METEOR-Berichte

Trans-Atlantic Equatorial cruise I

Cruise No. M158

September 19 – October 26, 2019
Walvis Bay (Namibia) – Recife (Brazil)

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1 Summary

The Transatlantic Equatorial Cruise I (TRATLEQ I) was an interdisciplinary cruise focusing on upwelling in the tropical Atlantic, its physical forcing, its importance for biological production and plankton communities, associated chemical cycles, as well as on the current system setting the background conditions for the downward carbon export. This cruise represents the first physical, chemical, biogeochemical and biological measurement program covering a whole equatorial section from the eastern to the western boundary and from the surface to the bottom. TRATLEQ I is a contribution to the GEOMAR research program OCEANS, to the EU projects TRIATLAS, the „Make Our Planet Great Again“ project by R. Kiko and to the BMBF cooperative project BANINO in the frame of the BMBF SPACES program.

Beside the equatorial Atlantic, another study area was the coastal upwelling off Angola, where the same techniques were applied to better understand the functioning of this tropical upwelling system. A particular focus is on the export flux of carbon to mesopelagic and bathypelagic depths associated with particle flux and diel vertical zooplankton migration. Physical ocean dynamics were studied by full-ocean-depth current measurements and tracer distributions allowing to quantify ventilation and water mass exchange between the western and the eastern boundary. The measurement program also included the service of long-term moorings at the equator at 23°W and off Angola at 11°S.

Zusammenfassung

Die „Transatlantische Äquatoriale Forschungsfahrt I“ (TRATLEQ I) konzentrierte sich mit interdisziplinären Arbeiten auf ein besseres Verständnis von ozeanischem Auftrieb, seinem physikalischen Antrieb, seiner Bedeutung für die biologische Produktivität und die Planktongemeinschaften, den mit ihm verbundenen chemischen Umsatzraten, sowie dem Strömungssystem, das die Hintergrundbedingungen für den Kohlenstoffexport in die Tiefe setzt. TRATLEQ I war die erste Forschungsfahrt mit physikalischen, chemischen, biogeochemischen, und biologischen Messungen, die den gesamten atlantischen Äquator vom östlichen bis zum westlichen Rand und von der Oberfläche bis zum Meeresboden erfasst hat. Neben dem äquatorialen Atlantik wurde auch das Küstenauftriebsgebiet vor Angola untersucht. TRATLEQ I trägt zum GEOMAR Forschungsprogramm OCEANS, zum EU Projekt TRIATLAS, zum „Make Our Planet Great Again“ Projekt von R. Kiko und zum BMBF Verbundprojekt BANINO im Rahmen des BMBF SPACES Programms bei.

Ein besonderer Schwerpunkt ist die Untersuchung des Kohlenstoffexports in größere Tiefen aufgrund von Teilchentransport und täglicher vertikaler Zooplanktonwanderung. Die physikalische Ozeandynamik wurde insbesondere mit Strömungs- und Tracermessungen studiert und soll eine Quantifizierung der Ventilation und des Wassermassenaustauschs zwischen westlichem und östlichem Rand erlauben. Das Messprogramm beinhaltete auch den Tausch von Langzeitverankerungen am Äquator bei 23°W und vor Angola bei 11°S.

2 Participants

2.1 Principal Investigators

Name	Institution
Brandt, Peter, Prof.	GEOMAR
Kiko, Rainer, Dr.	GEOMAR

2.2 Scientific Party

No.	Name	Discipline	Institution
1	Brandt, Peter, Prof.	PO, Chief Scientist	GEOMAR
2	Schmidtko, Sunke, Dr.	PO, CTD	GEOMAR
3	Czeschel, Rena, Dr.	PO, vmADCP, LADCP, CTD	GEOMAR
4	Imbol Koungue, Rodrigue Anicet, Dr.	PO, RapidCast, CTD, radar	GEOMAR
5	Tuchen, Franz Philip	PO, Microstructure, CTD,moored profiler	GEOMAR
6	Begler, Christian	PO, Moorings, logistics	GEOMAR
7	Kisjeloff, Boris	PO, Moorings/O_2 logger, salinometer	GEOMAR
8	Martens, Wiebke	PO, CTD technique	GEOMAR
9	Prigent, Arthur	PO, CTD, Argo, SVP, CARTHE	GEOMAR
10	Dennert, Peter	PO, CTD, salinometer, microstructure	GEOMAR
11	Heukamp, Finn	PO, CTD, microstructure	GEOMAR
12	Hans, Anna Christina	PO, CTD, Argo, SVP, CARTHE	GEOMAR
13	Coelho, Paulo	PO, CTD watch, ADCP	INIPM
14	Stoeven, Tim, Dr.	CO, Tracer	GEOMAR
15	Schrandt, Julia	CO, Tracer	GEOMAR
16	Kriest, Iris, Dr	CO, Tracer	GEOMAR
17	Gindorf, Sonja	CO, N_2O	GEOMAR
18	Subramaniam, Ajit, Prof.	BO, Biooptics, phytoplankton,	LDEO
19	Ramcharitar, Benjamin	BO, Primary production	LDEO
20	Sherman, Jonathan	BO, Biooptics, phytoplankton	RUTGERS
21	Fernandez Carrera, Ana Dr.	BO, Nitrogen fixation, Nutrients	UVIGO
22	Kiko, Rainer, Dr.	BO, Zooplankton, multinet, UVP, oxygen	GEOMAR
23	Gómez-Letona, Markel	BO, DOM, cDOM, POC	ULPGC
24	Sarmiento L., Airam Nauzet	BO, AZFP	ULPGC
25	Filella, Alba	BO, DOM, cDOM, POC	GEOMAR
26	Stelzner, Martin	Meteorology	DWD
27	Fonseca Figueredo, Adriana	Observer	Brazilian Navy

PO: Physical Oceanography, CO: Chemical Oceanography, BO: Biological Oceanography

2.3 Participating Institutions

GEOMAR	GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel, Germany
DWD	Deutscher Wetterdienst, Germany
INIPM	Instituto Nacional de Investigação Pesqueira e Marinha, Luanda, Angola
LDEO	Lamont Doherty Earth Observatory at Columbia University, USA
RUTGERS	Institute of Marine and Coastal Sciences, Rutgers University, USA
ULPGC	University of Las Palmas de Gran Canaria, Spain
UVIGO	Universidade de Vigo, Spain

3 Research Program

3.1 Description of the Work Area

The research program of TRATLEQ I (Fig. 3.1) covered two main research areas that are 1) the tropical coastal upwelling area off Angola and 2) the equatorial Atlantic. Focus areas were the 11°S section off Angola and the whole equatorial section from 5°E to 44°45'W. Additional measurements were performed underway and at a few CTD stations along the cruise track from Walvis Bay to 11°S and from 11°S to the first station on the equatorial section at 5°E. The work off Namibia and Angola covered the eastern boundary upwelling system. The seasonal upwelling off Angola was at its secondary minimum during the period of the cruise. Due to the refusal of the diplomatic application, no measurements could be performed in the territorial waters of Equatorial Guinea. The equatorial section covered the Atlantic cold tongue that represents the equatorial upwelling system east of 23°W and the western equatorial Atlantic characterized by warmer surface waters and deeper mixed layer depths. The equatorial upwelling was in its mature phase during which maximum carbon export from the upper ocean into the deep was expected.

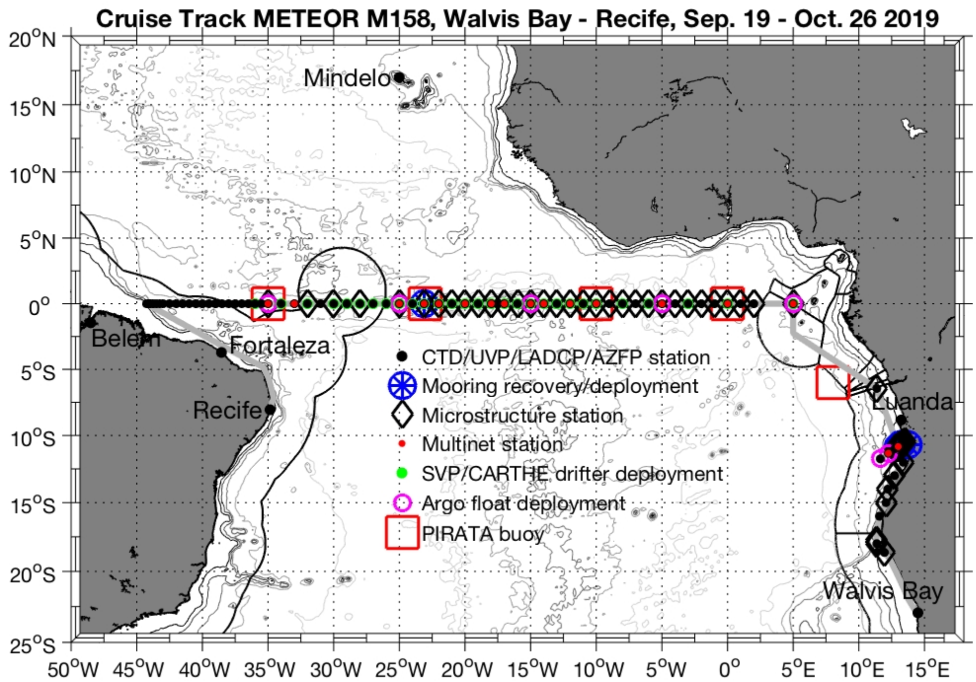


Fig. 3.1. Bathymetric map with cruise track of R/V METEOR cruise M158 (grey solid line) including locations of CTD/UVP/LADCP/AZFP stations, mooring recoveries and redeployments, microstructure and multinet stations and locations of drifter and float deployments. Territorial waters of different countries are marked with thin black solid lines.

3.2 Aims of the Cruise

TRATLEQ I was an interdisciplinary cruise focusing on upwelling in the tropical Atlantic, its physical forcing, its importance for biological production and plankton communities, associated chemical cycles, as well as on the current system setting the background conditions for the downward carbon export. This cruise represents the first physical, chemical, biogeochemical and biological measurement program covering a whole equatorial section from the eastern to the western boundary and from the surface to the bottom. A general aim of the research cruise was to assess the status of the southeast and equatorial Atlantic marine ecosystem, to identify its physical drivers and the impact of climate variability and change. A central question was which role does circulation and mixing play for the development of phytoplankton and zooplankton communities and specifically how variable (regionally and seasonally) is the export flux of carbon to mesopelagic and bathypelagic depths associated with particle flux and diel vertical zooplankton migration.

3.3 Agenda of the Cruise

The measurement program of TRATLEQ 1 included the section work along 11°S off Angola and along the equator starting at 5°E off São Tomé and Príncipe and ending at 44°45'W on the Brazilian shelf. Observations along the sections included full-depth station work with the CTD system measuring temperature, salinity, pressure, oxygen, nutrients (NOx), turbidity, fluorescence (i.e. chlorophyll- a and fluorescent dissolved organic matter (fDOM)), current velocity with the lowered acoustic Doppler current profilers (LADCP), particle size classes and plankton composition with an underwater vision profiler 5 (UVP5) and a continuous particle imaging and classification system (CPICS), as well as backscatter measurements with an acoustic zooplankton and fish profiler (AZFP). The CPICS was only operated on the CTD off Angola and then was deployed separately on shallower 110 m casts due to pressure-related problems.

Additional station work was carried out with a microstructure profiler measuring turbulent dissipation rates in the upper 100 m, and an Hydrobios Multinet Midi for the collection of zooplankton samples in the upper 1000 m. Water samples were analyzed for numerous variables including salinity, oxygen, tracer (CFC-12, SF_6), nutrients, N_2O, and colored dissolved organic matter (cDOM). N_2-fixation and primary production rates were determined through incubation of collected seawater. Underway measurements were performed with the two shipboard ADCPs for velocities in the upper 1000 m, the thermosalinograph for near-surface temperature and salinity, and a throughflow system for near-surface fluorescence intensity and phytoplankton physiological state via Fluorescence Induction Relaxation experiment (FIRe) and Picosecond Lifetime Fluorescence (PicoLif) measurements. Depth resolved FIRe measurements were also conducted using water samples from the CTD-Rosette. With regard to the original cruise proposal all proposed work could be performed with some slight deviations that include underway measurements of N_2O, CO_2, O_2 and total gas tension (due to the visa problems of few scientists not able to attend the cruise) and a malfunction of the RapidCast underway CTD system, where planned quasi-continuous measurements along the Namibian and Angolan shelf were replaced by on-station work with CTD and microstructure probe.

4 Narrative of the Cruise

On Thursday, September 19, 2019, R/V METEOR departed from the harbor of Walvis Bay, Namibia at about noon. The small delay was due to some late delivery of scientific equipment. More importantly, however, was that three members of the scientific team could not join the cruise because of visa issues. Two colleagues, with passports from countries that are not allowed to enter Namibia without a visa, were not able to enter Namibia. Another colleague from Angola (also acting as second observer) did not receive his visa for Brazil in time. Unfortunately, this also means that some measurements, like e.g. various biogeochemical underway measurements, could not be carried out as planned.

Sampling by the underway systems that included sea surface temperature, salinity, fluorescence intensity, upper ocean velocity and X-band radar measurements was started on September 19 at 14:00 UTC. The station work on the Angolan/Namibian shelf began on September 20 with the first CTD and MSS stations. Planned underway measurements of upper ocean temperature and salinity with the RapidCast system could not be performed due to the failure of the communication between the winch and the board unit that could not be fixed during the cruise. Instead, we decided to perform measurements approximately along the 500-m depth contour with the CTD and the MSS on a regular 1° latitude resolution while progressing northward. We arrived at 11°S on September 22 at 14:00 UTC. Along 11°S, we started with CTD and MSS measurements at very high spatial resolution. Since July 2013, we service a long-term mooring located at the continental slope measuring the strength of the southward Angola Current. This mooring had surfaced accidentally in July 2019 and could be recovered by Angolan colleagues from the Regional Centre of the National Fisheries and Aquaculture Inspection Service of Kwanza Sul, Angola. On September 23, Angolan colleagues delivered the recovered mooring to R/V Meteor off the port of Porto Amboím close to our measurement area. The main moored instrument, an upward looking ADCP, was still working properly, thus complementing the long-term velocity time series of the Angola Current. After mooring delivery, we continued with CTD and MSS station work along the 11°S section. At the nominal position of the mooring we did our first station with the multinet aimed at collecting zooplankton samples and characterizing the zooplankton community. Due to the diurnal vertical migration, we tried as much as possible during the cruise to have day and night stations with the multinet capturing diurnal differences in the zooplankton distribution. At the offshore end of the 11°S section, we deployed three Argo floats in deeper waters. The redeployment of the Angola Current mooring started on September 25 at 15:40 and could be finished without problems at 18:00. Additional to the standard tall mooring, we also deployed a pressure inverted echo sounder (PIES) that will be used to measure the variability in the bottom pressure difference between Brazil and Angola thereby delivering the mean geostrophic velocity anomaly across the Atlantic. After finishing the mooring and station work along 11°S, we continued underway measurements along the 500-m depth contour until the last CTD station at 6°27'S close to the border of the EEZ of Angola.

On the way toward the equator, we had to stop with all measurements when entering the EEZ of Equatorial Guinea as we did not receive allowance for measurements by this country.

We arrived at the equator at 5°E in the EEZ of São Tomé and Príncipe on September 28 at 23:00 UTC. Here, we started the main work along the trans-Atlantic equatorial section. Work at 5°E included double CTD stations to fulfill the extended requirements of all groups for water samples, MSS measurements and a multinet station. Here we also released an Argo float and we started a series of surface drifter deployments along the equator. We had two different drifters on board, the standard SVP drifters, which drift with the water at 15 m depth and CARTHE drifters measuring the velocity in the upper meter. Pairs of drifters were deployed every 1° longitude between 10°W and 30°W with some lower resolution toward east and west. The combined drifter data will allow us to assess the vertical shear of the flow field close to the surface.

After a short break due to another passing of the EEZ of Equatorial Guinea, we continued station work on September 29 at 20:00 at 2°E. Along the section, we did CTD and MSS stations every 1° longitude and multinet stations every few degrees. All sensors worked continuously without problems. After few stations the CPICS camera system developed a leakage but could be repaired and was in the following only used during shallow 110 m casts.

On October 8, we arrived at 18°W, where we deviated from the equatorial section to perform a short meridional section with the shipboard ADCP between 0°45'N/S to identify the latitudinal core location of the Equatorial Undercurrent and equatorial deep jets. On October 11 at 15:00 UTC, we reached the mooring position of the long-term mooring at 23°W. This mooring is operated in cooperation with the French PIRATA project since December 2001. Data of this mooring are used in many publications studying diverse topics such as the equatorial circulation, tropical climate, oxygen distribution and variability, sinking of particles at the equator and downward carbon flux. After having a day-time cast with the multinet, we recovered the mooring without problems. All instruments had worked throughout the mooring period with the moored profiler having a depth range slightly degrading with time. This gives us another excellent dataset to study long-term changes in the equatorial ocean. During the night, we did some CTD, MSS and multinet stations. The deployment of the equatorial mooring began on the next morning at 09:00 UTC and was finished four and a half hours later. We could nicely observe the submergence of the top-element confirming the successful deployment procedure. At the mooring, for the first time, two UVPs were installed to continuously measure particles (100 µm to about 2 cm) at 300 and 800 m depths.

After the mooring work was finished we continued with station work at a resolution of 1° longitude. When approaching the western boundary starting at 37°W, we decreased the distance between stations to 30' longitude and close to the continental slope we decreased it further to 5' longitude to capture the very narrow boundary currents. The last CTD station at the equator at 44°15'W was finished on October 22 at 07:30 UTC. We continued the section along the equator until 44°45'W doing particularly underway velocity measurements to capture also the shallow part of the North Brazil Current. After finishing the equatorial section, we turned back to a south-eastward direction heading toward the final destination, the port of Recife, where we arrived on October 26 at 09:00 UTC.

5 Preliminary Results

5.1 Hydrographic observations

5.1.1 CTD system, oxygen measurements, and calibration

(Sunke Schmidtko)

5.1.1.1 CTD-Rosette system

During M158 a total of 102 CTD-profiles and 2281 water samples were collected. The rosette system was installed in a Seabird Rosette System frame for 24 bottles. Most casts were made with 22 bottles installed, except casts made for the calibration of MicroCATs. Depth profiles up to a maximum pressure of 6048 dbar were performed. Deeper profiles were not possible due the maximum depth rating of installed instruments of 6000 m. For the majority of stations, the full water column was sampled. Data acquisition was done using Seabird Seasave software version 7.23.2. Preprocessing was done with SBE Data Processing 7.23.2.

The first CTD profile was collected at instrument test station #1. It was determined that all sensors recorded data with sufficient accuracy and no errors were detected. On the downcast of profile #79, there was a blackout of the CTD pump. The cast was canceled, but water samples were still taken. To analyze the cause of pump failure, conductivity sensors on the CTD were switched. However, the wrong configuration was loaded in the deck unit for that profile (#80). The raw data files were reprocessed after editing of the configuration xml-files. The conductivity sensors were swapped back for the following profiles and the CTD system worked without problems for the final 41 profiles. The oxygen sensors provided high quality reliable data throughout the cruise. The exact configuration of the CTD system can be found in Table 5.1. Additionally, two self-recording LADCPs, a self-recording, self-powered UVP5, a self-recording nutrient sensor, a self-recording, self-powered AZFP, and a self-recording, self-powered CPICS were attached to the water sampler. They are described separately in this cruise report.

Processed preliminary CTD data, 5-dbar binned, was sent in near real time to the Coriolis Data Centre in Brest, France, (via email: codata@ifremer.fr) for integration in the databases to be used for operational oceanography applications and the WMO supported GTS/TESAC system.

Table 5.1. *Summary of CTD system SBE #9 configuration used during M158.*

	CTD system SBE#9 (all except 80)	CTD system SBE#9 (cast 80)
Pressure sensor	# 1149	# 1149
T primary	# 2463	# 2463
T secondary	# 2120	# 2120
C primary	# 2443	# 3959
C secondary	# 3959	# 2443
O2 primary	SBE 43 # 1312	SBE 43 # 1312
O2 secondary	SBE 43 # 1739	SBE 43 # 1739
PAR Sensor	# 70714	# 70714
Altimeter	# 42299	# 42299
WET Labs ECO-AFL/FL	# 2294	# 2294

5.1.1.2 CTD-conductivity calibration

Overall 232 calibration points were obtained by sampling for salinity. Salinity samples were taken by the CTD watch in 'Flensburger' bottles, which proofed to be ideal for storing salt samples over a long time. The limited amount of bottle cases brought along required the washing and reuse of eight boxes. Reused bottles were used for salt samples from cast 42 onwards. Measurements are described in section 5.1.2. Due to the large number of samples a simple outlier removal method was applied that discharged the largest 33% deviations between CTD and bottle samples prior to calibration. The projection of data taken during the bottle stops of the upcast to the data from the downcast was done by searching within a 30-dbar pressure interval for similar potential temperatures. For the critical loop edit velocity 0.01m/s was used. The final CTD data set is composed from the primary set of sensors for all profiles, though the differences between sensor pairs were marginal. The conductivity calibration of the downcast data was performed using a 1st order linear fit with respect to temperature, pressure and conductivity (Table 5.2).

The calibration results in a salinity RMS-misfit for the downcast of order 0.00258 for the primary and 0.00267 for the secondary sensor. The upcast calibration surpasses these values with a RMS-misfit of 0.00208 psu for the primary and 0.00206 psu for the secondary sensor.

Table 5.2. *End of cruise salinity and pressure summary of downcast calibration information for the two CTD systems used during M116.*

	CTD system SBE#9	CTD system SBE#9
Sensor pair	primary	secondary
RMS misfit after calibration - salinity	0.00208	0.002057
Polynomial coefficients - conductivity	Offset: -0.0044922 P1: -7.528e-7 T1: +0.00014345 C1: -0.001481	Offset: +0.004605 P1: -1.5213e-8 T1: +0.00012203 C1: -0.001529
Pressure sensor correction (decks-offset)	-0.5	-0.5

5.1.1.3 Oxygen calibration

The CTD oxygen downcast for CTD systems is calibrated by using the best 66% of the joint data pairs between downcast CTD sensor value and Winkler-titrated oxygen (Section 5.1.3). For the calibration a linear correction polynomial depending on pressure, temperature and the actual oxygen value was fitted (Table 5.3). A total of 403 oxygen data points for CTD system SBE#5 were recorded, which resulted in an RMS-misfit for the downcast of 1.0859 µmol kg^{-1} for the primary SBE43 and 1.0143 µmol kg^{-1} for the secondary SBE43. The upcast calibration even surpassed these very good values with a RMS-misfit of 1.0489 µmol kg^{-1} for the primary SBE43 and 1.0105 µmol kg^{-1} for the secondary SBE43.

Table 5.3. *End of cruise downcast oxygen summary of calibration information for the CTD system SBE#9 used during M158.*

	Oxygen Sensor #1312	Oxygen Sensor #1739
Sensor pair	primary	secondary
RMS misfit after calibration - oxygen	1.0859	1.0143
Polynomial coefficients - oxygen	Offset: -2.2712 P1: 0.0032034 T1: 0.060801 O1: 0.030105	Offset: -0.68345 P1: 0.0025876 T1: 0.097481 O1: 0.055254

5.1.2 Conductivity measurements

(Boris Kisjeloff, Peter Dennert, Sunke Schmidtko)

In order to calibrate the conductivity sensors of the CTD system, the conductivity of more than 500 water samples was measured using the GEOMAR OPTIMARE Precision Salinometer (OPS) 10. The OPS has been tested for several years both in GEOMAR laboratories and on prior research cruises (see e.g. cruise report of RV Maria S. Merian MSM60). Before measuring the conductivity of the water samples with the OPS, the bottled water samples had to be degassed to remove gas micro-bubbles, which would deteriorate the OPS instrument performance. Degassing was done after warming the sample bottles in a water bath at a temperature of about 40°C. After approximately one hour the bottles were removed from the bath. The Flensburger bottles were opened shortly to release the gas. Afterwards the sample bottles were brought to the salinity lab where their conductivity could be measured after 24 hours of cooling down to the lab temperature.

During the cruise we realized a strong drift in the salinity measurements. Even with enhanced use of substandard and standard waters the measurements were not useful for calibration. Therefore, we tried to clean the Salinometer with distilled waters. However, further jumps of several thousandth PSU were noticed during the measurements. Therefore, we exchanged the bath of the already broken Salinometer 020 with the Salinometer 010. This led to a functioning Salinometer 020 which allowed for valuable measurements for the calibration of the CTD.

5.1.3. Oxygen Winkler measurements
(Rainer Kiko)

Discrete samples from selected depths were analyzed for oxygen at the majority of the stations. Bubble free samples were taken in 100 ml ground flasks, treated with alkaline sodium iodide and manganese chloride solutions and analyzed within eight hours after fixation using the Winkler method. In short, the precipitated hydroxides were dissolved with 1 ml sulphuric acid and the liberated iodine was then titrated to a light-yellow color using sodium thiosulfate. Thereafter, a zinc starch solution was added and the titration continued until the blue color disappeared. During the entire cruise three 1 l sodium thiosulfate bottles were prepared and used. For each bottle the calibration factor was determined using a WAKO iodate standard (batch no TWJ0275), see Table 5.4. In total 410 niskin bottles from 89 CTD profiles were sampled. The respective measurements were used to calibrate the profiling sensor of the CTD.

Table 5.4. *Calibration factors of sodium thiosulfate bottles.*

Date	Factor
Sep. 21, 2019 - Oct. 02, 2019	1.00181315
Oct. 03, 2019 - Oct. 19, 2019	0.99706067
Oct. 20, 2019 - Oct. 24, 2019	0.99440646

5.1.4 Thermosalinograph
(Anna Cristina Hans, Sunke Schmidtko)

Underway measurements of sea surface temperature (SST) and sea surface salinity (SSS) were continuously done by the ship's dual thermosalinograph. One inlet is located at the portside (TSG1) while the other thermosalinograph's inlet is at the starboard side (TSG2). The parallel system worked well and continuously throughout M158. Only data gaps were due to the switch off of scientific measurements in the EEZ of Equatorial Guinea. SSS and SST measured by the TSG system was calibrated with CTD measurements at 5m, with a resulting rms in SST of 0.005 °C and a resulting rms in SSS of <0.01.

5.2 Current observations

5.2.1 Vessel mounted ADCP
(Rena Czeschel, Rodrigue Anicet Imbol Koungue)

Underway-current measurements of the upper ocean were performed continuously throughout the entire cruise (except in the territorial waters of Equatorial Guinea) using two Vessel Mounted Acoustic Doppler Current Profilers (VMADCPs): a 75kHz RDI Ocean Surveyor (OS75) mounted in the ship's hull, and a 38kHz RDI Ocean Surveyor (OS38) placed in the moon pool. We had no allowance for ocean measurements for the territories of Equatorial Guinea. Therefore, we had to stop the record of both VMADCPs at the end of the coastal section from 7.11°E, 3.64°S to 5˚E; 0°N on September 27, 22:50 UTC to September 28, 21:45 UTC and at the beginning of the equatorial section from 5˚E; 0°N to 2.6˚E; 0°N on September 29, 04:00-16:40 UTC.

Overall, both Ocean Surveyor instruments worked well throughout the cruise with the exception of two failures of the OS38 computer during the coastal section on September 26/27 for about 15 hours and during the equatorial section on October 7 for ~6 hours. The malfunctioning of the deck unit was probably attributed to a voltage drop. After the reconnection of the deck unit with a buffered plug socket there was no failure anymore.

The OS38 was aligned to zero degrees (relative to the ship's center line) in order to reduce interference with the OS75, which was aligned to 45 degrees. Both instruments ran in narrowband mode. The OS75 instrument was configured with 100 bins of 8 m and a blanking distance of 4 m, pinging 23 times per minute and reaching a range of 600 m to 700 m. The OS38 used 55 bins of 32 m and a blanking distance of 16 m, pinging 18 times per minute and reaching a range between 1000 m and 1500 m. During the entire cruise, the SEAPATH navigation data was of high quality. No interference with the 12kHz echosounder EM122 that delivered high quality bathymetry data was detected.

Post processing of the data was carried out separately for each instrument. The applied mean misalignment angles and amplitude factors with the associated standard deviation are summarized in Table 5.5.

Table 5.5. *Vessel mounted ADCP calibration*

OS	Mode	Misalignment angle ± std	Amplitude factor ± std
75	NB	-1.0649° ± 0.5020°	1.0025 ± 0.0086
38	NB	-0.0134° ± 0.5675°	1.0011 ± 0.0094

5.2.2 Lowered ADCP

(Rena Czeschel, Franz Philip Tuchen)

During the whole cruise the CTD/Rosette system was equipped with a lowered ADCP setup based on two Teledyne RDI ADCPs. The setup consisted of an upward looking and a downward looking 300-kHz instrument. These two instruments were mounted inside the CTD rosette with especially manufactured frames protecting the instruments and allowing zero obstruction of the acoustic beams. The LADCP system worked without trouble with SN #20508 as downward-looking master instrument and #11436 as upward-looking slave during the whole cruise. During the cruise we used a software, which controlled the start, stop, download, and erase of the cycles of the two LADCP systems (ladcp_tool_1.9 developed at GEOMAR).

A newly developed energy supply system that draws energy for the ADCPs from the CTD system using rechargeable batteries worked well throughout the cruise with the exception of the very shallow profiles #1 and 13.

At the beginning of the cruise the transmission of the start signal for the LADCP system as well as the data download was very slow. For profile #24 the LADCP system could not be started due to problems of the transmission of the start signal via Bluetooth. During the search of the source of the error the traditional battery was reinstalled for profile #25, which worked well. The communication problems could then be minimized by reducing the distance between the LADCP instruments and the Bluetooth transmitter. During the shallow profile #26 the Bluetooth transmitter was installed at the ceiling outside the Geo Laboratory to provide a transmission of the start signal for the LADCP system as well as for the data download as fast and undisturbed as possible. Therefore, from profile #27 onwards the new energy system was installed again, which worked well and was used until the end of the cruise.

Data processing took place during the cruise using the GEOMAR LADCP processing software V10.22, which includes both shear and inversion methods to derive an absolute velocity profile. As additional data are necessary for the processing, the corresponding pre-processed CTD files were used containing pressure, temperature and salinity profiles as well as time and navigation data.

The instruments of Teledyne RDI instruments delivered very good deep-ocean velocity profiles when processed in conjunction with the observations of the vessel-mounted ADCP (VMADCP) and when coming close enough to the seafloor to obtain TRDI bottom track data. For profile #55 no bottom information was available due to water depth larger than 6000m resulting in enhanced uncertainties.

5.3 Drifter and floats

(Arthur Prigent and Anna Christina Hans)

In order to further investigate the equatorial current system, different types of drifters and floats were deployed during the cruise. The individual ID-numbers as well as deployment positions and dates are given in the supplements. First of all, 27 CARTHE (surface) drifters were deployed. These drifters follow the water movement in the upper meter. As the used drifters had already been deployed and again recovered during a French cruise, all drifters have been equipped with new batteries and the data transmission was checked. However, two of the deployed drifters have not been transmitting data after deployment. Simultaneously, five types of Surface Velocity Program (SVP) drifters were deployed: five Global Drifter Program (GDP) SVPB buoys measuring the SST as well as the sea-level air pressure, eleven GDP SVP buoys measuring the SST only, five E-SURFMAR PG upgraded SVPB buoys measuring SST and air pressure, five Copernicus SVP-BRST buoys measuring SST and depth and five Directional Wave Spectra Drifters from the Scripps Institution of Oceanography (SIO-DWS-D) measuring the directional properties of waves, SST and sea-level atmospheric pressure. These drifters are meant to follow the currents at 15 m depth thanks to a 'holey sock' drogue. In addition to these drifters following currents at 1 m and 15 m depth, ten Arvor-I floats designed for the Argo program were deployed. Argo floats measure temperature, salinity and depth of the upper 2000 m of the ocean.

The deployment procedures differed for each type. The CARTHE drifters were activated by a magnet and then partly deployed using the crane, partly lowered by rope. The SVP drifters were simply thrown in the water as they activate themselves when in contact to sea water. The Argo floats were tested, activated and then deployed using the crane.

5.4 Mooring operations

(Christian Begler, Rodrigue Imbol, Wiebke Martens, Franz Philip Tuchen)

***Table 5.6**. Mooring operations during M158*

M158 Mooring Recoveries					
Mooring	**New ID**	**Latitude**	**Longitude**	**Deployment Date**	**Recovery Date**

13°E 11°S	KPO_1200	10° 48.22'S	13° 01.40'E	22-Jun-2018	23-Sep-2019*
PIES-300m	KPO_1154	10° 40.44'S	13° 14.44'E	30-Oct-2015	23-Sep-2019**
PIES-500m	KPO_1155	10° 42.68'S	13° 11.08'W	04-Nov-2015	23-Sep-2019**
23°W 00°N	KPO_1201	00° 00.20'N	23° 06.80'W	24-Feb-2018	11-Oct-2019

* mooring started drifting in July 2019 and was delivered to RV Meteor by a fisher boat close to Porto Amboim, Angola
** no recovery, no acoustic communication, most likely lost.

M158 Mooring Deployments					
Mooring	**New ID**	**Latitude**	**Longitude**	**Deployment Date**	**Recovery Date**
13°E 11°S	KPO_1215	10° 49.64'S	13° 00.03'E	25-Sep-2019	
PIES-1224m	KPO_1219	10° 49.47'S	12° 59.67'E	25-Sep-2019	
23W 00N	KPO_1210	00° 00.21'S	23° 05.92'W	12-Oct-2019	

5.4.1 Instrument performance

(Franz Philip Tuchen, Rodrigue Anicet Imbol Koungue, Peter Brandt)

The Angolan mooring KPO-1200 was not recovered as usual during the cruise. For unknown reasons, the Long Ranger ADCP (LR ADCP) mooring installed at 1200 m surfaced on the July 14, 2019 as noticed by the Argos mooring alert. The mooring started to drift eastward and then poleward before being recovered by an Angolan Navy ship and being brought on land. During TRATLEQ 1, the remainders of the mooring (LR ADCP, MicroCAT, optode and floatations) were delivered offshore Porto Amboim by Angolan navy officers onboard a Chinese fisher boat. The instruments were transferred from board-to-board by the crane of RV Meteor on Sep. 23, 2019. Unfortunately, the MicroCAT instrument had a leakage and data were lost.

All recovered instruments of the equatorial mooring (KPO-1201) gave full records except for the McLane moored profiler (MMP) which most probably had a ballasting problem and only produced a reduced data set. Since the MMP was equipped with a CTD and an optode the instrument failure is leading to a lower overall instrument performance for all measured parameters. A summarized description over the performance of all instrument types is given in the following. Details are shown in Table 5.7.

Mini-TD: 1 Mini-TD at the equatorial mooring with a temporal resolution of one hour and a nominal depth of 214 m performed well and throughout the mooring.

MicroCATs: 3 MicroCATs at the equatorial mooring located at about 300 m, 500 m and 3905m performed well and provided complete and clean records with a temporal resolution of 10 minutes. The MicroCAT on the 11°S mooring located at about 500 m was damaged and therefore no data were recovered.

Oxygen sensors: 2 oxygen loggers at the equatorial mooring performed well and provided a clean and complete record. 1 oxygen logger located on the KPO-1200 performed well and complete records were collected until early mooring surfacing.

Single point current measurements: The equatorial mooring was equipped with 3 Aquadopps (nominal depths of 850 m, 3325 m and 3700 m) which all performed well and provided complete and clean records. The Aquadopps sampled at an interval of one to two hours.

ADCPs: The ADCP installed at the Angolan mooring at 11˚S performed well until the early mooring surfacing. The ADCPs on the equatorial mooring at 23˚W performed well and provided complete and clean records.

McLane Moored Profiler: The McLane moored profiler (equipped with a CTD, an ACM as well as an optode oxygen sensor), installed in mooring KPO-1201, delivered almost complete datasets during the first two months of its deployment. During the first two months it covered the whole measurement range between 900 m and 3320 m. After May 2018 the profiler could not reach the lower end of its measurement range which was most likely caused by ballasting issues. Until the end of the mooring period, the MMP measured between 900 m and a maximum of 2300 m. A first diagnosis showed that the battery consumption was higher on the downcast indicating a ballasting error with the MMP being too light. This problem will be further analyzed back at GEOMAR, Kiel. In total the MMP reached a data coverage of 50.7% and is providing a pair of upcast and downcast profiles every 5 days.

Table 5.7. *Instrument performance by sensor type and mooring*

sensor type mooring	**T (%)**	**C (%)**	**P (%)**	**U,V (%)**	**O_2 (%)**	**other (%)**
KPO_1200	56.3	00.0	84.4	84.4	84.4	0
KPO_1201	95.1	87.7	94.5	91.8	83.6	0
all moorings	**75.7**	**43.9**	**89.5**	**88.1**	**84.0**	**0**

5.4.2 Calibration of moored instruments
(Franz Philip Tuchen)

CTD/O_2 cast calibrations were performed for all Aquadopps, Mini-TDs, MicroCATs and O_2 loggers either as pre- or post-deployment calibrations (CTD casts 022, 050, 058, 080 and 101) by attaching the instruments to the CTD frame. During each upcast, 5-6 calibration stops were done over the whole profile range (depths chosen at low gradient-regimes for the respective parameters). Each stop had a duration of at least 6 min in order to ensure equilibrium at the calibration points. Additionally, releaser tests were performed at CTD casts 022, 058 and 080. Onboard lab calibrations were conducted for all oxygen loggers in water-filled beakers of 0% and 100% O_2-saturated water at two different temperatures (~6°C and ~22°C) following the Aanderaa optode manual.

Due to the short preparation time of the following cruise (M159) before reaching the Brazilian mooring array along 11°S, the pre-deployment calibrations for a total of 2 optodes, 22 Micro-CATs and 7 Aquadopps were already carried out during M158.

5.5 Shipboard microstructure measurements
(Finn Heukamp, Franz Philip Tuchen)

A MSS90-DII microstructure profiler (#073) of Sea and Sun Technology was used to infer turbulent dissipation rate and diapycnal diffusivity, aimed at calculating diapycnal fluxes of oxygen, heat, momentum, nutrients, and nitrous oxide (N_2O). The loosely tethered profilers are equipped with 3 airfoil shear sensors (#097, #135, #133) and a fast thermistor, as well as some common CTD sensors: pressure, conductivity, temperature and turbidity sensor. The sink velocity of the profilers was adjusted to about 0.55m/s. In total, 166 profiles to a maximum depth of 418m were recorded on 59 MSS stations. Most stations consisted of 3 microstructure profiles following a CTD/LADCP/UVP5/AZFP cast. A list of all profiles is given in Table 7.5.

Before the first MSS station, shear sensor #095 was replaced by shear sensor #133 due to a drift of the sensor at the end of a previous cruise (M156). The sensors worked fine throughout the cruise and performed well. However, problems with the winch and the electronics led to several changes of the deck unit, the electronic box and the hand control at the beginning of the cruise. Additionally, the cable of the MSS was found to be moist and had a corroding copper cable likely due to water entering the inside of the cable under pressure. Consequently, about 30 m of cable was removed. After MSS profile 46 an error occurred while cleaning the shear sensors with distilled water. The white plastic tip of the shear sensor (#133) was accidentally removed but put back on. An analysis of the following MSS profiles revealed no suspicious behavior of this sensor. During the first profile of MSS station 50 a high supply current of about 70mA (in contrast to a normal current of about 32mA) was noted indicating an upcoming shortcut. The profile was aborted. Back on deck a severely damaged part of the cable was detected and removed as it was most likely a source of water entering the interior of the cable. After removing another 5 m of cable the MSS performed well until the end of the cruise.

5.6 X-band Radar

(Rodrigue Anicet Imbol Koungue, Jochen Horstmann)

During TRATLEQ 1 a coherent-on-receive marine X-band radar developed at the Helmholtz-Zentrum Geesthacht (HZG) was installed on the RV Meteor above the bridge. The radar was operated 24/7 without any failure during the entire cruise. No permission for taking measurements within the Equatorial Guinean waters was available. Therefore, we switched off the radar twice: at the end of the coastal section from 7.11°E, 3.64°S to 5˚E, 0°N on September 27, 22:50 UTC to September 28, 21:45 UTC and at the beginning of the equatorial section from 5˚E, 0°N to 2.6˚E, 0°N on September 29, 04:00-16:40 UTC. Furthermore, the instrument was switched off for short periods, when the crew was working within the vicinity of the radar.

HZG’s marine radar was operated in its rotational mode acquiring radar backscatter intensity images within a range of 3.2 km around the vessel every 2 s at a resolution of 7.5 m in range and 0.9° in azimuth. These images will be utilized to observe ocean surface features, such as signatures of internal waves, current shear, surface slicks and fronts. Furthermore, these images will be utilized to retrieve surface current fields with a resolution of approximately 500 m. Therefore, the radar image sequences are analyzed with respect to surface wave properties such as wavelength and phase velocity, where the surface current vector results from the difference of the observed phase velocity to that given by the linear dispersion relation of surface gravity waves. All of the post processing of this extensive radar data set will be undertaken by HZG with particular focus on the observation of internal waves along the Angolan coast close to the shelf as well as investigation of the diurnal change of near surface current shear within the equatorial waters.

5.7 Biochemical measurements

5.7.1 Tracer measurements

(Tim Stöven, Iris Kriest, Julia Schrandt, Toste Tanhua)

Analysis System Setup: During the cruise, a gas chromatographic - electron capture detector system was used in connection with a purge and trap unit (GC-ECD/PT5) for the measurements of the transient tracers CFC-12 and SF_6. The systems is a modified version of the set-up normally used for the analysis of CFCs (Bullister and Weiss, 1988).

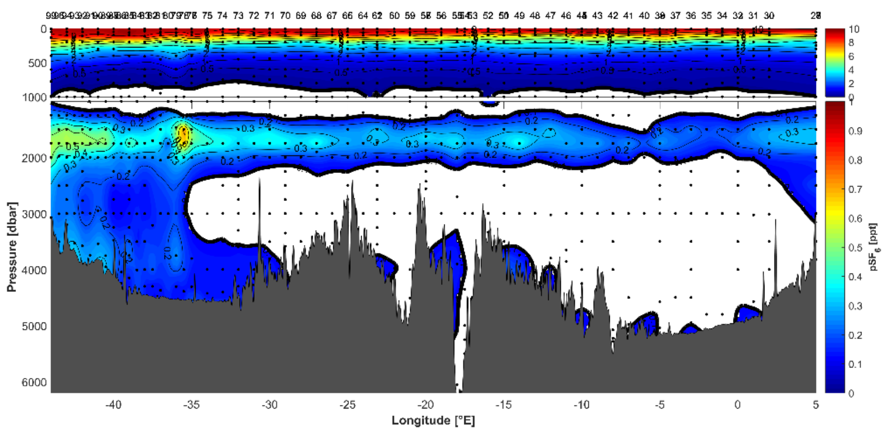
The trap consisted of a 100 cm 1/16" tubing packed with 70 cm Heysep D kept at temperatures between -60 and -68°C during the purge and trap process. The traps were desorbed by heating to 110°C and injection onto a pre-column of 20 cm Porasil C followed by 20cm Molsieve 5A in a 1/8" stainless steel tubing. The main column consisted of 1/8" packed stainless steel tubing with 180 cm Carbograph 1AC (60-80 mesh) and a 50 cm Molsieve 5A post-column. All columns were kept isothermal at 50°C. Detection was performed on an Electron Capture Detector (ECD). This set-up allowed efficient and simultaneous analysis of both tracers.

Samples were drawn from Niskin bottles using 250 ml ground glass syringes, of which an aliquot of about 200 ml was injected to the purge-and-trap system. The sampling strategy was based on full depths profiles with 22 specific depths. The sampling depths were chosen to cover the most prominent features in the water column such as biological features and characteristics of certain water masses.

Standardization was performed by injecting small volumes of gaseous standard containing SF_6 and CFC-12. This working standard was prepared by the company Deuste-Steiniger (Germany). The CFC-12 concentration in the standard has been calibrated vs. a reference standard obtained from R.F Weiss group at SIO, and the CFC-12 data are reported on the SIO98 scale. Another calibration of the working standard will take place in the home laboratory after the cruise. Calibration curves were measured roughly once a week in order to characterize the non-linearity of the system, depending on work load and system performance. Point calibrations were always performed between stations to determine the short-term drift in the detector. Replicate measurements were taken on several stations for data statistics (Table 5.8). The final processing and calibration of the obtained transient tracer data will be performed onshore at the GEOMAR in Kiel.

Table 5.8. *Detection limit and precision of PT5 system*

	SF_6	CFC-12
Limit of Detection	0.04 fmol kg^{-1}	0.2 fmol kg^{-1}
Precision	0.02 fmol kg^{-1} / 3.1 %	0.01 pmol kg^{-1} / 1.3 %



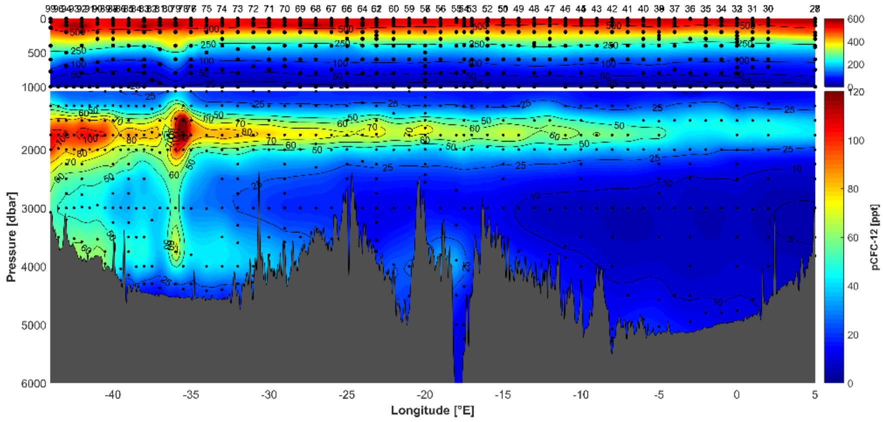


Fig. 5.1. Distribution of SF_6 (upper panel) and CFC-12 (lower panel) partial pressure along the equator.

Preliminary results: The distribution of CFC-12 and SF_6 along the equator describes the specific ventilation pattern of the different water masses (Fig. 5.1). The main difference in the distribution of both tracers is due to their different atmospheric histories so that CFC-12 already covers the deeper and less ventilated water masses. The shallow and intermediate water masses show the characteristic tracer gradients from equilibrated concentrations at the surface, which monotonically decline towards the Antarctic Intermediate Water (AAIW) at ~800 m. The first tracer minimum and thus less ventilated water layer at ~1000m originates from upper North Atlantic Deep Water (NADW), followed by a significant tracer maximum between 1300-2000 m originating from highly ventilated Labrador Sea Water (LSW). The deep water is dominated by only little ventilated lower NADW. The bottom water along the Romanche Fracture Zone and along the western boundary shows Denmark Strait Overflow water (DSOW). The elevated CFC-12 and SF_6 concentrations in the bottom water indicate the cold and dense Antarctic Bottom Water (AABW).

5.7.2 Underwater Vision Profiler
(Rainer Kiko)

During all regular CTD casts, an Underwater Vision Profiler 5 HD (UVP5 HD; serial number 210) was operated on the CTD rosette. The instrument consists of one down-facing HD camera in a 6000 dbar pressure-proof case and two red LED lights which illuminate a 1.24 L-water volume. During the downcast, the UVP5 takes 20 pictures of the illuminated field per second. For each picture, the number and size of particles are counted and stored for later data analysis. Furthermore, images of particles with a size > 500 µm are saved as a separate "Vignettes" - small cut-outs of the original picture – which allow for later, computer-assisted identification of these particles and their grouping into different particle, phyto- and zooplankton classes. Since the UVP5 was integrated in the CTD rosette and interfaced with the CTD sensors, fine-scale vertical distribution of particles and major planktonic groups can be related to environmental data. In total 102 UVP5 profiles could be obtained. At each station with a water depth < 6000 m a full-depth profile was obtained. Further, computer-assisted analysis of the approximately 750000 images taken with the UVP5 will be done in the home laboratory in order to reveal fine-scale distribution patterns of particles and zooplankton.

5.7.3 Underwater Microscope

(Rainer Kiko)

A continuous particle imaging and classification system was operated on the CTD-Rosette during the first 26 CTD profiles obtained off Angola. Pressure-related problems thereafter forced us to deploy the CPICS only down to 110 m depth. We therefore mounted and deployed the CPICS separately, packaged with a Seabird CTD (Table 7.6). The CPICS is an underwater microscope that allows to image plankton and particles in the size range of about 30 µm to 1 mm. Detailed image analysis will be conducted in the home laboratory using deep-learning image recognition algorithms to annotate the recovered images.

5.7.4 Acoustic Zooplankton and Fish Profiler, Mulitnet

(Airam Nauzet Sarmiento Lezcano, Rainer Kiko)

The Acoustic Zooplankton and Fish Profile (AZFP) was used for monitoring the presence and abundance of zooplankton and fish within the water column by measuring acoustic backscatter. This instrument was mounted on the CTD rosette with the 4 transducers (38, 125, 200 and 455 kHz) oriented towards the side of the rosette. The AZFP was configurated to detect different organisms on the down and upcast, in order to obtain the highest number of detections. The Echoview software and the python Echopype package were used to check the data collected and to get some preliminary results (Fig 5.2). A total of 96 profiles were collected (20 casts between Namibia to Angola and 76 along to the equator). The depth range was variable, reaching a maximum depth near 6000 m. Finally, we will analyze the different frequency profiles (38 kHz for fishes and 125, 200 and 455 kHz for zooplankton) to obtain the vertical distribution of different organisms in the water column and estimate their abundance and biomass.

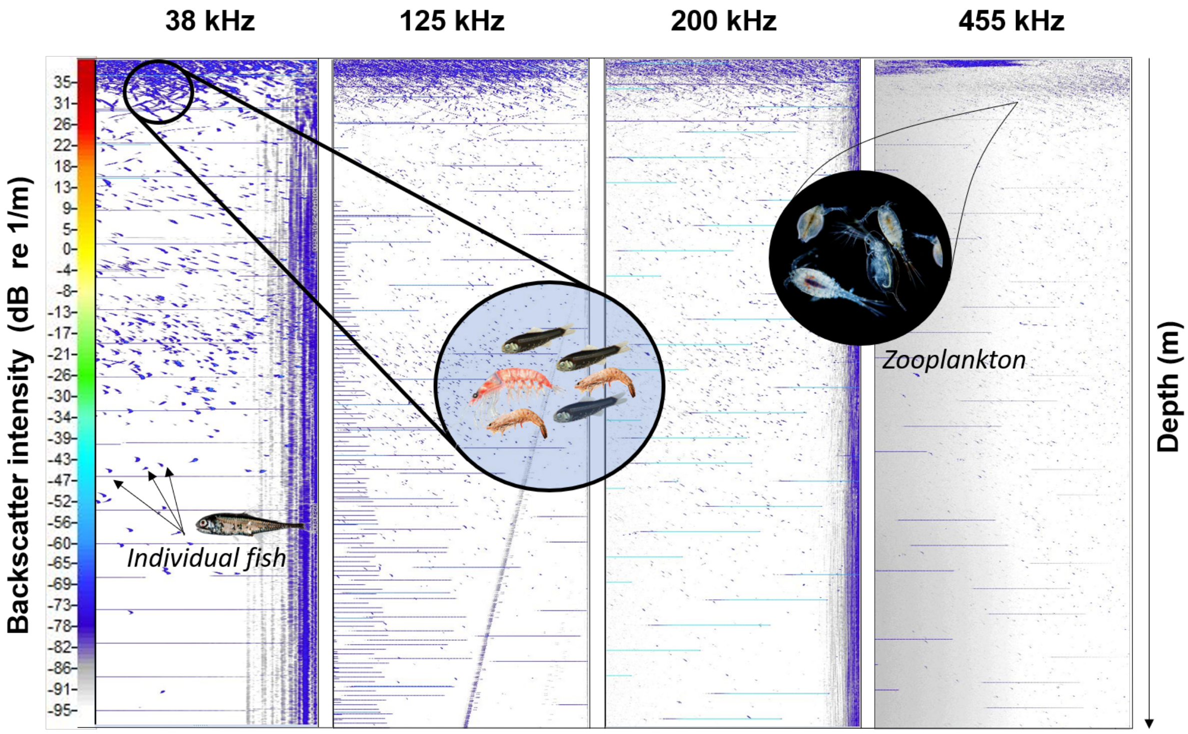


Fig. 5.2. Fish (38 kHz) and zooplankton (125, 200 and 455 kHz) echogram from the surface to 2500 m depth for one station on the equator.

5.7.5 Nutrient measurements

(Ajit Subramaniam, Rainer Kiko, Gerd Krahmann)

A total of 494 samples were collected for nutrient analysis from CTD casts. The samples were collected in 14 ml polyethylene sampling tubes and immediately frozen for later analysis using an autoanalyzer. While the focus of the nutrient sampling was to define the nutricline, samples from deeper depths were also collected to both serve as reference measurements and to study long term change. In addition, 221 samples were analyzed for NH_4 concentrations onboard the ship.

A miniature UV spectrometer (type OPUS manufactured by TriOS) was attached to the CTD during most casts. The spectrometer measures in situ the absorption of UV light by seawater. From comparison with the absorption of clear water and water with a known concentration of nitrate, the nitrate concentration in the seawater sample can be derived. No established processing routines were available during M158. Simple checks showed that the OPUS (#71F9) was properly recording spectra from which the nitrate concentration could be calculated. During the subsequent cruise M159 the same instrument was in use and a processing toolbox was developed based on an existing one for SUNA spectrometer (a similar instrument manufactured by a different company). Initial processing indicates that the OPUS worked fine during the whole cruise and that nitrate concentrations can indeed be derived. These concentrations still require a calibration comparable to that of the CTD's conductivity and oxygen sensors. The calibration will be finalized once the frozen nutrient samples have been analyzed. Further improvements of the OPUS processing might be possible by comparing its data with results from the Ocean Optics spectrometer (see section 5.7.8).

5.7.6 Biogeochemistry of nitrous oxide (N_2O)

(Sonja Gindorf, Damian Leonardo Arévalo-Martínez)

During TRATLEQ 1, we aimed to investigate the zonal variability of N_2O sea-air-fluxes along the equator and to assess the role of variable primary production and sinking organic matter for the cycling of N_2O throughout the water column. To this end, we carried out extensive water sampling both from surface waters (every 6 h) and the water column (29 stations spanning surface mixed layer to bottom) in order to measure concentrations of dissolved N_2O. Moreover, in order to identify the main processes responsible for N_2O production and their variability across the oxygen gradients in the water column, we also collected samples for analysis of N_2O isotope signatures. The measurements of N_2O concentrations will take place at the Chemical Oceanography Department of GEOMAR, whereas the isotopic analysis will take place at the Marine Stable Isotope Biogeochemistry at the University of South Carolina (USA). Together with oxygen, nutrients, primary production and particle distribution data, we aim to provide the first comprehensive view of the along-equatorial distribution and production of N_2O in the Atlantic Ocean.

5.7.7 N_2 Fixation, Primary productivity

(Ana Fernández Carrera, Ajit Subramaniam)

Primary production in size fractions was measured at 51 stations (Table 7.7) using two tracer techniques: the radiocarbon (^{14}C) technique (Steeman-Nielsen 1952) and the ^{13}C technique (Hama et al. 1983). The latter was coupled to the $^{15}N_2$ technique (Montoya et al. 1996) for the estimation of size-fractionated N_2 fixation and carbon uptake of the planktonic community in the same incubation bottles. Briefly, for the ^{14}C technique, at each station 1 dark and 3 clear 72 ml polystyrene bottles were filled per depth from 4 depth distributed through the lit upper layer (i.e., euphotic zone) of the water column, spiked with 10µCi of $NaH^{14}CO_3$ and incubated on deck in a system of re-circulating water simulating in situ PAR levels from dawn to dusk on deck. Incubation was terminated sequentially filtering the whole volume of the bottle though 10, 2 and 0.2 µm pore size filters. Then filters were treated on board and the radioactivity was measured in the ship's Tricarb 2910 scintillation counter. For the $^{13}C/^{15}N_2$ technique, at each station, triplicate 4.4-L clear polycarbonate bottles (Nalgene) were filled from 2-3 depth, directly from the CTD rosette, spiked with 3 ml of $^{15}N_2$ (98 atom%, Cambridge Isotopes) and 250 µL of ^{13}C-bicarbonate (0.2M). Incubation and filtration were similar to that of ^{14}C. The abundance of C and N isotopes in incubated and natural abundance samples will be measured by continuous-flow isotope-ratio mass spectrometry (CF-IRMS) ashore.

5.7.8 HPLC, flow cytometry, photophysiology

(Jonathan Joseph Sherman, Ajit Subramaniam)

Samples were collected for enumerating bacterial, cyanobacterial, and picoeukaryote abundance (Table 7.7) and frozen in liquid nitrogen until analysis ashore using a BD Influx flow cytometer following the methods described in (Duhamel et al. 2014).

Phytoplankton functional groups will be determined by High Performance Liquid Chromatography (HPLC) of samples collected throughout the upper 100m at the stations indicated in Table 7.7. Three liters of water were collected from the Niskin bottles fired at various depths in the euphotic zone and filtered through a GF/F filter. The filters were frozen in liquid nitrogen till analysis. The samples will be analyzed following the method of van Heukelem and Thomas (2001) at the NASA GSFC sample analysis facility.

Phytoplankton photophysiology was assessed using a Fluorescence Induction and Relaxation (mini-FIRe) instrument in combination with a Picosecond Lifetime Fluorescence (PicoLiF) instrument, both custom-built at Rutgers University. The mini-FIRe and PicoLiF use flow-through cuvettes, connected to the ships' seawater pump to measure continuously from the surface waters along the cruise track at high temporal resolution. System setup included seawater passing through two de-bubblers prior to measurement in order to reduce the effect of bubbles on fluorescence measurements. For a detailed description of methods refer to Lin et al. (2016) and Park et al. (2017), where the same setup was used. Data collection started on Sep. 19, 2019 at 20:40 and continued almost continuously until Oct. 23, 2019 at 13:30. Each day data collection was stopped in order to download data files for processing, to clean cuvettes, using 90% ethanol, and to collect a blank measurement. A blank sample was prepared by filtering seawater using a 0.2 µm filter. In addition, the mini-FIRe was used to conduct vertical profiles from the CTD casts. During these measurements underway data collection was paused. For vertical profiles, 50 ml of seawater was taken from Niskin bottles in the first 100m for standard measurements as well as blank samples from the surface and the deepest depth sampled for the mini-FIRe. In total 57 depth profile were taken (371 discrete measurements) at the 11ºS section off Angola and the equatorial section.

5.7.9 Organic matter

(Markel Gómez Letona, Alba Filella, Javier Arístegui)

Sampling and analysis: The sampling for the study of the organic matter consisted in samples for Total Organic Carbon (TOC), Particulate Organic Carbon and Nitrogen (POC & PON) and Chromophoric Dissolved Organic Matter (CDOM). Samples for these variables were collected at 63 profiles at 12 depths, from surface to bottom, including the 11ºS section off Angola, the Congo river outflow plume and the equatorial section (Fig. 5.3), for a total of 537 samples.

TOC samples were collected in topaz bottles and were distributed (10 ml, 2 replicates per depth) into high density polyethylene bottles after rinsing. All samples were acidified with 50 µl of phosphoric acid (50%) and stored at -20ºC. TOC samples will be analyzed after the cruise. Samples for POC & PON were filtered through precombusted (450ºC, 6h) glass microfiber GF/F filters. Upon filtration, filters were placed in individual, precombusted aluminum paper envelopes and stored at -20ºC. POC & PON samples will be analyzed after the cruise.

CDOM samples were collected in topaz bottles for in situ analysis with an Ocean Optics USB2000+UV-VIS-ES Spectrometer alongside a WPI liquid waveguide capillary cell (LWCC). Samples from the upper 200 meters of the water column were prefiltered using precombusted (450ºC, 6h) glass microfiber GF/F filters to avoid light dispersion by particles. For each sample, absorbance was measured across a wavelength spectrum between 178 nm and 878 nm, performing a blank measurement prior to each sample using ultrapure milli-Q water. Data processing was performed as follows:

1. Data files (samples and blanks) were cropped so as to only preserve wavelengths between 250 and 700 nm.
2. Blank correction: blank spectra were subtracted from sample spectra.
3. Dispersion correction: the average absorbance between 600 and 700 nm was subtracted from the whole spectra.

After processing, absorbance was transformed into absorption following the definition of the Napierian absorption coefficient:

$$a_\lambda = 2.303 \cdot \frac{Abs_\lambda}{L}$$

Where, for each wavelength λ, the absorption coefficient a_λ is given by Abs_λ (the absorbance at wavelength λ), L (the path length of the cuvette, in meters; the LWCC has a length of 0.9982 m) and 2.303, the factor that converts from decadic to natural logarithms.

From the a_λ spectra, several specific wavelengths of interest were considered, mainly a_λ at 254, 325, 354 and 370 nm. Furthermore, spectral slopes between wavelengths of interest were estimated following Helms et al. (2008).

Preliminary results: CDOM results obtained during the cruise present some interesting patterns. Surface waters show an overall decrease in a_{254} (a proxy for DOM) from east to west in the equatorial Atlantic (Fig. 5.3, upper panel), suggesting a decrease in DOM related to lower productivity in the western basin. However, this overall decrease is not linear, and patches of alternating higher/lower a_{254} can be appreciated. A preliminary study of this data in combination with meridional velocity data from the ADCP suggests that this patchiness can be related to the northward/southward advection of surface water across the equator due to tropical instability waves. The spectral slope between 275-295 nm (S275-295), which is inversely related to molecular weight of DOM, also shows this patchiness (Fig. 5.3, lower panel).

As expected, a_{254} decreases with depth as a consequence of the production of DOM by phytoplankton in the surface layer and the recycling and remineralization of DOM by prokaryotes throughout the water. Nonetheless, patterns among these low values can also be discerned, mostly related to the different water masses present in the equatorial region. Minimum a_{254} values were measured between ~600-1000 m depth and are associated to the Antarctic Intermediate Water (AAIW), which is also present in S275-295, suggesting low concentrations of high-molecular weight DOM as a result of greater remineralization by prokaryotes. This result would agree with the fact that the AAIW is an older water mass than the surrounding waters. Below the AAIW, higher values of a_{254} were registered in the North Atlantic Deep Water (NADW), although the eastern basin presented lower values than the western. Finally, in the bottom of the western basin, another minimum of a_{254} was present, a signal associated to the Antarctic Bottom Water (AABW).

Finally, at 25°W anomalously high values of a_{254} were measured in most of the deep samples (S275-295 also showed an analogous pattern). A comparison with the UVP5 data showed that these values can be considered real and are associated with high particle abundance. We suggest that this signal stems from hydrothermal activity.

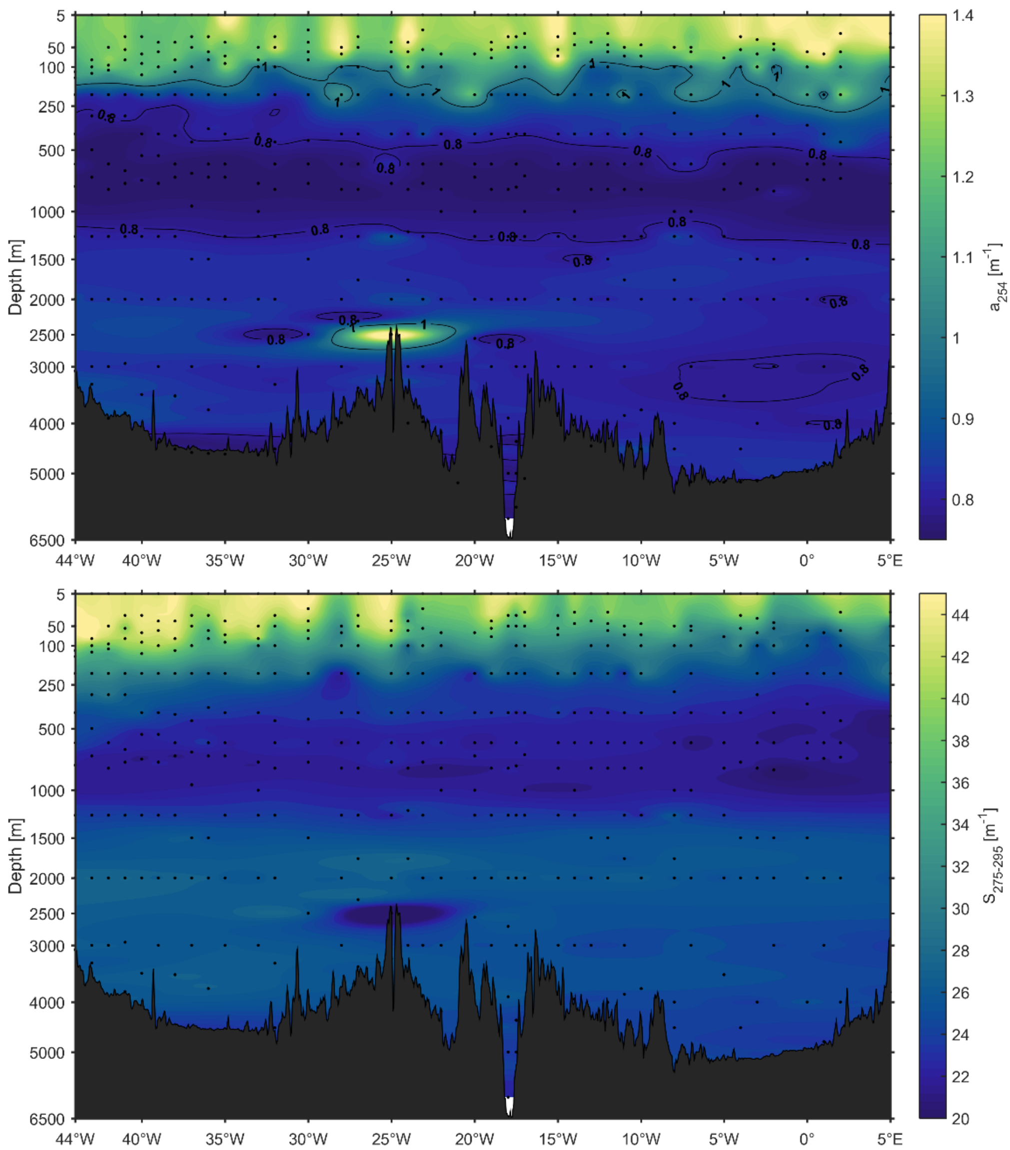


Fig. 5.3 Preliminary results from the CDOM analysis: absorption coefficient at 254 nm (a_{254}, upper panel) and spectral slope between 275 and 295 nm ($S_{275\text{-}295}$, lower panel). Note that the Y-axis has been square-root-transformed in order to better show the epipelagic layer.

5.7.10 Prokaryotes

(Markel Gómez Letona, Alba Filella, Javier Arístegui)

Sampling for the study of the prokaryotic community consisted of four types of samples: flow cytometry, DNA, BioOrthogonal Non-Canonical Amino acid Tagging (BONCAT) and Electron Transport System (ETS).

Samples for flow cytometry were taken at 62 profiles, including the 11ºS section off Angola and the equatorial section, for a total of 531 samples. In the equatorial section, sampling was performed at 12 depths per station, from surface to bottom. Samples were distributed into cryovials (1.6 ml), fixed with paraformaldehyde (PFA) and stored at -80ºC. At each depth, two replicates were taken. Flow cytometry analysis will be performed after the cruise.

DNA filtrations were carried out at 28 profiles in the equatorial section, excluding Brazilian waters, for a total of 164 samples. In each station, samples were taken at 8 depths, from surface to bottom. Samples were prefiltered though a 200 µm mesh and subsequently filtered through 2 sets of polycarbonate filters (3 µm and 0.2 µm) using a peristaltic pump. Upon filtration, filters were placed in individual, autoclaved Eppendorf vials and stored at -80ºC. After the cruise, DNA extraction and sequencing will be performed to study the diversity of the prokaryotic community.

BONCAT incubations were performed at 5 stations: 5ºE, 5ºW, 15ºW, 23ºW and 35ºW. At each station, incubations were carried out at 4 depths: surface (~5 m, 9 ml), deep chlorophyll maximum (DCM, variable depth, 9 ml), mesopelagic (~700 m, 45 ml) and bathypelagic (~2000 m, 45 ml). For each depth, 2 replicates and 1 control were performed. Controls were fixed prior to incubation with PFA, and homopropargylglycine (HPG) was subsequently added to all samples to yield a 200 µM final concentration. All samples were incubated at dark, but incubation temperatures and times differed: surface and DCM samples were incubated making use of the continuous water pumping system of the ship for 2h, whereas meso- and bathypelagic samples were incubated for 5h at 6-7ºC. Incubations were finalised with addition of PFA and filtered through 0.2 µm polycarbonate filters 1h – 24h after fixation. Filters were labelled and stored at -80ºC and will be analysed after the cruise.

Filtrations for ETS were performed for 18 profiles along the equatorial section, excluding Brazilian waters, for a total of 43 samples. Seawater samples were filtered through glass microfiber GF/F filters. Upon filtration, filters were placed in individual Eppendorf vials and stored at -80ºC. ETS samples will be analysed after the cruise.

5.8 Hydrosweep, topography

(Franz Philip Tuchen)

During TRATLEQ 1, the shipboard multibeam echo sounder EM-122 recorded ocean depth continuously without failing. The resulting data were used to derive bottom topography along different sections of interest, which were particularly the cross-shore section at 11°S off Angola and the equatorial section.

6 Ship´s Meteorological Station

(Martin Stelzner)

On Sep. 19, 2019, R/V METEOR left the harbour of Walvis Bay / Namibia. At the beginning of the voyage, the west coast of Africa was located between an extensive South Atlantic subtropical high in the north and a stable trough extending far southwards from the tropics in the area of low air pressure contrasts. During the one-and-a-half-day transit to the first station at 18°S, 11°22'E a mostly weak southeasterly to southerly wind appeared. The significant wave height was approx. 1.5 m with a swell coming from southwest. While travelling north along Angola's coast, the significant wave height decreased to 1.0 m, at times even to 0.5 m. The wind weakened to 2 to 3 Bft.

After a 2-day transit, the first station at the equator at 5°E was reached. R/V METEOR gradually came to the area of the tropical low-pressure trough. The southwest trade wind blew with 3 to 4 Bft. This led to a rise of the significant wave height to 1.5 m and a swell from the southwest. In the evening of Sep. 28, 2019, R/V METEOR reached the equator with unchanged wind and sea state conditions. During the following 3 weeks, the voyage was continued along the equator toward the west. R/V METEOR was now located between the ITCZ (Intertropical Convergence Zone) in the north and a subtropical South Atlantic High (25° to 30°S) in the south. At the beginning, a south-westerly wind with 4 to 5 Bft was prevailing. From Sep. 30, 2019 it turned south. The significant wave height remained at 1.5 m with an initial swell from the southwest, which gradually turned to south on the way westwards. Around the Oct. 06, 2019 the wind turned slowly from south to southeast and decreased. From Oct. 10, 2019 unchanged wave heights including a south-easterly swell occurred for one week. Between Oct. 17 and 18, 2019, wind and swell changed direction almost simultaneously from southeast to east and on Oct. 20, 2019 from east to northeast. Wind force and significant wave height remained unchanged at 1.5 m with 4 to 5 Bft.

In the morning of the Oct. 22, 2019, the station work ended at 44°15'W and the four-day transit to Recife began. During the transit, the trade wind temporarily freshened up to 5 to 6 Bft and changed direction back to southeast as R/V METEOR headed south. After passing the eastern tip of Brazil, the northeasterly swell was overlaid by a second swell from southeast, which dominated during the further voyage to the south. In the morning of Oct. 26, 2019, R/V METEOR reached the harbour of Recife under unchanged weather conditions.

7 Station Lists M158

7.1 Station list

Station No.		Date	Gear	Time	Latitude	Longitude	Water Depth	Remarks
METEOR (M158)	GEOMAR	2019		[UTC]	[°]	[°]	[m]	
1-1	CTD 1	20.09.	CTD	12:40-12:55	18°38.13'S	011°56.73'W	122	**CTD** test station (to bottom)
2-1	MSS 1	20.09.	MSS	13:30-13:45	18°38.13'S	011°56.73'W	123	**MSS** station
3-1	CTD 2	20.09.	CTD	18:10-18:40	18°00.00'S	011°22.00'W	550	**CTD** station (to bottom)
4-1	MSS 2	20.09.	MSS	18:50-19:30	18°00.00'S	011°22.00'W	550	**MSS** station
5-1	MSS 3	20.09.	MSS	21:10-21:30	17°45.64'S	011°19.54'W	580	**MSS** station
6-1	MSS 4	20.09.	MSS	23:11-23:15	17°30.04'S	011°17.63'W	580	**MSS** station (no profile)
7-1	MSS 5	21.09.	MSS	01:10	17°12.00'S	011°15.80'W	650	**MSS** station (no profile)
8-1	CTD 3	21.09.	CTD	02:30-03:00	17°00.00'S	011°16.00'W	690	**CTD** station (to bottom)
9-1	CTD 4	21.09.	CTD	08:40-09:20	16°00.00'S	011°34.00'E	860	**CTD** station (to bottom)
10-1	CTD 5	21.09.	CTD	15:15-15:40	15°00.00'S	012°04.00'W	430	**CTD** station (to bottom)
11-1	MSS 6	21.09.	MSS	16:00	15°00.00'S	012°04.00'W	420	**MSS** station (no profile)
12-1	MSS 7	21.09.	MSS	21:25-21:45	14°00.00'S	012°12.00'W	500	**MSS** station
13-1	CTD 6	21.09.	CTD	21:55-22:20	14°00.00'S	012°12.00'W	450	**CTD** station (to bottom)
14-1	MSS 8	21.09.	MSS	22:30-23:05	14°00.00'S	012°12.00'W	450	**MSS** station
15-1	MSS 9	22.09.	MSS	05:20-05:50	13°00.00'S	012°43.00'W	950	**MSS** station
16-1	CTD 7	22.09.	CTD	05:55-06:35	13°00.00'S	012°43.00'W	940	**CTD** station (to bottom)
17-1	MSS 10	22.09.	MSS	13:15-13:45	12°00.00'S	013°23.00'W	550	**MSS** station
18-1	CTD 8	22.09.	CTD	13:50-14:25	12°00.00'S	013°23.00'W	550	**CTD** station (to bottom)
19-1	CTD 9	22.09.	CTD	21:22-21:37	10°38.00'S	013°18.00'E	130	**CTD** station (to bottom)
20-1	MSS 11	22.09.	MSS	21:46-22:26	10°38.00'S	013°18.00'E	130	**MSS** station
21-1	CTD 10	22.09.	CTD	23:10-23:30	10°40.00'S	013°15.00'E	230	**CTD** station (to bottom)
22-1	MSS 12	22.09.	MSS	23:30-00:30	10°40.00'S	013°15.00'E	250	**MSS** station
23-1	CTD 11	23.09.	CTD	01:05-01:30	10°42.00'S	013°12.00'E	440	**CTD** station (to bottom)
24-1	MSS 13	23.09.	MSS	01:35-02:40	10°42.00'S	013°12.00'E	440	**MSS** station
25-1	CTD 12	23.09.	CTD	04:15-04:30	10°44.00'S	013°09.00'E	700	**CTD** station (to bottom)
26-1	KPO1200	23.09.	Mooring	10:30-10:50	10°42.11'S	013°43.13'E	30	**Mooring** delivery
27-1	CTD 13	23.09.	CTD	13:25-13:35	10°30.00'S	013°30.00'E	50	**CTD** station (to bottom)
28-1	MSS 14	23.09.	MSS	13:45-14:15	10°30.00'S	013°30.00'E	50	**MSS** station
29-1	CTD 14	23.09.	CTD	14:55-15:05	10°32.00'S	013°27.00'E	65	**CTD** station (to bottom)
30-1	MSS 15	23.09.	MSS	15:15-15:50	10°32.00'S	013°27.00'E	65	**MSS** station
31-1	CTD 15	23.09.	CTD	16:30-16:40	10°34.00'S	013°24.00'E	95	**CTD** station (to bottom)
32-1	MSS 16	23.09.	MSS	16:45-17:20	10°34.00'S	013°24.00'E	95	**MSS** station
33-1	CTD 16	23.09.	CTD	17:55-18:05	10°36.00'S	013°21.00'E	112	**CTD** station (to bottom)
34-1	MSS 17	23.09.	MSS	18:15-18:40	10°36.00'S	013°21.00'E	112	**MSS** station
35-1	KPO1154	23.09.	Mooring	19:50-20:45	10°40.44'S	013°14.44'E	290	**PIES** search (not successful)
36-1	KPO1155	23.09.	Mooring	21:30-22:05	10°42.68'S	013°11.08'E	490	**PIES** search (not successful)

37-1	CTD 17	23.09.	CTD	22:55-23:40	10°46.00'S	013°06.00'E	945	**CTD** station (to bottom)
38-1	MSS 18	23.09.	MSS	23:50-00:40	10°46.00'S	013°06.00'E	945	**MSS** station
39-1	CTD 18	24.09.	CTD	01:15-02:05	10°48.00'S	013°03.00'E	1160	**CTD** station (to bottom)
40-1	MSN 1	24.09.	MSN	02:50-04:00	10°50.00'S	013°00.00'E	1230	**Multinet** station
41-1	CTD 19	24.09.	CTD	04:15-05:05	10°50.00'S	013°00.00'E	1230	**CTD** station (to bottom)
42-1	MSS 19	24.09.	MSS	05:15-05:45	10°50.00'S	013°00.00'E	1230	**MSS** station
43-1	CTD 20	24.09.	CTD	06:40-07:35	10°53.03'S	012°55.00'E	1285	**CTD** station (to bottom)
44-1	MSS 20	24.09.	MSS	07:45-08:50	10°53.03'S	012°55.00'E	1285	**MSS** station
45-1	CTD 21	24.09.	CTD	09:40-10:40	10°56.07'S	012°50.00'E	1382	**CTD** station (to bottom)
46-1	MSS 21	24.09.	MSS	10:55-11:35	10°56.07'S	012°50.00'E	1382	**MSS** station
47-1	CTD 22	24.09.	CTD	12:45-14:30	11°00.00'S	012°45.00'E	1430	**CTD** station (to bottom);
48-1	MSS 22	24.09.	MSS	14:35-15:10	11°00.00'S	012°45.00'E	1430	**MSS** station
49-1	CTD 23	24.09.	CTD	18:35-20:15	11°20.00'S	012°15.00'E	2295	**CTD** station (to bottom)
50-1	ARGO 1	24.09.	Float	20:25	11°20.00'S	012°15.00'E	2295	**Argo float** deployment
51-1	MSN 2	24.09.	MSN	20:35-21:30	11°20.00'S	012°15.00'E	2295	**Multinet** station
52-1	CTD 24	25.09.	CTD	01:40-04:30	11°45.00'S	011°38.00'E	3460	**CTD** station (to bottom)
53-1	ARGO 2	25.09.	Float	04:35	11°45.00'S	011°38.00'E	3460	**Argo float** deployment
53-2	ARGO 3	25.09.	Float	04:40	11°45.00'S	011°38.00'E	3460	**Argo float** deployment
54-1	CTD 25	25.09.	CTD	12:55-13:45	10°50.00'S	013°00.00'E	1230	**CTD** station (to bottom)
55-1	MSN 3	25.09.	MSN	13:55-14:55	10°50.00'S	013°00.00'E	1230	**Multinet** station
56-1	KPO1215	25.09.	Mooring	15:40-17:40	10°50.00'S	013°00.00'E	1230	**Mooring** deployment
57-1	KPO1219	25.09.	Mooring	18:00	10°49.50'S	012°59.70'E	1230	**PIES** deployment
58-1	CTD 26	26.09.	CTD	19:25-20:15	06°27.00'S	011°22.00'E	530	**CTD** station (to bottom)
59-1	MSS 23	26.09.	MSS	20:20-21:05	06°27.00'S	011°22.00'E	530	**MSS** station
60-1	CTD 27	28.09.	CTD	22:25-22:50	00°00.00'S	005°00.00'E	3815	**CTD** station (200m)
61-1	MSN 4	28.09.	MSN	23:00-00:10	00°00.00'S	005°00.00'E	3815	**Multinet** station
62-1	CTD 28	29.09.	CTD	00:25-02:45	00°00.00'S	005°00.00'E	3815	**CTD** station (to bottom)
63-1	SVP 1	29.09.	Drifter	03:05	00°00.00'S	005°00.00'E	3815	**SVP Drifter** deployment
64-1	ARGO 4	29.09.	Float	03:10	00°00.00'S	005°00.00'E	3815	**Argo float** deployment
65-1	MSS 24	29.09.	MSS	03:15-03:55	00°00.00'S	005°00.00'E	3815	**MSS** station
66-1	CTD 29	29.09.	CTD	20:05-20:19	00°00.00'S	002°00.00'E	4612	**CTD** station (100m)
67-1	CTD 30	29.09.	CTD	20:50-23:45	00°00.00'S	002°00.00'E	4612	**CTD** station (to bottom)
68-1	MSS 24	29.09.	MSS	23:55-00:20	00°00.00'S	002°00.00'E	4612	**MSS** station
69-1	CTD 31	30.09.	CTD	05:45-08:55	00°00.00'S	001°00.00'E	4832	**CTD** station (to bottom)
70-1	MSS 25	30.09.	MSS	09:00-09:30	00°00.00'S	001°00.00'E	4832	**MSS** station
71-1	CTD 32	30.09.	CTD	16:05-16:35	00°00.00'S	000°00.00'E	4935	**CTD** station (200m)
72-1	MSN 5	30.09.	MSN	16:35-17:30	00°00.00'S	000°00.00'E	4935	**Multinet** station
73-1	CTD 33	30.09.	CTD	17:40-20:50	00°00.00'S	000°00.00'E	4935	**CTD** station (to bottom)
74-1	MSN 6	30.09.	MSN	21:00-22:00	00°00.00'S	000°00.00'E	4935	**Multinet** station
75-1	SVP 2	30.09.	Drifter	22:10	00°00.00'S	000°00.00'E	4935	**SVP Drifter** deployment
76-1	CARTHE 1	30.09.	Drifter	22:15	00°00.00'S	000°00.00'E	4935	**CARTHE Drifter** deployment
77-1	MSS 26	30.09.	MSS	22:20-22:55	00°00.00'S	000°00.00'E	4935	**MSS** station
78-1	CTD 34	01.10.	CTD	04:15-07:45	00°00.00'S	001°00.00'W	4998	**CTD** station (to bottom)
79-1	MSS 27	01.10.	MSS	07:55-08:25	00°00.00'S	001°00.00'W	4998	**MSS** station

80-1	CTD 35	01.10.	CTD	13:45-17:05	00°00.00'S	002°00.00'W	5055	**CTD** station (to bottom)
81-1	MSS 28	01.10.	MSS	17:15-17:50	00°00.00'S	002°00.00'W	5055	**MSS** station
82-1	CTD 36	01.10.	CTD	23:15-02:55	00°00.00'S	003°00.00'W	5125	**CTD** station (to bottom)
83-1	CARTHE 2	02.10.	Drifter	03:10	00°00.00'S	003°00.00'W	5125	**CARTHE Drifter** deployment
84-1	SVP 3	02.10.	Drifter	03:10	00°00.00'S	003°00.00'W	5125	**SVP Drifter** deployment
85-1	MSS 29	02.10.	MSS	03:15-03:55	00°00.00'S	003°00.00'W	5125	**MSS** station
86-1	CTD 37	02.10.	CTD	09:15-12:25	00°00.00'S	004°00.00'W	5141	**CTD** station (to bottom)
87-1	MSS 30	02.10.	MSS	12:35-13:15	00°00.00'S	004°00.00'W	5141	**MSS** station
88-1	CTD 38	02.10.	CTD	18:25-18:50	00°00.00'S	005°00.00'W	5157	**CTD** station (200m)
89-1	MSN 7	02.10.	MSN	18:55-20:10	00°00.00'S	005°00.00'W	5157	**Multinet** station
90-1	CTD 39	02.10.	CTD	20:20-23:25	00°00.00'S	005°00.00'W	5157	**CTD** station (to bottom)
91-1	ARGO 5	02.10.	Float	23:40	00°00.00'S	005°00.00'W	5157	**Argo float** deployment
92-1	MSS 31	03.10.	MSS	00:05-00:45	00°00.00'S	005°00.00'W	5157	**MSS** station
93-1	CTD 40	03.10.	CTD	06:00-09:15	00°00.00'S	006°00.00'W	5081	**CTD** station (to bottom)
94-1	CARTHE 3	03.10.	Drifter	09:25	00°00.00'S	006°00.00'W	5081	**CARTHE Drifter** deployment
95-1	SVP 4	03.10.	Drifter	09:30	00°00.00'S	006°00.00'W	5081	**SVP Drifter** deployment
96-1	MSS 32	03.10.	MSS	09:30-10:05	00°00.00'S	006°00.00'W	5081	**MSS** station
97-1	CTD 41	03.10.	CTD	15:30-18:40	00°00.00'S	007°00.00'W	5141	**CTD** station (to bottom)
98-1	CPICS 1	03.10.	CTD	18:50-19:05	00°00.00'S	007°00.00'W	5141	**CPICS** station
99-1	MSS 33	03.10.	MSS	19:10-19:45	00°00.00'S	007°00.00'W	5141	**MSS** station
100-1	CTD 42	04.10.	CTD	01:15-04:35	00°00.00'S	008°00.00'W	5198	**CTD** station (to bottom)
101-1	CPICS 2	04.10.	CTD	04:40-04:55	00°00.00'S	008°00.00'W	5198	**CPICS** station
102-1	CARTHE 4	04.10.	Drifter	05:10	00°00.00'S	008°00.00'W	5198	**CARTHE Drifter** deployment
103-1	SVP 5	04.10.	Drifter	05:15	00°00.00'S	008°00.00'W	5198	**SVP Drifter** deployment
104-1	MSS 34	04.10.	MSS	05:15-05:55	00°00.00'S	008°00.00'W	5198	**MSS** station
105-1	CPICS 3	04.10.	CTD	11:35-11:45	00°00.00'S	009°00.00'W	4462	**CPICS** station
106-1	CTD 43	04.10.	CTD	11:50:14:40	00°00.00'S	009°00.00'W	4462	**CTD** station (to bottom)
107-1	MSS 35	04.10.	MSS	14:45-15:15	00°00.00'S	009°00.00'W	4462	**MSS** station
108-1	CPICS 4	04.10.	CTD	22:15-22:25	00°00.00'S	010°00.00'W	4761	**CPICS** station
109-1	CTD 44	04.10.	CTD	22:35-22:50	00°00.00'S	010°00.00'W	4761	**CTD** station (200m)
110-1	MSN 8	04.10.	MSN	23:00-00:05	00°00.00'S	010°00.00'W	4761	**Multinet** station
111-1	CTD 45	05.10.	CTD	00:10-03:05	00°00.00'S	010°00.00'W	4761	**CTD** station (to bottom)
112-1	MSN 9	05.10.	MSN	03:15-04:25	00°00.00'S	010°00.00'W	4761	**Multinet** station
113-1	CARTHE 5	05.10.	Drifter	04:30	00°00.00'S	010°00.00'W	4761	**CARTHE Drifter** deployment
114-1	SVP 6	05.10.	Drifter	04:35	00°00.00'S	010°00.00'W	4761	**SVP Drifter** deployment
115-1	MSN 10	05.10.	MSN	04:40-05:35	00°00.00'S	010°00.00'W	4761	**Multinet** station
116-1	MSS 36	05.10.	MSS	05:40-06:15	00°00.00'S	010°00.00'W	4761	**MSS** station
117-1	CPICS 5	05.10.	CTD	12:05-12:20	00°00.00'S	011°00.00'W	3855	**CPICS** station
118-1	CTD 46	05.10.	CTD	12:30-14:55	00°00.00'S	011°00.00'W	3855	**CTD** station (to bottom)
119-1	CARTHE 6	05.10.	Drifter	15:05	00°00.00'S	011°00.00'W	3855	**CARTHE Drifter** deployment
120-1	SVP 7	05.10.	Drifter	15:10	00°00.00'S	011°00.00'W	3855	**SVP Drifter** deployment
121-1	MSS 37	05.10.	MSS	15:15-15:55	00°00.00'S	011°00.00'W	3855	**MSS** station
122-1	CTD 47	05.10.	CTD	21:40-00:15	00°00.00'S	012°00.00'W	3982	**CTD** station (to bottom)
123-1	CPICS 6	06.10.	CTD	00:20-00:35	00°00.00'S	012°00.00'W	3982	**CPICS** station

124-1	MSN 11	06.10.	MSN	00:40-01:50	00°00.00'S	012°00.00'W	3982	**Multinet** station
125-1	CARTHE 7	06.10.	Drifter	02:00	00°00.00'S	012°00.00'W	3982	**CARTHE Drifter** deployment
126-1	SVP 8	06.10.	Drifter	02:05	00°00.00'S	012°00.00'W	3982	**SVP Drifter** deployment
127-1	MSS 38	06.10.	MSS	02:05-02:40	00°00.00'S	012°00.00'W	3982	**MSS** station
128-1	CPICS 7	06.10.	CTD	08:10-08:25	00°00.00'S	013°00.00'W	4392	**CPICS** station
129-1	CTD 48	06.10.	CTD	08:35-11:20	00°00.00'S	013°00.00'W	4392	**CTD** station (to bottom)
130-1	CARTHE 8	06.10.	Drifter	11:35	00°00.00'S	013°00.00'W	4392	**CARTHE Drifter** deployment
131-1	SVP 9	06.10.	Drifter	11:35	00°00.00'S	013°00.00'W	4392	**SVP Drifter** deployment
132-1	MSS 39	06.10.	MSS	11:40-12:20	00°00.00'S	013°00.00'W	4392	**MSS** station
133-1	MSN 12	06.10.	MSN	17:40-18:30	00°00.00'S	014°00.00'W	3865	**Multinet** station
134-1	CPICS 8	06.10.	CTD	17:35-18:50	00°00.00'S	014°00.00'W	3865	**CPICS** station
135-1	CTD 49	06.10.	CTD	18:55-21:25	00°00.00'S	014°00.00'W	3865	**CTD** station (to bottom)
136-1	MSN 13	06.10.	MSN	21:30-22:30	00°00.00'S	014°00.00'W	3865	**Multinet** station
137-1	CARTHE 9	06.10.	Drifter	22:40	00°00.00'S	014°00.00'W	3865	**CARTHE Drifter** deployment
138-1	SVP 10	06.10.	Drifter	22:40	00°00.00'S	014°00.00'W	3865	**SVP Drifter** deployment
139-1	MSS 40	06.10.	MSS	22:45-23:25	00°00.00'S	014°00.00'W	3865	**MSS** station
140-1	MSN 14	07.10.	MSN	05:00-05:55	00°00.00'S	015°00.00'W	3778	**Multinet** station
141-1	CTD 50	07.10.	CTD	06:00-07:05	00°00.00'S	015°00.00'W	3780	**CTD** station (to 600m)
142-1	CPICS 9	07.10.	CTD	07:10-07:55	00°00.00'S	015°00.00'W	3780	**CPICS** yoyo-station
143-1	CTD 51	07.10.	CTD	08:10-10:30	00°00.00'S	015°00.00'W	3780	**CTD** station (to bottom)
144-1	MSN 15	07.10.	MSN	10:40-11:40	00°00.00'S	015°00.00'W	3780	**Multinet** station
145-1	ARGO 6	07.10.	Float	11:50	00°00.00'S	015°00.00'W	3780	**Argo float** deployment
146-1	CARTHE 10	07.10.	Drifter	11:55	00°00.00'S	015°00.00'W	3780	**CARTHE Drifter** deployment
147-1	SVP 11	07.10.	Drifter	11:55	00°00.00'S	015°00.00'W	3780	**SVP Drifter** deployment
148-1	MSS 41	07.10.	MSS	12:00-12:35	00°00.00'S	015°00.00'W	3780	**MSS** station
149-1	CPICS 10	07.10.	CTD	18:25-18:40	00°00.00'S	016°00.00'W	3302	**CPICS** station
150-1	CTD 52	07.10.	CTD	18:45-20:45	00°00.00'S	016°00.00'W	3302	**CTD** station (to bottom)
151-1	CARTHE 11	07.10.	Drifter	21:00	00°00.00'S	016°00.00'W	3302	**CARTHE Drifter** deployment
152-1	SVP 12	07.10.	Drifter	21:00	00°00.00'S	016°00.00'W	3302	**SVP Drifter** deployment
153-1	MSS 42	07.10.	MSS	21:05-21:45	00°00.00'S	016°00.00'W	3302	**MSS** station
154-1	MSN 16	08.10.	MSN	03:20-04:25	00°00.00'S	017°00.00'W	5100	**Multinet** station
155-1	CTD 53	08.10.	CTD	05:00-08:05	00°00.00'S	017°00.00'W	5100	**CTD** station (to bottom)
156-1	MSS 43	08.10.	MSS	08:15-08:45	00°00.00'S	017°00.00'W	5100	**MSS** station
157-1	CARTHE 12	08.10.	Drifter	08:50	00°00.00'S	017°00.00'W	5100	**CARTHE Drifter** deployment
158-1	SVP 13	08.10.	Drifter	08:50	00°00.00'S	017°00.00'W	5100	**SVP Drifter** deployment
159-1	MSN 17	08.10.	MSN	09:00-10:00	00°00.00'S	017°00.00'W	5100	**Multinet** station
160-1	CTD 54	08.10.	CTD	13:00-16:30	00°00.00'S	017°30.00'W	5660	**CTD** station (to bottom)
		08.10.		16:30	00°45.00'N-00°45.00'S	018°00.00'W	6588	**ADCP** measurements
161-1	MSN 18	09.10.	MSN	11:50-12:55	00°00.00'S	018°00.00'W	6588	**Multinet** station
162-1	CPICS 11	09.10.	CTD	13:00-13:15	00°00.00'S	018°00.00'W	6588	**CPICS** station
163-1	CTD 55	09.10.	CTD	13:30-17:30	00°00.00'S	018°00.00'W	6588	**CTD** station (to 6000m)
164-1	CARTHE 13	09.10.	Drifter	17:40	00°00.00'S	018°00.00'W	6588	**CARTHE Drifter** deployment
165-1	SVP 14	09.10.	Drifter	17:45	00°00.00'S	018°00.00'W	6588	**SVP Drifter**

								deployment
166-1	MSS 44	09.10.	MSS	17:45-18:15	00°00.00'S	018°00.00'W	6588	**MSS** station
167-1	CTD 56	09.10.	CTD	00:05-02:50	00°00.00'S	019°00.00'W	4420	**CTD** station (to bottom)
168-1	CARTHE 14	10.10.	Drifter	03:20	00°00.00'S	019°00.00'W	4420	**CARTHE Drifter** deployment
169-1	SVP 15	10.10.	Drifter	03:20	00°00.00'S	019°00.00'W	4420	**SVP Drifter** deployment
170-1	MSS 45	10.10.	MSS	03:30-04:10	00°00.00'S	019°00.00'W	4420	**MSS** station
171-1	CTD 57	10.10.	CTD	09:40-10:00	00°00.00'S	020°00.00'W	2540	**CTD** station (to 200m)
172-1	MSN 19	10.10.	MSN	10:15-11:15	00°00.00'S	020°00.00'W	2540	**Multinet** station
173-1	CTD 58	10.10.	CTD	11:15-13:05	00°00.00'S	020°00.00'W	2540	**CTD** station (to bottom)
174-1	CARTHE 15	10.10.	Drifter	13:15	00°00.00'S	020°00.00'W	2540	**CARTHE Drifter** deployment
175-1	SVP 16	10.10.	Drifter	13:15	00°00.00'S	020°00.00'W	2540	**SVP Drifter** deployment
176-1	MSS 46	10.10.	MSS	13:20-14:00	00°00.00'S	020°00.00'W	2540	**MSS** station
177-1	CTD 59	10.10.	CTD	19:15-22:20	00°00.00'S	021°00.00'W	5127	**CTD** station (to bottom)
178-1	CARTHE 16	10.10.	Drifter	22:35	00°00.00'S	021°00.00'W	5127	**CARTHE Drifter** deployment
179-1	SVP 17	10.10.	Drifter	22:35	00°00.00'S	021°00.00'W	5127	**SVP Drifter** deployment
180-1	MSS 47	10.10.	MSS	22:40-23:20	00°00.00'S	021°00.00'W	5127	**MSS** station
181-1	MSN 20	11.10.	MSN	04:40-05:40	00°00.00'S	022°00.00'W	4119	**Multinet** station
182-1	CTD 60	11.10.	CTD	05:45-08:15	00°00.00'S	022°00.00'W	4119	**CTD** station (10 m above the bottom)
183-1	CARTHE 17	11.10.	Drifter	08:25	00°00.00'S	022°00.00'W	4119	**CARTHE Drifter** deployment
184-1	SVP 18	11.10.	Drifter	08:25	00°00.00'S	022°00.00'W	4119	**SVP Drifter** deployment
185-1	MSS 48	11.10.	MSS	08:30-09:05	00°00.00'S	022°00.00'W	4119	**MSS** station
186-1	MSN 21	11.10.	MSN	14:50-16:00	00°00.00'S	023°06.80'W	3930	**Multinet** station
187-1	KPO1201	11.10.	Mooring	16:40-20:10	00°00.00'N	023°06.80'W	3930	**Mooring recovery**
188-1	CARTHE 18	11.10.	Drifter	20:25	00°00.00'S	023°06.80'W	3930	**CARTHE Drifter** deployment
189-1	SVP 19	11.10.	Drifter	20:25	00°00.00'S	023°06.80'W	3930	**SVP Drifter** deployment
190-1	MSS 49	11.10.	MSS	20:35-20:55	00°00.00'S	023°06.80'W	3930	**MSS** station
191-1	CPICS 12	11.10.	CTD	21:25-22:15	00°00.00'S	023°06.80'W	3930	**CPICS** yoyo station
192-1	CTD 61	11.10.	CTD	22:35-22:55	00°00.00'S	023°06.80'W	3930	**CTD** station (to 200m)
193-1	MSN 22	11.10.	MSN	23:00-00:05	00°00.00'S	023°06.80'W	3930	**Multinet** station
194-1	CTD 62	12.10.	CTD	00:20-02:45	00°00.00'S	023°06.80'W	3930	**CTD** station (to bottom)
195-1	MSN 23	12.10.	MSN	02:55-04:00	00°00.00'S	023°06.80'W	3930	**Multinet** station
196-1	MSS 50	12.10.	MSS	04:05-04:55	00°00.00'S	023°06.80'W	3930	**MSS** station
197-1	CTD 63	12.10.	CTD	05:05-05:25	00°00.00'S	023°06.80'W	3930	**CTD** station (to 200m)
198-1	CPICS 12	11.10.	CTD	05:40-06:50	00°00.00'S	023°06.80'W	3930	**CPICS** yoyo station
199-1	KPO1210	12.10.	Mooring	09:10-13:45	00°00.00'S	023°06.80'W	3930	**Mooring deployment**
200-1	CTD 64	12.10.	CTD	18:30-21:00	00°00.00'S	024°00.00'W	3262	**CTD** station (10 m above the bottom)
201-1	CARTHE 19	12.10.	Drifter	21:05	00°00.00'S	024°00.00'W	3262	**CARTHE Drifter** deployment
202-1	SVP 20	12.10.	Drifter	21:05	00°00.00'S	024°00.00'W	3262	**SVP Drifter** deployment
203-1	CTD 65	13.10.	CTD	02:25-02:45	00°00.00'S	025°00.00'W	3204	**CTD** station (to 200m)
204-1	MSN 24	13.10.	MSN	02:55-05:05	00°00.00'S	025°00.00'W	3204	**Multinet** station
205-1	CTD 66	13.10.	CTD	05:15-07:15	00°00.00'S	025°00.00'W	3204	**CTD** station (to bottom)
206-1	ARGO 7	13.10.	Float	07:25	00°00.00'S	025°00.00'W	3204	**Argo float**

								deployment
207-1	CARTHE 20	13.10.	Drifter	07:25	00°00.00'S	025°00.00'W	3204	**CARTHE Drifter** deployment
208-1	SVP 21	13.10.	Drifter	07:25	00°00.00'S	025°00.00'W	3204	**SVP Drifter** deployment
209-1	MSS 51	13.10.	MSS	07:30-08:00	00°00.00'S	025°00.00'W	3204	**MSS** station
210-1	MSN 25	13.10.	MSN	08:05-09:05	00°00.00'S	025°00.00'W	3204	**Multinet** station
211-1	CTD 67	13.10.	CTD	14:20-16:40	00°00.00'S	026°00.00'W	3700	**CTD** station (10 m above the bottom)
212-1	CPICS 13	13.10.	CTD	16:50-17:05	00°00.00'S	026°00.00'W	3700	**CPICS** station (110 m)
213-1	CARTHE 21	13.10.	Drifter	17:10	00°00.00'S	026°00.00'W	3700	**CARTHE Drifter** deployment
214-1	SVP 22	13.10.	Drifter	17:10	00°00.00'S	026°00.00'W	3700	**SVP Drifter** deployment
215-1	CTD 68	13.10.	CTD	22:40-00:45	00°00.00'S	027°00.00'W	3329	**CTD** station (10 m above the bottom)
216-1	CARTHE 22	14.10.	Drifter	00:50	00°00.00'S	027°00.00'W	3329	**CARTHE Drifter** deployment
217-1	SVP 23	14.10.	Drifter	00:50	00°00.00'S	027°00.00'W	3329	**SVP Drifter** deployment
218-1	CTD 69	14.10.	CTD	06:20-08:45	00°00.00'S	028°00.00'W	3950	**CTD** station (10 m above the bottom)
219-1	CPICS 14	14.10.	CTD	08:50-09:00	00°00.00'S	028°00.00'W	3950	**CPICS** station (110 m)
220-1	CARTHE 23	14.10.	Drifter	09:10	00°00.00'S	028°00.00'W	3950	**CARTHE Drifter** deployment
221-1	SVP 24	14.10.	Drifter	09:10	00°00.00'S	028°00.00'W	3950	**SVP Drifter** deployment
222-1	MSS 52	14.10.	MSS	09:15-09:50	00°00.00'S	028°00.00'W	3950	**MSS** station
223-1	CTD 70	14.10.	CTD	15:25-18:05	00°00.00'S	029°00.00'W	3536	**CTD** station (10 m above the bottom)
224-1	CARTHE 24	14.10.	Drifter	18:10	00°00.00'S	029°00.00'W	3536	**CARTHE Drifter** deployment
225-1	SVP 25	14.10.	Drifter	18:15	00°00.00'S	029°00.00'W	3536	**SVP Drifter** deployment
226-1	CTD 71	15.10.	CTD	00:00-02:35	00°00.00'S	030°00.00'W	3849	**CTD** station (10 m above the bottom)
227-1	CPICS 15	15.10.	CTD	02:45-03:00	00°00.00'S	030°00.00'W	3849	**CPICS** station (110 m)
228-1	CARTHE 25	15.10.	Drifter	03:10	00°00.00'S	030°00.00'W	3849	**CARTHE Drifter** deployment
229-1	SVP 26	15.10.	Drifter	03:10	00°00.00'S	030°00.00'W	3849	**SVP Drifter** deployment
230-1	MSS 53	15.10.	MSS	03:10-03:45	00°00.00'S	030°00.00'W	3849	**MSS** station
231-1	CTD 72	15.10.	CTD	08:50-11:30	00°00.00'S	031°00.00'W	4325	**CTD** station (10 m above the bottom)
232-1	CTD 73	15.10.	CTD	16:45-19:30	00°00.00'S	032°00.00'W	4437	**CTD** station (10 m above the bottom)
233-1	CPICS 16	15.10.	CTD	19:35-19:50	00°00.00'S	032°00.00'W	4437	**CPICS** station (110 m)
234-1	CARTHE 26	15.10.	Drifter	19:50	00°00.00'S	032°00.00'W	4437	**CARTHE Drifter** deployment
235-1	SVP 27	15.10.	Drifter	19:50	00°00.00'S	032°00.00'W	4437	**SVP Drifter** deployment
236-1	MSS 54	15.10.	MSS	19:55-20:30	00°00.00'S	032°00.00'W	4437	**MSS** station
237-1	CTD 74	16.10.	CTD	01:45-04:45	00°00.00'S	033°00.00'W	4551	**CTD** station (10 m above the bottom)
238-1	MSN 25	16.10.	MSN	04:55-06:00	00°00.00'S	033°00.00'W	4551	**Multinet** station
239-1	CTD 75	16.10.	CTD	11:00-13:55	00°00.00'S	034°00.00'W	4564	**CTD** station (10 m above the bottom)
240-1	CARTHE 27	16.10.	Drifter	14:00	00°00.00'S	034°00.00'W	4564	**CARTHE Drifter** deployment
241-1	SVP 28	16.10.	Drifter	14:00	00°00.00'S	034°00.00'W	4564	**SVP Drifter** deployment
242-1	CTD 76	16.10.	CTD	20:10-20:35	00°00.00'S	035°00.00'W	4546	**CTD** station (to 200m)

243-1	MSN 26	16.10.	MSN	20:40-21:35	00°00.00'S	035°00.00'W	4546	**Multinet** station
244-1	CTD 77	16.10.	CTD	21:45-00:40	00°00.00'S	035°00.00'W	4546	**CTD** station (10 m above the bottom)
245-1	MSN 27	17.10.	MSN	01:00-02:05	00°00.00'S	035°00.00'W	4546	**Multinet** station
246-1	CPICS 17	17.10.	CTD	02:10-02:25	00°00.00'S	035°00.00'W	4546	**CPICS** station (110 m)
247-1	ARGO 8	17.10.	Float	02:30	00°00.00'S	035°00.00'W	4546	**Argo float** deployment
248-1	MSS 55	17.10.	MSS	02:35-03:10	00°00.00'S	035°00.00'W	4546	**MSS** station
249-1	CTD 78	17.10.	CTD	05:50-08:35	00°00.00'S	035°30.00'W	4537	**CTD** station (10 m above the bottom)
250-1	CTD 79	17.10.	CTD	11:25-14:20	00°00.00'S	036°00.00'W	4537	**CTD** station (10 m above the bottom)
251-1		17.10.		14:25-15:25	00°00.00'S	036°00.00'W	4537	**ADCP** pressure test
252-1	SVP 29	17.10.	Drifter	15:35	00°00.00'S	036°00.00'W	4537	**SVP Drifter** deployment
253-1	CTD 80	17.10.	CTD	18:15-21:40	00°00.00'S	036°30.00'W	4522	**CTD** station (10 m above the bottom)
254-1	CTD 81	17.10.	CTD	00:45-03:55	00°00.00'S	037°00.00'W	4514	**CTD** station (10 m above the bottom)
255-1	MSN 28	18.10.	MSN	04:05-05:10	00°00.00'S	037°00.00'W	4514	**Multinet** station
256-1	CPICS 18	18.10.	CTD	05:15-05:25	00°00.00'S	037°00.00'W	4514	**CPICS** station (110 m)
257-1	SVP 30	18.10.	Drifter	05:35	00°00.00'S	037°00.00'W	4514	**SVP Drifter** deployment
258-1	MSS 55	18.10.	MSS	05:40-06:20	00°00.00'S	037°00.00'W	4514	**MSS** station
259-1	CTD 82	18.10.	CTD	09:25-12:25	00°00.00'S	037°30.00'W	4490	**CTD** station (10 m above the bottom)
260-1	CTD 83	18.10.	CTD	15:05-18:00	00°00.00'S	038°00.00'W	4450	**CTD** station (10 m above the bottom)
261-1	SVP 31	18.10.	Drifter	18:05	00°00.00'S	038°00.00'W	4450	**SVP Drifter** deployment
262-1	CTD 84	18.10.	CTD	20:50-23:40	00°00.00'S	038°30.00'W	4379	**CTD** station (10 m above the bottom)
263-1	CTD 85	19.10.	CTD	02:40-05:20	00°00.00'S	039°00.00'W	4317	**CTD** station (10 m above the bottom)
264-1	CTD 86	19.10.	CTD	08:15-11:00	00°00.00'S	039°30.00'W	4191	**CTD** station (10 m above the bottom)
265-1	CTD 87	19.10.	CTD	13:55-14:15	00°00.00'S	040°00.00'W	3450	**CTD** station (to 200m)
266-1/2	CPICS 19	19.10.	CTD	14:20-15:15	00°00.00'S	040°00.00'W	3450	**CPICS** station (110 m) yoyo 45 min
267-1	CTD 88	19.10.	CTD	15:30-17:35	00°00.00'S	040°00.00'W	3450	**CTD** station (10 m above the bottom)
268-1	MSS 56	19.10.	MSS	17:40-18:50	00°00.00'S	040°00.00'W	3450	**MSS** station
269-1	CTD 89	19.10.	CTD	21:10-23:45	00°00.00'S	040°30.00'W	3905	**CTD** station (10 m above the bottom)
270-1	CTD 90	20.10.	CTD	02:35-05:00	00°00.00'S	041°00.00'W	3820	**CTD** station (10 m above the bottom)
271-1	CTD 91	20.10.	CTD	07:45-10:05	00°00.00'S	041°30.00'W	3901	**CTD** station (10 m above the bottom)
272-1	CTD 92	20.10.	CTD	12:50-15:15	00°00.00'S	042°00.00'W	3865	**CTD** station (10 m above the bottom)
273-1	CPICS 20	20.10.	CTD	15:20-16:00	00°00.00'S	042°00.00'W	3865	**CPICS** station (110 m) yoyo 45 min
273-2				16:15-16:35	00°00.00'S	042°00.00'W	3865	**ADCP** test
274-1	MSS 57	20.10.	MSS	16:45-17:50	00°00.00'S	042°00.00'W	3865	**MSS** station
275-1	CTD 93	20.10.	CTD	20:25-22:40	00°00.00'S	042°30.00'W	3688	**CTD** station (10 m above the bottom)
276-1	CTD 94	21.10.	CTD	01:25-03:25	00°00.00'S	043°00.00'W	3362	**CTD** station (10 m above the bottom)
277-1	CPICS 21	21.10.	CTD	03:35-04:25	00°00.00'S	043°00.00'W	3362	**CPICS** station (110 m) yoyo 45 min
278-1	CTD 95	21.10.	CTD	05:55-08:05	00°00.00'S	043°15.00'W	3501	**CTD** station (10 m above the bottom)
279-1	CTD 96	21.10.	CTD	09:40-11:50	00°00.00'S	043°30.00'W	3468	**CTD** station (10 m above the bottom)

280-1	CTD 97	21.10.	CTD	13:15-15:20	00°00.00’S	043°45.00’W	3252	**CTD** station (10 m above the bottom)
281-1	CTD 98	21.10.	CTD	16:20-19:00	00°00.00’S	043°55.00’W	3109	**CTD** station (10 m above the bottom)
282-1	CPICS 22	21.10.	CTD	19:45-20:35	00°00.00’S	044°00.00’W	3049	**CPICS** station (110 m) yoyo 45 min
283-1	CTD 99	21.10.	CTD	20:50-22:50	00°00.00’S	044°00.00’W	3049	**CTD** station (10 m above the bottom)
284-1	CTD 100	21.10.	CTD	23:50-02:10	00°00.00’S	044°05.00’W	2730	**CTD** station (10 m above the bottom)
285-1	CTD 101	22.10.	CTD	02:55-04:50	00°00.00’S	044°10.00’W	1904	**CTD** station (10 m above the bottom)
286-1	CTD 102	22.10.	CTD	05:30-06:30	00°00.00’S	044°15.00’W	1245	**CTD** station (500 m)
287-1	CPICS 23	22.10.	CTD	06:40-07:35	00°00.00’S	044°15.00’W	1245	**CPICS** station (110 m) yoyo 45 min

7.2 CTD Station list

Station	CTD	Date	Time	Latitude	Longitude	max. CTD Depth	Bottom depth	Bottom depth	Add. Sensors				
	#	MM/D	UTC			(m)	(m)	EM122					
1-1	1	9/20/19	12:32	18° 38.112'S	11° 56.718'E	107.32	117.5	115.3	O	P		L	U
3-1	2	9/20/19	18:01	17° 59.952'S	11° 21.960'E	527.14	543.8	543.8	O	P		L	U
8-1	3	9/21/19	02:24	16° 59.970'S	11° 15.930'E	654.04	692.0	687.8	O	P		L	U
9-1	4	9/21/19	08:32	16° 0.018'S	11° 34.128'E	841.28	855.8	857.5	O	P		L	U
10-1	5	9/21/19	15:14	14° 59.988'S	12° 3.960'E	398.27	429.6	425.4	O	P		L	U
13-1	6	9/21/19	21:49	14° 0.240'S	12° 12.108'E	435.99	448.0	444.2	O	P		L	U
16-1	7	9/22/19	05:55	12° 59.982'S	12° 43.080'E	891.89	934.1	934.9	O	P	A	L	U
18-1	8	9/22/19	13:50	11° 59.790'S	13° 22.818'E	529.27	548.7	546.0	O	P	A	L	U
19-1	9	9/22/19	21:18	10° 38.040'S	13° 17.982'E	116.30	126.2	122.3	O	P	A	L	U
21-1	10	9/22/19	23:09	10° 39.990'S	13° 14.988'E	212.68	222.8	219.7	O	P	A	L	U
23-1	11	9/23/19	01:01	10° 41.970'S	13° 11.970'E	423.15	433.2	433.1	O	P	A	L	U
25-1	12	9/23/19	03:56	10° 43.992'S	13° 9.012'E	645.30	695.2	696.5		P	A	L	U
27-1	13	9/23/19	13:24	10° 29.988'S	13° 29.982'E	35.79	45.9	42.7	O	P	A	L	U
29-1	14	9/23/19	14:51	10° 31.998'S	13° 27.030'E	47.72	61.8	58.4	O	P	A	L	U
31-1	15	9/23/19	16:28	10° 34.008'S	13° 24.060'E	80.52	90.1	87.1	O	P	A	L	U
33-1	16	9/23/19	17:53	10° 35.982'S	13° 21.012'E	97.42	108.9	105.1	O	P	A	L	U
37-1	17	9/23/19	22:49	10° 45.930'S	13° 6.090'E	914.73	934.8	939.0	O	P	A	L	U
39-1	18	9/24/19	01:12	10° 47.940'S	13° 3.078'E	1124.49	1144.3	1152.5	O	P	A	L	U
41-1	19	9/24/19	04:14	10° 49.950'S	13° 0.078'E	1193.71	1214.7	1222.2	O	SP	A	L	U
43-1	20	9/24/19	06:42	10° 53.280'S	12° 55.008'E	1254.99	1267.1	1278.5	O	SP	A	L	U
45-1	21	9/24/19	09:35	10° 56.022'S	12° 50.088'E	1357.75	1373.5	1376.6	O	SP	A	L	U
47-1	22	9/24/19	12:40	10° 59.982'S	12° 45.072'E	1404.17	1424.7	1426.8	O	SP	A		U
49-1	23	9/24/19	18:32	11° 20.058'S	12° 15.012'E	2259.66	2280.7	2287.8	O	SP	A	L	U
52-1	24	9/25/19	01:39	11° 44.982'S	11° 38.058'E	3395.68	3446.0	3455.8	O	SP	A	L	U
54-1	25	9/25/19	12:51	10° 49.920'S	13° 0.012'E	1197.66	1219.7	1224.1	O	SP	A	L	U
58-1	26	9/26/19	19:22	6° 27.000'S	11° 22.020'E	534.31	551.0	548.1	O	SP	A	L	U
60-1	27	9/28/19	22:21	0° 0.020'N	5° 0.072'E	203.77	-	3807.3	O	SP	A	L	U
62-1	28	9/29/19	00:21	0° 0.020'N	5° 0.072'E	3762.15	3811.0	3809.3	O	SP	A	L	U
66-1	29	9/29/19	20:03	0° 0.000'N	2° 0.000'E	99.43	-	4611.4	O	SP	A	L	U
67-1	30	9/29/19	20:49	0° 0.000'N	2° 0.012'E	4594.04	4609.6	4609.9	O	SP	A	L	U

69-1	31	9/30/19	05:44	0° 0.040'N	1° 0.018'E	4776.97	4821.5	4824.3	O	SP	A	L	U
71-1	32	9/30/19	16:04	0° 0.070'N	0° 0.070'E	248.48	-	4928.8	O	SP	A	L	U
73-1	33	9/30/19	17:39	0° 0.010'N	0° 0.000'E	4879.07	4927.6	4928.1	O	SP	A	L	U
78-1	34	10/1/19	04:15	0° 0.020'N	0° 59.990'W	4935.45	4985.3	4983.5	O	SP	A	L	U
80-1	35	10/1/19	13:42	0° 0.010'N	2° 0.150'W	5001.54	5044.5	5042.8	O	SP	A	L	U
82-1	36	10/1/19	23:02	0° 0.090'N	3° 0.030'W	5070.52	5116.3	5118.0	O	SP	A	L	U
86-1	37	10/2/19	09:12	0° 0.090'N	3° 59.910'W	5095.77	5138.4	5142.5	O	SP	A	L	U
88-1	38	10/2/19	18:26	0° 0.040'N	5° 0.018'W	248.48	-	5148.8	O	SP	A	L	U
90-1	39	10/2/19	20:14	0° 0.060'N	4° 59.862'W	5098.68	5147.2	5149.1	O	SP	A	L	U
93-1	40	10/3/19	06:03	0° 0.000'N	6° 0.018'W	5021.94	5072.0	5070.5	O	SP	A	L	U
97-1	41	10/3/19	15:26	0° 0.050'N	6° 59.988'W	5089.94	5139.7	5133.6	O	SP	A	L	U
100-1	42	10/4/19	01:13	0° 0.070'N	7° 59.940'W	5184.14	5193.6	5194.5	O	SP	A	L	U
106-1	43	10/4/19	11:47	0° 0.110'N	8° 59.838'W	4426.54	4475.5	4456.8	O	SP	A	L	U
109-1	44	10/4/19	22:32	0° 0.080'N	9° 59.952'W	226.62	-	4770.1		SP	A	L	U
111-1	45	10/5/19	00:10	0° 0.170'N	9° 59.400'W	4690.39	4739.3	4760.0	O	SP	A	L	U
118-1	46	10/5/19	12:28	0° 0.090'N	10° 59.898'W	3796.34	3851.1	3880.7	O	SP	A	L	U
122-1	47	10/5/19	21:37	0° 0.070'N	12° 0.012'W	3948.69	3958.3	3968.5	O	SP	A	L	U
129-1	48	10/6/19	08:32	0° 0.010'N	13° 0.078'W	4369.06	4378.3	4388.0	O	SP	A	L	U
135-1	49	10/6/19	18:54	0° 0.000'N	13° 59.760'W	3885.23	3933.6	3916.5	O	SP	A	L	U
141-1	50	10/7/19	05:58	0° 0.130'N	14° 59.958'W	602.78	-	3773.5		SP	A	L	U
143-1	51	10/7/19	08:10	0° 0.360'N	14° 58.710'W	3757.26	3767.6	3768.0	O	SP	A	L	U
150-1	52	10/7/19	18:43	0° 0.000'N	16° 0.270'W	3287.76	3298.6	3296.5	O	SP	A	L	U
155-1	53	10/8/19	04:59	0° 0.060'S	16° 59.880'W	5020.97	5032.4	5041.5	O	SP	A	L	U
160-1	54	10/8/19	13:00	0° 0.080'N	17° 30.000'W	5633.22	5643.8	5653.3	O	SP	A	L	U
163-1	55	10/9/19	13:28	0° 0.060'N	17° 59.130'W	5931.48	-	6385.2	O	SP	A	L	U
167-1	56	10/10/19	00:02	0° 0.020'N	19° 0.090'W	4382.70	4393.6	4420.2	O	SP	A	L	U
171-1	57	10/10/19	09:38	0° 0.010'N	20° 0.120'W	247.48	-	2607.7		SP	A	L	U
173-1	58	10/10/19	11:21	0° 0.090'N	19° 59.820'W	2526.58	2536.4	2535.0	O	SP	A	L	U
177-1	59	10/10/19	19:13	0° 0.010'S	21° 0.558'W	5111.31	5121.3	5121.0	O	SP	A	L	U
182-1	60	10/11/19	05:44	0° 0.030'N	22° 0.588'W	4113.62	4123.5	4112.0	O	SP	A	L	U
192-1	61	10/11/19	22:32	0° 0.000'N	23° 6.942'W	269.33	-	3928.5		SP	A	L	U
194-1	62	10/12/19	00:16	0° 0.040'N	23° 6.552'W	3915.50	3926.3	3927.0	O	SP	A	L	U
197-1	63	10/12/19	05:05	0° 1.130'S	23° 6.918'W	199.80	-	3933.9	O	SP	A	L	U
200-1	64	10/12/19	18:28	0° 0.090'S	24° 0.192'W	3937.95	3947.0	3946.6	O	SP	A	L	U
203-1	65	10/13/19	02:23	0° 0.160'S	25° 0.438'W	197.81	-	3253.8		SP	A	L	U
205-1	66	10/13/19	05:12	0° 0.140'S	24° 59.988'W	3181.98	3194.1	3200.3	O	SP	A	L	U
211-1	67	10/13/19	14:19	0° 0.010'S	26° 0.000'W	3682.01	3694.1	3694.4	O	SP	A	L	U
215-1	68	10/13/19	22:34	0° 0.010'N	27° 0.042'W	3316.15	3324.6	3323.7	O	SP	A	L	U
218-1	69	10/14/19	06:18	0° 0.030'N	27° 59.952'W	3935.02	3946.2	3945.9	O	SP	A	L	U
223-1	70	10/14/19	15:24	0° 0.010'N	28° 59.928'W	3534.37	3544.3	4089.2	O	SP	A	L	U
226-1	71	10/14/19	23:55	0° 0.040'N	30° 0.000'W	3850.07	3861.2	3842.3	O	SP	A	L	U
231-1	72	10/15/19	08:49	0° 0.030'S	31° 0.072'W	4207.25	4216.8	4371.1	O	SP	A	L	U
232-1	73	10/15/19	16:41	0° 0.030'S	32° 0.078'W	4428.49	4441.9	4422.7	O	SP	A	L	U
237-1	74	10/16/19	01:44	0° 0.000'N	33° 0.180'W	4542.44	4553.3	4546.8	O	SP	A	L	U
239-1	75	10/16/19	10:52	0° 0.010'S	34° 0.072'W	4538.54	4549.5	4555.5	O	SP	A	L	U
242-2	76	10/16/19	20:07	0° 0.030'N	35° 0.018'W	254.44	-	4541.5	O	SP	A	L	U

244-1	77	10/16/19	21:43	0° 0.020'N	35° 0.000'W	4526.86	4537.5	4541.7	O	SP	A	L	U
249-1	78	10/17/19	05:50	0° 0.020'N	35° 30.042'W	4521.02	4530.7	4531.3	O	SP	A	L	U
250-1	79	10/17/19	11:23	0° 0.000'N	35° 59.970'W	4514.20	4527.0	4529.6	O	SP	A	L	U
253-1	80	10/17/19	18:12	0° 0.030'N	36° 30.018'W	4507.38	4517.6	4518.2	O	SP	A	L	U
254-1	81	10/18/19	00:37	0° 0.040'N	37° 0.012'W	4496.67	4507.9	4508.3	O	SP	A	L	U
259-1	82	10/18/19	09:21	0° 0.000'N	37° 30.120'W	4473.30	4482.4	4481.8	O	SP	A	L	U
260-1	83	10/18/19	15:05	0° 0.000'N	38° 0.090'W	4432.39	4526.0	4444.1	O	SP	A	L	U
262-1	84	10/18/19	20:51	0° 0.040'N	38° 30.120'W	4361.26	4373.5	4371.8	O	SP	A	L	U
263-1	85	10/19/19	02:39	0° 0.030'N	39° 0.078'W	4300.84	4311.2	4311.0	O	SP	A	L	U
264-1	86	10/19/19	08:16	0° 0.000'N	39° 30.030'W	4178.97	4189.5	4191.2	O	SP	A	L	U
265-1	87	10/19/19	13:51	0° 0.020'N	39° 59.982'W	196.82	-	3419.8	O	SP	A	L	U
267-1	88	10/19/19	15:27	0° 0.020'N	39° 59.982'W	3427.74	3437.2	3441.7	O	SP	A	L	U
269-1	89	10/19/19	21:12	0° 0.000'N	40° 30.030'W	3893.04	3902.1	3899.7	O	SP	A	L	U
270-1	90	10/20/19	02:31	0° 0.010'S	41° 0.102'W	3805.14	3816.6	3815.5	O	SP	A	L	U
271-1	91	10/20/19	07:45	0° 0.030'S	41° 30.072'W	3887.18	3897.4	3895.5	O	SP	A	L	U
272-1	92	10/20/19	12:45	0° 0.070'S	42° 0.150'W	3851.04	3861.2	3858.8	O	SP	A	L	U
275-1	93	10/20/19	20:24	0° 0.020'S	42° 30.060'W	3674.19	3686.5	3684.5	O	SP	A	L	U
276-1	94	10/21/19	01:15	0° 0.230'N	42° 59.958'W	3252.50	3260.6	3352.1	O	SP	A	L	U
278-1	95	10/21/19	05:53	0° 0.050'S	43° 15.138'W	3488.40	3498.8	3496.2	O	SP	A	L	U
279-1	96	10/21/19	09:37	0° 0.020'S	43° 30.072'W	3452.20	3462.4	3461.9	O	SP	A	L	U
280-1	97	10/21/19	13:12	0° 0.080'S	43° 45.090'W	3233.90	3245.5	3244.6	O	SP	A	L	U
281-1	98	10/21/19	16:18	0° 0.030'S	43° 55.092'W	3092.81	3103.9	3101.4	O	SP	A	L	U
283-1	99	10/21/19	20:44	0° 0.540'N	44° 0.360'W	3034.00	3044.6	3039.2	O	SP	A	L	U
284-1	100	10/21/19	23:45	0° 0.540'S	44° 5.082'W	2722.03	2820.8	2725.0	O	SP	A	L	U
285-1	101	10/22/19	02:47	0° 0.530'S	44° 10.380'W	1858.34	1878.9	1882.9	O	SP	A	L	U
286-1	102	10/22/19	05:30	0° 0.480'S	44° 14.982'W	489.71	579.4	1247.7	O	SP	A	L	U

Abbreviations of additional measurements given in the CTD station list

L	LADCP
U	UVP5
P / SP	PAR light sensor / PAR and Surface Irradiance
O	Trios OPUS Nitrate Sensor
A	AZFP

Depth information given in the CTD station list

max Depth	maximum depth reached by the CTD
Bottom Depth	bottom depth calculated from LADCP backscatter when CTD was at maximum depth (only if bottom was within the range of the LADCP)
Bottom Depth EM122	bottom depth from shipboard multibeam echosounder

7.3 Drifter and float deployments

7.3.1 SVP buoy deployments

IMEI	WMO	Program and Platform	Latitude	Longitude	Deployment Date (UTC)
300234066438030	4401868	E-SURFMAR PG Upgraded SVPB	00˚00.006’S	005˚00.026’E	29-Sep-2019 03:07
300234066312490	4101684	SIO DWS-D	00˚00.125’N	000˚00.081’W	30-Sep-2019 22:14
300234066025240	1501669	GDP SVPB	00˚00.036’S	003° 00.06’W	02-Oct-2019 03:12
300234067112260	1501663	GDP SVP	00° 00.098’S	005° 59.873’W	03-Oct-2019 09:28
300234066312380	4101680	SIO DWS-D	00° 00.048’N	007° 59.447’W	04-Oct-2019 05:13
300234066513790	4402502	Copernicus SVP-BRST	00˚ 00.155’N	009° 58.876’W	05-Oct-2019 04:33
300234067112280	1501664	GDP SVP	00˚ 00.007’S	010° 59.59’W	05-Oct-2019 15:10
300234066438020	4401867	E-SURFMAR PG Upgraded SVPB	00˚ 00.199’S	011°59.211’W	06-Oct-2019 02:04
300234067112240	1501661	GDP SVP	00˚ 00.117’S	12˚59.892’W	06-Oct-2019 11:33
300234066025220	1501667	GDP SVPB	00˚ 00.170’S	013˚58.960’W	06-Oct-2019 22:39
300234066518820	4402500	Copernicus SVP-BRST	00˚ 00.067’N	014˚57.722’W	07-Oct-2019 11:55
300234067112180	1501660	GDP SVP	00˚ 00.035’S	015˚59.829’W	07-Oct-2019 21:00
300234065514820	4101677	SIO DWS-D	00˚ 00.377’S	016˚59.478’W	08-Oct-2019 08:50
300234067112250	1501662	GDP SVP	00˚00.010’S	017˚58.740’W	09-Oct-2019 17:42
300234066438040	4401869	E-SURFMAR PG Upgraded SVPB	00˚00.330’S	018˚59.630’W	10-Oct-2019 03:21
300234066519790	4402503	Copernicus SVP-BRST	00˚ 00.138’S	019˚59.738’W	10-Oct-2019 13:15
300234067111290	1501659	GDP SVP	00˚00.809’S	020˚59.970’W	10-Oct-2019 22:33
300234066025230	1501668	GDP SVPB	00˚00.256’S	022˚00.352’W	11-Oct-2019 08:25
300234067111280	1501658	GDP SVP	00˚00.370’N	023˚06.350’W	11-Oct-2019 20:27
300234066838680	4401859	E-SURFMAR PG Upgraded SVPB	00˚00.300’S	023˚59.880’W	12-Oct-2019 21:06
300234066514830	4402501	Copernicus SVP-BRST	00˚00.422’S	024˚59.722’W	13-Oct-2019 07:26
300234066312570	4101685	SIO DWS-D	00˚00.250’N	026˚00.240’W	13-Oct-2019 17:10
300234067110240	1501655	GDP SVP	00˚00.116’N	027˚00.038’W	14-Oct-2019 00:48
300234066025210	1501666	GDP SVPB	00˚00.440’N	028˚00.050’W	14-Oct-2019 09:09
300234064909760	1501654	GDP SVP	00˚00.400’N	028˚59.820’W	14-Oct-2019 18:12
300234066514800	4101773	Copernicus SVP-BRST	00˚00.471’N	030˚00.092’W	15-Oct-2019 03:09
300234067110300	1501657	GDP SVP	00˚00.310’S	032˚00.130’W	15-Oct-2019 19:52

300234066312250	4101679	SIO DWS-D	00˚00.120'S	034˚00.060'W	16-Oct-2019 14:00
300234066837700	4401858	E-SURFMAR PG Upgraded SVPB	00˚00.430'S	035˚59.780'W	17-Oct-2019 15:35
300234067110280	1501656	GDP SVP	00˚00.380'S	036˚59.610'W	18-Oct-2019 05:35
300234066025100	1501665	GDP SVPB	00˚ 00.000'N	038°00.050'W	18-Oct-2019 18:05

7.3.2 CARTHE drifter deployments

Buoy ID	Latitude	Longitude	Deployment Date (UTC)
0-3149279	00˚00.092'S	000˚00.057'E	30-Sep-2019 22:11
0-3150050	00˚00.265'N	003° 00.062'W	02-Oct-2019 03:09
0-3149722	00˚00.024'S	005° 59.922'W	03-Oct-2019 09:25
0-3151450	00° 00.048'N	007° 59.447'W	04-Oct-2019 05:12
0-3174870	00˚ 00.193'N	009° 58.895'W	05-Oct-2019 04:30
0-3151555	00˚ 00.018'N	010° 59.638'W	05-Oct-2019 15:06
0-3151545	00˚ 00.129'S	011°59.224'W	06-Oct-2019 02:00
0-3151563	00˚00.184'S	12˚59.892'W	06-Oct-2019 11:35
0-3150824	00˚00.200'S	013˚58.990'W	06-Oct-2019 22:37
0-3151446	00˚00.107'N	014˚57.750'W	07-Oct-2019 11:53
0-3150827	00˚00.049'S	015˚59.848'W	07-Oct-2019 20:58
0-3151385	00˚00.377'S	016˚59.486'W	08-Oct-2019 08:49
0-3151447	00˚00.013'S	017˚58.758'W	09-Oct-2019 17:41
0-3148285	00˚00.265'S	018˚59.648'W	10-Oct-2019 03:20
0-3151549	00˚00.104'S	019˚59.740'W	10-Oct-2019 13:15
0-3149469	00˚00.785'S	020˚59.970'W	10-Oct-2019 22:33
0-3149465	00˚00.231'S	022˚00.352'W	11-Oct-2019 08:24
0-3151448	00˚00.360'N	023˚06.349'W	11-Oct-2019 20:27
0-3150858	00˚00.287'S	023˚59.879'W	12-Oct-2019 21:06
0-3151541	00˚00.431'S	024˚59.775'W	13-Oct-2019 07:25
0-3150817	00˚00.198'N	026˚00.198'W	13-Oct-2019 17:09
0-3150984	00˚00.116'N	027˚00.038'W	14-Oct-2019 00:48
0-3150829	00˚00.408'N	028˚00.045'W	14-Oct-2019 09:09
0-3150825	00˚00.369'N	028˚59.835'W	14-Oct-2019 18:11
0-3151452	00˚00.462'N	030˚00.089'W	15-Oct-2019 03:09
0-3149415	00˚00.290'S	032˚00.147'W	15-Oct-2019 19:51
0-3149469	00˚00.111'S	034˚00.059'W	16-Oct-2019 13:59

7.3.3 Argo float deployments

Float serial number	IMEI	WMO	Latitude	Longitude	Deployment Date (UTC)
AI2600-19DE026	300234068806580	7900546	11˚20.104'S	012˚15.004'E	24-Sep-2019 19:23
AI2600-19DE032	300234068609280	6900541	11˚45.000'S	011° 38.000'E	25-Sep-2019 03:41
AI2600-19DE035	300234068606270	3901685	11˚45.000'S	011° 38.000'E	03-Oct-2019 03:41
AI2600-19DE027	300234068601920	7900547	00° 00.041'S	004° 59.964'E	29-Sep-2019 03:11
AI-2600-19DE037	300234068703120	6902651	00˚ 00.033'S	004° 58.817'W	02-Oct-2019 23:37
AI2600-19DE030	300234068601300	6900893	00˚00.190'N	014˚57.803'W	07-Oct-2019 11:49
AI2600-19DE036	300234068608100	6902651	00˚00.387'S	024˚59.851'W	13-Oct-2019 07:22

AI2600-19DE029	300234068807570	6900892	00˚00.415'S	034˚59.796'W	17-Oct-2019 02:32

7.4 List of mooring deployments and recoveries

7.4.1 Mooring Recoveries

Mooring Recovery Equatorial Atlantic 23W 0N					**Notes:**	**KPO_1201**
Vessel:	Meteor		M145			
Deployed:	24-Feb		2018	17:32		
Vessel:	Meteor		M158			
Recovered:	11-Oct		2019	16:40		
Latitude:			00°	00.20'	N	
Longitude:			23°	06.80'	W	
Water depth:			3930	Mag Var:	-14.6	
ID	**Depth**	**Instr. Type**	**s/n**	**Start-up ready**	**Remarks**	
KPO_1201_01	214	Argos	12619			
KPO_1201_02	214	ADCP QM up /p	21861	x	complete record	
KPO_1201_03	214	Mini-TD /p	70	x	complete and clean record	
KPO_1201_04	218	ADCP LR down /p	19398	x	complete and clean record	
KPO_1201_05	300	Microcat	2617	x	complete and clean record	
KPO_1201_06	300	O2 Logger	942	x	complete and clean record	
KPO_1201_07	499	Microcat /p	6863	x	complete and clean record	
KPO_1201_08	499	O2 Logger	1140	x	complete and clean record	
KPO_1201_09	849	Aquadopp up /p	P26209-3	x	complete and clean record	
KPO_1201_10	3324	MMP	11617	x	clean record (approx. 50% data coverage)	
KPO_1201_11	3342	Aquadopp down /p	P26209-6	x	complete and clean record	
KPO_1201_12	3699	Aquadopp down /p	P25460-2	x	complete and clean record	
KPO_1201_13	3905	Microcat /p	2485	x	complete and clean record	
KPO_1140_14	3916	Release RT661	28	Code:	Enable: 5022 / Release: 5024	
KPO_1140_15	3916	Release AR861	107	Code:	Enable: 0495 / Release: 0455	

Mooring Recovery Angola Current mooring					**Notes:**	**KPO_1200**
Vessel:	Meteor		M148			
Deployed:	22-Jun		2018	16:58		
Vessel:	Meteor		M158			
Recovered:	23-Sep		2019	13:00		
Latitude:			10°	50.00'	S	
Longitude:			13°	00.00'	E	
Water depth:			1221	Mag Var:	-4.4	
ID	**Depth**	**Instr. Type**	**s/n**	**Start-up ready**	**Remarks**	
KPO_1200_01		Argos	2255			
KPO_1200_02	499	ADCP LR 75 kHz up	2395	x	clean record (approx. 84.4% data coverage)	
KPO_1200_03	503	Microcat	1717	x	No record	
KPO_1200_04	503	Optode	1133	x	clean record (approx. 84.4% data coverage)	
KPO_1200_05	1216	Release AR861	1644		**Mode**:B **Range**: 0A89 **Release**:0A55	
KPO_1200_06	1216	Release AR861	1646	Code:	**Mode**:B **Range**: 0A8B **Release**:0A55	

7.4.2 Mooring Deployments

Mooring Deployment: Pressure inverted echo sounder						**Notes:**	**KPO_1219**
Vessel:	Meteor		M158				
Deployed:	25-Sep		2019	17:57			
Vessel:							
Recovered:							
Latitude:			10°	49.473’	S		
Longitude:			12°	59.675’	E		
Water depth:			1226				
ID	**Depth**	**Instr. Type**		**s/n**	**Start-up**	**Remarks**	
KPO_1219_01	1226	PIES		123	x		

Mooring Deployment Angola Current mooring						**Notes:**	**KPO_1215**
Vessel:	Meteor		M158				
Deployed:	25-Sep		2019	17:32			
Vessel:							
Recovered:							
Latitude:			10°	50.07’	S		
Longitude:			13°	00.00’	E		
Water depth:			1229	Mag Var:	-5.0		
ID	**Depth**	**Instr. Type**		**s/n**	**Start-up Ready**	**Remarks**	
KPO_1215_01	271	Buoy w/transmitter		02271			
KPO_1215_02	296	Microcat		10654	**X**		
KPO_1215_03	296	Optode			**X**		
KPO_1215_04		SMM Argos		1160 12617			
KPO_1215_05	498	ADCP LR 75 kHz up		17570	**X**		
KPO_1215_06	501	Microcat /p		10655	**X**	P (with Pressure sensor)	
KPO_1215_07	501	Optode		1141	**X**		
KPO_1215_08	654	Argonaut down		187	**X**		
KPO_1215_09	699	Microcat		936	**X**		
KPO_1215_10	848	Argonaut down		294	**X**		
KPO_1215_11	949	Microcat /p		2265	**X**	P (with Pressure sensor)	
KPO_1215_12	1048	Argonaut down		304	**X**		
KPO_1215_13	1213	Microcat		1285	**X**		
KPO_1215_14	1215	Release AR661		642		**Mode**:A **Enable**: 4A83 **Release**:4A84	
KPO_1215_15	1215	Release AR861		1104	Code:	**Mode**:B **Enable**: 0804 **Release**:0855	

Mooring Deployment Equatorial Atlantic 23W 0N						**Notes:**	**KPO_1210**
Vessel:	Meteor		M158				
Deployed:	12-Oct		2019	13:19			
Vessel:							
Recovered:							
Latitude:			00°	00.134’	S		
Longitude:			23°	07.016’	W		
Water depth:			3930	Mag Var:	-14.4		
ID	**Depth**	**Instr. Type**		**s/n**	**Start-up ready**	**Remarks**	
KPO_1210_01	211	Argos		2267			
KPO_1210_02	211	ADCP QM up /p		14910	x		

KPO_1210_03	211	Mini-TD /p	55	x	
KPO_1210_04	215	ADCP LR down /p	12530	x	
KPO_1210_05	297	Microcat /p	10709	x	
KPO_1210_06	297	O2 Logger	379	x	
KPO_1210_07	297	UVP6	000004LP	x	
KPO_1210_08	497	Microcat /p	10708	x	
KPO_1210_09	497	O2 Logger	375	x	
KPO_1210_10	829	Microcat	2614	x	
KPO_1210_11	829	UVP6	000002LP	x	
KPO_1210_12	844	Aquadopp up /p	26209-37	x	
KPO_1210_13	3329	MMP	12201	x	
KPO_1210_14	3329	Aquadopp down /p	26209-30	x	
KPO_1210_15	3699	Aquadopp up /p	26209-9	x	
KPO_1210_16	3905	Microcat	2618	x	
KPO_1210_17	3916	Release AR661	351	Code:	Enable: C375 / Release: C376
KPO_1210_18	3916	Release AR861	975	Code:	Enable: 1816 / Release: 1855

7.5 Microstructure station list

Station	MSS station	Date	Time	Latitude	Longitude	Pro files	max. Depth (dbar)
2-1	001	20.09.2019	13:30-13:45	18°38.13’S	011°56.73’E	1	80
4-1	002	20.09.2019	18:50-19:30	18°00.00’S	011°22.00’E	4	17/99/106/113
5-1	003	20.09.2019	21:10-21:30	17°45.64’S	011°19.54’E	3	99/98/99
6-1	004	20.09.2019	23:11-23:15	17°30.04’S	011°17.63’E	n.a.	-
7-1	005	21.09.2019	01:10 - --:--	17°12.00’S	011°15.80’E	n.a.	-
11-1	006	21.09.2019	16:00 - --:--	15°00.00’S	012°04.00’E	n.a.	-
12-1	007	21.09.2019	21:25-21:45	14°00.00’S	012°12.00’E	1	111
14-1	008	21.09.2019	22:30-23:05	14°00.00’S	012°12.00’E	3	111/113/114
15-1	009	22.09.2019	05:20-05:50	13°00.00’S	012°43.00’E	2	173/147
17-1	010	22.09.2019	13:15-13:45	12°00.00’S	013°23.00’E	3	97/99/107
20-1	011	22.09.2019	21:46-22:26	10°38.00’S	013°18.00’E	5	85/20/107/120/118
22-1	012	22.09.2019	23:30-00:30	10°40.00’S	013°15.00’E	3	225/247/268
24-1	013	23.09.2019	01:35-02:40	10°42.00’S	013°12.00’E	2	349/279
28-1	014	23.09.2019	13:45-14:15	10°30.00’S	013°30.00’E	6	46/43/42/47/48
30-1	015	23.09.2019	15:15-15:50	10°32.00’S	013°27.00’E	6	44/57/53/55/63/60
32-1	016	23.09.2019	16:45-17:20	10°34.00’S	013°24.00’E	4	75/81/82/78
34-1	017	23.09.2019	18:15-18:40	10°36.00’S	013°21.00’E	3	95/101/96
38-1	018	23.09.2019	23:50-00:40	10°46.00’S	013°06.00’E	2	371/393
42-1	019	24.09.2019	04:15-05:05	10°50.00’S	013°00.00’E	1	418
44-1	020	24.09.2019	07:45-08:50	10°53.03’S	012°55.00’E	1	325
46-1	021	24.09.2019	10:55-11:35	10°56.07’S	012°50.00’E	3	204/192/196
48-1	022	24.09.2019	14:35-15:10	11°00.00’S	012°45.00’E	3	182/171/140
59-1	023	26.09.2019	20:20-21:05	06°27.00’S	011°22.00’E	3	180/173/171
65-1	024	29.09.2019	03:15-03:55	00°00.00’S	005°00.00’E	3	134/157/147
68-1	025	29.09.2019	23:55-00:20	00°00.00’S	002°00.00’E	3	110/96/102
70-1	026	30.09.2019	09:00-09:30	00°00.00’S	001°00.00’E	3	96/117/92
77-1	027	30.09.2019	22:20-22:55	00°00.00’S	000°00.00’E	3	131/116/131
79-1	028	01.10.2019	07:55-08:25	00°00.00’S	001°00.00’W	3	118/128/147
81-1	029	01.10.2019	23:15-02:55	00°00.00’S	002°00.00’W	3	121/129/122
85-1	030	02.10.2019	03:15-03:55	00°00.00’S	003°00.00’W	3	142/136/128

87-1	031	02.10.2019	12:35-13:15	00°00.00'S	004°00.00'W	3	163/154/167
92-1	032	03.10.2019	00:05-00:45	00°00.00'S	005°00.00'W	3	127/177/183
96-1	033	03.10.2019	09:30-10:05	00°00.00'S	006°00.00'W	3	124/145/128
99-1	034	03.10.2019	19:10-19:45	00°00.00'S	007°00.00'W	3	120/121/120
104-1	035	04.10.2019	05:15-05:55	00°00.00'S	008°00.00'W	3	136/135/148
107-1	036	04.10.2019	14:45-15:15	00°00.00'S	009°00.00'W	3	133/168/130
116-1	037	05.10.2019	05:40-06:15	00°00.00'S	010°00.00'W	3	121/125/128
121-1	038	05.10.2019	15:15-15:55	00°00.00'S	011°00.00'W	3	180/137/169
127-1	039	06.10.2019	02:05-02:40	00°00.00'S	012°00.00'W	3	135/146/132
132-1	040	06.10.2019	11:40-12:20	00°00.00'S	013°00.00'W	3	138/127/149
139-1	041	06.10.2019	22:42-23:25	00°00.00'S	014°00.00'W	3	170/155/146
148-1	042	07.10.2019	11:59-12:32	00°00.00'S	015°00.00'W	3	129/144/148
153-1	043	07.10.2019	21:04-21:43	00°00.00'S	016°00.00'W	3	146/194/144
156-1	044	08.10.2019	08:15-08:44	00°00.00'S	017°00.00'W	3	107/124/127
166-1	045	09.10.2019	17:45-18:17	00°00.00'S	018°00.00'W	3	132/139/137
170-1	046	10.10.2019	03:29-04:08	00°00.00'S	019°00.00'W	3	140/144/152
176-1	047	10.10.2019	13:21-13:58	00°00.00'S	020°00.00'W	3	124/128/137
180-1	048	10.10.2019	22:39-23:21	00°00.00'S	021°00.00'W	3	145/145/151
185-1	049	11.10.2019	08:29-09:04	00°00.00'S	022°00.00'W	3	133/139/150
190-1	050	11.10.2019	20:36-20:53	00°00.00'S	023°00.00'W	1	174
196-1	051	12.10.2019	04:03-04:55	00°00.00'S	023°00.00'W	4	126/131/141/140
209-1	052	13.10.2019	07:30-08:01	00°00.00'S	025°00.00'W	3	123/125/123
222-1	053	14.10.2019	09:17-09:51	00°00.00'S	028°00.00'W	3	131/136/148
230-1	054	15.10.2019	03:11-03:43	00°00.00'S	030°00.00'W	3	125/140/143
236-1	055	15.10.2019	19:54-20:27	00°00.00'S	032°00.00'W	3	127/155/142
248-1	056	17.10.2019	02:36-03:09	00°00.00'S	035°00.00'W	3	152/156/158
258-1	057	18.10.2019	05:40-06:21	00°00.00'S	037°00.00'W	3	202/145/142
268-1	058	19.10.2019	17:39-18:09	00°00.00'S	040°00.00'W	3	191/135/148
274-1	059	20.10.2019	16:42-17:51	00°00.00'S	042°00.00'W	3	188/132/280

7.6 CPICS deployment list

CPICS deployments in standalone mode				
Station number	**Date and Time**	**Latitude**	**Longitude**	**Deployment depth**
M158_98-1	03.10.19 18:47	00˚ 00.067' N	006˚ 59.843' W	100
M158_101-1	04.10.19 04:42	00˚ 00.083' N	007˚ 59.687' W	110
M158_105-1	04.10.19 11:32	00˚ 00.077' N	008˚ 59.967' W	110
M158_108-1	04.10.19 22:14	00˚ 00.052' N	010˚ 00.005' W	110
M158_117-1	05.10.19 12:06	00˚ 00.044' N	011˚ 00.009' W	110
M158_123-1	06.10.19 00:20	00˚ 00.091' N	011˚ 59.761' W	110
M158_128-1	06.10.19 08:11	00˚ 00.001' N	013˚ 00.142' W	110
M158_134-1	06.10.19 18:37	00˚ 00.041' S	013˚ 59.885' W	110
M158_142-1	07.10.19 07:09	00˚ 00.214' N	014˚ 59.383' W	4 x 110
M158_149-1	07.10.19 18:24	00˚ 00.008' N	016˚ 00.451' W	110
M158_162-1	09.10.19 12:59	00˚ 00.025' N	017˚ 59.217' W	110
M158_191-1	11.10.19 21:24	00˚ 00.013' S	023˚ 06.936' W	110
M158_198-1	12.10.19 05:40	00˚ 01.119' S	023˚ 06.808' W	110
M158_212-1	13.10.19 16:48	00˚ 00.006' S	026˚ 00.026' W	110

M158_219-1	14.10.19 08:49	00˚ 00.216' N	028˚ 00.033' W	110
M158_227-1	15.10.19 02:42	00˚ 00.068' N	030˚ 00.001' W	110
M158_233-1	15.10.19 19:33	00˚ 00.098' S	032˚ 00.309' W	110
M158_246-1	17.10.19 02:08	00˚ 00.405' S	034˚ 59.788' W	110
M158_256-1	18.10.19 05:12	00˚ 00.103' S	036˚ 59.793' W	110
M158_266-1	19.10.19 14:22	00˚ 00.025' N	039˚ 59.970' W	110
M158_266-2	19.10.19 14:47	00˚ 00.025' N	039˚ 59.970' W	2 x 110
M158_273-1	20.10.19 15:21	00˚ 00.045' S	042˚ 00.112' W	3 x 110
M158_277-1	21.10.19 03:33	00˚ 00.033' N	043˚ 00.084' W	4 x 110
M158_282-1	21.10.19 19:46	00˚ 00.001' N	044˚ 00.106' W	110
M158_287-1	22.10.19 06:42	00˚ 00.433' N	044˚ 15.370' W	110

7.7 Biogeochemical sampling station list

^{14}C Primary production (14C), ^{13}C carbon and ^{15}N nitrogen fixation (NF), flow cytometry (FC), HPLC, natural abundance of C/N isotopes in particles (PN), NH_4 (NH4), and nutrients (NUTS) sampling list. Not all variables were measured all depths indicated.

Event	Cast	Latitude	Longitude	Depth	Measurements
ST01	CTD1	-18.7	12.0	5	PN, HPLC
ST09	CTD4	-16.0	11.6	100, 85, 55, 20, 10	PN, NF, FC, HPLC, NUTS
ST18	CTD8	-12.0	12.0	150, 100, 36, 22, 5	PN, NF, FC, HPLC, NUTS
ST25	CDT12	-10.7	13.2	150, 100, 30, 18, 5	PN, NF, 14C, FC, HPLC, NUTS
ST49	CTD23	-11.3	12.3	150, 50, 35, 16, 5	PN, NF, FC, HPLC, NUTS, NH4
ST55	CTD25	-10.8	13.0	200, 70, 50, 40, 25, 10	FC, HPLC, NUTS, NH4
ST58	CTD26	-6.5	11.4	535, 300, 50, 25, 14, 8, 5	PN, NF, FC, HPLC, NH4, NUTS
ST60	CTD27	0.0	5.0	100, 55, 45, 25, 5	PN, NF, 14C, FC, HPLC, NH4, NUTS
ST62	CTD28	0.0	5.0	3000, 1250, 1000, 750, 200	NH4, NUTS
ST66	CTD29	0.0	2.0	60, 45, 25, 5	PN, NF, FC, HPLC
ST66	CTD30	0.0	2.0	3000, 1250, 1000, 710, 100, 60, 5	NH4, NUTS
ST69	CTD31	0.0	1.0	1500, 720, 200, 100, 65, 50, 20, 5	PN, NF, FC, HPLC, NH4, NUTS
ST71	CTD32	0.0	0.0	200, 100, 75, 60, 30, 5	PN, NF, FC, HPLC, NH4, NUTS
ST73	CTD33	0.0	0.0	2000, 1250, 720	NUTS
ST78	CTD34	0.0	-1.0	1500, 1000, 800, 200, 100, 65, 45, 20, 5	14C, FC, HPLC, NH4, NUTS
ST80	CTD35	0.0	-2.0	600, 300, 200, 100, 55, 43, 20, 5	PN, NF, FC, HPLC, NH4, NUTS
ST82	CTD36	0.0	-3.0	200, 100, 60, 45, 35, 5	14C, FC, HPLC, NH4, NUTS
ST86	CTD37	0.0	-4.0	200, 100, 70, 55, 45, 30, 5	PN, NF, FC, HPLC, NH4, NUTS
ST88	CTD38	0.0	-5.0	250, 100, 75, 35, 20, 5	PN, NF, FC, HPLC, NH4, NUTS
ST90	CTD39	0.0	-5.0	1250, 1000, 600, 300	NUTS
ST93	CTD40	0.0	-6.0	200, 100, 65, 40, 20, 5	14C, FC, HPLC, NH4, NUTS
ST97	CTD41	0.0	-7.0	600, 400, 200, 100, 60, 50, 20, 5	PN, NF, FC, HPLC, NH4, NUTS
ST100	CTD42	0.0	-8.0	500, 400, 200, 100, 60, 45, 20, 5	14C, FC, HPLC, NH4, NUTS

ST106	CTD43	0.0	-9.0	600, 400, 200, 100, 60, 45, 20, 5	PN, NF, FC, HPLC, NH4, NUTS
ST110	CTD44	0.0	-10.0	200, 100, 70, 45, 20, 55	PN, NF, FC, HPLC, NH4, NUTS
ST118	CTD46	0.0	-11.0	600, 400, 200, 100, 70, 50, 25, 5	PN, NF, FC, HPLC, NH4, NUTS
ST122	CTD47	0.0	-12.0	1500, 800, 600, 400, 300, 200, 100, 60, 45, 25, 5	14C, FC, HPLC, NUTS, NH4
ST129	CTD48	0.0	-13.0	1500, 1000, 800, 600, 400, 200, 100, 55, 40, 25, 5	PN, NF, FC, HPLC, NH4, NUTS
ST135	CTD49	0.0	-14.0	1250, 1000, 600, 400, 200, 100, 65, 45, 25, 5	PN, NF, FC, HPLC, NH4, NUTS
ST141	CTD50	0.0	-15.0	200, 100, 70, 55, 30, 5	14C, FC, HPLC, NH4, NUTS
ST143	CTD51	0.0	-15.0	1250, 1000, 600, 400	NUTS
ST150	CTD52	0.0	-16.0	1250, 1000, 800, 600, 400, 300, 200, 100, 60, 45, 30, 5	PN, NF, FC, HPLC, NH4, NUTS
ST155	CTD55	0.0	-17.0	1250, 1000, 690, 600, 400, 300, 200, 100, 50, 40, 25, 5	14C, FC, HPLC, NH4, NUTS
ST163	CTD55	0.0	-18.0	200, 50, 30, 5	PN, NF, FC, HPLC, NUTS, NH4
ST167	CTD56	0.0	-19.0	1250, 1000, 800, 600, 400, 300, 200, 100, 75, 55, 40, 5	14C, FC, HPLC, NUTS, NH4
ST171	CTD57	0.0	-20.0	200, 100, 65, 45, 30, 5	PN, NF, FC, HPLC, NUTS, NH4
ST173	CTD58	0.0	-20.0	1250, 1000, 800, 600, 500, 400	NUTS
ST177	CTD59	0.0	-21.0	1250, 1000, 600, 400, 200, 100, 75, 55, 40, 5	PN, NF, FC, HPLC, NH4, NUTS
ST182	CTD60	0.0	-22.0	800, 600, 400, 300, 200, 100, 80, 65, 50, 5	14C, FC, HPLC, NH4, NUTS
ST197	CTD63	0.0	-23.0	200, 100, 70, 55, 35, 5	PN, NF, 14C, FC, HPLC, NH4, NUTS
ST200	CTD64	0.0	-24.0	1500, 1000, 800, 600, 400, 300, 200, 100, 60, 40, 20, 5	PN, NF, FC, HPLC, NH4, NUTS
ST203	CTD65	0.0	-25.0	200, 100, 75, 60, 30, 5	14C, FC, HPLC, NH4, NUTS
ST211	CTD67	0.0	-26.0	1250, 1000, 750, 400, 200, 100, 70, 50, 30, 5	PN, NF, FC, HPLC, NH4, NUTS
ST215	CTD68	0.0	-27.0	1200, 1000, 800, 600, 400, 200, 100, 70, 50, 30, 5	PN, NF, FC, HPLC, NH4, NUTS
ST218	CTD69	0.0	-28.0	1250, 1000, 800, 600, 400, 200, 100, 65, 50, 40, 5	PN, NF, FC, HPLC, NH4, NUTS
	CTD70	0.0	-29.0	1250, 1000, 700, 600, 400, 200, 100, 80, 60, 30, 5	FC, HPLC, NH4, NUTS
ST231	CTD72	0.0	-31.0	1250, 1000, 700, 400, 200, 100, 80, 65, 40, 5	PN, NF, FC, HPLC, NH4, NUTS
ST232	CTD73	0.0	-32.0	1250, 1000, 800, 600, 450, 200, 100, 30, 5	NH4, NUTS
ST237	CTD74	0.0	-33.0	1250, 1000, 750, 400, 300, 200, 100, 80, 60, 40, 5	14C, FC, HPLC, NH4, NUTS
ST239	CTD75	0.0	-34.0	1000, 750, 500, 400, 300, 200, 100, 80, 45, 5	PN, NF, FC, HPLC, NH4, NUTS
ST242	CTD76	0.0	-35.0	200, 100, 90, 70, 40, 5	PN, NF, FC, HPLC, NH4, NUTS
ST249	CTD78	0.0	-35.5	1250, 1000, 600, 400, 200, 80, 60, 30, 5	14C, FC, HPLC, NH4, NUTS
ST250	CTD79	0.0	-36.0	1500, 1000, 800, 600, 400, 370, 200, 100, 80, 60, 30, 5	NH4, NUTS
ST253	CTD80	0.0	-36.5	45, 5	PN, NF, FC, HPLC, NH4, NUTS
ST254	CTD81	0.0	-37.0	1250, 950, 670, 450, 200, 100, 75, 50, 30, 5	PN, NF, 14C, FC, HPLC, NH4, NUTS
ST259	CTD82	0.0	-37.5	200, 100, 65, 50, 25, 5	FC, HPLC, NH4, NUTS

ST262	CTD84	0.0	-38.5	1250, 1000, 600, 400, 200, 110, 70, 40, 5	PN, NF, FC, HPLC, NH4, NUTS
ST265	CTD87	0.0	-40.0	200, 125, 90, 65, 30, 5	PN, NF, FC, HPLC, NH4, NUTS
ST267	CTD88	0.0	-40.0	3475, 3250, 3000, 2500, 2000, 1750, 1500, 1250, 1000, 800, 725, 600, 540, 400, 300	NUTS
ST270	CTD90	0.0	-41.0	1250, 1000, 750, 650, 300, 200, 80, 55, 30, 5	PN, NF, FC, HPLC, NH4, NUTS
ST272	CTD92	0.0	-42.0	1250, 1000, 795, 600, 300, 195, 110, 90, 75, 50, 5	NH4, NUTS
ST275	CTD93	0.0	-42.5	1250, 1000, 800, 600, 400, 200, 100, 75, 40, 5	PN, NF, FC, HPLC, NH4, NUTS
ST276	CTD94	0.0	-42.5	1250, 1000, 900, 500, 300, 200, 120, 100, 80, 50, 5	NH4, NUTS
ST278	CTD95	0.0	-43.3	1250, 1000, 700, 400, 200, 100, 90, 75, 40, 5	PN, NF, FC, HPLC, NH4, NUTS
ST283	CTD99	0.0	-44.0	1250, 1000, 775, 600, 400, 200, 135, 115, 50, 5	PN, NF, FC, HPLC, NH4, NUTS

8 Data and Sample Storage and Availability

In Kiel, a joint data management team is set up to store the data from various projects and cruises in a web-based multi-user-system. Data gathered during M158 are stored at the Kiel data portal, and remain proprietary for the PIs of the cruise and for members of EU-TRIATLAS and the BMBF-BANINO project. Each station is logged as an event file https://portal.geomar.de/metadata/leg/show/344906. All data will be submitted to PANGAEA within 3 years after the cruise, i.e. by October 2022. Preliminary CTD data were submitted to CORIOLIS during the cruise for real time oceanographic analysis and Argo calibration. Contact persons for the different datasets are listed in Table 8.1.

Table 8.1: Overview of contact persons for the different data sets.

Data Type	Contact Person	Current Affiliation	Email
CTD/O_2	Sunke Schmidtko	GEOMAR	sschmidtko@geomar.de
VMADCP	Rena Czeschel	GEOMAR	rczeschel@geomar.de
LADCP	Rena Czeschel	GEOMAR	rczeschel@geomar.de
Mooring data	Peter Brandt	GEOMAR	pbrandt@geomar.de
Microstructure data	Marcus Dengler	GEOMAR	mdengler@geomar.de
Thermosalinograph	Sunke Schmidtko	GEOMAR	sschmidtko@geomar.de
Multibeam echosounder	Colin Devey	GEOMAR	cdevey@geomar.de
Nutrients	Ajit Subramaniam	LDEO	ajit@ldeo.columbia.edu
Underwater Vision Profiler	Rainer Kiko	GEOMAR	rkiko@geomar.de
Multinet	Rainer Kiko	GEOMAR	rkiko@geomar.de
AZFP	Rainer Kiko	GEOMAR	rkiko@geomar.de
Tracer data (CFC-12, SF_6)	Toste Tahnua	GEOMAR	ttanhua@geomar.de
Nitrous oxide	Damian L. Arévalo-Martínez	GEOMAR	darevalo@geomar.de
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Flow cytometry	Ajit Subramaniam	LDEO	ajit@ldeo.columbia.edu
Organic matter	Javier Arístegui	ULPGC	javier.aristegui@ulpgc.es
C/N fixation	Ana Fernández	UVIGO	afcarrera@uvigo.es
C/N isotopes	Ana Fernández	UVIGO	afcarrera@uvigo.es

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11 Appendix – List of Abbreviations

AABW	Antarctic Bottom Water
AAIW	Antarctic Intermediate Water
ACM	Acoustic Current Meter
ADCP	Acoustic Doppler Current Profiler
AZFP	Acoustic Zooplankton and Fish Profiler
BMBF	Federal Ministry of Education and Research
BONCAT	BioOrthogonal Non-Canonical Amino acid Tagging
cDOM	Colored Dissolved Organic Matter
CFC	Chloroflourocarbons
CF IRMS	Continuous-Flow Isotope-Ratio Mass Spectrometry
CPICS	Continuous particle imaging and classification system
CTD	Conductivity-temperature-depth (system)
DCM	Deep Chlorophyll Maximum
DFG	German Science Foundation
DSOW	Denmark Strait Overflow Water
ECD	Electron Capture Detector
ETS	Electron Transport System

fDOM	Fluorescent Dissolved Organic Matter
FIRe	Fluorescence Induction Relaxation experiment
GC-ECD	Gas chromatographic – electron capture detector system
GDP	Global Drifter Program
HPG	Homopropargylglycine
HPLC	High Performance Liquid Chromatography
ITCZ	Intertropical Convergence Zone
LADCP	Lowered ADCP
LR ADCP	Longranger ADCP
LSW	Labrador Sea Water
MMP	McLane Moored Profiler
MSS	Microstructure system
NADW	North Atlantic Deep Water
NOx	Nutrients
OPS	OPTIMARE Precision Salinometer
OS38	38kHz RDI Ocean Surveyor
OS75	75kHz RDI Ocean Surveyor
PAR	Photosynthetically active radiation
PFA	Paraformaldehyde
PicoLif	Picosecond Lifetime Fluorescence
PIES	Pressure inverted echo sounder
POC	Particulate organic carbon
PON	Particulate organic nitrogen
SBE	Seabird Electronics
SSS	Sea surface salinity
SST	Sea surface temperature
SVP	Surface Velocity Program
TOC	Total Organic Carbon
TRATLEQ	Transatlantic Equatorial Cruise
TSG	Thermosalinograph
UVP	Underwater vision profiler
VMADCP	Vessel-mounted Acoustic Doppler Current Profiler