METEOR-Berichte

Oxygen Variability and Tropical Atlantic Circulation

Cruise No. M130

August 28 – October 3, 2016
Mindelo (Cape Verde) – Recife (Brazil)

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1 Cruise summary

1.1 Summary in English

A physical - biogeochemical survey was carried out in the northeastern tropical Atlantic and in the western tropical South Atlantic. The main objective of the works in the oxygen minimum zone of the eastern tropical North Atlantic was to improve oxygen budget estimates. Additional objectives were to investigate the role of zooplankton for fluxes of particulate and dissolved organic matter and to advance quantitative understanding of nitrogen fixation in the tropical Atlantic. The main objective of the measurements program in the western tropical South Atlantic was to investigate the variability of transport and water mass properties of the western boundary circulation.

A major component of the work program was the recovery of nine and the redeployment of eight moorings. The moorings positioned off Cape Verde, in the tropical northeastern Atlantic and at the western boundary off Brazil are collecting velocity, oxygen, temperature, and salinity time series since several years. All moorings were successfully recovered and redeployed. Section work focused on 23°W from 15°N to 5.5°S, on 11.5°S from 32°W to the coast of Brazil and on 5°S from 29.5°W to the coast of Brazil. Parameters measured along the sections included temperature-salinity-depth, oxygen and turbulence profiles, lowered acoustic Doppler current profiles, underwater vision profiles, shipboard velocity profiles, multinet and Working Party 2 net casts, and photosynthetically active radiation profiles. Water samples were analyzed for numerous variables including salinity, oxygen concentrations, tracer concentrations (CFC-12, SF6, CF_3SF_5), nutrients in micro and nano range, and halocarbons. Filtered samples were taken for NanoSIMS, flow cytometry, dissolved organic phosphorus, DNA/RNA, particulate organic matter, particulate organic nitrogen, and chlorophyll *a*. Samples of Heme content and dissolved iron were taken from a towed trace metal clean fish. Furthermore, on-board incubations to quantify nitrogen and carbon fixation and primary productivity were performed. The measurement program was successfully completed and all data sets were acquired as planned.

1.2 Zusammenfassung

Auf dem Fahrtabschnitt M130 wurde ein physikalisches-biogeochemisches Messprogramm in nordöstlichen und südwestlichen tropischen Atlantik durchgeführt. Die Hauptzielsetzung der Arbeiten in der Sauerstoffminimumzone des nordöstlichen tropischen Atlantiks war die Quantifizierung der Variabilität von Sauerstofftransportprozessen. Zusätzlich wurde der Einfluss von Zooplankton auf Flüsse von partikulärem und gelöstem organischen Material untersucht und die Nährstoffproduktion durch Stickstofffixierung bestimmt. Die Zielsetzung der Untersuchungen im westlichen tropischen Südatlantik war die Bestimmung der Variabilität der Randstromtransporte und der Wassermassen vor der Küste Brasiliens.

Eine Hauptkomponente der Arbeiten war die Bergung von 9 und erneute Auslegung von 8 Verankerungen. Die seit mehreren Jahren vor den Cape Verden, im tropischen Nordatlantik und vor der Küste Brasiliens existierenden Tiefseeverankerungen liefern Zeitserien von Strömungen, Sauerstoffgehalt, Temperatur und Salzgehalt. Alle Verankerungsarbeiten konnten erfolgreich abgeschlossen werden. Die Beprobung eines meridionalen Schnitts entlang 23°W (15°N bis 5.5°S) und zwei zonaler Schnitte entlang von 11°S (32°W bis Küste Brasiliens) und 5°S (29.5°W bis Küste Brasiliens) im westlichen Südatlantik wurde erfolgreich durchgeführt. Dabei wurden Temperatur-, Salzgehalts-, Druck-, Strömungs- und Turbulenzprofile aufgenommen,

Planktonproben mit Multinetzen und WP2 Netz gesammelt, photosynthetisch aktive Strahlungsprofile gemessen, Bilder mit einer Unterwasserkamera aufgezeichnet und Wasserproben genommen. Anhand der Wasserproben wurden die Konzentrationen von einer Vielzahl unterschiedlicher physikalischer und biogeochemischer Variablen bestimmt, darunter Sauerstoff, Salzgehalt, Tracer (CFC-12, SF_6, CF_3SF_5), Nährstoffe in Mikro- und Nanobereich und Halogenkohlenwasserstoffe. Zusätzlich wurden Filtrate für NanoSIMS und Durchflusszytometrie erstellt und Proben für die Bestimmung von DNA/RNA, gelösten organischen Phosphat, partikulären organischen Kohlenstoff und Stickstoff sowie Chlorophyll *a* genommen. Proben für die Heme und Eisenbestimmung wurden mit einem spurenmetallfreien Gerät gesammelt. Messungen zur Bestimmung der Rate der Stickstoffstofffixierung und der Primärproduktion wurden an Deck mit Inkubatoren durchgeführt.

2 Participants

No.	Name	Discipline	Institution
1	Dengler, Marcus, Dr.	Physical Oceanography / Chief scientist	GEOMAR
2	Al Balushi, Hajar	Physical Oceanography / LADCP	GEOMAR
3	Bruto, Leonardo, Dr.	Physical Oceanography / Moorings	UFPE
4	Burmeister, Kristin	Physical Oceanography / Mooring proc.	GEOMAR
5	Caricchio Espinheira, Camilla	Observer	Brazilian Navy
6	Dürschlag, Julia	Marine Biology / N_2-fixation	MPI Bremen
7	Faustmann, Jannik	Marine Biology / Multinet, WP 2 net	GEOMAR
8	Fernandez Carrera, Ana, Dr.	Marine Biology / N_2-fixation	UVIGO
9	Gutekunst, Sören Dr.	Marine Chemistry / Tracer, CFC-12, SF_6	GEOMAR
10	Hahn, Johannes, Dr.	Physical Oceanography / Optodes	GEOMAR
11	Hauschildt, Jaard	Physical Oceanography / Moored profiler	GEOMAR
12	Hemmen, Joost	Physical Oceanography / Aerosols	GEOMAR
13	Ivanciu, Ioana	Physical Oceanography / T, S, P - logger	GEOMAR
14	Kiko, Rainer Dr.	Marine Biology / UVP, multinet, driftnet	GEOMAR
15	Kloewer, Milan	Physical Oceanography /MSS	GEOMAR
16	Krahmann, Gerd, Dr.	Physical Oceanography / CTD and LADCP	GEOMAR
17	Kriest, Iris, Dr.	Marine Biology / Multinet, nutrients	GEOMAR
18	Li, Pingyang	Marine Chemistry / Tracer, CFC-12, SF_6	GEOMAR
19	Link, Rudolf	Physical Oceanography / CTD tech.	GEOMAR
20	Louropoulou, Evangelia	Marine Chemistry / Heme, nutrients	GEOMAR
21	Maas, Josefine	Marine Chemistry / Oxygen titration, $CHBr_3$	GEOMAR
22	Niehus, Gerd	Physical Oceanography / Moorings tech.	GEOMAR
23	Papenburg, Uwe	Physical Oceanography / Moorings tech.	GEOMAR
24	Patey, Matt, Dr.	Marine Chemistry / Nano-nutrients	GEOMAR
25	Philippi, Miriam	Marine Biology / N_2-fixation, incubation	MPI Bremen
26	Rohleder, Christian	Meteorology / Bordwetterwarte	DWD
27	Stöven, Tim, Dr.	Marine Chemistry / Tracer, CFC-12, SF_6	GEOMAR
28	Subramaniam, Ajit, Dr.	Marine Biology / Biooptics, N_2-fixation	LDEO
29	Wagner, Partick	Physical Oceanography / T, S, P – logger	GEOMAR
30	Witt, Rene	Physical Oceanography / Optodes tech.	GEOMAR

GEOMAR	GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel
DWD	Deutscher Wetterdienst, Geschäftsfeld Seeschiffahrt
LDEO	Lamont Doherty Earth Observatory at Columbia University
MPI Bremen	Max-Planck Institute for Marine Microbiology
UVIGO	Universidade de Vigo
UFPE	Universidade Federal de Pernambuco

3 Research program

The research program was an integral component of the DFG Collaborative Research Center "Climate - Biogeochemistry Interactions in the Tropical Ocean" (SFB 754) and the BMBF-collaborative project "Regional Atlantic Circulation and Global Change" (RACE II). Within the framework of the SFB 754 the main scientific questions addressed during M130 were: (1) How does subsurface dissolved oxygen in the tropical ocean respond to variability in ocean circulation and ventilation? (2) What are the relations and feedbacks linking low or variable oxygen levels and key nutrient source/sink mechanisms in the water column? The cruise contributed to the research objectives by quantifying variability of ventilation processes of the oxygen minimum zone (OMZ) of the eastern tropical North Atlantic (ETNA) including oxygen fluxes due to lateral mixing, vertical mixing and lateral advective fluxes. A particular objective related to research question (2) was to quantify oxygen consumption within the OMZ. This was approached by tracer concentration measurements to assess the age of the tracers and hence water masses in the OMZ and by investigating the role of zooplankton and its vertical migration for fluxes of particulate and dissolved matter. Additionally, quantitative understanding of nitrogen fixation in the tropical Atlantic was advanced by measuring nitrogen fixation rates.

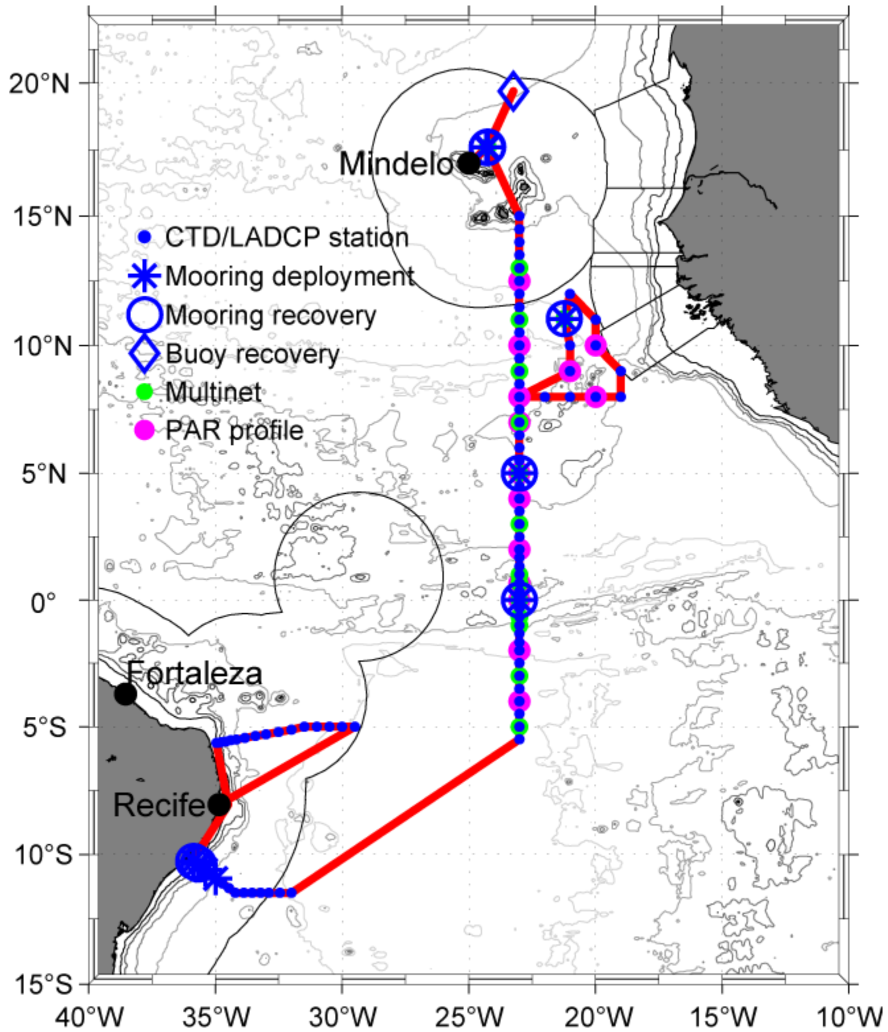

Fig. 3.1. Bathymetric map with cruise track of R/V METEOR cruise M130 (red solid line) including locations of CTD/LADCP stations, mooring recoveries and redeployments, multinet and photosynthetically active radiation (PAR) profile stations. Territorial waters of different countries are marked with thin black solid lines.

Within the framework of RACE II, the aim of this cruise is to investigate the variability of the western boundary current system off Brazil as well as providing a contribution for an estimate of the Atlantic meridional overturning circulation (AMOC) at 11°S. A particular focus at the western boundary will be on the transport variability of the North Brazil Undercurrent (NBUC) – as part of the AMOC and the subtropical cells (STCs) – on timescales from intraseasonal to decadal.

4 Narrative of the cruise

Due to a late arrival of a one of our container carrying dangerous goods in Mindelo, São Vicente, Cape Verde, the departure of R/V METEOR was delayed by one day. Customs cleared the delayed container in the morning of August 29 and we were able to leave port at 11:00 local time (12:00 UTC). The working program started 6 hours later with a successful recovery of a mooring at the Cape Verde ocean observatory (CVOO) site 50 nautical miles (nm) northwest of São Vicente. During the night, a full-depth profile with the conductivity-temperature-depth-oxygen (CTD/O_2) rosette system was measured and plankton samples with a multinet were collected. The main CVOO mooring was successfully recovered in the early morning of August 30. After additional CTD, multinet and microstructure stations and trace metal clean water sampling using a towed fish, R/V METEOR left the CVOO site for an emergency recovery of a drifting buoy about 150 nm to the northeast. The buoy was originally deployed off Cape Blanc just outside the EEZ of Mauritania and had broken loose a month before our cruise. It weight 2.3 tons, had a diameter of 3 m and was equipped with a dust collector for investigating Saharan dust deposition. Additionally, meteorological sensors were attached to the buoy. The rescue of the buoy, owned by the Royal Netherlands Institute of Sea Research (NIOZ), was coordinated jointly with the DFG Senatskommission für Ozeanographie, the Leitstelle Deutsche Forschungsschiffe and the National Marine Faculty at NIOZ. Prior to the recovery, it was agreed that NIOZ would refund the dedicated ship time within the OFEG barter ship-time framework. Thanks to the professionalism of R/V METEOR's crew, the recovery of the buoy was completed within a few hours, minimizing the loss of ship time for our cruise. The vessel returned to the CVOO site on Sep. 1 at 4:00 UTC to redeploy the CVOO mooring and to collect additional water samples with the CTD rosette system and the towed fish. The CVOO related activities were completed 13h later at 17:00 UTC.

CTD/O_2 section work along 23°W started at 15°N on September 2, 10:00 UTC and ended at 5.5°S on September 19, 10:30 UTC. CTD/O_2 profiles were collected from the surface to a depth of 1200m between 15°N and 5.5°N and to full ocean depth between 5°N and 5.5°S. In addition to the CTD/O_2 sensors and the attached underwater vision system, a chlorophyll sensor, turbidity sensor and an optical nitrate sensor was attached to the rosette frame. The latter could only be used during CTD casts to a depth above 2000 m. In addition, an upward and a down-looking acoustic Doppler current profiler (LADCP) were attached to the rosette frame to measure full depth velocity profiles. Apart from CTD profiles, spectroradiometer profiles were collected every mid-day to infer the distribution of photosynthetically active radiation in the upper 100 m of the water column, multinet casts were performed to a depth of 1000m at several positions along the transect for the sampling of zooplankton and microstructure profiles of velocity shear and temperature were collected to infer mixing levels required for determining diapycnal oxygen and nutrient fluxes. Water sampling focused on resolving the vertical spreading of an artificial tracer (CF_3SF_5) that was released in the center of the oxygen minimum zone at 11°N, 21°S in December 2012 and on biogeochemical parameters including nutrients and chlorophyll to advance understanding of nitrogen fixation. Additionally, two shipboard ADCPs with a frequency of 38 kHz and 75 kHz were continuously sampling horizontal velocities in the upper 600 and 1000 m, respectively, and two thermosalinographs were measuring near-surface temperature and salinity. All systems worked well throughout the cruise. However, in the morning of September 11 contact to the tethered microstructure profiler was lost while the profiler was descending during a microstructure (MSS) station at 6°S, 23°W. When we attempted to recover the profiler using its own winch, the microstructure cable broke and the profiler (serial number 32) was lost. The most likely explanation for the broken cable is that it was damaged by the bite of a fish. Microstructure measurements performed later during the cruise were done with a spare profiler (serial number 26) that had an identical sensor setup.

In the afternoon of September 5, the 23°W transect was discontinued to conducted a survey focussing on determining the variability of the artificial tracer concentrations in the region between 8°N and 11.5°N, 19°W and 23°W. Water samples were taken at stations where tracer concentrations had been determined during the previous R/V METEOR cruises M97, M105 and M116. During the survey, a mooring at 11°N, 21°13'W was recovered and redeployed in the morning and evening of September 8, respectively. This position approximately marks the center of the oxygen minimum zone of the tropical Atlantic. The mooring was equipped with velocity, temperature, salinity and oxygen sensors. The tracer survey was completed in the morning of September 10.

In the morning of September 11, a mooring at 23°W, 5°N was recovered. The mooring's instrumentation was identical to those deployed at the 11°N mooring. Similar to the 11°N mooring, all sensors had worked well, but some of the oxygen loggers had stopped data recording early - a few weeks or months after mooring deployment in 2015. This error was due to a falsely adjusted operational mode of the recording units that caused elevated power consumption. R/V METEOR reached the equator just after midnight on September 15. In the morning of that day, the equatorial mooring was successfully recovered and redeployed in the afternoon. Again, all sensors had worked well and we were particularly happy to have retrieved complete velocity, temperature, oxygen and salinity time series from a moored profiler that climbed the mooring wire between 1000m and 2500m depth.

After finalizing the 23°W section in the morning of September 19, R/V METEOR headed southwest towards the western boundary off Brazil. During the two-day transit a crossing-the-line ceremony and the "Bergfest" provided a welcomed change. The work program along the 11°S section started at 11.5°S, 32°W in the evening of September 21. During the 11°S section work, four moorings were recovered and redeployed and the data of two pressure-inverted echo sounders were read-out using acoustic modems. All mooring operations went well and we were very happy about the returned data - 37 of the 38 instruments mounted to the moorings recorded full data sets. Additionally, 20 full-depth CTD/O_2 profiles were collected along the 11°S section. The last CTD/O_2 station along 11°S was completed shortly after midnight of September 27. The final CTD/O_2 section along 5°S was started in the morning of September 28 and completed in the late afternoon of October 1. A total of 19 full depth CTD/O_2 stations were collected at 5°S. R/V METEOR arrived as scheduled in the old port of Recife at 6:00 in the morning of October 3.

5 Preliminary results

In the following, a detailed account of the types of observations, methods and instruments used as well as some of the early results are presented.

5.1 Hydrographic observations

5.1.1 CTD system, oxygen measurements, and calibration

(Gerd Krahmann, Jaard Hauschildt)

During M130, 118 profiles of pressure (P), temperature (T), conductivity (C) and oxygen (O) were recorded. While 69 of these CTD-O_2 profiles ranged to the bottom or near the bottom, the remaining profiles ranged to 1200 m or shallower depth. We used a Seabird Electronics (SBE) 9plus system, attached to the water sampler carousel, and recent Seabird Seasave software (V7.23.2). The SBE underwater unit had, in addition to its own pressure sensor, two parallel sensor sets for T, C, and O. Additionally, a Wetlabs turbidity/chl *a* fluorescence sensor and a Wetlabs transmissometer was used on all casts (see table in section 7.2). Three altimeter systems were used during the cruise with different success. One system, manufactured by Teledyne Benthos, was able to reliably detect the sea floor during the CTDs approach. This system, however, transmits on a frequency that interferes with the lowered ADCPs, usually resulting in unreliable velocity profiles. Two other systems, manufactured by Valeport, use a different frequency but were not able to detect the seafloor in waters greater than 3000m. We were not able to identify the reason for this malfunction (possibly a bad firmware version). As one of the major goals of the cruise was the collection of deep velocity profiles, we lowered the CTD without a sea floor warning to the depths of previous CTDs on the same position. Despite our cautious approach that typically stopped 30 to 100 m above the sea floor, the CTD touched ground during profile 59. A wire bent close to the CTD resulting from the grounding required the removal of some 30 m of wire and a new termination.

The CTD system itself performed without major problems and the same set of sensors was used throughout the whole cruise. As underwater unit was GEOMAR's SBE1 (SN #75760). Serial numbers of primary and secondary conductivity sensors were SN #2452 and SN #3373, respectively. Primary and secondary oxygen sensors were SN #0631 and SN #2592. Finally, serial numbers of temperature sensors were SN #4831 and SN #4823.

The usual procedures for calibration of the conductivity and oxygen sensors were performed. Conductivity was calibrated using a linear relation in P, T and C and, in case of the secondary conductivity sensor, a temporal trend correction was additionally used. More than 400 water samples were collected for the conductivity calibration and analyzed using a GEOMAR's Guidline Autosal salinometers 8 and 4. Intermittent problems with the stability of the salinometers measurements lead to a switch from Autosal 4 to Autosal 8, which however showed similar instabilities of the measurement results. Nevertheless, the results are deemed accurate enough for the calibration of conductivity sensors to typical accuracies. The conductivity calibration resulted in a root mean square (rms) salinity misfit between 0.002 and 0.003 for the two sensors after removal of the most deviating 33% of samples. Oxygen was calibrated using a relation linear in T and O, and quadratic in P. Winkler titration of more than 1100 bottle samples led to a relation with an rms misfit of 0.9 µmol/kg (33% of bottle values removed).

Further sensors were attached to the carousel and recorded data, but were not calibrated: a fluorescence and turbidity sensor (FLNTU manufactured by Wetlabs), and an optical nitrate sensor

(SUNA manufactured by Satlantic). The latter could only be used during casts less than 2000 m deep.

5.1.2. Oxygen Winkler measurements
(Josefine Maas)

Observing and understanding the concentration of dissolved oxygen in the ocean is one of the key objectives of the SFB754. While the CTD system is capable of measuring dissolved oxygen in the ocean at high vertical resolution, the sensors need to be carefully calibrated. Thus, very precise reference measurements are essential. During the entire cruise, water samples were taken for the determination of dissolved oxygen after Winkler (1888). Sampling was done with 100 ml WOCE bottles with well-defined volumes (calibrated flasks) to calibrate the oxygen sensors (SBE 43) and to support chemical and biological CTD data.

Oxygen samples were taken from the Niskin bottles immediately after tracer sampling. From each CTD/O_2 cast, seven to eight water samples were taken. During the selection of sampling depth, regions of elevated vertical oxygen gradients identified from the CTD/O_2 profile were avoided. Additionally, dissolved oxygen samples were taken from all bottles every second CTD station concurrently with tracer samples (see Section 5.5.1). For the entire cruise, this yields 1250 samples from 90 CTD casts.

The precision of the oxygen concentration measurements determined from Winkler titration was 0.37 μmol/L. This estimate is based on the arithmetical average of standard deviations from 15 duplicates and 68 triplicates.

The reagents used during the cruise were: sulfuric acid (50%), zinc iodide starch solution (500 mL, Merck KGaA), stock solution, fixation solution and standard solution. The stock solution consisted of sodium thiosulfate pentahydrate (49.5 g L^{-1}). It was diluted by a factor of 10 to create the working solution (0.02 mol L^{-1}). The fixation solution consisted of manganese (II) chloride (600 g L^{-1}), sodium iodide (600 g L^{-1}) and sodium hydroxide (320 g L^{-1}). Potassium hydrogen diiodate (0,325 g L^{-1}, homemade) was used for standard solution.

Standard measurements for the determination of the thiosulfate factor of the working solution were carried out on a daily basis. In addition to that, standard measurements were performed every time new reagents were applied. Titrations were performed within the WOCE bottles using a 20 mL Piston Burette (No. M 006989) TITRONIC universal from Schott Instruments. Dosing accuracy reported by the company is 0.15%, referred to the nominal volume, indicated as a measurement uncertainty with a confidence level of 95%. The iodate standard was added with a 50 mL Piston Burette (No. M 003550) TITRONIC universal from Schott Instruments. 1 mL of the fixation solutions (NaI/NaOH and $MnCl_2$, respectively) were dispensed with a high precision bottle-top dispenser (0.4-2.0 mL, Ceramus classic, Hirschmann). Please note that possible errors from sampling, storing (air bubbles) or errors introduced while measuring were noted. Results derived from those measurements were not considered in the data precision estimate.

5.1.3 Thermosalinograph
(Gerd Krahmann)

Two thermosalinograph systems are installed on R/V METEOR. Both systems are operated in parallel, system 1 drawing water from the port side, system 2 from starboard side of the ship. The comparison of the thermosalinograph temperatures with CTD temperatures from 5 m depth showed a very good agreement with no significant offset (-0.002 and -0.001°C for systems 1 and

2). The thermosalinograph's salinities did however not agree as well with the CTD's. For system 1, we found a difference of about -0.04 PSU (thermosal salinity minus CTD salinity) at the beginning of the cruise, which remained stable for about 10 days and then reduced in an approximately linear trend down to about -0.003 PSU. After day 23, however the salinity of system 1 changed the linear drift direction and reached nearly -0.02 PSU on day 33. System 2 also showed a significant drift but kept a constant direction and strength of the drift from -0.08 PSU at the beginning of the cruise to -0.04 PSU on day 33. Similar drifts and changes of drift direction have been seen on previous legs. As long as comparison samples from the well-calibrated CTD/water sampling system are frequently available, the deviations of thermosalinograph salinity appear to be correctable. The underlying cause for the drifts and in particular the changes in drift remains unclear, however.

Daily water samples were also taken from the thermosalinograph system and measured with GEOMAR's salinometers. Unfortunately, these data from the samples were available only on the last day of the cruise so that no time remained for a detailed comparison with the thermosalinograph calibration described above. Results from recent cruises have however shown good agreements between both approaches.

5.2 Current observations

5.2.1 Vessel mounted ADCP

(Kristin Burmeister, Camilla Caricchio Espinheira)

Underway current measurements of the upper ocean were performed continuously throughout the entire cruise track using two 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. Both Ocean Surveyor instruments worked well throughout the cruise. The OS38 was aligned to zero degrees (relative to the ship's centerline) in order to reduce interference with the OS75, which was aligned to 45 degrees.

The OS75 instrument was configured with 100 bins of 8 m, pinging 37.5 times per minute, with an averaged data range of 600 m. It was run in the more precise but less robust broadband mode until September 24. Due to a decrease in the range, the mode was switch to the more robust narrowband mode then. The OS38 instrument ran in narrowband mode and used 55 bins of 32 m, pinging 20 times per minute that resulted in a depth range between 1000 m and 1500 m. During the entire cruise, the SEAPATH navigation data was of high quality. To avoid interference with other acoustic devices, bathymetry measurements were performed using the 12kHz echo sounder EM122.

Table 5.1: Misalignment angle and amplitude factor of the Ocean Surveyors determined from water track calibration.

OS	Mode	Misalignment angle ± Standard deviation	Amplitude factor ± Standard deviation
75	BB/NB	-0.0053° ± 0.4769°	1.0000± 0.0080
38	NB	-0.0004° ± 0.48178°	1.0000 ± 0.0072

Post processing of the data was carried out separately for each instrument. Accounting for a time shift of the heading and position data recorded by the SEAPATH device relative to the raw OS data allowed for a significant reduction in the scatter of the calibration angles and amplitude factors. The applied shifts, as well as mean misalignment angles and amplitude factors with the associated standard deviations, are summarized in Table 5.1.

5.2.2 Lowered ADCP
(Gerd Krahmann)

During most of the cruise, the CTD/Rosette system was equipped with a lowered ADCP setup based on two Teledyne RDI ADCPs. The setup consisted of an up-looking and a down-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. A battery pack was mounted below the up-looking slave. Both ADCPs were connected to the battery case, which was also the connection point for the data interface cable.

During the first 10 days of the cruise, several independent problems interfered with the collection of reliable LADCP data. During the initial installation one of the ADCP systems, SN #20507 stopped communication with the control computer. During profile 6 the long communication cable between the battery container and the control computer in the GEO-lab malfunctioned, likely a broken internal communication chip. Subsequently we discovered two leaks in battery-container-to-ADCP cables, which prevented the slave system from operating properly. Lastly, a newly developed energy supply system that draws energy for the ADCPs from the CTD cable lead to malfunctions of the slave system and likely spurious error indications for the slave systems. Because of these error indications, four different ADCPs were used as slave until we realized the underlying energy supply problem. The master system remained the same throughout the whole cruise (SN #20508). As slave system, we used SN #11436 for profiles 1 to 7, SN #6468 for profiles 11 to 25, and SN 839 for profiles 26 and 27. As the broken system SN #20507 was expected to perform best, we attempted to repair it by combining three internal boards from SN #11436 with the transducer head of SN #20507. This indeed worked and the hybrid SN #20507/#11436 ADCP was used from profile 40 to 118.

During the cruise we used and further developed a simple to use software with which the start, stop, download, and erase cycles of the two LADCP systems can be controlled.

Data processing took place during the cruise using the GEOMAR LADCP processing software V10.21, 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 containing pressure, temperature and salinity profiles as well as time and navigation data were used.

Overall, the Teledyne RDI instruments resulted in reasonable to 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. Nevertheless, the generally adverse conditions for LADCP in the open tropical South Atlantic Ocean (too few scatterers) lead to a several profiles with high uncertainties in particular along the 11°S transect.

5.3 Mooring operations
(Johannes Hahn, Kristin Burmeister, Patrick Wagner, Marcus Dengler)

Altogether, nine mooring were recovered, eight moorings were deployed and data from two pressure-inverted echo sounders (PIES) were collected using acoustic modems during the cruise (Table 5.2). With the exception of the oxygen sensors, the instruments recovered from the mooring had functioned very well. Table 5.3 shows the instrument performance for each mooring and sensor type calculated as the percentage of maximum obtainable data. For the calculation of the instrument performance, every instrument was weighted homogeneously taking the following instrument types into account: Mini-TD (T, P), MicroCAT (T, C, P), O_2-Logger and Hydroflash O_2 Optode (T, O_2), ADCP (U, V), RCM (P, U, V), Argonaut (U, V), Aquadopp (P, U, V), moored profiler M-CTD MMP (T, C, U, V, O_2), PIES (P), other (other parameters).

Table 5.2: Summary of mooring operations performed during the cruise.

M130 Mooring Recoveries					
Mooring	**New ID**	**Latitude**	**Longitude**	**Deployment Date**	**Recovery Date**
CVW 2015	KPO_1156	17°N 36.27’	24°W 14.82‘	09-Sep-2015	29-Aug-2016
V440-07	KPO_1143	17°N 36.40’	24°W 14.98‘	10-Sep-2015	30-Aug-2016
21W 11N	KPO_1142	11°N 02.22’	21°W 13.29‘	14-Sep-2015	08-Sep-2016
23W 5N	KPO_1141	05°N 01.00’	23°W 00.00’	19-Sep-2015	11-Sep-2016
23W 0N	KPO_1140	00°N 00.20’	23°W 06.80’	23-Sep-2015	15-Sep-2016
K1	KPO_1144	10°S 16.00’	35°W 51.70’	01-Oct-2015	25-Sep-2016
K2	KPO_1145	10°S 22.80’	35°W 40.80’	02-Oct-2015	25-Sep-2016
K3	KPO_1146	10°S 36.50’	35°W 23.60’	03-Oct-2015	23-Sep-2016
K4	KPO_1147	10°S 56.40’	34°W 59.60’	04-Oct-2015	23-Sep-2016
PIES-300m	KPO_1134	10°S 13.58’	35°W 52.42’	14-May-2014	26-Sep-2016*
PIES-500m	KPO_1135	10°S 13.97’	35°W 51.74’	14-May-2014	26-Sep-2016*

* No recovery, acoustic communication and data download only.

M130 Mooring Deployments					
Mooring	**New ID**	**Latitude**	**Longitude**	**Deployment Date**	**Recovery Date**
V440-08	KPO_1179	17° 36.39’N	24° 14.98’W	01-Sep-2016	
21W 11N	KPO_1178	11° 02.22’N	21° 13.28’W	08-Sep-2016	
23W 5N	KPO_1177	05° 01.01’N	23° 00.00’W	11-Sep-2016	
23W 0N	KPO_1176	00° 00.06’S	23° 06.78’W	15-Sep-2016	
K4	KPO_1172	10° 56.41’S	34° 59.60’W	24-Sep-2016	
K3	KPO_1171	10° 36.50’S	35° 23.56’W	25-Sep-2016	
K2	KPO_1170	10° 22.79’S	35° 40.78’W	26-Sep-2016	
K1	KPO_1169	10° 15.99’S	35° 51.68’W	26-Sep-2016	

Instrument performance of better than 90% was reached for temperature, conductivity and pressure sensors as well as current meters. Oxygen sensors (O2-logger) performed only partly well (67%). The major problem of these sensors was the logger unit, which consumed too much battery due to a wrong setup of the board system. A summarized description over the performance of all instrument types is given in the following. Details of the moorings are shown in the mooring tables in section 7.3 below.

Out of the five temperature-depth recorders (Mini-TDs), three instruments had a complete and clean data record. One instrument (s/n 71) had a drift of the pressure sensor by 1-2 dbar throughout the last three months of the mooring period. Communication to one instrument (s/n 64) was not possible after recovery (no data).

Table 5.3: Instrument performance in percent of data return by sensor type and mooring (T - temperature; C - conductivity; P - pressure; U,V - zonal, meridional velocity; O_2 - oxygen; other – other parameters).

sensor type mooring	**T (%)**	**C (%)**	**P (%)**	**U,V (%)**	**O_2 (%)**	**other (%)**
KPO_1156	50	-	0	100	-	0
KPO_1143	85.6	92.2	100	100	5.6	?
KPO_1142	84.1	96.8	100	100	64.3	-
KPO_1141	83.8	87.5	97.3	100	76.0	-
KPO_1140	99.3	96.6	98.6	98.6	92.3	-
KPO_1144	100	100	100	100	-	-
KPO_1145	90.9	83.3	100	100	-	-
KPO_1146	97.1	92.9	94.9	100	-	-
KPO_1147	100	100	100	100	-	-
KPO_1134	-	-	100	-	-	-
KPO_1135	-	-	100	-	-	-
all moorings	**89.5**	**92.6**	**96.8**	**99.7**	**67.2**	**0**

Recovered MicroCATs performed well and 38 out of 49 instruments provided a complete and clean record. One MicroCAT deployed close to the surface in KPO_1143 showed a bad conductivity cell for 3 days throughout the deployment period. Three MicroCATs (2933, 10609, and 2933) from KPO_1142 showed a bad conductivity cell for 16 days, one day and 4 months respectively. The same holds for one MicroCAT (2717) from KPO_1140, which had a bad conductivity cell for 5 days. The pressure sensors of two MicroCATs (10642, 6860) recovered at KPO_1143 and KPO_1141 showed a small drift of about 2dbar, while temperature and conductivity sensors worked fine. Two MicroCATs (2256, 2257), recovered at KPO_1143 and KPO_1141, respectively, had a corrupt memory status and provided no data at all. One MicroCAT (1286) was recovered damaged from KPO_1145 and provided no data due to water ingress. One MicroCAT (10712) recovered at KPO_1146 provided only 8 months of data for unknown reasons.

For collecting oxygen concentration time series, 20 optodes manufactured by AADI Aanderaa Data Instruments (subsequently named: O_2-Logger) as well as two optodes from manufacturer Kongsberg Maritime Contros (subsequently named: Hydroflash O_2 Optode) were installed in the recovered moorings. Only eight of the 20 O_2-Logger performed with a complete and clean data record. The major problem of nine other O_2-Logger was a too high battery consumption due to a wrong setup mode of the logger board yielding data records between 2 weeks and 7 months only. The optode (s/n 147) of one logger had water ingress throughout the mooring period (only 3 months of data). One logger (s/n 1465) performed almost completely with a data coverage of 96% (15 days of data are missing within six different intervals). The foil of the sensor of one optode (s/n 1461) was partly detached from the sensor throughout the mooring period and the data quality of this instrument needs to be carefully checked. Two optodes (s/n 219 and 942), aforementioned with a complete and clean data record, showed small marks of the sensor foil at one edge of the sensor spot. The sensor foils of the latter three optodes were changed after the onboard calibration. The status of the two Hydroflash O_2 Optodes remains unknown so far. However, the sensor foils of these two optodes had become completely detached from the sensors during recovery. It remains unclear, whether this happened throughout the mooring period or during the instrument cleaning process after recovery.

All 21 single point current meter instruments (16 Aquadopps, 3 Argonauts, 2 RCM-11) performed well and provided complete and clean records. Furthermore, nine out of 10 ADCPs performed well and provided a complete and clean record. The QM14911 ADCP from KPO_1140 provided a complete record, but had problems with pitch and role. It was not redeployed but instead send to the manufacturer for maintenance after the cruise.

A McLane moored profiler (equipped with a CTD, a single point ADCP as well as an optode oxygen sensor) deployed in mooring KPO_1140 performed almost completely. It operated in the measurement range between 3500m and 1000m, where only during a few profiles the upper stopper at the mooring cable was not reached (due to ballasting issues or obstructions on the cable) or sensor measurements were partly bad, providing a data coverage of 89%.

Other instruments, such as two sediment traps in KPO_1143 had full bottles (no. 1-13). A fluorometer and a SAMI (CO_2 sensor) performed completely, but the quality of the data is so far unknown. The winch with profiler in KPO_1156 had been already recovered one day after deployment during R/V METEOR cruise M119 (see this cruise report).

MicroCATs and O_2-logger generally sampled using an interval of minimum 30 minutes and one hour, respectively. However, for O_2 loggers and MicroCAT instruments deployed in the OMZ regime (KPO_1140, KPO_1141, KPO_1142), a sampling interval of 5 minutes was used to record variability from internal waves. For single point current meters and ADCPs, a sampling interval of one or two hours was used. The McLane moored profiler operated (upcast and subsequent downcast profile) every 4 days.

Mooring dynamics:

In general, moorings deployed in the western boundary current regime off Brazil as well as the mooring KPO_1143 located north of the Cape Verde Islands showed much higher dynamic variability than the moorings deployed in the moderate to sluggish flow regime of the eastern tropical North Atlantic (ETNA). The near-surface elements in the moorings off Brazil exhibited depth variability of 50 to 100 m with a maximum dive event of about 300 m (KPO_1147) on time scales of days to weeks. KPO_1143 had two dive events of 100 m and 150 m depth change for several weeks and two months, respectively. In contrast, depth variability of the ETNA moorings (KPO_1140, KPO_1141, KPO_1142) was very much reduced. Only few short dive events with about 100 m depth change occurred for mooring KPO_1141.

5.3.1 Calibration of moored instruments

CTD-O_2 cast calibrations were performed for all Mini-TDs, MicroCATs and O_2-Loggers either as pre- or post-deployment calibrations (CTD casts 001, 003, 005, 006, 020, 031, 035, 038, 041, 056, 058 067, 082, 088, 094, 109 and 113) by attaching the instruments to the CTD frame. Some additional O_2-Loggers that were deployed on subsequent cruises were calibrated as well. Aquadopps were attached to the CTD frame as well during casts 020, 067, 088 and 109 in order to test the performance of the temperature sensor.

During each upcast, 7-8 calibration stops were done over the whole profile range (depths chosen at low gradient-regimes for the respective parameters). In order to ensure equilibrium at the calibration stops, CTD heaving was discontinued for at least 4 minutes for Mini-TDs and MicroCATs calibration stops and 2.5 min for optode calibration stops. For MicroCATs, calibration stops at around thermocline depth (upper few hundred meters of the water column) were prolonged by 1 minute. However, in test cases we found that even 5 to 10 minute-long calibration stops were too short (and had to be discarded afterwards) to achieve equilibrium within the conductivity cells of the MicroCATs. The long equilibration times are likely a result of the thermal mass effect. As an alternative, we partly conducted calibration stops of 5 minutes at 10 m depth before starting the regular downcast profile right at the beginning of the CTD cast. This approach reduced the average equilibration time of the MicroCat conductivity sensors.

Additionally, onboard lab calibrations were conducted for all O_2-loggers in water-filled beakers of 0% and 100% O_2-saturated water at two different temperatures (~5°C and ~23°C) following the Aanderaa optode calibration procedure outlined in their user manual. Sensor foils of four optodes (O_2-loggers) had to be changed due to their obvious bad mechanical quality at the sensor spot.

5.4 Shipboard microstructure measurements

(Ioana Ivanciu, Milan Kloewer, Joost Hemmen, Marcus Dengler)

Two MSS90-D microstructure profilers (#032 and #026) manufactured by Sea and Sun Technology were used to infer turbulent dissipation rates of turbulent kinetic energy and diapycnal diffusivity. The measurements aimed at calculating diapycnal fluxes of oxygen, nitrous oxide (N_2O) and other solutes in the water column. The loosely tethered profilers are equipped with three airfoil shear sensors and a fast thermistor, as well as common CTD sensors: pressure, conductivity, temperature and turbidity sensor. The sink velocity of the profilers was adjusted to 0.55m/s. In total, 56 profiles to maximum depth of 291m were recorded on 19 ship stations. Most stations consisted of three microstructure profiles following a CTD cast with oxygen, N_2O and/or tracer sampling. All profiles were obtained in selected locations on or near 23°W.

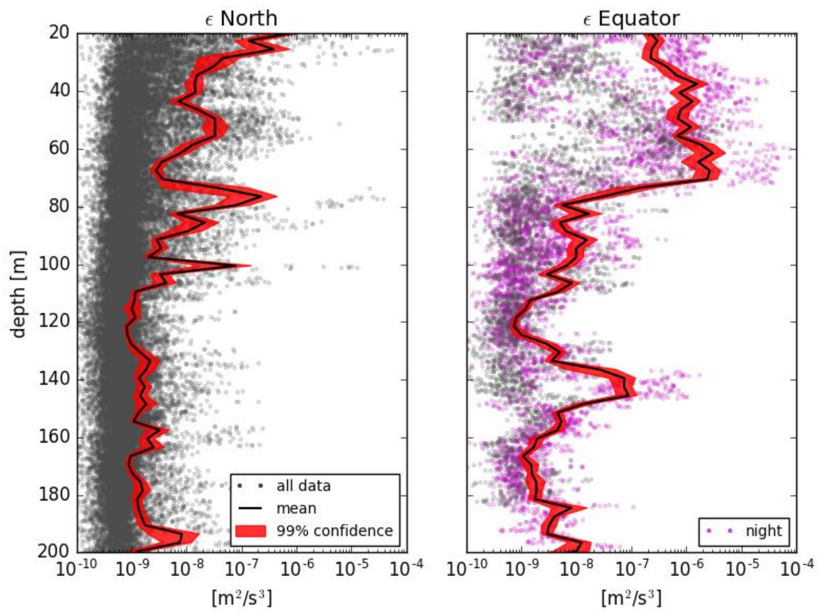

Fig. 5.1: Individual and average turbulent dissipation rates determined from the microstructure data collected north of 6°N (left panel) and from within 2° of the equator (right panel). In the right panel, data collected during the night (8pm-8am) are ploted in magenta color, while data collected during day time are dark grey.

Profiler #032 was used for the profiles 1 to 44. At the beginning of the next planned cast at 6°N the deck-unit could not establish connection to the instrument. While heaving the instrument back to the surface, the cable broke and the profiler was lost. During the later MSS stations, 11 more profiles were taken between 0°40’ N and 1°S using profiler #026.

In the upper 100m, the average turbulent dissipation rate was in the order of $3x10^{-7}$ m^2s^{-3} for stations north of 6°N (Fig. 5.1). However, below 100m water depth, turbulence is weaker and its dissipation rate is mostly smaller than 10^{-8} m^2s^{-3}. In the vicinity of the equator, a decay with depth is even more evident. Turbulent dissipation rates regularly exceeded values of $5x10^{-6}$ m^2s^{-3} within the upper 80m, but was several orders of magnitude weaker below that depth. In the upper equatorial ocean, a nighttime enhancement of turbulence was clearly observed.

5.5 Biochemical measurements

5.5.1 Tracer measurements

(Tim Stöven, Sören Gutekunst)

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, SF_6 and the deliberately released tracer CF_3SF_5. The system is a modified version of the set-up normally used for the analysis of CFCs (Bullister and Weiss, 1988). The PT5 instrument was used for measuring the transient tracers SF_6 and CFC-12 as well as the released tracer CF_3SF_5 on all depths. Samples around the target density of the released tracer were taken with high volume ampoules of 1 L and the adjoining depths with syringes of 250 mL.

The trap consisted of 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 injected 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 all three tracers with some restrictions for CFC-12 due to the high sample volume in the target depth range.

The transient tracer samples were collected in 250 ml ground glass syringes, of which an aliquot about 200 ml was injected to the purge-and-trap system. The SF_5CF_3 samples were collected in ~1300 ml ampoules, of which an aliquot of ~990 ml was injected to the vacuum-sparge system by evacuating the purge chamber and then sucking in the water through an orifice.

Standardization was performed by injecting small volumes of gaseous standard containing SF_6, SF_5 and CFC-12. The company Dueste-Steiniger (Germany) prepared this working standard. 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 lab after the cruise. Calibration curves were measured roughly once a week in order to characterize the non-linearity of the system, depending on workload 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. The final processing and calibration of the obtained transient tracer data will be performed onshore at the GEOMAR in Kiel. At several stations along the 23°W section water samples for determination of HFCs, HCFCs and PFCs were flame-sealed in ~1300ml ampoules for measurement onshore at GEOMAR.

The fourth survey of the deliberately released transient tracer CF_3SF_5 showed a lateral distribution from south of Cap Verdi Islands down to 4°30’ N along the 23°W section. Eight depths around the target density covered the vertical distribution of the tracer patch within the control volume. This provides additional information about the total amount of tracer remaining in the control volume and contributes to the preceding calculations on spreading rates and diffusion coefficients of the OMZ.

The distribution of CFC-12 and SF_6 along 23°W and the two sections along the shelf break off Brazil describes the specific ventilation pattern of the different water masses (Fig. 3). The different distribution of both tracers is based on their different atmospheric histories so that CFC-12 already covers the deeper and less ventilated water masses. However, both tracers show a tracer maximum between 1800-2000 m originating from the Labrador Sea Water (LSW) situated in that depth range. The bottom water north of the mid-Atlantic ridge shows Denmark Strait Overflow water supplied by an eastward current whereas the elevated CFC-12 concentrations in bottom water south of the ridge indicate the cold and dens Antarctic Bottom Water (AABW). The two tracer sections along the Brazilian shelf break covering the boundary currents at ~5°S and 10°S were not processed until the end of the cruise.

All sections are an important contribution to the transient tracer data collection. The time series and repeat hydrography sections in the Atlantic Ocean allow for additional investigations on changes in ventilation and the adjoining parameters such as the anthropogenic carbon column inventory, i.e. the carbon uptake by the ocean, and the oxygen budgets in the ocean, especially in the oxygen minimum zones.

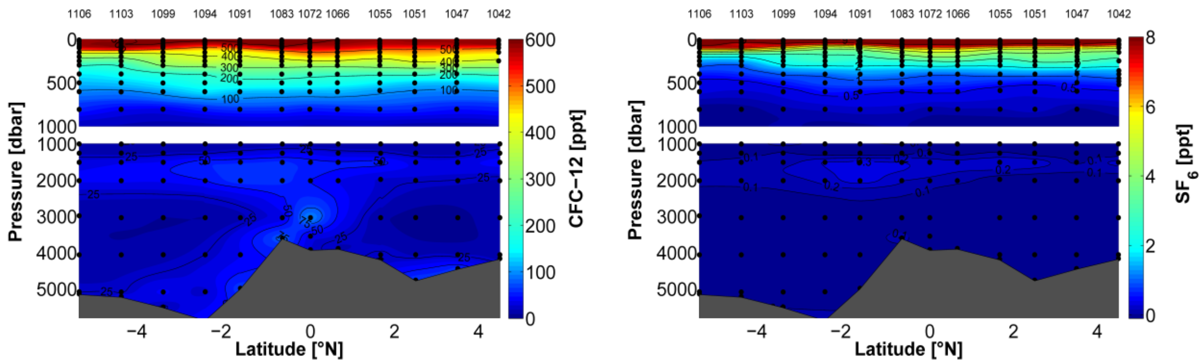

Fig. 5.2: Distribution of CFC-12 (left panel) and SF_6 (right panel) partial pressure along 23°W.

5.5.2 Zooplankton ecology and particle dynamics

(Rainer Kiko, Iris Kriest, Jannik Faustmann)

A Hydrobios® Multinet Midi with an aperture of 0.25 m^2 and 5 net bags (mesh size 200 µm) was deployed at 7 daytime and 12 nighttime stations for vertically stratified hauls (sampling depths: 1000-600 m, 600-300 m, 300-200 m, 200-100 m, 100-0 m). Samples were fixed in 4% formaldehyde in seawater solution. They will be scanned and analyzed in the home laboratory using automated imaging software allowing taxonomical classification and biomass estimation.

During 112 CTD casts, an UVP 5 (serial number 10) 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 0.88 L-water volume. During the downcast, the UVP takes 3-11 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 UVP 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.

During CTD casts and mooring work on 17 different stations a modified Working Party 2 (WP2) net was deployed by hand as a driftnet to collect different Rhizaria species from surface waters (1 to 5 m). Incubation experiments to determine respiration and NH_4 excretion rates were conducted with the retrieved specimens at 18˚C and 23˚C. The collected organisms were scanned on an Epson Perfection V750 scanner to obtain size measurements and dried for later biomass analysis in the home laboratory. Additional 79 samples were collected for species identification via DNA analysis in the home laboratory.

5.5.3 Nutrient sampling and analysis

(Matthew Patey, Evangelia Louropoulou, Iris Kriest, Rainer Kiko)

Samples for inorganic nutrient and dissolved organic phosphorus were collected and frozen for transport to Kiel. Samples were also taken for dissolved nitrate + nitrite (NO_{2-} and NO_{3-}) (hereinafter nitrate) and dissolved phosphate ($PO^4{}_{3-}$), at nanomolar concentration, and for dissolved ammonium (NH^{4+}). Nanomolar nitrate and phosphate measurements were made on board using a purpose-built, segmented-flow autoanalyser following a method described in Patey et al. (2008) with some changes to reagent flow rates. Ammonium was measured using the OPA fluorescence method, as described by Holmes et al. (1999). Please note throughout this report molar concentrations are reported in concentrations per unit volume (i.e. nM, μM and mM refer to nmol l^{-1}, μmol l^{-1}, mmol l^{-1}, respectively).

To determine nanomolar concentrations of nitrate and phosphate two liquid waveguide capillary flow cells (LWCCs) were used to provide a two-meter path-length, enabling the detection of nanomolar concentrations. A single tungsten-halogen lamp (HL2000-HP, Ocean Optics) provided illumination for both LWCCs, with a bifurcated fibre-optic cable being used to divide the light between the two channels. Two Ocean Optics USB spectrometers monitored the absorbance in each cell. Samples were introduced manually by switching a sample line between a reference solution (low nutrient surface seawater) and sample or standard solution and the resulting change in absorbance was monitored. Absorbance versus time was continuously recorded for each channel and stored electronically in a plain text format. Calibration curves and results were generated manually from the peak heights using spreadsheet software.

Ortho-phosphate is measured by formation of a blue reduced Molybdophosphate-complex at pH 0.9-1.1. Potassium Antimonyltartrate used as the catalyst and ascorbic acid as a reducing agent. The absorbance is measured at 700 nm rather than the usual 880 nm due to low optical transmission at wavelengths longer than 700 nm (Murphy and Riley, 1962). Nitrate is first reduced in a copperized cadmium-coil using imidazole as buffer and is then measured as nitrite at 540 nm with reference correction using 700 nm (Grasshof, 1983).

Nanomolar concentrations of ammonium were determined by overnight incubation of 20 mL of sample with 2 mL of OPA reagent, prepared as described by Holmes et al. (1999). Standard additions were prepared using seawater taken from 600 – 1000 m depth and a 25 µM standard solution prepared from ammonium sulphate. Sample fluorescence were measured in a Trilogy Fluorometer equipped with an ammonium module and a 1 cm quartz cuvette. Data quality and consistency of the nanomolar nitrate and phosphate measurements was checked by daily monitoring of various parameters, including the Cu-Cd column reduction efficiency (for nitrate measurements) and measurement of nutrient reference samples containing a stable nutrient concentration.

The sampling approach for nanomolar nitrate and phosphate, and ammonium included that all apparatus coming into contact with the samples or reagents were cleaned by soaking in 1M HCl and rinsing thoroughly with ultrapure water from a MilliQ system (hereafter referred to as MQ). Samples were taken from the CTD rosette using 60 mL acid-washed LDPE bottles (nitrate and phosphate) and 50 mL polypropylene tubes (ammonium), rinsing three times before filling, and were stored in the fridge until analysis. Analysis was typically undertaken within 12 hours, although some samples collected during the night were not measured until the following afternoon (typically 18 – 20 hours later). For each CTD profile, typically 4 to 5 samples for nitrate and phosphate and 6 to 7 samples for ammonium were taken from the uppermost depths. Additionally, a number of surface samples were collected from a towed fish sampler.

Samples from the CTD for dissolved organic phosphorus (DOP) and inorganic nutrients were sampled into 40 mL or 50 mL polypropylene tubes, rinsing three times before filling. Inorganic nutrient samples were frozen (-25 °C) immediately for transport to Kiel. DOP samples were first filtered using 0.2 µm cellulose acetate syringe filters before freezing (-25 °C). Samples from the towed fish sampler for DOP and inorganic nutrients were filtered directly using a Sartobran 0.2 µm filter and frozen for transport to Kiel. A total of 106 samples were measured from the underway system and 85 samples were taken from Niskin bottles (Table 5.4).

Table 5.4: Nutrient samples collected during M130.

Parameter	**CTDs**	**Fish Samples**
Inorganic nutrients (frozen)	~650 (63 stations)	29
DOP (frozen)	~ 200 (40 stations)	29
Nanomolar nitrate and phosphate	133 (51 stations)	32
Ammonium	288 (60 stations)	32

5.5.4 N_2 fixation, primary productivity

(Ajit Subramaniam, Ana Fernández Carrera, Julia Dürschlag)

Size-fractionated N_2 fixation and carbon uptake of the planktonic community were estimated following a dual $^{15}N_2$ and ^{13}C-bicarbonate tracer technique (Montoya et al. 1996) with water from 10 m at 36 stations (Table 7.4). In addition, “profile” measurements were made from three depths at seven stations. At each station, triplicate 4.4-L, clear polycarbonate bottles were filled directly from the CTD-rosette. After removing all air bubbles, 3 ml of $^{15}N_2$ (98 atom%, SerCon) and 250 µL of ^{13}C-bicarbonate were injected to each bottle. The 24-hour incubation was carried out on-deck in a system of re-circulating water simulating *in situ* photosynthetically active radiation levels, using neutral density screens/meshes. Particles for defining the natural abundance of carbon and nitrogen isotopes were collected at several sampling depth at each station by passing 1–15 L of water through pre-combusted 47 mm GF/F filters under gentle pressure. The abundance of carbon (C) and nitrogen (N) stable isotopes in incubated and natural abundance samples will be measured using the methods described in Montoya et al. (1996).

Samples were collected for analysis of High Performance Liquid Chromatography for estimating phytoplankton pigment concentrations from the upper 120m at 45 stations (Table 7.4). Three liters of water were collected from 3-4 depths in the euphotic zone and filtered through a

GF/F filter. The filters were frozen in liquid nitrogen until analysis. The samples will be analyzed following the method of (Van Heukelem and Thomas 2001) at the NASA GSFC sample analysis facility. Samples were also collected from the same depths for enumerating bacterial, cyanobacterial, and picoeukaryote abundance and frozen in liquid nitrogen until analysis using a BD Influx Flowcytometer following the methods described in Duhamel et al. (2014).

The in-water light field was studied using a multichannel free falling spectroradiometer (Satlantic Micropro) that measured downwelling irradiance and upwelling radiance. A surface reference sensor mounted on the ship was used to measure the above water downwelling irradiance. This data was collected at 14 stations and was used to calculate the attenuation of light in the water column and depth of the euphotic zone.

Phytoplankton pigments were measured using Advanced Laser Fluorometry (ALF), a dual laser fluorescence sensor that was plumbed to the ship's flow-through seawater system. This data was integrated with the ship's GPS and thermosalinograph data to provide surface maps of chlorophyll concentration, a measure of phytoplankton abundance and phycoerythrin, a measure of cyanobacterial abundance. Profile measurements were also done using the ALF at 46 stations (Table 7.4).

In addition to the measurements described above, a total of 14 stations including three stations off the coast of Brazil (Table 7.2) were sampled for N_2 fixation and primary production measurements (MPI-Bremen). A depth profile of four different depths were obtained; surface (10 m), above chlorophyll a maximum (Chl *a* max), Chl *a* max and below Chl *a* max. N_2 fixation and primary production rates are determined through a 24h- incubation of collected seawater directly from the CTD with stable isotopes, i.e. $^{15}N_2$ and ^{13}C-bicarbonate, respectively. Incubations lasted 24 hours in on-deck incubators, which were kept at surface water temperature via seawater flow-through and were adjusted to three different light levels or kept in dark. The incubations were started in triplicate 4.7-L bottles by the addition of the stable isotopes using tested and recommended protocols (Klawonn et al. 2015) after methodological difficulties had been identified earlier (Mohr et al. 2010, Grosskopf et al. 2012, Wilson et al. 2012). After the 24-h incubation period, the seawater was filtered onto pre-combusted GF/F filters (0.7µm nominal pore size); the filters were frozen for later determination of the concentration of particulate organic carbon (POC) and particulate organic nitrogen (PON) as well as the carbon and nitrogen isotopic composition using an elemental analyser coupled to an continuous-flow isotope ratio mass spectrometer (EA-IRMS) at the Max-Planck-Institute for Marine Microbiology in Bremen.

For natural isotope abundance in particulate organic carbon and nitrogen at sampled depths, 4.7 L of seawater was filtered onto pre-combusted 25 mm GF/F filters. In addition, t_0 samples was obtained from the respectively depth, which was filtered immediately on pre-combusted GF/F filter. Further, Chl *a* samples from the respectively depth were obtained.

In addition, also subsamples from the incubated samples will be selected for single-cell analyses of targeted organism to determine the individual activity of selected organisms as well as their contribution to total N_2 fixation and primary production rates. Single-cell analyses will be carried out using a NanoSIMS 50L instrument located at the MPI Bremen. To clarify and study diazotrophic organisms, subsamples were transferred into glycerol to obtain isolates (not in Brazilian waters). Furthermore, samples for DNA and CARD-FISH analysis were collected (DNA not in Brazilian waters) by filtering of seawater through 0.22 µm polycarbonate filters The exact volumes were determined and recorded for each sample. CARD-FISH analyses were conducted on board targeting unicellular cyanobacteria type a (UCYN-A). The organisms could be found in surface waters at two stations (St. 961, St. 1109).

5.5.5 Iron biogeochemistry and utilization by marine diazotrophs

(Evangelia Louropoulou)

A key issue to marine diazotrophs is the need for iron, which is present at very low concentrations in open ocean surface waters. Iron is contained in nitrogenase complexes that catalyze the reduction of N2 to fixed (reduced) nitrogen. Additionally, iron is also contained in proteins of the photosynthetic and respiration apparatus, bound to heme complexes.

The objective of this study is to assess the biological activity in terms of nitrogen fixation and photosynthesis/respiration of marine nitrogen fixers in the area of the Tropical/Subtropical South Atlantic Ocean in relation to iron and nutrient availability. The study includes investigation of key iron containing proteins and the genes encoding them in order to identify differences in their expression patterns according to Fe availability.

During the M130 research cruise, water was sampled in order to investigate the following parameters: heme b contents of the marine particulate matter, DNA/RNA, particulate organic carbon and nitrogen, chlorophyll-a, flow cytometry and dissolved trace metals.

Sampling of seawater was performed the CTD rosette equipped with Niskin Bottles from 5 to 6 different depths of the upper 200 m depending on the profile. Additionally, samples were obtained underway using the Towed FISH seawater sampler.

The overall data set will provide a spatial (both horizontal and vertical) distribution of the key biogeochemical parameters and information on the activity and abundance of diazotrophs throughout the Tropical/Subtropical Atlantic Ocean. In total 37 stations were sampled from the CTD rosette and 92 stations from the towed FISH sampler. The sampling stations are presented in Tables 7.4 for the CTD samples.

All samples were treated immediately after their collection. For the determination of heme b contents of the marine particulate matter, particulate organic nitrogen and carbon, chlorophyll a, seawater was vacuum filtered in GF/F filters. For flow cytometry, Paraformaldehyde was added to 2 ml of seawater to final concentrations of 1%. In addition, seawater samples were also filtered for DNA and RNA analysis on 0.22 μm PES filters, in order to investigate the genes encoding key Fe-proteins and their expression patterns (e.g. nifH, PSaC, PsbA and cytochrome b6f). Finally, samples for dissolved trace metals were collected from the Towed Fish sampler only using a pre-installed 0.22 μm filter, as sampling needs to be carried out under trace metal clean conditions.

It should be noted that during the research cruise the samples were prepared but the analysis of all the samples should have been carried out upon return in the GEOMAR laboratory in Kiel, Germany. Unfortunately, due to a freezer malfunctioning during the follow-up cruise M131, a large part of the samples stored on board for World Currier pickup in Walvis Bay defrosted and a subsequent analysis lead to questionable results. To date, their quality remains unclear.

5.6 Aerosol concentrations

(Joost Hemmen, Milan Kloewer)

The fifth assessment report of the intergovernmental panel on climate change (IPCC) shows large uncertainties in the radiative forcing of aerosol contribution to global warming. Measurements of aerosol optical depth are especially sparse over sea, where satellite-based measurements need calibration with ground-based observations. A handheld MICROTOPS-II sunphotometer was used to measure aerosol optical depth and water vapor concentration in the atmosphere. The instrument measures the incoming solar radiation on five wavelengths (380nm, 440nm, 675nm, 870nm and 936nm) and calculates the extinction of incoming solar radiation in the atmosphere due to absorption and scattering processes by aerosols. GPS fixes, needed to prescribe the available sun-energy above the atmosphere, were provided by a Garmin GPS unit. To obtain reliable measurements, a cloud-free view at the sun is required. A total of 1255 data points were recorded during 23 days with favorable weather conditions. The collected data was provided to Dr. Smirnov at NASA-GSFC on a daily basis and contributed directly to the Maritime Aerosol Network. This allowed for immediate feedback on data quality. The data are available at http://aeronet.gsfc.nasa.gov/new_web/maritime_aerosol_network.html.

5.7 Expected results

The hydrographic data combined with our highly accurate oxygen concentration data will support the analysis of oxygen variability and deoxygenation in the tropical oceans. Together with the velocity and turbulence data, understanding of the physical processes driving oxygen variability and trends will advance. The moored records from the eastern tropical North Atlantic that also measure velocity and oxygen concentration time series using O_2 loggers will allow quantifying oxygen fluxes by eddies and oxygen trend analysis. Deoxygenation is particularly noticeable in the 4-year long records from the deep OMZ core (400m depth, Fig. 5.3).

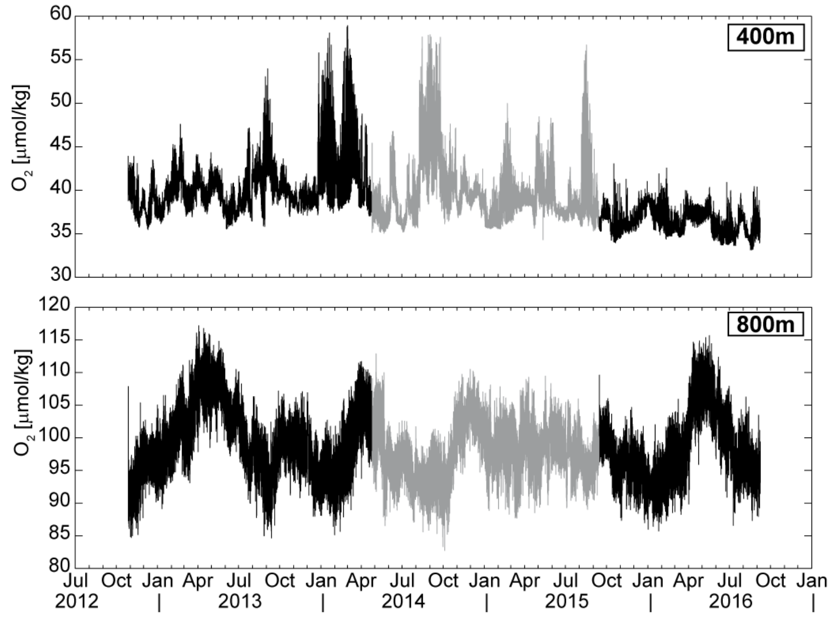

Fig. 5.3: Time series of oxygen concentration from the centre of the oxygen minimum zone (11°N, 21°W) from 400m (upper) und 800m (lower) depth. Black lines indicate the first (left) and during M130 recovered third (right) mooring period. The grey line indicates oxygen concentrations measured during the second deployment period (2014-2015).

The tracer observations collected within the OMZ will be used to assess the age of the tracers and hence the age of the water masses. This information will then be used to assess oxygen consumption rate. Complementary oxygen consumption rate estimates will be available from the quantitative and qualitative analysis of zooplankton data collected during the multi net and WP2 net stations and from the underwater vision profiler that will additionally allow a better understanding of the role of zooplankton in biogeochemical cycling within the OMZ.

A second focus of the biogeochemical work was on advancing understanding of nitrogen fixation in the tropical Atlantic. Primary productivity in the tropical and subtropical oceans is generally limited by the availability of fixed nitrogen (N) as observed through nutrient stoichiometry. This fixed N-limitation indicates that the main sources of fixed N in the ocean (i.e. N_2 fixation to NH_4), cannot fully compensate for the fixed N-loss, where nitrate, nitrite and ammonium are converted to N_2, N_2O and NO. However, there are large discrepancies between different estimates of the oceanic N budget, from almost twice as much N-loss as N_2 fixation (e.g. Codispoti, 2007) to nearly balanced budgets (e.g. Gruber et al., 2008). With the effort described above, we intend to accurately quantify N_2 fixation rates in the northeastern tropical and equatorial Atlantic as well as identify parameters controlling N_2 fixation such as phosphate and iron availability.

The mooring program in the western boundary region of the tropical South Atlantic was completed very successfully. In particular, we obtained a complete set of velocity records from the moorings allowing for accurate estimates of western boundary transport variability. With this new data, the transport time series of the NBUC and the deep western boundary current can be extended by one year to a total of more than 7 years of data (from March 2000 to August 2004 and from July 2013 to September 2016). The time series will allow to separate wind stress and wind stress curl induced transport variability from other forcing mechanism. Additionally, the transport time series from the western boundary together with the bottom-pressure time series from the two PIES recovered off Brazil and off Angola during the follow-up cruise M131 will be used to estimate the variability of the meridional overturning circulation in the upper 1000m of the tropical Atlantic for the first time.

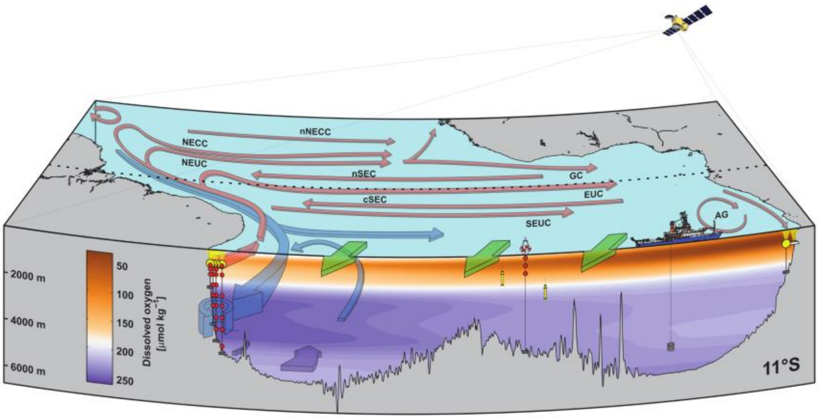

Fig. 5.4: Schematic sketch of the equatorial upper ocean currents and the variability of the western boundary current system off Brazil as well as the Atlantic Meridional Overturning Circulation measured at 11°S (TRACOS array).

6 Weather report and meteorological station

(Christian Rohleder)

In the morning of the 29th of August 2016, R/V METEOR started expedition M130 from the harbor of Mindelo (Cape Verde). Weather conditions in the first working area to the north of the Cape Verde Islands were governed by the southeastern fringe of a high (1028 hPa) centered to the north of the Azores. Off the coast of Mauretania a low (1008 hPa) moved to the west causing an increasing pressure gradient in the working area. Hence winds increased and a few showers were experienced. On the evening of September 1, the work to the north of the Cape Verdes was completed. R/V METEOR was on transit to the south of the island to the 23th longitude to commence a measurement program in the oxygen minimum zone. With the low centered on 10°N 32°W to the west of Mauritania, a weak trough developed over the working area. However, R/V METEOR experienced a weak pressure gradient with light and variable winds. Small-scale low-pressure troughs were embedded in the ITC, but were hardly evident in the surface pressure field. Starting September 3, scattered showers were experienced near the vessel and the winds increased to 6 to 7 Bft. In the following days, the ITC situated between 6°N and 12°N intensified and a cluster not far from the vessel developed. One of these clusters crossed the track of R/V METEOR on September 9. Intense rainfall was experienced in the next 24 hours and precipitation accumulated to 200 liter per square meter.

As R/V METEOR sailed further to the south on 23°W, the ship gradually left the ITC and showers became less frequent. Before crossing the equator, the trade winds from the southern subtropical high dominated and wind speed increased to 5 Bft. A trade inversion between 1500 und 2000 m above ground level prevented the development of thunderstorms. However, a few brief showers on 23° W towards the end of the section were spotted. On the transit to the working area off Brazil, the southeast trade winds shifted a relatively stable tropical air mass into the working area. Significant changes in the weather were no longer present. On September 21, R/V METEOR reached the working area off Brazil and wind blew from the east with a force of about 4 Bft. Local showers were experienced in the vicinity of the vessel. While wind conditions prevailed during the next working days, plenty of sunshine persisted. The work program along 11°S off Brazil was completed in the evening of September 27. During the transit to the coastal areas of Natal, the southeast trade wind continued to dominate. In the lower atmospheric levels, an instable air mass was shifted into the working area at 5°S and local showers developed. Furthermore, the southeast trade wind freshened and wind speed increased to 6 Bft. Towards the end of the CTD station program, a stable southeast trade wind set in, dominating the following days until R/V METEOR reached the harbor of Recife on October 3.

7. Station list

7.1 General station list

Station No.		Date	Gear	Time	Latitude	Longitude	Water Depth	Remarks
METEOR (M130-)	**GEOMAR**	**2016**		**[UTC]**	**[°]**	**[°]**	**[m]**	
931-1	KPO 1156	29.08.	Mooring	18:25 - 21:20	17°36.27'N	024°18.82'W	3596	Mooring recovery
932-1	FISH 1	29.08.	FISH	22:15 - 22:45	17°35.01'N	024°17.26'W	3584	**Towed-Fish**
933-1	CTD 1	29.08.	CTD	22:45 - 02:40	17°34.93'N	024°17.01'W	3587	**CTD** station (3573m)
934-1	MSN 1	30.08.	MSN	02:50 - 03:35	17°34.95'N	024°17.02'W	3583	**Multinet** (1050m)
935-1	CTD 2	30.08.	CTD	04:00 - 07:00	17°34.93'N	024°17.02'W	3585	**CTD** station (3573m
936-1	KPO 1143	30.08.	Mooring	07:10 - 12:50	17°36.40'N	024°14.98'W	3585	**Mooring** recovery (CVOO)
937-1	MSN 2	30.08.	MSN	13:25 - 14:10	17°34.97'N	024°17.05'W	3600	**Multinet** (1050m)
938-1	FISH 2	30.08. - 31.08.	FISH	14:30 - 10.30	17°35.01'N	024°17.26'W	3599	**Towed-Fish**
939-1	CTD 3	30.08.	CTD	15:30 - 17:00	17°34.97'N	024°17.04'W	3600	**CTD** station (1200m)
940-1	MSS 1	30.08.	MSS	17:16 - 18:00	17°35.24'N	024°16.89'W	3600	**MSS** station
941-1	CTD 4	30.08.	CTD	19:10 - 19:30	17°42.15'N	024°12.81'W	3597	**CTD** station
942-1	Buoy	31.08.	Buoy	10:40 - 15:20	19°42.73'N	023°11.00'W	4139	**Buoy** recovery (Dutch dust buoy)
943-1	FISH 3	31.08. - 01.09	FISH	15:30 - 09:20	17°35.01'N	024°17.26'W	4139	**Towed-Fish**
944-1	CTD 5	01.09.	CTD	04:20 - 05:44	17°35.01'N	024°17.01'W	3600	**CTD** station
945-1	CTD 6	01.09.	CTD	06:36 - 09:10	17°35.00'N	024°17.02'W	3599	**CTD** station (3591m)
946-1	KPO 1179	01.09.	Mooring	10:30 - 15:10	17°36.394'N	024°14.98'W	3600	**Mooring** deployment (CVOO)
947-1	CTD 7	01.09.	CTD	16:10 - 17:10	17°34.87'N	024°17.05'W	3600	**CTD** station (1200m)
948-1	FISH 4	01.09. - 03.09.	FISH	17:40 - 22:00	17°35.01'N	024°17.26'W	3601	**Towed-Fish**
949-1	CTD 8	02.09.	CTD	09:55 - 10:45	15°00.02'N	023°00.00'W	2709	**CTD** station (1200m)
950-1	MSS 2	02.09.	MSS	10:45 - 11:30	15°00.05'N	023°59.90'W	2731	**MSS** station (200m)
951-1	SR 1	02.09.	SR	15:00 - 15:15	14°29.93°N	022°29.94'W	3068	**Spectroradiometer**
952-1	CTD 9	02.09.	CTD	15:30 - 16:30	14°29.92°N	022°29.94'W	3068	**CTD** station (1200m)
953-1	MSS 3	02.09.	MSS	16:30 - 17:15	14°29.99°N	023°00.00'W	4094	**MSS** station (200m)
954-1	WP2 1	02.09.	WP2	20:30 - 21:05	14°00.01°N	023°00.00'W	4325	**Working Party 2 net**
955-1	CTD 10	02.09.	CTD	20:45 - 21:30	14°00.01°N	023°00.00'W	4325	**CTD** station (1200m)
956-1	MSS 4	02.09.	MSS	21:45 - 22:30	13°59.96°N	023°00.00'W	4331	**MSS** station (200m)
957-1	CTD 11	03.09.	CTD	01:30 - 02:30	13°30.02°N	023°00.00'W	4543	**CTD** station (1200m)
958-1	MSN 3	03.09.	MSN	05:30 - 06:15	13°00.00'N	023°00.01'W	4743	**Multinet** (1050m)
959-1	CTD 12	03.09.	CTD	06:30 - 07:30	13°00.20°N	023°00.00'W	4743	**CTD** station (1200m)
960-1	MSS 5	03.09.	MSS	07:45 - 08:15	13°00.00°N	023°00.00'W	4742	**MSS** station (200m)
961-1	CTD 13	03.09.	CTD	08:45 - 09:00	13°00.00°N	023°00.00'W	4743	**CTD** station (200m)
962-1	CTD 14	03.09.	CTD	12:30 - 13:30	12°30.00°N	023°00.00'W	4921	**CTD** station (1200m)
963-1	WP2 2	03.09.	WP2	12:45 - 13:15	12°30.00°N	023°00.00'W	4921	**WP2** net
964-1	SR 2	03.09.	SR	13:30 - 14:00	12°30.00°N	023°00.00'W	4923	**Spectroradiometer**
965-1	MSS 6	03.09.	MSS	14:00 - 14:45	12°30.00°N	023°00.00'W	4923	**MSS** station (200m)
966-1	CTD 15	03.09.	CTD	18:00 - 19:00	12°00.00°N	023°00.00'W	5047	**CTD** station (1200m)
967-1	WP2 3	03.09.	WP2	18:05 - 18:55	12°00.00°N	023°00.00'W	5047	**Working Party 2** net
968-1	FISH 5	03.09. - 08.09.	FISH	23:15 - 11:15	11°28.00'N	023°00.00'W	5544	**Towed-Fish**
969-1	CTD 16	03.09.	CTD	23:30 - 00:30	11°27.80°N	022°59.30'W	5505	**CTD** station (1200m)
970-1	MSS 7	04.09.	MSS	00:30 - 01:15	11°27.50°N	022°59.00'W	5121	**MSS** station (200m)
971-1	MSN 4	04.09.	MSN	04:00 - 04:30	11°00.00'N	023°00.00'W	5154	**Multinet** (1050m)
972-1	CTD 17	04.09.	CTD	04:45 - 05:30	11°00.00°N	023°00.00'W	5156	**CTD** station (1200m)
973-1	MSS 8	04.09.	MSS	05:45 - 06:20	11°00.00°N	023°00.00'W	5155	**MSS** station (200m)
974-1	CTD 18	04.09.	CTD	09:30 - 10:30	10°30.00°N	023°00.00'W	5189	**CTD** station (1200m)
975-1	SR 3	04.09.	SR	13:30 - 14:00	10°00.00°N	023°00.00'W	5033	**Spectroradiometer**

976-1	CTD 19	04.09.	CTD	14:15 - 15:15	10°00.00°N	023°00.00’W	5006	**CTD** station (1200m)
977-1	WP2 4	04.09.	WP2	14:20 - 15:10	10°00.00°N	023°00.00’W	5011	**Working Party 2 net**
978-1	CTD 20	04.09.	CTD	18:30 - 21:45	09°30.00°N	023°00.00’W	4634	**CTD** station (4622m)
979-1	WP2 5	04.09.	WP2	19:40 - 20:20	09°30.00°N	023°00.00’W	4633	**Working Party 2 net**
980-1	MSS 9	04.09.	MSS	22:00 - 22:30	09°30.00°N	023°00.00’W	4641	**MSS** station (200m)
981-1	CTD 21	04.09.	CTD	23:00 - 23:30	09°30.00°N	023°00.00’W	4640	**CTD** station (600m)
982-1	MSN 5	05.09.	MSN	03:00 - 03:30	09°00.00’N	023°00.00’W	4899	**Multinet** (1050m)
983-1	CTD 22	05.09.	CTD	03:45 - 04:30	09°00.00°N	023°00.00’W	4898	**CTD** station (1200m)
984-1	MSS 10	05.09.	MSS	04:45 - 05:30	09°00.00°N	023°00.00’W	4905	**MSS** station (200m)
985-1	CTD 23	05.09.	CTD	08:30 - 09:00	08°30.00°N	023°00.00’W	4788	**CTD** station (200m)
986-1	MSS 11	05.09.	MSS	09:00 - 09:45	08°30.00°N	023°00.00’W	4788	**MSS** station (200m)
987-1	CTD 24	05.09.	CTD	09:45 - 10:45	08°30.00°N	023°00.00’W	4780	**CTD** station (1200m)
988-1	SR 4	05.09.	SR	14:00 - 14:20	08°00.00°N	023°00.00’W	4420	**Spectroradiometer**
989-1	CTD 25	05.09.	CTD	14:30 - 15:20	08°00.00°N	023°00.00’W	4419	**CTD** station (1200m)
990-1	WP2 6	05.09.	WP2	14:40 - 15:20	08°00.00°N	023°00.00’W	4423	**Working Party 2 net**
991-1	MSS 12	05.09.	MSS	15:30 - 16:10	08°00.00°N	023°00.00’W	4419	**MSS** station (200m)
992-1	CTD 26	05.09.	CTD	22:15 - 23:15	08°00.00°N	022°00.00’W	4392	**CTD** station (1200m)
993-1	WP2 7	05.09.	WP2	22:20 - 23:00	08°00.00°N	022°00.00’W	5374	**Working Party 2 net**
994-1	CTD 27	06.09.	CTD	05:10 - 06:10	08°00.00°N	020°58.50’W	2943	**CTD** station (1200m)
995-1	CTD 28	06.09.	CTD	22:15 - 23:15	08°00.00°N	020°00.00’W	3999	**CTD** station (600m)
996-1	WP2 8	06.09.	WP2	11:30 - 12:15	08°00.00°N	020°00.00’W	3999	**Working Party 2 net**
997-1	SR 5	06.09.	SR	12:20 - 12:40	08°00.00°N	020°00.00’W	5428	**Spectroradiometer**
998-1	CTD 29	06.09.	CTD	18:00 - 18:45	08°00.00°N	019°00.00’W	4570	**CTD** station (600m)
999-1	WP2 9	06.09.	WP2	18:10 - 18:40	08°00.00°N	019°00.00’W	4571	**Working Party 2 net**
1000-1	CTD 30	07.09.	CTD	00:30 - 01:15	09°00.00°N	019°00.00’W	4601	**CTD** station (600m)
1001-1	CTD 31	07.09.	CTD	06:00 - 07:15	09°00.00°N	020°00.00’W	4481	**CTD** station (1000m)
1002-1	CTD 32	07.09.	CTD	11:45 - 12:30	10°00.00°N	020°00.00’W	4481	**CTD** station (600m)
1003-1	SR 6	07.09.	SR	12:40 - 13:00	10°00.00°N	020°00.00’W	4481	**Spectroradiometer**
1004-1	CTD 33	07.09.	CTD	19:00 - 19:30	11°00.00°N	020°00.00’W	4805	**CTD** station (600m)
1005-1	CTD 34	08.09.	CTD	04:00 - 05:00	12°00.00°N	021°00.00’W	4922	**CTD** station (1200m)
1006-1	KPO 1142	08.09.	Mooring	11:15 - 15:06	11°02.42°N	021°13.04’W	5073	**Mooring** recovery
1007-1	WP2 10	08.09.	WP2	12:00 - 15:15	11°02.42°N	021°13.04’W	5078	**Working Party 2 net**
1008-1	MSN 6	08.09.	MSN	15:15 - 16:00	11°01.09’N	021°09.45’W	5080	**Multinet** (1050m)
1009-1	KPO 1178	08.09.	Mooring	17:00 - 21:02	11°02.22’N	021°13.27’W	5072	**Mooring** deployment
1010-1	CTD 35	08.09.	CTD	21:40 - 23:00	11°01.80°N	021°12.50’W	5082	**CTD** station (1200m)
1011-1	MSS 13	08.09.	MSS	23:10 - 23:50	11°00.00°N	021°11.60’W	5086	**MSS** station (200m)
1012-1	MSN 7	09.09.	MSN	00:00 - 00:45	10°59.00’N	023°11.10’W	5086	**Multinet** (1050m)
1013-1	CTD 36	09.09.	CTD	06:30 - 07:00	10°00.00°N	021°00.00’W	5071	**CTD** station (1200m)
1014-1	CTD 37	09.09.	CTD	10:30 - 11:00	09°30.00°N	021°00.00’W	4099	**CTD** station (200m)
1015-1	FISH 6	09.09. - 11.09.	FISH	11:00 - 09:15	09°30.00’N	021°00.00’W	4091	**Towed-Fish**
1016-1	CTD 38	09.09.	CTD	14:15 - 15:30	09°00.00°N	021°00.00’W	2054	**CTD** station (1200m)
1017-1	WP2 11	09.09.	WP2	14:15 - 15:15	09°00.00°N	021°00.00’W	2060	**Working Party 2 net**
1018-1	SR 7	09.09.	SR	15:40 - 16:00	09°00.00°N	021°00.00’W	2038	**Spectroradiometer**
1019-1	CTD 39	10.09.	CTD	09:00 - 10:00	07°30.00°N	023°00.00’W	4389	**CTD** station (1200m)
1020-1	CTD 40	10.09.	CTD	13:00 - 13:45	07°00.00°N	023°00.00’W	4473	**CTD** station (1200m)
1021-1	WP2 12	10.09.	WP2	13:00 - 13:45	07°00.00°N	023°00.00’W	4475	**Working Party 2 net**
1022-1	MSS 14	10.09.	MSS	13:50 - 14:40	07°00.00°N	023°00.00’W	4473	**MSS** station (200m)
1023-1	SR 8	10.09.	SR	14:40 - 15:00	07°00.00°N	023°00.00’W	4478	**Spectroradiometer**
1024-1	MSN 8	10.09.	MSN	15:00 - 15:45	07°00.00°N	023°00.00’W	4480	**Multinet** (1050m)
1025-1	WP2 11	10.09.	WP2	15:00 - 15:45	07°00.00°N	023°00.00’W	4594	**Working Party 2 net**
1026-1	CTD 41	10.09.	CTD	16:20 - 17:10	07°00.00°N	023°00.00’W	4683	**CTD** station (1200m)
1027-1	CTD 42	10.09.	CTD	20:00 - 21:00	06°30.00°N	023°00.00’W	3040	**CTD** station (1200m)
1028-1	MSS 15	10.09.	MSS	21:00 - 21:45	06°30.00°N	023°00.00’W	3001	**MSS** station (200m)
1029-1	CTD 43	11.09.	CTD	00:45 - 01:30	06°00.00°N	023°00.00’W	4101	**CTD** station (1200m)
1030-1	MSS 16	11.09.	MSS	01:30 - 01:45	06°00.00°N	023°00.00’W	4099	**MSS** station (200m)
1031-1	CTD 44	11.09.	CTD	05:00 - 06:00	05°30.00°N	023°00.00’W	4237	**CTD** station (1200m)
1032-1	KPO 1141	11.09.	Mooring	09:10 - 12:20	05°01.35°N	023°00.00’W	4229	**Mooring** recovery
1033-1	WP2 12	11.09.	WP2	10:30 - 12:30	05°01.06°N	023°00.00’W	4228	**Working Party 2 net**
1034-1	SR 9	11.09.	SR	12:45 - 13:00	05°01.06°N	023°00.00’W	4217	**Spectroradiometer**

1035-1	MSN 9	11.09.	MSN	13:20 - 14:00	05°00.00°N	023°00.00’W	4217	**Multinet** (1050m)
1036-1	WP2 13	11.09.	WP2	13:30 - 14:00	05°00.00°N	023°00.00’W	4218	**Working Party 2 net**
1037-1	CTD 45	11.09.	CTD	14:00 - 15:00	05°00.00°N	023°00.00’W	4217	**CTD** station (1200m)
1038-1	KPO 1177	11.09.	Mooring	16:04 - 19:27	05°01.005’N	023°00.00’W	4217	**Mooring** deployment
1039-1	FISH 7	11.09. - 12.09.	FISH	19:30 - 09:10	05°00.00’N	023°00.00’W	4211	**Towed-Fish** deployment
1040-1	CTD 46	11.09.	CTD	20:00 - 22:30	05°00.00°N	023°00.00’W	4213	**CTD** station (4197m)
1041-1	MSN 10	11.09.	MSN	22:30 - 23:15	05°00.00°N	023°00.00’W	4216	**Multinet** (1050m)
1042-1	CTD 47	12.09.	CTD	03:00 - 05:20	04°30.00°N	023°00.00’W	4128	**CTD** station (4100m)
1043-1	CTD 48	12.09.	CTD	03:00 - 05:20	04°02.70°N	023°00.00’W	4211	**CTD** station (200m)
1044-1	SR 10	12.09.	SR	13:05 - 13:20	04°00.00°N	023°00.00’W	4221	**Spectroradiometer**
1045-1	CTD 49	12.09.	CTD	13:25 - 16:00	04°00.00°N	023°00.00’W	4221	**CTD** station (4198m)
1046-1	WP2 14	12.09.	WP2	13:30 - 13:50	04°00.00°N	023°00.00’W	4219	**Working Party 2 net**
1047-1	CTD 50	12.09.	CTD	19:20 - 22:00	03°30.00°N	023°00.00’W	4388	**CTD** station (4370m)
1048-1	FISH 8	12.09. - 15.09.	FISH	22:00 - 08:00	03°30.00’N	023°00.00’W	4387	**Towed-Fish** deployment
1049-1	MSN 11	13.09.	MSN	01:00 - 01:45	03°00.00°N	023°00.00’W	4652	**Multinet** (1050m)
1050-1	CTD 51	13.09.	CTD	02:00 - 04:40	03°00.00°N	023°00.00’W	4649	**CTD** station (4620m)
1051-1	CTD 52	13.09.	CTD	08:00 - 10:45	02°30.00°N	023°00.00’W	4830	**CTD** station (4690m)
1052-1	WP2 15	13.09.	WP2	08:15 - 10:30	02°30.00°N	023°00.00’W	4714	**Working Party 2 net**
1053-1	SR 11	13.09.	SR	14:00 - 14:20	02°00.00°N	023°00.00’W	4335	**Spectroradiometer**
1054-1	CTD 53	13.09.	CTD	14:20 - 17:00	02°00.00°N	023°00.00’W	4334	**CTD** station (4300m)
1055-1	CTD 54	13.09.	CTD	19:00 - 21:30	01°40.00°N	023°00.00’W	4129	**CTD** station (4120m)
1056-1	CTD 55	14.09.	CTD	00:00 - 03:00	01°20.00°N	023°00.00’W	4723	**CTD** station (4690m)
1057-1	MSN 12	14.09.	MSN	05:15 - 06:00	01°00.00°N	023°00.00’W	3549	**Multinet** (1050m)
1058-1	CTD 56	14.09.	CTD	06:00 - 07:30	01°00.00°N	023°00.00’W	3236	**CTD** station (1200m)
1059-1	CTD 57	14.09.	CTD	08:10 - 10:20	01°00.00°N	023°00.00’W	3223	**CTD** station (3180m)
1060-1	CTD 58	14.09.	CTD	12:45 - 14:00	00°40.00°N	023°00.00’W	4314	**CTD** station (1200m)
1061-1	WP2 16	14.09.	WP2	13:10 - 14:00	00°40.00°N	023°00.00’W	5345	**Working Party 2 net**
1062-1	SR 12	14.09.	SR	14:15 - 14:30	00°40.00°N	023°00.00’W	3898	**Spectroradiometer**
1063-1	MSN 13	14.09.	MSN	14:40 - 15:20	00°40.00°N	023°00.00’W	3892	**Multinet** (1050m)
1064-1	WP2 17	14.09.	WP2	14:45 - 15:15	00°40.00°N	023°00.00’W	3893	**Working Party 2 net**
1065-1	MSS 17	14.09.	MSS	15:30 - 16:10	00°40.00°N	023°00.00’W	3886	**MSS** station (200m)
1066-1	CTD 59	14.09.	CTD	16:15 - 18:40	00°40.00°N	023°00.00’W	3886	**CTD** station (3830m)
1067-1	WP2 18	14.09.	WP2	6:45 - 18:30	00°40.00°N	023°00.00’W	3887	**Working Party 2 net**
1068-1	CTD 60	14.09.	CTD	21:10 - 23:30	00°20.00°N	023°00.00’W	3919	**CTD** station (3870m)
1069-1	CTD 61	15.09.	CTD	01:45 - 02:30	00°00.00°N	023°00.00’W	3951	**CTD** station (1200m)
1070-1	MSN 14	15.09.	MSN	02:40 - 03:30	00°00.00°N	023°00.00’W	3950	**Multinet** (1050m)
1071-1	MSS 18	15.09.	MSS	03:30 - 04:15	00°00.00°N	023°00.00’W	3950	**MSS** station (200m)
1072-1	CTD 62	15.09.	CTD	04:50 - 07:10	00°00.00°N	023°00.00’W	3951	**CTD** station (3860m)
1073-1	KPO 1140	15.09.	Mooring	07:45 - 11:30	00°00.48°N	023°06.90’W	3930	**Mooring** recovery
1074-1	WP2 19	15.09.	WP2	09:20 - 11:30	00°00.48°N	023°06.90’W	3901	**Working Party 2 net**
1075-1	MSN 14	15.09.	MSN	12:00 - 12:45	00°00.00°N	023°02.00’W	3950	**Multinet** (1050m)
1076-1	SR 13	15.09.	SR	12:45 - 13:15	00°00.00°N	023°02.00’W	3949	**Spectroradiometer**
1077-1	KPO 1176	15.09.	Mooring	16:22 - 19:35	00°00.55°S	023°06.78’W	3816	**Mooring** deployment
1078-1	CTD 63	15.09.	CTD	22:10 - 01:30	00°20.00°S	023°00.00’W	4617	**CTD** station (4580m)
1079-1	FISH 9	15.09. - 19.09.	FISH	22:20 - 19.09.	00°20.00’S	023°00.00’W	4621	**Towed-Fish** deployment
1080-1	CTD 64	16.09.	CTD	04:00 - 05:00	00°40.00°S	023°00.00’W	3568	**CTD** station (1200m)
1081-1	MSN 15	16.09.	MSN	05:00 - 05:45	00°40.00°S	023°00.00’W	3570	**Multinet** (1050m)
1082-1	MSS 19	16.09.	MSS	05:45 - 06:30	00°40.00°S	023°00.00’W	4789	**MSS** station (200m)
1083-1	CTD 65	16.09.	CTD	06:45 - 09:00	00°40.00°S	023°00.00’W	3577	**CTD** station (3550m)
1084-1	CTD 66	16.09.	CTD	11:45 - 14:15	01°00.00°S	023°00.00’W	4107	**CTD** station (4080m)
1085-1	WP2 20	16.09.	WP2	11:50 - 15:3	01°00.00°S	023°00.00’W	5097	**Working Party 2 net** (4 casts)
1086-1	SR 14	16.09.	SR	14:20 - 14:45	01°00.00°S	023°00.00’W	4115	**Spectroradiometer**
1087-1	MSN 16	16.09.	MSN	14:45 - 15:30	01°00.00°S	023°00.00’W	4426	**Multinet** (1050m)
1088-1	MSS 20	16.09.	MSS	15:30 - 16:15	01°00.00°S	023°00.00’W	4204	**MSS** station (200m)
1089-1	CTD 67	16.09.	CTD	16:15 - 17:45	01°00.00°S	023°00.00’W	4043	**CTD** station (1200m)
1090-1	CTD 68	16.09.	CTD	20:15 - 23:00	01°20.00°S	023°00.00’W	4867	**CTD** station (4780m)

1091-1	CTD 69	17.09.	CTD	01:30 - 04:30	01°40.00°S	023°00.00'W	4934	**CTD** station (4900m)
1092-1	CTD 70	17.09.	CTD	06:45 - 09:45	02°00.00°S	023°00.00'W	5244	**CTD** station (5200m)
1093-1	SR 15	17.09.	SR	13:00 - 13:30	02°30.00°S	023°00.00'W	5783	**Spectroradiometer**
1094-1	CTD 71	17.09.	CTD	13:30 - 17:00	02°30.00°S	023°00.00'W	5779	**CTD** station (5740m)
1095-1	WP2 21	17.09.	WP2	14:06 - 14:15	02°30.00°S	023°00.00'W	5777	**Working Party 2 net**
1096-1	CTD 72	17.09.	CTD	20:15 - 23:30	03°00.00°S	023°00.00'W	5503	**CTD** station (5440m)
1097-1	MSN 17	17.09.	MSN	23:30 - 00:15	03°00.00°S	023°00.00'W	5498	**Multinet** (1050m)
1098-1	CTD 73	18.09.	CTD	00:30 - 01:00	03°00.00°S	023°00.00'W	5498	**CTD** station (200m)
1099-1	CTD 74	18.09.	CTD	06:15 - 07:15	03°30.00°S	023°00.00'W	5478	**CTD** station (5400m)
1100-1	CTD 75	18.09.	CTD	10:45 - 14:15	04°00.00°S	023°00.00'W	5860	**CTD** station (5810m)
1101-1	WP2 22	18.09.	WP2	11:30 - 13:45	04°00.00°S	023°00.00'W	5854	**Working Party 2 net**
1102-1	SR 16	18.09.	SR	14:30 - 14:45	04°00.00°S	023°00.00'W	5839	**Spectroradiometer**
1103-1	CTD 76	18.09.	CTD	17:45 - 21:00	04°30.00°S	023°00.00'W	5173	**CTD** station (5120m)
1104-1	CTD 77	19.09.	CTD	00:15 - 03:15	05°00.00°S	023°00.00'W	5190	**CTD** station (5160m)
1105-1	MSN 18	19.09.	MSN	03:30 - 04:15	05°00.00°S	023°00.00'W	5191	**Multinet** (1050m)
1106-1	CTD 78	19.09.	CTD	07:30 - 10:30	05°30.00°S	023°00.00'W	5094	**CTD** station (5050m)
1107-1	FISH 10	19.09. - 22.09.	FISH	10:40 - 03:00	05°30.00'S	023°00.00'W	5091	**Towed-Fish** deployment
1108-1	CTD 79	21.09.	CTD	21:00 - 00:00	11°30.00°S	032°00.00'W	5031	**CTD** station (5000m)
1109-1	CTD 80	22.09.	CTD	02:45 - 06:00	11°30.00°S	032°27.00'W	4784	**CTD** station (4830m)
1110-1	CTD 81	22.09.	CTD	08:30 - 10:45	11°30.00°S	032°53.00'W	3487	**CTD** station (3470m)
1111-1	CTD 82	22.09.	CTD	13:00 - 16:30	11°30.00°S	033°13.00'W	4264	**CTD** station (4250m)
1112-1	CTD 83	22.09.	CTD	18:30 - 21:45	11°30.00°S	033°33.00'W	4994	**CTD** station (4980m)
1113-1	CTD 84	22.09.	CTD	23:45 - 02:30	11°30.00°S	033°53.00'W	4622	**CTD** station (4480m)
1114-1	CTD 85	23.09.	CTD	04:30 - 07:15	11°30.00°S	034°13.00'W	4582	**CTD** station (4480m)
1115-1	KPO 1147	23.09.	Mooring	12:35 - 15:08	10°56.32°S	034°58.81'W	4110	**Mooring** recovery
1116-1	KPO 1146	23.09.	Mooring	18:02 - 20:09	10°36.51°S	035°23.85'W	3503	**Mooring** recovery
1117-1	FISH 11	23.09. - 24.09.	FISH	21:15 - 16:45	10°40.11'S	035°18.90'W	3646	**Towed-Fish** deployment
1118-1	CTD 86	24.09.	CTD	03:45 - 06:45	11°18.80°S	034°28.21'W	4638	**CTD** station (4450m)
1119-1	CTD 87	24.09.	CTD	08:45 - 11:15	11°07.80°S	034°43.93'W	4256	**CTD** station (4200m)
1120-1	CTD 88	24.09.	CTD	13:15 - 16:30	11°07.80°S	034°43.93'W	4099	**CTD** station (4070m)
1121-1	KPO 1172	24.09.	Mooring	18:02 - 20:47	10°56.411°S	034°59.600' W	4112	**Mooring** deployment
1122-1	FISH 12	24.09. - 25.09.	FISH	21:00 - 09:00	10°56.41°S	034°59.60'W	4115	**Towed-Fish** deployment
1123-1	CTD 89	24.09.	CTD	22:00 - 00:30	10°51.40°S	035°05.66'W	3971	**CTD** station (3980m)
1124-1	CTD 90	25.09.	CTD	01:30 - 04:00	10°46.40°S	035°11.60'W	3878	**CTD** station (3850m)
1125-1	CTD 91	25.09.	CTD	05:00 - 07:30	10°41.40°S	035°17.60'W	3677	**CTD** station (3660m)
1126-1	KPO 1171	25.09.	Mooring	10:00 - 12:35	10°36.50°S	035°23.56'W	3497	**Mooring** deployment
1127-1	KPO 1145	25.09.	Mooring	15:00 - 17:00	10°22.81°S	035°41.05'W	2300	**Mooring** recovery
1128-1	KPO 1144	25.09.	Mooring	18:20 - 19:00	10°16.00°S	035°51.93'W	0	**Mooring** recovery
1129-1	FISH 13	25.09. - 26.09.	FISH	21:00 - 08:00	10°16.16°S	035°51.91'W	0	**Towed-Fish** deployment
1130-1	CTD 92	25.09.	CTD	22:45 - 01:00	10°36.80°S	035°23.95'W	3495	**CTD** station (3460m)
1131-1	CTD 93	26.09.	CTD	02:00 - 04:00	10°31.70°S	035°29.55'W	3207	**CTD** station (3160m)
1132-1	CTD 94	26.09.	CTD	04:45 - 07:15	10°26.95°S	035°35.25'W	2800	**CTD** station (2800m)
1133-1	CTD 95	26.09.	CTD	08:15 - 10:00	10°22.50°S	035°40.05'W	2313	**CTD** station (2280m)
1134-1	KPO 1170	26.09.	Mooring	10:58 - 13:04	10°22.793'S	35°40.784'W	2292	**Mooring** deployment
1135-1	PIES 1	26.09.	PIES	14:45 - 16:45	10°13.63'S	35°52.25'W	301	**PIES** acoustic data readout
1136-1	PIES 2	26.09.	PIES	17:00 - 17:30	10°14.07'S	35°51.80'W	500	**PIES** acoustic data readout
1137-1	KPO 1169	26.09.	Mooring	18:45 - 19:15	10°15.993'S	35°51.682'W	749	**Mooring** deployment
1138-1	FISH 14	26.09. - 01.10.	FISH	19:30 - 13:30	10°16.16°S	035°51.91'W	956	**Towed-Fish** deployment
1139-1	CTD 96	26.09.	CTD	20:30 - 21:30	10°19.51°S	035°46.12'W	1712	**CTD** station (1680m)
1140-1	CTD 97	26.09.	CTD	22:30 - 23:00	10°16.30°S	035°52.04'W	880	**CTD** station (800m)
1141-1	CTD 98	26.09.	CTD	23:30 - 00:00	10°15.32°S	035°52.63'W	513	**CTD** station (490m)
1142-1	CTD 99	27.09.	CTD	00:30 - 00:45	10°14.67°S	035°53.59'W	231	**CTD** station (210m)

1143-1	CTD 100	28.09.	CTD	06:00 - 06:30	05°38.88°S	034°57.56’W	825	**CTD** station (300m)
1144-1	CTD 101	28.09.	CTD	07:00 - 07:30	05°38.04°S	034°55.94’W	701	**CTD** station (680m)
1145-1	CTD 102	28.09.	CTD	08:15 - 09:30	05°37.35°S	034°54.01’W	1349	**CTD** station (1560m)
1146-1	CTD 103	28.09.	CTD	10:30 - 12:30	05°35.53°S	034°46.04’W	2649	**CTD** station (2650m)
1147-1	CTD 104	28.09.	CTD	14:00 - 16:00	05°34.74°S	034°36.04’W	3441	**CTD** station (3360m)
1148-1	CTD 105	28.09.	CTD	18:15 - 21:00	05°32.65°S	034°24.05’W	3763	**CTD** station (3700m)
1149-1	CTD 106	28.09.	CTD	23:00 - 01:45	05°30.19°S	034°10.04’W	4116	**CTD** station (4080m)
1150-1	CTD 107	29.09.	CTD	04:00 - 06:45	05°26.58°S	033°50.05’W	4322	**CTD** station (4290m)
1151-1	CTD 108	29.09.	CTD	09:30 - 12:15	05°21.71°S	033°25.01’W	4481	**CTD** station (4440m)
1152-1	CTD 109	29.09.	CTD	15:00 - 19:00	05°17.71°S	033°00.03’W	4600	**CTD** station (4460m)
1153-1	CTD 110	29.09.	CTD	19:45 - 22:30	05°17.69°S	033°00.01’W	3596	**CTD** station (4480m)
1154-1	CTD 111	30.09.	CTD	02:45 - 04:30	05°12.34°S	032°30.10’W	3584	**CTD** station (4480m)
1155-1	CTD 112	30.09.	CTD	08:00 - 10:30	05°07.00°S	032°00.03’W	3587	**CTD** station (4480m)
1156-1	CTD 112	30.09.	CTD	14:15 - 15:15	05°00.02°S	031°30.01’W	3583	**CTD** station (4480m)
1157-1	CTD 114	30.09.	CTD	16:00 - 19:00	05°00.00°S	031°30.00’W	3585	**CTD** station (4480m)
1158-1	CTD 115	30.09.	CTD	22:30 - 01:00	05°00.00°S	031°00.07’W	3585	**CTD** station (4480m)
1159-1	CTD 116	01.10.	CTD	04:45 - 07:15	05°00.00°S	030°30.02’W	3600	**CTD** station (4320m)
1160-1	CTD 117	01.10.	CTD	10:45 - 13:30	05°00.00°S	030°00.04’W	3599	**CTD** station (4480m)
1161-1	CTD 118	01.10.	CTD	17:00 - 19:45	05°00.00°S	029°30.01’W	3600	**CTD** station (4480m)

7.2 CTD Station list

Station	CTD cast	Date	Time	Latitude	Longitude	max. d [m]	bottom [m]	Additional measurements						
ME1300/0933-1	001	2016/08/29	23:41	17° 34.93' N	24° 17.01' W	3573	3584	L	U	T				
ME1300/0935-1	002	2016/08/30	04:27	17° 34.93' N	24° 17.02' W	3573	3588	L		T				
ME1300/0939-1	003	2016/08/30	15:30	17° 34.96' N	24° 17.04' W	1201	3600	L		T				
ME1300/0941-1	004	2016/08/30	19:05	17° 42.13' N	24° 12.81' W	215	3599			T	N			D
ME1300/0944-1	005	2016/09/01	04:15	17° 34.95' N	24° 17.08' W	1000	3601	L	U	T	N			D
ME1300/0945-1	006	2016/09/01	06:34	17° 34.99' N	24° 17.02' W	3592	3601	L	U	T				
ME1300/0947-1	007	2016/09/01	16:08	17° 34.87' N	24° 17.05' W	1199	3599	L		T		S		
ME1300/0949-1	008	2016/09/02	09:53	15° 00.00' N	22° 59.98' W	1201	2721		U	T	N			
ME1300/0952-1	009	2016/09/02	15:28	14° 29.92' N	22° 59.95' W	1199	3945		U	T	N	S		
ME1300/0955-1	010	2016/09/02	20:44	14° 00.01' N	23° 00.00' W	1200	4324		U	T	N	S		D
ME1300/0957-1	011	2016/09/03	01:32	13° 30.04' N	23° 00.01' W	1202	4540	L		T	N	S		
ME1300/0959-1	012	2016/09/03	06:28	12° 59.95' N	22° 59.83' W	1203	4745	L	U	T	N	S		
ME1300/0961-1	013	2016/09/03	08:48	13° 00.06' N	23° 00.24' W	212	4747	L	U	T	N	S		D
ME1300/0962-1	014	2016/09/03	12:33	12° 30.04' N	22° 59.97' W	1201	4921		U	T	N	S		
ME1300/0966-1	015	2016/09/03	18:01	12° 00.12' N	22° 59.95' W	1204	5047		U	T	N	S		D
ME1300/0969-1	016	2016/09/03	23:27	11° 27.97' N	22° 59.34' W	1201	5170		U	T	N	S		
ME1300/0972-1	017	2016/09/04	04:38	10° 59.95' N	22° 59.97' W	1201	5154		U	T	N	S		
ME1300/0974-1	018	2016/09/04	09:29	10° 30.06' N	22° 59.98' W	1200	5208		U	T	N	S		
ME1300/0976-1	019	2016/09/04	14:11	10° 00.27' N	22° 59.92' W	1200	5065	L		T	N	S	I	
ME1300/0978-1	020	2016/09/04	18:26	9° 29.96' N	22° 59.98' W	4624	4635	L	U	T				
ME1300/0981-1	021	2016/09/04	23:00	9° 30.67' N	23° 00.42' W	601	4665		U	T	N	S		
ME1300/0983-1	022	2016/09/05	03:43	8° 59.98' N	22° 59.98' W	1200	4914	L	U	T	N	S		
ME1300/0985-1	023	2016/09/05	08:29	8° 29.95' N	22° 59.98' W	210	4798	L	U	T	N	S		D
ME1300/0987-1	024	2016/09/05	09:49	8° 30.76' N	22° 59.73' W	1199	4818	L	U	T		S		
ME1300/0989-1	025	2016/09/05	14:28	8° 00.01' N	22° 59.98' W	1200	4421	L	U	T	N	S	I	D
ME1300/0992-1	026	2016/09/05	22:12	8° 00.06' N	22° 00.03' W	1200	4378	L	U	T		S		
ME1300/0994-1	027	2016/09/06	05:05	7° 59.68' N	20° 58.48' W	1201	2835		U	T	N	S		
ME1300/0995-1	028	2016/09/06	11:31	7° 59.98' N	19° 59.82' W	631	4570		U	T		S	I	
ME1300/0998-1	029	2016/09/06	18:03	8° 00.03' N	18° 59.97' W	661	4567		U	T	N	S		
ME1300/1000-1	030	2016/09/07	00:35	9° 00.07' N	18° 59.86' W	600	4639		U	T		S		
ME1300/1001-1	031	2016/09/07	05:58	9° 30.01' N	19° 29.93' W	1002	xxxx		U	T		S		
ME1300/1002-1	032	2016/09/07	11:47	10° 00.00' N	19° 59.93' W	610	4523		U	T	N	S	I	D
ME1300/1004-1	033	2016/09/07	18:47	11° 00.07' N	19° 59.95' W	590	4827		U	T		S		
ME1300/1005-1	034	2016/09/08	03:51	12° 00.00' N	20° 59.98' W	1200	4939		U	T	N	S		
ME1300/1010-1	035	2016/09/08	21:37	11° 01.89' N	21° 12.84' W	1199	5088		U	T	N	S		
ME1300/1013-1	036	2016/09/09	06:27	10° 00.12' N	20° 59.86' W	1200	5105		U	T		S		
ME1300/1014-1	037	2016/09/09	10:26	9° 30.07' N	20° 59.92' W	220	4316		U	T	N	S		D
ME1300/1016-1	038	2016/09/09	14:13	9° 00.00' N	20° 59.95' W	1200	2039		U	T	N	S	I	
ME1300/1019-1	039	2016/09/10	08:51	7° 29.97' N	22° 59.97' W	1201	4389		U	T	N	S		
ME1300/1020-1	040	2016/09/10	12:54	6° 59.98' N	22° 59.94' W	1200	3588	L	U	T		S	I	
ME1300/1026-1	041	2016/09/10	15:48	6° 59.50' N	23° 01.33' W	1201	4333	L	U	T		S		
ME1300/1027-1	042	2016/09/10	19:58	6° 29.95' N	22° 59.94' W	1201	3178	L	U	T	N	S		
ME1300/1029-1	043	2016/09/11	00:48	6° 00.03' N	23° 00.00' W	1200	4122	L	U	T	N	S		D
ME1300/1031-1	044	2016/09/11	05:02	5° 30.04' N	22° 59.98' W	1201	4233	L	U	T	N	S		
ME1300/1037-1	045	2016/09/11	14:07	5° 00.01' N	22° 59.98' W	1200	4216	L	U	T	N	S	I	D
ME1300/1040-1	046	2016/09/11	19:50	5° 00.06' N	22° 59.95' W	4199	4263	L	U	T				
ME1300/1042-1	047	2016/09/12	02:51	4° 30.06' N	22° 59.98' W	4100	4147	L	U	T	N			
ME1300/1043-1	048	2016/09/12	08:39	4° 02.71' N	22° 59.98' W	199	4225	L	U	T	N			D
ME1300/1045-1	049	2016/09/12	13:24	3° 59.97' N	22° 59.98' W	4194	4214	L	U	T	N		I	

Station	CTD cast	Date	Time	Latitude	Longitude	max. d [m]	bottom [m]	Additional measurements						
ME1300/1047-1	050	2016/09/12	19:18	3° 30.06' N	22° 59.98' W	4371	4390	L	U	T	N			
ME1300/1050-1	051	2016/09/13	01:54	3° 00.04' N	23° 00.03' W	4621	4650	L	U	T	N			D
ME1300/1051-1	052	2016/09/13	07:52	2° 30.10' N	23° 00.04' W	4689	4808	L	U	T	N			
ME1300/1054-1	053	2016/09/13	14:16	1° 59.89' N	23° 00.10' W	4300	4335	L	U	T	N		I	
ME1300/1055-1	054	2016/09/13	19:02	1° 40.08' N	23° 00.04' W	4120	4127	L		T				
ME1300/1056-1	055	2016/09/14	00:04	1° 20.04' N	23° 00.06' W	4690	4724	L		T	N			
ME1300/1058-1	056	2016/09/14	06:00	1° 00.01' N	23° 00.00' W	1201	3240	L		T	N			D
ME1300/1059-1	057	2016/09/14	08:11	1° 00.01' N	23° 00.01' W	3180	3364	L		T				
ME1300/1060-1	058	2016/09/14	12:42	0° 40.06' N	23° 00.00' W	1201	4017	L		T	N		I	
ME1300/1066-1	059	2016/09/14	16:18	0° 39.49' N	22° 59.74' W	3831	4421	L		T				
ME1300/1068-1	060	2016/09/14	21:06	0° 20.02' N	23° 00.01' W	3871	3919	L		T	N			
ME1300/1069-1	061	2016/09/15	01:40	0° 00.04' N	23° 01.96' W	1200	3973	L		T	N		I	
ME1300/1072-1	062	2016/09/15	04:45	0° 00.04' N	23° 02.01' W	3862	4152	L		T				
ME1300/1078-1	063	2016/09/15	22:07	0° 19.93' S	23° 00.01' W	4581	4624	L		T	N			
ME1300/1080-1	064	2016/09/16	03:50	0° 39.94' S	22° 59.98' W	1200	3566	L		T	N			D
ME1300/1083-1	065	2016/09/16	06:46	0° 40.12' S	22° 59.50' W	3550	3653	L		T				
ME1300/1084-1	066	2016/09/16	11:38	0° 59.91' S	23° 00.00' W	4079	4341	L		T				
ME1300/1089-1	067	2016/09/16	16:24	1° 00.65' S	22° 59.28' W	1200	4124	L		T				
ME1300/1090-1	068	2016/09/16	20:07	1° 19.93' S	23° 00.01' W	4780	4850	L		T	N			
ME1300/1091-1	069	2016/09/17	01:39	1° 39.96' S	23° 00.01' W	4900	4951	L		T				
ME1300/1092-1	070	2016/09/17	06:41	1° 59.95' S	23° 00.01' W	5201	5229	L		T	N			
ME1300/1094-1	071	2016/09/17	13:26	2° 30.16' S	23° 00.07' W	5742	5794	L		T	N		I	
ME1300/1096-1	072	2016/09/17	20:12	2° 59.95' S	23° 00.06' W	5441	5589	L		T	N			
ME1300/1098-1	073	2016/09/18	00:36	2° 59.97' S	23° 00.01' W	217	6021	L		T	N			D
ME1300/1099-1	074	2016/09/18	04:14	3° 29.94' S	23° 00.04' W	5401	5827	L		T				
ME1300/1100-1	075	2016/09/18	10:44	3° 59.91' S	23° 00.04' W	5815	5865	L		T	N		I	
ME1300/1103-1	076	2016/09/18	17:47	4° 29.92' S	23° 00.06' W	5121	5289	L		T				
ME1300/1104-1	077	2016/09/19	00:14	4° 59.97' S	23° 00.03' W	5162	5298	L		T	N			
ME1300/1106-1	078	2016/09/19	07:20	5° 29.95' S	23° 00.04' W	5052	5212	L		T				
ME1300/1108-1	079	2016/09/21	20:56	11° 29.98' S	32° 00.10' W	5000	5197	L		T				
ME1300/1109-1	080	2016/09/22	02:49	11° 30.04' S	32° 27.07' W	4751	4786	L		T	N			D
ME1300/1110-1	081	2016/09/22	08:27	11° 30.06' S	32° 53.11' W	3476	4734	L		T				
ME1300/1111-1	082	2016/09/22	12:57	11° 30.03' S	33° 13.11' W	4251	4350	L		T				
ME1300/1112-1	083	2016/09/22	18:14	11° 29.98' S	33° 33.01' W	4901	4895	L		T				
ME1300/1113-1	084	2016/09/22	23:37	11° 30.03' S	33° 53.08' W	4481	4685	L		T				
ME1300/1114-1	085	2016/09/23	04:25	11° 30.00' S	34° 13.06' W	4480	4578	L		T				
ME1300/1118-1	086	2016/09/24	03:45	11° 18.78' S	34° 28.24' W	4455	4638	L		T	N			
ME1300/1119-1	087	2016/09/24	08:39	11° 07.78' S	34° 43.96' W	4200	4277	L		T				
ME1300/1120-1	088	2016/09/24	13:20	10° 56.38' S	34° 59.62' W	4074	4104	L		T				
ME1300/1123-1	089	2016/09/24	22:04	10° 51.39' S	35° 05.66' W	3920	3970	L		T				
ME1300/1124-1	090	2016/09/25	01:29	10° 46.39' S	35° 11.62' W	3850	3878	L		T				
ME1300/1125-1	091	2016/09/25	04:54	10° 41.35' S	35° 17.65' W	3662	3686	L		T				
ME1300/1130-1	092	2016/09/25	22:41	10° 36.78' S	35° 23.95' W	3461	3495	L		T				
ME1300/1131-1	093	2016/09/26	01:55	10° 31.98' S	35° 29.33' W	3161	3206	L		T				
ME1300/1132-1	094	2016/09/26	04:43	10° 27.37' S	35° 34.99' W	2802	2863	L		T	N			
ME1300/1133-1	095	2016/09/26	08:15	10° 22.80' S	35° 40.81' W	2280	2318	L		T				
ME1300/1139-1	096	2016/09/26	20:18	10° 19.57' S	35° 46.24' W	1680	1656	L		T				
ME1300/1140-1	097	2016/09/26	22:23	10° 16.29' S	35° 52.03' W	802	1129	L		T				
ME1300/1141-1	098	2016/09/26	23:33	10° 15.34' S	35° 52.63' W	492	513	L		T				
ME1300/1142-1	099	2016/09/27	00:24	10° 14.67' S	35° 53.59' W	210	252	L		T				
ME1300/1143-1	100	2016/09/28	05:51	5° 38.94' S	34° 57.58' W	297	520	L		T				
ME1300/1144-1	101	2016/09/28	07:02	5° 38.28' S	34° 55.99' W	680	722	L		T				

Station	CTD cast	Date	Time	Latitude	Longitude	max. d [m]	bottom [m]	Additional measurements						
ME1300/1145-1	102	2016/09/28	08:19	5° 37.98' S	34° 54.00' W	1561	-	L		T	N			
ME1300/1146-1	103	2016/09/28	10:33	5° 36.52' S	34° 46.05' W	2650	2697	L		T				
ME1300/1147-1	104	2016/09/28	13:55	5° 34.72' S	34° 36.04' W	3360	3371	L		T				
ME1300/1148-1	105	2016/09/28	18:11	5° 32.55' S	34° 24.01' W	3701	3765	L		T				
ME1300/1149-1	106	2016/09/28	22:59	5° 30.18' S	34° 10.03' W	4081	4113	L		T				
ME1300/1150-1	107	2016/09/29	04:02	5° 26.56' S	33° 50.05' W	4291	4321	L		T				
ME1300/1151-1	108	2016/09/29	09:30	5° 21.64' S	33° 25.03' W	4443	4487	L		T				
ME1300/1152-1	109	2016/09/29	15:03	5° 17.68' S	33° 00.01' W	4457	4603	L		T				
ME1300/1153-1	110	2016/09/29	19:42	5° 17.68' S	33° 00.01' W	4481	4569			T				
ME1300/1154-1	111	2016/09/30	01:55	5° 12.31' S	32° 30.10' W	4479	4600	L		T				
ME1300/1155-1	112	2016/09/30	07:49	5° 06.97' S	32° 00.05' W	4477	4613	L		T				
ME1300/1156-1	113	2016/09/30	14:09	5° 00.00' S	31° 30.04' W	1000	4737	L		T				
ME1300/1157-1	114	2016/09/30	15:51	4° 59.98' S	31° 30.01' W	4481	4740	L		T				
ME1300/1158-1	115	2016/09/30	22:20	4° 59.98' S	31° 00.07' W	4480	4855	L		T				
ME1300/1159-1	116	2016/10/01	04:40	4° 59.97' S	30° 30.10' W	4326	4344	L		T				
ME1300/1160-1	117	2016/10/01	10:43	5° 00.00' S	30° 00.04' W	4478	4989	L		T				
ME1300/1161-1	118	2016/10/01	17:02	4° 59.95' S	29° 30.04' W	4480	-	L		T				

Explanation of additional measurements of CTD station list

L	LADCP
U	UVP
T	Transmissometer
N	N_2 fixation, FISH, NanoSims samples, Chl *a*
S	SUNA
I	Light profile
D	Samples for DNA analysis for Trichodesm. (MPI)

7.3 List of mooring deployments and recoveries

Mooring recoveries:

Mooring Recovery CVW 2015						**Notes:**	**KPO_1156**
Vessel:	Meteor	M119					
Deployed:	09-Sep	2015	14:41				
Vessel:	Meteor	M130					
Recovered:	29-Aug	2016	18:30				
Latitude:		17°	36.27’	N			
Longitude:		24°	18.82’	W			
Water depth:		3603	Mag Var:		-9.8		

ID	**Depth**	**Instr. Type**	**s/n**	**Start-up**	**Remarks**
KPO_1156_01	138	Winch with profiler		**ready**	Winch recovery on 10-Sep-2015 16:00 during M119
KPO_1156_02	161	Release AR661	220	Code:	recovered with winch and profiler on 10-Sep-2015 16:00 during M119
KPO_1156_03	163	WH-ADCP up	1972	**x**	complete and clean record; range problems to surface, when mooring submerged during one period

KPO_1156_04	163	Mini-TD/p	64	x	no data; no communication with instrument possible
	3567	Release AR661	822	Code:	Enable: 4AA0 / Release: 4AA9
	3567	Release RT661	174	Code:	Enable: 9337 / Release: 9339

Mooring Recovery Cape Verde V440-07					**Notes:**	**KPO_1143**
Vessel:	Meteor	M119				
Deployed:	10-Sep	2015	14:07			
Vessel:	Meteor	M130				
Recovered:	30-Aug	2016	07:57			
Latitude:		17°	36.40’	N		
Longitude:		24°	14.98’	W		
Water depth:		3604	Mag Var:	-9.8		

ID	**Depth**	**Instr. Type**	**s/n**	**Start-up Ready**	**Remarks**
	-232	Develogic Sat-Trans	????		
KPO_1143_01	-220	Microcat-IM	2255	x	complete and clean record
KPO_1143_02	-206	Microcat-IM /p	1717	x	complete record, bad conductivity cell from 12-Mar-2016 to 15-Mar-2016
KPO_1143_03	43	Microcat-IM	2256	x	no data
KPO_1143_04	43	O2 Logger (ind. Opt.)	383	x	record stopped at 24-Sep-2015 (high battery consumption)
	49	XEOS Argos Beacon	5481	**ready**	
KPO_1143_05	49	Mini-TD /p	60	x	complete and clean record
KPO_1143_06	70	Microcat-IM	2269	x	complete and clean record
KPO_1143_07	70	Fluorometer	1833	x	complete record, status of data unknown
KPO_1143_08	90	Microcat-IM	1722	x	complete and clean record
KPO_1143_09	119	Microcat-IM /p	3413	x	complete and clean record
KPO_1143_10	119	O2 Logger	939	x	record stopped at 04-Oct-2015 (high battery consumption)
KPO_1143_11	119	Hydroflash O2 Optode	DO-0615-005	x	device labeled as DO-1014-001, status of data unknown
KPO_1143_12	119	Hydroflash O2 Optode	DO-0615-012	x	device labeled as DO-1014-004, status of data unknown
KPO_1143_13	121	SAMI-2	C0048	**ready**	complete record, status of data unknown
KPO_1143_14	161	Microcat-IM	1721	x	complete and clean record
KPO_1143_15	201	Microcat	921	x	complete and clean record
KPO_1143_16	301	ADCP QM 150 up /p	21861	x	complete and clean record
KPO_1143_17	402	Microcat	933	x	complete and clean record
KPO_1143_18	616	Aquadopp down /p	P25460-02	x	complete and clean record
KPO_1143_19	755	Microcat	934	x	complete and clean record
KPO_1143_20	1106	Microcat-IM /p	3755	x	complete and clean record
KPO_1143_21	1304	Sediment Trap	890006	**ready**	complete record / bottles 1-13 filled
KPO_1143_22	1316	Aquadopp down	P26209-17	x	complete and clean record
KPO_1143_23	1500	Microcat	1319	x	complete and clean record
KPO_1143_24	3002	Sediment Trap	940060	**ready**	complete record / bottles 1-13 filled
KPO_1143_25	3014	Aquadopp down /p	P27523	x	complete and clean record
KPO_1143_26	3548	Microcat, pumped /p	10642	x	complete and clean record, pressure sensor drift by about 2dbar
KPO_1143_27	3578	Release AR861	1772	Code:	Enable: 0AF0 / Release: 0A55
KPO_1143_28	3578	Release AR661	839	Code:	Enable: 4AD5 / Release: 4AD6

Mooring Recovery Equatorial Atlantic 21W 11N						**Notes:**	**KPO_1142**
Vessel:	Meteor		M119				
Deployed:	14-Sep		2015	20:46			
Vessel:	Meteor		M130				
Recovered:	08-Sep		2016	11:17			
Latitude:			11°	02.22’	N		
Longitude:			21°	13.29’	W		
Water depth:			5070	Mag Var:	-10.1		

ID	**Depth**	**Instr. Type**	**s/n**	**Start-up**	**Remarks**
	96	Argos Beacon	12619	**ready**	
KPO_1142_01	96	Mini-TD /p	48	**ready**	complete and clean record
KPO_1142_02	97	Microcat-IM /p	3754	**x**	complete record, bad conductivity cell between 13-Jun-2016 to 29-Jun-2016
KPO_1142_03	97	O2 Logger	206	**x**	record stopped at 16-Apr-2016 (high battery consumption)
KPO_1142_04	199	Microcat-IM	2933	**x**	complete record, bad conductivity cell after 26-Jun-2016 (probably until end of mooring period)
KPO_1142_05	199	O2 Logger	215	**x**	record stopped at 19-Jan-2016 (high battery consumption)
KPO_1142_06	294	Microcat /p	10609	**x**	complete record, partly bad conductivity cell between 10-Nov-2015 to 11-Nov-2015
KPO_1142_07	294	O2 Logger	216	**x**	complete and clean record
KPO_1142_08	396	Microcat-IM	2801	**x**	complete and clean record
KPO_1142_09	396	O2 Logger	375	**x**	complete and clean record
KPO_1142_10	498	Microcat	2247	**x**	complete and clean record
KPO_1142_11	498	O2 Logger	379	**x**	record stopped at 15-Feb-2016 (high battery consumption)
KPO_1142_12	594	Microcat-IM /p	10696	**x**	complete and clean record
KPO_1142_13	594	O2 Logger	940	**x**	record stopped at 19-Jan-2016 (high battery consumption)
KPO_1142_14	696	Microcat	1550	**x**	complete and clean record
KPO_1142_15	696	O2 Logger	1074	**x**	record stopped at 09-Feb-2016 (high battery consumption)
KPO_1142_16	798	ADCP LR up /p	2330	**x**	complete and clean record
KPO_1142_17	800	Microcat /p	10709	**x**	complete and clean record
KPO_1142_18	800	O2 Logger	1463	**x**	complete and clean record
KPO_1142_19	4381	Release AR661	220	Code:	Enable: 9151 / Release: 9152
KPO_1142_20	4381	Release AR861	1771	Code:	Enable: 0AEF / Release: 0A55

Mooring Recovery Equatorial Atlantic 23W 5N						**Notes:**	**KPO_1141**
Vessel:	Meteor		M119				
Deployed:	19-Sep		2015	13:50			
Vessel:	Meteor		M130				
Recovered:	11-Sep		2016	09:15			
Latitude:			5°	01.00’	N		
Longitude:			23°	00.00’	W		
Water depth:			4210	Mag Var:	-12.9		

ID	**Depth**	**Instr. Type**	**s/n**	**Start-up**	**Remarks**
	97	Argos Beacon	12617	**ready**	
KPO_1141_01	97	Mini-TD /p	71	**x**	complete record, pressure sensor drift of about 1-2 dbar after 21-Jun-2016

KPO_1141_02	98	Microcat-IM /p	2488	**x**	complete record, offset in conductivity cell after 27-Feb-2016
KPO_1141_03	98	O2 Logger	147	**x**	record stopped end of Dec-2015, optode dead (water ingress)
KPO_1141_04	200	Microcat-IM	2257	**x**	no data
KPO_1141_05	200	O2 Logger	148	**x**	record stopped at 28-Feb-2016 (high battery consumption)
KPO_1141_06	296	Microcat-IM /p	10694	**x**	complete and clean record
KPO_1141_07	296	O2 Logger	219	**x**	complete and clean record (sensor foil very slightly released at one edge of the sensor spot)
KPO_1141_08	398	Microcat	8945	**x**	complete and clean record
KPO_1141_09	398	O2 Logger	1461	**x**	complete record, sensor foil partly scratched and detached from sensor spot!
KPO_1141_10	500	Microcat	8946	**x**	complete and clean record
KPO_1141_11	500	O2 Logger	1465	**x**	14.6 days of data missing throughout 6 time intervals (else: clean record until recovery)
KPO_1141_12	595	Microcat-IM /p	10653	**x**	complete record, bad conductivity cell from 21-Apr-2016 to 22-Apr-2016
KPO_1141_13	595	O2 Logger	1470	**x**	complete and clean record
KPO_1141_14	697	Microcat	8947	**x**	complete and clean record
KPO_1141_15	697	O2 Logger	942	**x**	complete and clean record (sensor foil slightly scratched at one edge of the sensor spot)
KPO_1141_16	799	ADCP LR up /p	1181	**x**	complete and clearn record
KPO_1141_17	801	Microcat /p	6860	**x**	complete record, pressure drift of about 2 dbar (from Sep-2015 to Nov-2015)
KPO_1141_18	801	O2 Logger	1069	**x**	record stopped at 16-Jan-2016 (high battery consumption)
KPO_1141_19	3612	Release AR661	122	Code:	Enable: 6170 / Release: 6179
KPO_1141_20	3612	Release AR681	1104	Code:	Enable: 0804 / Release: 0855

Mooring Recovery Equatorial Atlantic 23W 0N					**Notes:**	**KPO_1140**
Vessel:	Meteor	M119				
Deployed:	23-Sep	2015	12:42			
Vessel:	Meteor	M130				
Recovered:	15-Sep	2016	07:52			
Latitude:		00°	00.20’	N		
Longitude:		23°	06.80’	W		
Water depth:		3930	Mag Var:	-15.1		

ID	Depth	Instr. Type	s/n	Start-up ready	Remarks
	214	Argos Beacon	7372		
KPO_1140_01	214	ADCP QM up /p	14911	**x**	complete record, pitch and role problems
KPO_1140_02	214	Mini-TD /p	68	**x**	complete and clean record
KPO_1140_03	218	ADCP LR down /p	2627	**x**	complete and clean record
KPO_1140_04	300	Microcat	2248	**x**	complete and clean record
KPO_1140_05	300	O2 Logger	938	**x**	complete and clean record
KPO_1140_06	506	Microcat /p	2717	**x**	complete record, bad conductivity cell between 25-Aug-2016 to 30-Aug-2016
KPO_1140_07	506	O2 Logger	1140	**x**	complete and clean record

KPO_1140_08	831	Argonaut down	D187	x	complete and clean record
KPO_1140_09	906	Aquadopp down /p	P26209-34	x	complete and clean record
KPO_1140_10	983	RCM-11	477	x	complete and clean record
KPO_1140_11	1489	MMP, M-CTD, O2	11617	x	almost complete and clean record with 88.7% data coverage over all profiles
KPO_1140_12	3634	Release RT661	108	Code:	Enable: E962 / Release: E964
KPO_1140_13	3634	Release AR861	110	Code:	Enable: 0498 / Release: 0455

Mooring Recovery NBUC 11°S Array mooring K1						**Notes:**	**KPO_1144**
Vessel:	Meteor		M119				
Deployed:	01-Oct		2015	12:25			
Vessel:	Meteor		M130				
Recovered:	25-Sep		2016	18:20			
Latitude:			10°	16.00’	S		
Longitude:			35°	51.70’	W		
Water depth:			900	Mag Var:	-22.8		

ID	**Depth**	**Instr. Type**	**s/n**	**Start-up ready**	**Remarks**
	499	Argos Beacon	2267		
KPO_1144_01	499	ADCP LR up /p	2395	x	complete and clean record
KPO_1144_02	502	Microcat /p	10710	x	complete and clean record
KPO_1144_03	647	Microcat	939	x	complete and clean record
KPO_1144_04	648	Aquadopp down /p	P26209-36	x	complete and clean record
KPO_1144_05	873	Microcat	910	x	complete and clean record
KPO_1144_06	875	Release AR861	1642	Code:	Enable: 0A87 / Release: 0A55
KPO_1144_07	875	Release AR661	188	Code:	Enable: 8181 / Release: 8182

Mooring Recovery NBUC 11°S Array mooring K2						**Notes:**	**KPO_1145**
Vessel:	Meteor		M119				
Deployed:	02-Oct		2015	13:12			
Vessel:	Meteor		M130				
Recovered:	25-Sep		2016	15:05			
Latitude:			10°	22.80’	S		
Longitude:			35°	40.80’	W		
Water depth:			2320	Mag Var:	-22.9		

ID	**Depth**	**Instr. Type**	**s/n**	**Start-up ready**	**Remarks**
	500	Argos Beacon	2255		
KPO_1145_01	500	ADCP LR up /p	2290	x	complete and clean record
KPO_1145_02	503	Microcat /p	10711	x	complete and clean record
KPO_1145_03	647	Microcat	941	x	complete and clean record
KPO_1145_04	648	RCM-11	441	x	complete and clean record
KPO_1145_05	885	Aquadopp down /p	P26209-13	x	complete and clean record
KPO_1145_06	1190	Microcat	935	x	complete record, probably partly bad conductivity cell throughout mooring period
KPO_1145_07	1394	Aquadopp down /p	P26209-20	x	complete and clean record
KPO_1145_08	1486	Microcat	1282	x	complete and clean record, microcat was mounted not above, but below buoyancy package (instrument a few meters deeper)
KPO_1145_09	1896	Microcat	1286	x	no data, water ingress due to ripped plug (possibly during recovery)
KPO_1145_10	1897	Argonaut down	D185	x	complete and clean record
KPO_1145_11	2293	Microcat	1288	x	complete and clean record

KPO_1145_12	2295	Release AR861	1643	Code:	Enable: 0A88 / Release: 0A55
KPO_1145_13	2295	Release AR661	460	Code:	Enable: 5811 / Release: 5813

Mooring Recovery NBUC 11°S Array mooring K3					**Notes:**	**KPO_1146**
Vessel:	Meteor	M119				
Deployed:	03-Oct	2015	14:36			
Vessel:	Meteor	M130				
Recovered:	23-Sep	2016	18:03			
Latitude:		10°	36.50’	S		
Longitude:		35°	23.60’	W		
Water depth:		3520	Mag Var:	-22.9		

ID	**Depth**	**Instr. Type**	**s/n**	**Start-up ready**	**Remarks**
	500	Argos Beacon	5506		
KPO_1146_01	500	ADCP LR up /p	17570	**x**	complete and clean record
KPO_1146_02	506	Microcat /p	10712	**x**	record stopped on 19-May-2016
KPO_1146_03	660	Microcat	922	**x**	complete and clean record
KPO_1146_04	661	Aquadopp down /p	P26209-33	**x**	complete and clean record
KPO_1146_05	906	Aquadopp down /p	P26209-28	**x**	complete and clean record
KPO_1146_06	1403	Aquadopp down /p	P26209-24	**x**	complete and clean record
KPO_1146_07	1900	Microcat	1281	**x**	complete and clean record
KPO_1146_08	1901	Aquadopp down /p	P26209-21	**x**	complete and clean record
KPO_1146_09	2408	Argonaut down	D144	**x**	complete and clean record
KPO_1146_10	2801	Microcat	1285	**x**	complete and clean record
KPO_1146_11	3007	Aquadopp down /p	P26209-19	**x**	complete and clean record
KPO_1146_12	3402	Microcat	1269	**x**	complete and clean record
KPO_1146_12	3455	Release AR861	1645	Code:	Enable: 0A8A / Release: 0A55
KPO_1146_12	3455	Release AR861	1648	Code:	Enable: 0A8D / Release: 0A55

Mooring Recovery NBUC 11°S Array mooring offshore K4					**Notes:**	**KPO_1147**
Vessel:	Meteor	M119				
Deployed:	04-Oct	2015	19:12			
Vessel:	Meteor	M130				
Recovered:	23-Sep	2016	12:37			
Latitude:		10°	56.40’	S		
Longitude:		34°	59.60’	W		
Water depth:		4110	Mag Var:	-23.0		

ID	**Depth**	**Instr. type**	**s/n**	**Start-up ready**	**Remarks**
	499	Argos Beacon	7373		
KPO_1147_01	499	ADCP LR up /p	12530	**x**	complete and clean record
KPO_1147_02	504	Microcat /p	10713	**x**	complete and clean record
KPO_1147_03	648	Microcat	1682	**x**	complete and clean record
KPO_1147_04	649	Aquadopp down /p	P26209-16	**x**	complete and clean record
KPO_1147_05	904	Aquadopp down /p	P26209-02	**x**	complete and clean record
KPO_1147_06	1907	Microcat	2618	**x**	complete and clean record
KPO_1147_07	1908	Aquadopp down /p	P26209-27	**x**	complete and clean record
KPO_1147_08	2900	Aquadopp down /p	P26209-18	**x**	complete and clean record
KPO_1147_09	3397	Microcat	1583	**x**	complete and clean record
KPO_1147_09	3854	Release AR661	221	Code:	Enable: 9153 / Release: 9154
KPO_1147_09	3854	Release AR861	1644	Code:	Enable: 0A89 / Release: 0A55

Mooring Communication PIES Brazil 300m				**Notes:**	**KPO_1134**
Vessel:	Meteor	M106			
Deployed:	14-May	2014	15:28		

Vessel:	Meteor		M130			
Recovered:	-		-	-		
Latitude:			10°	13.580’	S	
Longitude:			35°	52.420’	W	
Water depth:			301	Mag Var:	-22.8	

ID	Depth	Instr. type	s/n	Start-up	Remarks
KPO_1134_01	301	PIES	320	x	Telem:66, XPND:70, BEACON:74, RELEASE:0 complete and clean data record transmitted on 26-Sep-2016
KPO_1134_02	301	Develogic Modem	3070	x	Address: 0x0031
				Code:	
				Code:	

Mooring Communication PIES Brazil 500m					**Notes:**	**KPO_1135**
Vessel:	Meteor		M106			
Deployed:	14-May		2014	15:53		
Vessel:	Meteor		M130			
Recovered:	-		-	-		
Latitude:			10°	13.970’	S	
Longitude:			35°	51.740’	W	
Water depth:			494	Mag Var:	-22.8	

ID	Depth	Instr. type	s/n	Start-up	Remarks
KPO_1135_01	500	PIES	319	x	Telem:65, XPND:69, BEACON:73, RELEASE:63 complete and clean data record transmitted on 26-Sep-2016
KPO_1135_02	500	Develogic Modem	3065	x	Address: 0x0021
				Code:	
				Code:	

Mooring Deployments:

Mooring Deployment Cape Verde V440-08					**Notes:**	**KPO_1179**
Vessel:	Meteor		M130			
Deployed:	01-Sep		2016	15:15		
Vessel:						
Recovered:						
Latitude:			17°	36.394’	N	
Longitude:			24°	14.980’	W	
Water depth:			3604	Mag Var:	-9.7	

ID	Depth	Instr. Type	s/n	Start-up	Remarks
KPO_1179_01	-232	Develogic Sat-Trans		**ready**	
KPO_1179_02	-220	Microcat-IM	7416	x	
KPO_1179_03	-205	Microcat-IM /p	10650	x	
KPO_1179_04	40	Microcat-IM	2492	x	
KPO_1179_05	40	O2 Logger (ind. Opt.)	385	x	
KPO_1179_06	40	VR2W	120195	x	
KPO_1179_07	72	Fluorometer	1834	x	
KPO_1179_08	72	Microcat	2472	x	
KPO_1179_09	92	Microcat	2246	x	
KPO_1179_10	121	Microcat/p	2485	x	
KPO_1179_11	121	O2 Logger	839	x	
KPO_1179_12	121	Hydroflash O2 Optode	DO-0216-003	x	
KPO_1179_13	121	Hydroflash O2 Optode	DO-0216-005	x	

KPO_1179_14	122	SAMI-2	C0067	**x**	
KPO_1179_15	162	Microcat	2245	**x**	
KPO_1179_16	202	Mini-TD /p	77	**x**	
KPO_1179_17	202	Microcat	2251	**x**	
KPO_1179_18	301	Argos	2271	**ready**	
KPO_1179_19	302	ADCP QM 150 up /p	21861	**x**	
	394	Plankton sampler		**ready**	
	394	Plankton sampler		**ready**	
KPO_1179_20	404	Microcat	3144	**x**	
KPO_1179_21	615	Aquadopp down /p	P26209-01	**x**	
	744	Plankton sampler		**ready**	
	744	Plankton sampler		**ready**	
KPO_1179_22	754	Microcat	1268	**x**	
KPO_1179_23	1105	Microcat /p	6863	**x**	
KPO_1179_24	1311	Aquadopp down /p	P26209-03	**x**	
	1489	Plankton sampler		**ready**	
	1489	Plankton sampler		**ready**	
KPO_1179_25	1499	Microcat	381	**x**	
KPO_1179_26	3003	Aquadopp down /p	P26209-06	**x**	
	3568	Plankton sampler		**ready**	
	3568	Plankton sampler		**ready**	
KPO_1179_27	3578	Microcat /p	10705	**x**	
KPO_1179_28	3590	Release AR661	839	Code:	Enable: 4AD5 / Release: 4AD6
KPO_1179_29	3590	Release RT661	174	Code:	Enable: 9337 / Release: 9339

Mooring Deployment Equatorial Atlantic 21W 11N					**Notes:**	**KPO_1178**
Vessel:	Meteor	M130				
Deployed:	08-Sep	2016	21:02			
Vessel:						
Recovered:						
Latitude:		11°	02.224’	N		
Longitude:		21°	13.227’	W		
Water depth:		5070	Mag Var:	-9.9		

ID	Depth	Instr. Type	s/n	Start-up	Remarks
KPO_1178_01	95	Argos Beacon	12619	**ready**	
KPO_1178_02	95	Mini-TD /p	70	**x**	
KPO_1178_03	99	Microcat /p	1717	**x**	
KPO_1178_04	99	O2 Logger	939	**x**	
KPO_1178_05	199	Microcat	2250	**x**	
KPO_1178_06	199	O2 Logger	1464	**x**	
KPO_1178_07	299	Microcat /p	2269	**x**	
KPO_1178_08	299	O2 Logger	1160	**x**	
KPO_1178_09	399	Microcat	2617	**x**	
KPO_1178_10	399	O2 Logger	1141	**x**	
KPO_1178_11	499	Microcat	3413	**x**	
KPO_1178_12	499	O2 Logger	1133	**x**	
KPO_1178_13	598	Microcat /p	3755	**x**	
KPO_1178_14	598	O2 Logger	1471	**x**	
KPO_1178_15	699	Microcat	2249	**x**	
KPO_1178_16	699	O2 Logger	1135	**x**	
KPO_1178_17	799	ADCP LR up /p	19398	**x**	
KPO_1178_18	801	Microcat /p	3416	**x**	
KPO_1178_19	801	O2 Logger	349	**x**	
KPO_1178_20	5044	Microcat /p	10688	**x**	

KPO_1178_21	5056	Release RT661	28	Code:	Enable: 5022 / Release: 5024
KPO_1178_22	5056	Release AR861	107	Code:	Enable: 0495 / Release: 0455

Mooring Deployment Equatorial Atlantic 23W 5N					**Notes:**	**KPO_1177**
Vessel:	Meteor		M130			
Deployed:	11-Sep		2016	19:27		
Vessel:						
Recovered:						
Latitude:			05°	01.005’	N	
Longitude:			22°	59.997’	W	
Water depth:			4210	Mag Var:	-12.8	
ID	**Depth**	**Instr. Type**	**s/n**	**Start-up**	**Remarks**	
KPO_1177_01	96	Argos	5467	**ready**		
KPO_1177_02	96	Mini-TD /p	79	**x**		
KPO_1177_03	100	Microcat /p	3754	**x**		
KPO_1177_04	100	O2 Logger	216	**x**		
KPO_1177_05	200	Microcat	1722	**x**		
KPO_1177_06	200	O2 Logger	1463	**x**		
KPO_1177_07	300	Microcat /p	10709	**x**		
KPO_1177_08	300	O2 Logger	1469	**x**		
KPO_1177_09	400	Microcat	1721	**x**		
KPO_1177_10	400	O2 Logger	215	**x**		
KPO_1177_11	500	Microcat	2247	**x**		
KPO_1177_12	500	O2 Logger	206	**x**		
KPO_1177_13	599	Microcat /p	10609	**x**		
KPO_1177_14	599	O2 Logger	944	**x**		
KPO_1177_15	700	Microcat	2933	**x**		
KPO_1177_16	700	O2 Logger	1074	**x**		
KPO_1177_17	800	ADCP LR up /p	2330	**x**		
KPO_1177_18	802	Microcat /p	10696	**x**		
KPO_1177_19	802	O2 Logger	375	**x**		
KPO_1177_20	4184	Microcat /p	10641	**x**		
KPO_1177_21	4196	Release AR861	975	Code:	Enable: 1816 / Release: 1855	
KPO_1177_22	4196	Release RT661	31	Code:	Enable: 5037 / Release: 5039	

Mooring Deployment Equatorial Atlantic 23W 0N					**Notes:**	**KPO_1176**
Vessel:	Meteor		M130			
Deployed:	15-Sep		2016	19:34		
Vessel:						
Recovered:						
Latitude:			00°	00.055’	S	
Longitude:			23°	06.783’	W	
Water depth:			3930	Mag Var:	-15.0	
ID	**Depth**	**Instr. Type**	**s/n**	**Start-up**	**Remarks**	
KPO_1176_01	218	Argos	7372	**ready**		
KPO_1176_02	218	ADCP QM up /p	14910	**x**		
KPO_1176_03	218	Mini-TD /p	80	**x**		
KPO_1176_04	222	ADCP LR down /p	1181	**x**		
KPO_1176_05	304	Microcat	8947	**x**		
KPO_1176_06	304	O2 Logger	940	**x**		
KPO_1176_07	503	Microcat /p	2488	**x**		
KPO_1176_08	503	O2 Logger	1142	**x**		
KPO_1176_09	831	Aquadopp down /p	P25460-02	**x**		
KPO_1176_10	845	MMP, M-CTD	12201	**x**		

KPO_1176_11	3342	Aquadopp down /p	P26209-17	**x**	
KPO_1176_12	3698	Aquadopp down /p	P27523	**x**	
KPO_1176_13	3904	Microcat /p	10652	**x**	
KPO_1176_14	3916	Release AR861	110	Code:	Enable: 0498 / Release: 0455
KPO_1176_15	3916	Release RT661	108	Code:	Enable: E962 / Release: E964

Mooring Deployment NBUC 11°S Array mooring K1					**Notes:** **KPO_1169**
Vessel:	Meteor	M130			
Deployed:	26-Sep	2016	19:21		
Vessel:					
Recovered:					
Latitude:		10°	15.993'	S	
Longitude:		35°	51.682'	W	
Water depth:		900	Mag Var:	-22.8	
ID	**Depth**	**Instr. Type**	**s/n**	**Start-up ready**	**Remarks**
KPO_1169_01	500	Argos	2267		
KPO_1169_02	500	ADCP LR up /p	2290	**x**	
KPO_1169_03	506	Microcat /p	10653	**x**	
KPO_1169_04	649	Microcat	2618	**x**	
KPO_1169_05	649	Aquadopp down /p	P26209-20	**x**	
KPO_1169_06	875	Microcat	1583	**x**	
KPO_1169_07	887	Release AR861	1644	Code:	Enable: 0A89 / Release: 0A55
KPO_1169_08	887	Release AR661	54	Code:	Enable: E920 / Release: E929

Mooring Deployment NBUC 11°S Array mooring K2					**Notes:** **KPO_1170**
Vessel:	Meteor	M130			
Deployed:	26-Sep	2016	13:04		
Vessel:					
Recovered:					
Latitude:		10°	22.793'	S	
Longitude:		35°	40.784'	W	
Water depth:		2320	Mag Var:	-22.9	
ID	**Depth**	**Instr. Type**	**s/n**	**Start-up ready**	**Remarks**
KPO_1170_01	500	Argos	2255		
KPO_1170_02	500	ADCP LR up /p	17570	**x**	
KPO_1170_03	506	Microcat /p	2717	**x**	
KPO_1170_04	650	Microcat	1682	**x**	
KPO_1170_05	650	Aquadopp down /p	P26209-27	**x**	
KPO_1170_06	900	Aquadopp down /p	P26209-18	**x**	
KPO_1170_07	1200	Microcat	1281	**x**	
KPO_1170_08	1401	Aquadopp down /p	P26209-02	**x**	
KPO_1170_09	1501	Microcat	954	**x**	
KPO_1170_10	1901	Microcat	1285	**x**	
KPO_1170_11	1902	Aquadopp down /p	P26209-28	**x**	
KPO_1170_12	2295	Microcat	1269	**x**	
KPO_1170_13	2306	Release AR661	460	Code:	Enable: 5811 / Release: 5813
KPO_1170_14	2306	Release AR861	1772	Code:	Enable: OAFO / Release: 0A55

Mooring Deployment NBUC 11°S Array mooring K3					**Notes:** **KPO_1171**
Vessel:	Meteor	M130			
Deployed:	25-Sep	2016	18:35		

Vessel:						
Recovered:						
Latitude:			10°	36.497'	S	
Longitude:			35°	23.564'	W	
Water depth:			3521	Mag Var:	-22.9	
ID	**Depth**	**Instr. Type**		**s/n**	**Start-up ready**	**Remarks**
KPO_1171_01	500	Argos		5506		
KPO_1171_02	500	ADCP LR up /p		12530	x	
KPO_1171_03	506	Microcat /p		10694	x	
KPO_1171_04	650	Microcat		8946	x	
KPO_1171_05	650	Aquadopp down /p		P26209-21	x	
KPO_1171_06	900	Aquadopp down /p		P26209-19	x	
KPO_1171_07	1401	Aquadopp down /p		P26209-16	x	
KPO_1171_08	1901	Microcat		8945	x	
KPO_1171_09	1902	Aquadopp down /p		P26209-24	x	
KPO_1171_10	2382	Argonaut down		D144	x	
KPO_1171_11	2803	Microcat		953	x	
KPO_1171_12	3002	Aquadopp down /p		P26209-33	x	
KPO_1171_13	3400	Microcat		921	x	
KPO_1171_14	3507	Release AR661		220	Code:	Enable: 9151 / Release: 9152
KPO_1171_15	3507	Release AR861		1771	Code:	Enable: OAEF / Release: 0A55

Mooring Deployment NBUC 11°S Array mooring offshore K4						**Notes:** **KPO_1172**
Vessel:	Meteor		M130			
Deployed:	24-Sep		2016	20:48		
Vessel:						
Recovered:						
Latitude:			10°	56.411'	S	
Longitude:			34°	59.600'	W	
Water depth:			4110	Mag Var:	-23.0	
ID	**Depth**	**Instr. Type**		**s/n**	**Start-up ready**	**Remarks**
KPO_1172_01	500	Argos		7373		
KPO_1172_02	500	ADCP LR up /p		2627	x	
KPO_1172_03	506	Microcat /p		10685	x	
KPO_1172_04	730	Microcat		929	x	
KPO_1172_05	730	Aquadopp down /p		P26209-34	x	
KPO_1172_06	880	RCM11		477	x	
KPO_1172_07	1901	Microcat		950	x	
KPO_1172_08	1902	Aquadopp down /p		P24543-01	x	
KPO_1172_09	2881	Argonaut down		D187	x	
KPO_1172_10	3401	Microcat		934	x	
KPO_1172_11	4085	Microcat /p		10640	x	
KPO_1172_12	4097	Release AR861		1104	Code:	Enable: 0804 / Release: 0855
KPO_1172_13	4097	Release RT661		110	Code:	Enable: E972 / Release: E974

7.4 Biochemical sampling list

METEOR station / CTD cast	Lat. [°]	Lon. [°]	C/N isotopes natural abundance	C/N fixation	ALF (profile)	Flow Cytometry (profile)	HPLC (profile)	Tricho DNA
941 CTD_4	17.70	-24.21	surface	surface				
949 CTD_8	15.00	-23.00	6 depths	surface	X	X	X	surface
952 CTD_9	14.50	-23.00	6 depths	surface	X	X	X	surface
955 CTD_10	14.00	-23.00	6 depths	surface	X	X	X	surface
957 CTD_11	13.50	-23.00	surface	surface	X	X	X	surface
959 CTD_12	13.00	-23.00	6 depths	surface	X	X	X	
962 CTD_14	12.50	-23.00	6 depths	surface	X	X	X	
966 CTD_15	12.00	-23.00	6 depths	surface	X	X	X	surface
969 CTD_16	11.47	-22.99	6 depths	surface	X	X	X	
972 CTD_17	11.00	-23.00	6 depths	surface	X	X	X	
974 CTD_18	10.50	-23.00	6 depths	surface	X	X	X	
976 CTD_19	10.00	-23.00	6 depth	surface	X	X	X	
981 CTD_21	9.51	-23.01	6 depths	surface	X	X	X	
983 CTD_22	9.00	-23.00	6 depths	surface	X	X	X	surface
989 CTD_25	8.00	-23.00	6 depths	surface	X	X	X	
994 CTD_27	7.99	-20.97	6 depths	3 depths	X	X	X	surface
995 CTD_28	8.00	-19.99			X	X	X	
998 CTD_29	8.00	-19.00	6 depths	Surface	X	X	X	surface
1002 CTD_32	10.00	-20.00	6 depths	3 depths	X	X	X	surface
1004 CTD_33	11.00	-20.00			X			
1005 CTD_34	12.00	-21.00	6 depths	3 depths	X	X	X	surface
1010 CTD_35	11.03	-21.21	6 depths	3 depths	X	X	X	surface
1016 CTD_38	9.00	-21.00	6 depths	3 depths	X	X	X	surface
1019 CTD_39	7.50	-23.00	6 depths	surface	X	X	X	surface
1020 CTD_40	7.00	-23.00			X	X	X	
1027 CTD_42	6.50	-23.00	6 depths	surface	X	X	X	surface
1031 CTD_44	5.50	-23.00	6 depths	surface	X	X	X	surface
1037 CTD_45	5.00	-23.00	6 depths	surface	X	X	X	surface
1042 CTD_47	4.50	-23.00	6 depths	surface	X	X	X	surface
1045 CTD_49	4.00	-23.00	6 depths	surface	X	X	X	surface
1047 CTD_50	3.50	-23.00	6 depths	surface	X	X	X	surface
1050 CTD_51	3.00	-23.00	6 depths	surface	X	X	X	surface
1051 CTD_52	2.50	-23.00	6 depths	surface	X	X	X	surface
1054 CTD_53	2.00	-23.00	6 depths	surface	X	X	X	surface
1056 CTD_55	1.33	-23.00	6 depths	surface	X	X	X	surface
1060 CTD_58	0.67	-23.00	6 depths	surface	X	X	X	surface
1068 CTD_60	0.33	-23.00	6 depths	3 depth	X	X	X	surface
1069 CTD_61	0.00	-23.03	6 depths	surface	X	X	X	surface
1078 CTD_63	-0.33	-23.00	6 depths	surface	X	X	X	surface
1080 CTD_64	-0.67	-23.00	5 depths	3 depths	X	X	X	surface
1084 CTD_66	-1.00	-23.00			X	X	X	
1090 CTD_68	-1.33	-23.00	6 depths	surface	X	X	X	surface
1092 CTD_70	-2.00	-23.00	6 depths	surface	X	X	X	surface
1094 CTD_71	-2.50	-23.00	6 depths	surface	X	X	X	surface
1096 CTD_72	-3.00	-23.00	6 depths	surface	X	X	X	surface
1100 CTD_75	-4.00	-23.00	6 depths	surface	X	X	X	surface
1104 CTD_77	-5.00	-23.00	6 depths	surface	X	X	X	surface

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 M130 are stored at the Kiel data portal, and remain proprietary for the PIs of the cruise and for members of EU-PREFACE and the BMBF-SACUS project. Each station is logged as an event file https://portal.geomar.de/metadata/leg/show/333353. All data will be submitted to PANGAEA within 3 years after the cruise, i.e. by October 2019. 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.

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

Data Type	Contact Person	Current Affiliation	Email
CTD/O_2	Gerd Krahmann	GEOMAR	gkrahmann@geomar.de
VMADCP	Marcus Dengler	GEOMAR	mdengler@geomar.de
LADCP	Gerd Krahmann	GEOMAR	gkrahmann@geomar.de
Mooring data	Peter Brandt	GEOMAR	pbrandt@geomar.de
Mooring data (CVOO)	Johannes Karstensen	GEOMAR	jkarstensen@geomar.de
Microstructure data	Marcus Dengler	GEOMAR	mdengler@geomar.de
Thermosalinograph	Gerd Krahmann	GEOMAR	gkrahmann@geomar.de
Multibeam echo sounder	Colin Devey	GEOMAR	cdevey@geomar.de
Nutrients	Eric Achterberg	GEOMAR	eachterberg@geomar.de
Heme, Iron	Eric Achterberg	GEOMAR	eachterberg@geomar.de
Underwater Vision Profiler	Rainer Kiko	GEOMAR	rkiko@geomar.de
Tracer data (CFC-12, SF_6, SF_5Cl_3)	Toste Tahnua	GEOMAR	ttanhua@geomar.de
ALFA	Ajit Subramaniam	LDEO	ajit@ldeo.columbia.edu
Card FISH	Gaute Lavik	MPI-Bremen	glavik@mpi-bremen.de
C^{13}; N^{15} incubation	Gaute Lavik	MPI-Bremen	glavik@mpi-bremen.de
N^{15} incubations	Ajit Subramaniam	LDEO	ajit@ldeo.columbia.edu

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11 Appendix – list of abbreviations (excerpt)

ADCP	Acoustic Doppler Current Profiler
AMOC	Atlantic meridional overturning circulation
ALF	Advanced Laser Fluorometry
BMBF	Federal Ministry of Education and Research
CFC	Chlorofluorocarbon
CTD/O_2	Conductivity-temperature-depth and oxygen (system)
CVOO	Cape Verde ocean observatory
LADCP	Lowered Acoustic Doppler Current Profiler
MSS	Microstructure profiling system
NBUC	North Brazil Undercurrent
OMZ	Oxygen Minimum Zone
OS	Ocean surveyor
PAR	Photosynthetically active radiation
PIES	Pressure-inverted echo sounders

SR	Spectroradiometer profile measuring light absorption in the water column of the upper ocean
STC	Subtropical cells
RACE	Research Project: Regional Atlantic Circulation and Global Change
SFB	Collaborative Research Project
UVP	Underwater vision profiler
VMADCP	Vessel-mounted Acoustic Doppler Current Profiler
WP 2	Working Party 2 net (hand-held vertical Plankton net)