	
MSM80_95-4	22.01.2019 21:18	MSN	16° 00.808' S	074° 09.551' W	124.5	
MSM80_95-5	22.01.2019 21:38	MSN	16° 00.941' S	074° 09.311' W	128.1	
MSM80_95-6	22.01.2019 22:03	MSN	16° 01.156' S	074° 08.924' W	130.6	
MSM80_95-7	22.01.2019 22:39	NET-IKMT	16° 01.673' S	074° 08.451' W	130.9	
MSM80_95-8	22.01.2019 23:48	SCF	16° 00.025' S	074° 10.099' W	118.0	Start of Profile
MSM80_95-8	23.01.2019 17:20	SCF	16° 00.006' S	076° 00.006' W	3727.6	End of Profile
MSM80_96-1	23.01.2019 18:32	CTD	15° 59.983' S	076° 00.015' W	3725.9	
MSM80_96-2	23.01.2019 19:10	ACS	15° 59.983' S	076° 00.015' W	3734.9	
MSM80_96-3	23.01.2019 19:20	MSS	16° 00.004' S	076° 00.007' W	3730.9	
MSM80_96-4	23.01.2019 21:11	MSN	16° 00.813' S	075° 59.410' W	3766.1	
MSM80_97-1	23.01.2019 23:09	MSS	16° 00.030' S	075° 45.005' W	4877.6	
MSM80_98-1	24.01.2019 01:37	MSS	16° 00.072' S	075° 30.038' W	5587.0	
MSM80_99-1	24.01.2019 04:50	CTD	15° 59.996' S	075° 15.039' W	4509.6	
MSM80_99-2	24.01.2019 05:33	ACS	15° 59.993' S	075° 15.038' W	4499.2	
MSM80_99-3	24.01.2019 05:42	MSS	16° 00.017' S	075° 15.020' W	4509.3	
MSM80_99-4	24.01.2019 08:06	MOCNESS	16° 02.067' S	075° 12.419' W	4533.7	
MSM80_99-5	24.01.2019 09:34	MSN	16° 03.119' S	075° 10.372' W	5952.5	
MSM80_99-6	24.01.2019 11:09	MSN	15° 59.995' S	075° 15.028' W	4507.3	
MSM80_100-1	24.01.2019 14:04	MSS	16° 00.020' S	074° 50.042' W	2298.6	
MSM80_101-1	24.01.2019 16:10	MSS	16° 00.019' S	074° 40.004' W	1796.3	
MSM80_102-1	24.01.2019 18:40	CTD	15° 59.990' S	074° 30.029' W	965.5	
MSM80_102-2	24.01.2019 19:17	ACS	15° 59.989' S	074° 30.027' W	963.5	
MSM80_102-3	24.01.2019 19:26	MSS	16° 00.011' S	074° 30.017' W	961.9	
MSM80_102-4	24.01.2019 21:09	MSN	16° 00.910' S	074° 29.241' W	912.3	
MSM80_102-5	24.01.2019 21:53	MSN	16° 01.013' S	074° 29.014' W	916.9	
MSM80_102-6	24.01.2019 23:16	NET-IKMT	16° 02.368' S	074° 27.603' W	923.2	
MSM80_102-7	25.01.2019 01:04	MSN	16° 00.155' S	074° 29.849' W	951.5	
MSM80_102-8	25.01.2019 01:43	CTD	16° 00.329' S	074° 29.703' W	933.3	
MSM80_103-1	25.01.2019 03:01	MSS	16° 00.047' S	074° 24.924' W	929.4	
MSM80_104-1	25.01.2019 04:44	CTD	15° 59.980' S	074° 19.985' W	615.4	
MSM80_104-2	25.01.2019 05:19	ACS	15° 59.980' S	074° 19.983' W	618.2	
MSM80_104-3	25.01.2019 05:27	MSS	16° 00.019' S	074° 19.980' W	622.0	

MSM80_104-4	25.01.2019 06:52	MSN	16° 01.659' S	074° 19.250' W	693.4	
MSM80_104-5	25.01.2019 07:25	MSN	16° 02.154' S	074° 18.643' W	546.2	
MSM80_104-6	25.01.2019 08:00	MSN	16° 02.319' S	074° 18.409' W	514.7	
MSM80_104-7	25.01.2019 09:13	CTD	15° 59.978' S	074° 20.015' W	625.3	deployed as Jo-Jo
MSM80_105-1	25.01.2019 13:00	MSS	15° 59.927' S	074° 15.002' W	285.3	
MSM80_106-1	25.01.2019 23:44	CTD	16° 23.850' S	076° 02.604' W	3835.9	
MSM80_106-2	26.01.2019 00:49	ACS	16° 23.849' S	076° 02.603' W	3842.5	
MSM80_106-3	26.01.2019 01:00	MSS	16° 23.982' S	076° 02.618' W	3847.3	
MSM80_106-4	26.01.2019 02:25	MSS	16° 25.505' S	076° 03.077' W	4194.0	Equipment Test
MSM80_106-5	26.01.2019 02:46	MSS	16° 25.942' S	076° 03.124' W	4004.9	Untwisting of Cable
MSM80_106-6	26.01.2019 04:25	MSN	16° 26.779' S	076° 03.001' W	4038.3	
MSM80_106-7	26.01.2019 05:45	MSN	16° 26.990' S	076° 02.729' W	4028.8	