MARIA S. MERIAN-Berichte

Physical and Biogeochemical Studies in the Subtropical and Tropical Atlantic

Cruise No. 18, Leg 2

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Mindelo (Cape Verde Islands) – Mindelo (Cape Verde Islands)

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1 Summary

MSM18/2 was a joint effort of the BMBF joint projects NORDATLANTIK and SOPRAN as well as of the Kiel Collaborative Research Centre SFB 754. The research cruise was closely related to MSM18/3. Both legs were planned to cover the onset as well as the height of the equatorial upwelling. The main work during MSM18/2 consisted of the deployment and recovery of several subsurface moorings for the observation of current and oxygen variability in the oxygen minimum zone and near the equator, a glider swarm experiment within the cold tongue of the eastern equatorial Atlantic, and hydrographic CTD/LADCP and microstructure station work. Additionally to standard meteorological measurements, different atmospheric parameters were acquired continuously during the cruise. This work was aimed to observe the physical processes relevant for the evolution of the mixed layer heat and freshwater content during a phase of particularly strong changes of sea surface temperature and salinity. The cruise contributed to the quantification of mean water mass transport pathways and its variability in the shallow and deep tropical Atlantic Ocean.

Zusammenfassung

Die wissenschaftlichen Arbeiten auf dem Fahrtabschnitt MSM18/2 sind Teil der BMBF Verbundprojekte NORDATLANTIK und SOPRAN sowie des SFB 754. MSM18/2 steht in engem Zusammenhang mit dem folgenden Abschnitt MSM18/3. Beide Abschnitte haben die Entwicklung des oberflächennahen Ozeans während der Entwicklung und maximalen Entfaltung des äquatorialen Auftriebs untersucht. Die Hauptarbeiten während MSM18/2 bestanden in der Bergung und Ausbringung von Tiefseeverankerungen (eine multidisziplinäre Verankerung bei den Kapverden, Verankerungen mit Strömungs- und Sauerstoffsensoren in der Sauerstoffminimumzone sowie ein Strömungsmesserverankerungsarray am Äquator), der Durchführung eines Gleiterschwarmexperiments sowie in Stationsarbeiten mit CTD/LADCP und Mikrostruktursonde. Zusätzlich zu den meteorologischen Standardmessungen wurden turbulente atmosphärische Flüsse und andere Parameter bestimmt, die eine Bestimmung der Entwicklung von Wärme- und Frischwasserinhalt der Deckschicht erlauben. Die Messungen während MSM18/2 haben zur generellen Quantifizierung der mittleren ozeanischen Strömung und ihrer Variabilität im flachen und tiefen tropischen Atlantik beigetragen.

2 Participants

Participants MSM18/2

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2	Dengler, Marcus, Dr.	Microstructure, microrider	IFM-GEOMAR
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4	Hogue, Brian	Moorings, CTD	WHOI
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7	Tippenhauer, Sandra	CTD, LADCP	IFM-GEOMAR
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10	Martens, Wiebke	CTD	IFM-GEOMAR
11	Müller, Mario	Underway CTD, moorings	IFM-GEOMAR
12	Niehus, Gerd	Moorings, technology	IFM-GEOMAR
13	Papenburg, Uwe	Moorings, technology	IFM-GEOMAR
14	Pinck, Andreas	Optodes, CTD, microcats	IFM-GEOMAR
15	Kock, Annette	N_2O	IFM-GEOMAR
16	Martogli, Natascha	O_2, nutrients (freezing)	IFM-GEOMAR
17	Schlundt, Michael	Salinometer, meteorology	IFM-GEOMAR
18	Vogt, Martin	Helium, CTD	IUP-B
19	Arevalo Martinez, Damian	Underway pN_2O, O_2, pCO_2	IFM-GEOMAR
20	Schütte, Florian	CTD, salinometer	IFM-GEOMAR
21	Didwischus, Sven-Helge	CTD, microstructure, MMP	IFM-GEOMAR
22	Kemena, Tronje	CTD, in-situ light	IFM-GEOMAR
23	Wolters, Gabriele, Dr.	Physician	-

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3 Research Program

The ultimate goal of the BMBF joint project NORDATLANTIK subproject "Role of the equatorial Atlantic as key region for Atlantic climate variability" is to improve predictions of the tropical Atlantic variability (TAV). By using moored, glider, and shipboard observations as well as numerical modeling, predictable and non-predictable elements of the TAV were aimed to be identified. The primary research objectives of the observational program of MSM18/2 were to

- quantify strength and variability of the zonal currents in the central equatorial Atlantic from the deep ocean toward the surface using shipboard ADCP and CTD measurements and moored observations along the 23°W cross-equatorial section;
- estimate i) mixed layer heat and fresh-water content change using CTD and glider measurements, ii) diapycnal fluxes across the base of the mixed layer using microstructure measurements, and iii) air-sea heat and freshwater fluxes by additional atmospheric measurements in the central and eastern equatorial Atlantic during cold tongue development.

Additional to the main objectives described also in the cruise proposal the observational program also included research topics of the SFB 754 "Climate - Biogeochemistry Interactions in the Tropical Ocean" and the BMBF joint project SOPRAN. The main goal of the SFB754 adressed during the cruise was to quantify oxygen changes and variability in the tropical North Atlantic oxygen minimum zone (OMZ) using moored and shipboard (CTD) observations. The goals of SOPRAN addressed during the cruise were i) the quantification of vertical fluxes and oceanic emission of greenhouse gas N_2O in the equatorial upwelling region by underway and water sample measurements.and ii) a better understanding of physical and biogeochemical processes at the CVOO (Cape Verde Ocean Observatory) mooring site.

The measurement program was very successful by allowing important steps toward achieving the above described research goals. The CTD system was used along the 23°W section between 5°N and 5°S as well as during the different sections within the equatorial cold tongue. Together with the glider swarm data an exceptional dataset was acquired describing hydrographic variability in the equatorial region encompassing the heat and freshwater content variability in and below the oceanic mixed layer and changes in the oxygen inventory of the OMZ and in the equatorial belt with respect to previous cruises. Both shipboard ADCPs worked very well throughout the cruise yielding another excellent velocity dataset along the 23°W and 10°W meridional repeat sections as well as along zonal section at the equator and 2°S.The use of two different microstructure profilers (shipboard and attached to a glider) allowed sampling of microstructure data with good temporal and spatial coverage in the equatorial cold tong region. Together with the additional atmospheric measurements this dataset will allow addressing the mixed layer heat and freshwater budget during the onset of the equatorial cold tongue. All moorings could be successfully recovered and redeployed according to the cruise plan. These moorings include the interdisciplinary CVOO mooring, oxygen and current meter moorings in the topical North Atlantic OMZ, and the current meter and hydrographic moorings of the equatorial mooring array along 23°W. The chemical underway observations run smoothly throughout the cruise delivering data required to estimate the air-sea gas exchange of N_2O and CO_2. Overall, no important deviations from the planned research program were necessary.

4 Narrative of the Cruise

R/V MARIA S. MERIAN departed from Mindelo on May 11, 2011 at 8:30 and headed north between the Cape Verdian islands of São Vicente and Santo Antão. The TENATSO mooring north of São Vicente was recovered as the first activity of the cruise – just 5h after leaving port. All instruments were in place, biofouling of the upper part of the mooring was once again an issue. Following the mooring recovery, three CTD/O_2 stations were carried out which were used for water samples of N_2O, nutrients, and oxygen. One CTD/O_2 station was also needed for calibration of different moored instruments which were either just recovered or to be deployed during the upcoming days. In between the CTD/O_2 stations, we had microstructure stations for determining the strength of diapycnal mixing. As two instruments needed for the redeployment of this mooring were not delivered in time, we had to postpone the mooring deployment to the end of the cruise to facilitate the instrument pickup during a stop at the port of Mindelo.

Following the work at the TENATSO mooring position, R/V MARIA S. MERIAN headed southeast to reach the 23°W meridian at about 15°N. The 23°W section is an important repeat section for hydrographic and current observations within the SFB 754. However, hydrographic observations with the CTD/O_2 rosette along this section will be carried out during the following leg with Arne Körtzinger from IFM-GEOMAR as chief scientist. Current observations from aboard R/V MARIA S. MERIAN were carried out using two shipboard ADCPs, a 75-kHz instrument permanently installed in the ship's hull and a 38kHz instrument installed in the moon pool. Both instruments delivered very good data.

In the morning of May 13, we took a CTD/O_2 station near the PIRATA buoy at 23°W, 11.5°N. This mooring also carries two oxygen loggers and their data will be compared later against our CTD/O_2 observations. May 14 began with microstructure measurements close to the position of an oxygen/current meter mooring located at about 8°N, 23°W within the oxygen minimum zone. The mooring was recovered after releasing it at 6:10 in the morning. Before the mooring was redeployed at the same location in the afternoon, we took a CTD/O_2 station and our first station with a light instrument to measure underwater light. These measurements are aimed at determining that part of solar radiation that reaches the base of the mixed layer and does not contribute to mixed layer warming. During the next day at 5°N, 23°W, we again had a mooring recovery and redeployment. All oxygen loggers in both moorings worked perfectly, providing an excellent dataset for studying the local oxygen variability.

On May 16, we deployed the first glider of our glider swarm at 2°N, 23°W. We were able to follow the first dives of the glider while performing light, CTD and microstructure measurements at that location. During the next day, we began a zonal section along the equator starting at 21°30'W using a new Underway CTD system on loan from the University of Hamburg (Detlef Quadfasel). Originally we planned to perform continuous tow-yo casts allowing approximately 4 profiles per hour. However, it turned out that the system overheated during continuous work and we decided to measure only one profile per hour at about 12kn ship speed.

The next glider deployments were carried out on May 18. It was planned to send one glider to the north and another glider to south measuring along meridional sections. However, one glider sent a leak alarm during the following CTD/O_2 cast and was subsequently recovered. It turned out that this was a false alarm due to a malfunctioning leak detector. However, at the same time our first glider, deployed at 2°N, 23°W, also sent a leak alarm. As the glider drifted in the strong

South Equatorial Current, we had to made a tough decision, either to recover the glider and lose approximately two days of ship time or to lose the glider that would rapidly drift out of reach. We decided to recover the glider and to use the additional section for underway measurements of pCO_2, pN_2O, temperature and salinity, which became increasingly interesting as the upwelling started to develop. On the way to the glider recovery, we also used the Underway CTD system. However, the winch motor of the system overheated after approximately 35 profiles and was no longer usable. The glider recovery with the Zodiac inflatable boat turned out to be very easy as the glider continuously transmitted its position.

On May 21, we continued the CTD section along the equator. The next deployment of two gliders was planned in the morning of that day. Again, one glider developed a leak and was recovered. The other one worked fine and was set on a southward track. On the next day we recovered “deepy”, the glider with a microstructure probe. This glider had been deployed by the French N/O LE SUROIT on May 8 near 10°W, 0°N. Several days after deployment, it developed a leak and, following its recovery, we also noticed water in the cone head of the microstructure probe. The usefulness of the acquired microstructure data is still being evaluated. We were able to repair the leak problem in “deepy” and the microrider and redeployed the coupled system on May 26. In between we performed a deep CTD/LADCP section along 10°W from 1°30’N to 1°30’S. Here we used the three newly purchased 150 kHz lowered ADCPs. Two ADCPs, one upward and one downward looking were attached to the CTD rosette. However, two instruments had to be exchanged after few profiles, one developed two weak beams, and the other one a broken beam. So we ended up with a downward looking 150 kHz instrument and one of our older 300 kHz ADCPs in an upward looking mode. On May 24, right on the equator, we celebrated the crossing from the northern into the southern hemisphere with an appropriate equatorial baptism, with lots of fun for all participants. At the time of this reporting, there are only Shellbacks on this ship!

With the successful glider deployment at 2°S, 13°30’W, we had 5 IFM-GEOMAR gliders in the water running on regular North-South sections within the equatorial cold tongue or circling around the PIRATA buoy at the equator 10°W (deepy with microrider). The glider swarm is completed by a French glider deployed near 0°E, 0°N running also on a North-South section. At this point, our first open ocean glider swarm experiment can be deemed a technical success, the evaluation of the acquired data will follow after recovery of the gliders.

During the next days we continued the observational program along 2°S, performing CTD casts, microstructure measurements, and light profiling. This zonal section ended on May 29 at 21°30’W and we transferred toward the most southern point of our cruise at 5°S, 23°W. The meridional section along 23°W is a central piece to different programs. During our last cruise in this region (M80/1) we deployed a mooring array consisting of five moorings between 2°S and 2°N and also observed the hydrographic and current field from the surface to the bottom between 5°S and 5°N using CTD/LADCP profiles. The same type of CTD/LADCP measurements started on May 30. For the lowered ADCP casts we used again a downward looking 150 kHz ADCP and an upward looking 300 kHz ADCP. Both instruments were adjusted during previous casts to ping exactly at the same time with a ping rate of about 1s. During most of the stations we were able to come close to the bottom, thereby enhancing the quality of deep velocity measurements with the lowered ADCPs. Following most of the CTD casts, we took about 3 profiles with the microstructure probe and light profiler measurements during the noontime hours. We reached the first mooring position at 2°S on June 1 and, following CTD and microstructure measurements, we recovered it early in the morning without problems. Most of the moored instruments worked fine, with exception of the MMP. About one month into the deployment, the profiler developed a leak in the oxygen optode attached to it and stopped profiling. During the next day we recovered the moorings at 0°45'S and 0°N without problems. In the meantime, our CTD started to develop spikes in different sensors, beginning with the oxygen sensor. Changing different sensors and cables did not resolve the problem so we switched to our second system, beginning with CTD cast 54 at 0°40'S.

The redeployment of the equatorial mooring started at 10:00 on June 3. Due to our experience with mooring deployments at the equator, we unconventionally deployed the mooring with the wind and current from the back steaming toward WNW. The deployment went very smoothly, without problems, and after about 3.5 h the anchor was dropped at the planned position.

When we recovered the next mooring at 0°45'N on June 4, all seemed to work well similar to previous mooring recoveries. However, near the end of the mooring recovery, the 2.5 km wire section with the MMP broke. As the profiler runs up and down the wire, a loss of the instrument was very likely. Nevertheless, we stopped immediately and brought out the fast-rescue boat. R/V MARIA S. MERIAN backed slowly toward the benthos flotation group and picked it up. We tried to bring it onboard as slowly as possible, always looking from the fast rescue boat if the profiler would become visible below the surface. However, the profiler, owned by WHOI and deployed as part of a WHOI research project led by J. Toole and T. Farrar (WHOI), was no longer on the wire, probably drifting away in the deep due to its neutral buoyancy. The "bitter" end of the wire looked clean, without any signs of corrosion. Our review of the recovery procedure indicated that the 2.5 km wire likely twisted after release, and when tension was applied with the spill during recovery, a kink must have developed and the wire broke under otherwise normal tension.

The last mooring of the equatorial mooring array was recovered on June 5. This time we arrived even faster at the top element, picked it up and turned the ship to take the wind and the current on the stern. We were able to have some tension on the wire early before the benthos group below the profiler was at surface, thus reducing the possibility of a twisted wire. The recovery went very smooth without problems. Altogether, we had good success with the recovery of the equatorial mooring array: all moorings were recovered, all six ADCPs had full datasets, most of the current meters worked fine, 3 out of 5 moored profilers worked perfectly covering the entire depth range from 1000m to 3500m, one had about 40 days of data. Although one profiler was lost, we have a great data set of equatorial Atlantic circulation at hand to work with.

Following the mooring work, we continued the 23°W section with deep CTD/LADCP and microstructure stations and reached the northernmost point of this section at 5°N on June 7. R/V MARIA S. MERIAN turned south to reach the equator at 23°W for a meeting with the French N/O LE SUROIT on June 8. This French research vessel was scheduled to recover and redeploy the PIRATA buoy at this location. Empty glider boxes, needed for the transportation of gliders back to Germany after their recovery during the next leg, as well as a glider that could not deployed by the French colleagues because of a leak, and some supplies were transported from N/O LE SUROIT to R/V MARIA S. MERIAN. We had some time for visiting the respective research vessels and discussing our work.

Measurements along the last section started at noon of the same day. This section was planned to be along the equator, cutting this time through the now well-developed equatorial cold tongue. On our eastward track, shallow CTD casts down to 500m together with microstructure measurements were taken on a closely spaced grid. At 18°W, 0°50'S just before sunset on June 9, we recovered the glider ifm07 whose speed had been strongly reduced due to biofouling. The glider was easily recovered and cleaned and is ready for a next deployment at 10°W. The section along the equator was completed when we arrived at 10°W on June 12. The first activity at 10°W was the deployment of two gliders: 1) the glider that was just recovered and cleaned and 2) the glider from N/O LE SUROIT that we were able to repair meanwhile. Both gliders worked fine and were sent on mission along the 10°W meridian toward north and south, respectively. In the afternoon, we recovered - for the second time during this cruise - the glider "deepy" and its attached microstructure probe. This time both, glider and microstructure probe worked without leak; however the microstructure probe stopped recording data after about a week. During the night, we proceeded with two deep CTD/LADCP stations, one of the two used for the calibration of instruments to be moored at the end of the cruise north of São Vicente. The glider and the microstructure probe were prepared for the third deployment: new batteries for the glider as well as a new cone head and sensors for the microstructure probe; the deployment took place before lunch on June 13. During a deep CTD/LADCP station, we were able to observe the behavior of the three gliders that were just deployed. All seemed to be working fine, and at 16:00 we started our transit back to Mindelo. Seven gliders are concurrently involved in this swarm experiment, acquiring an exceptional dataset in a remote ocean area. Their recovery will take place during the following leg of R/V MARIA S. MERIAN.

During the transit to Mindelo, continuous shipboard ADCP measurements were carried out. We arrived at the port of Mindelo on June 18 at 8:00. Using our fast rescue boat to the pier, we picked up the two SAMI instruments that were scheduled to be deployed within the TENATSO mooring north of São Vicente. Before deploying this last mooring, a short CTD cast for the calibration of the fluorometer was performed. The TENATSO mooring deployment started at 15:45 and the anchor was dropped about 5h later already during darkness. Following a deep CTD/LADCP cast, we returned to the mooring position to search for any sign of the flash light or the ARGOS transmitter that were attached to the top element of the mooring planned to be 16m below the sea surface. We did not receive a signal from the Argos transmitter, but found the flashlight blinking at 17°36.32'N, 24°15,19'W. At that time it was about 3h after anchor drop and the mooring should be right up. We estimated the depth of the flashlight to be about 5 to 10m below the surface (which also very likely means that the light switch of the ARGOS transmitter will not turn off during day time) and decided to leave the mooring as it is. We continued with a last microstructure station before heading to the port of Mindelo, where R/V MARIA S. MERIAN arrived in the morning of June 19. The cruise track of MSM18/2 is depicted in Fig. 4.1.

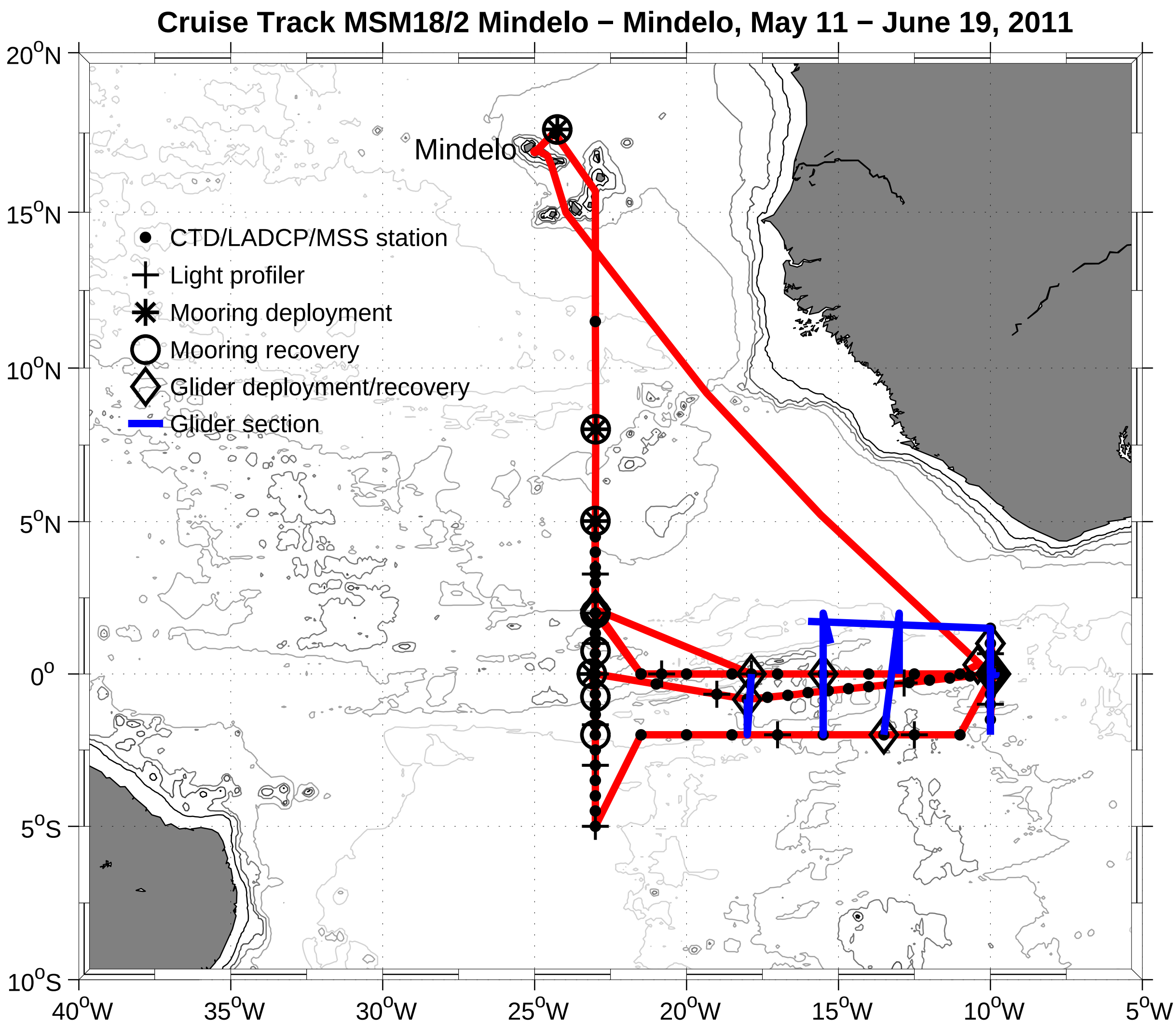

Fig. 4.1 Ship track of R/V MARIA S. MERIAN cruise MSM18/2 with locations of CTD/LADCP/MSS and light profiler stations, mooring deployments and recoveries, glider deployments and recoveries, and glider sections marked**.**

5 Preliminary Results

5.1 CTD and Oxygen Measurements

(Andreas Funk)

CTD-Measurements were taken using two Seabird SBE 9 plus systems. During profiles 1 to 53 IFM-GEOMAR SBE-1 was used, during profiles 54 to 89 IFM-GEOMAR SBE 3 was used. Data were recorded and processed using latest Seabird Seasave software. For the final calibrated data sets the second sensor set (SBE-1, temperature s/n 4823, conductivity s/n3374, and oxygen s/n 1718) was used for profiles 1 to 53. For profiles 54 to 89 the primary sensor set was used (SBE-3, temperature s/n 4835, conductivity s/n 3381, oxygen s/n 1718). Several problems with spiky data forced us to use the second CTD-sonde SBE-3 after profile 53. From there on the primary sensor set worked fine, while the secondary oxygen had to be changed twice. (See Tab. 5.1). Oxygen was calibrated using offset and linear corrections in pressure, temperature and oxygen itself, resulting in an RMS-misfit of 1.07 µmol/kg for profiles 1-53 and 0.90 µmol/kg for profiles 54-89. The conductivity calibration were performed using offset and linear correction in pressure and temperature, with an RMS salinity misfit of 0.00219 for profiles 1-53 and 0.00203 for profiles 54-89. For both calibrations 33% of the bottle values were regarded as outliers and removed from the data.

	Profile 1 - 53	54	55-65	66-89
pressure sensor	#75760	#82991	#82991	#82991
primary temperature sensor	#4875	#4835	#4835	#4835
secondary temperature sensor	#4823	#4867	#4867	#4867
primary conductivity sensor	#2443	#3381	#3381	#3381
secondary conductivity sensor	#3374	#3300	#3300	#3300
primary oxygen sensor	#1739	#1718	#1718	#1718
secondary oxygen sensor	#1718	#215	#1314	#1739
Sonde	SBE-1	SBE-3	SBE-3	SBE-3

Table 5.1 Sensors and sondes used during MSM18/2 CTD-measurements.

5.2. Current Observations: Technical Aspects

5.2.1 Vessel mounted ADCP

(Andreas Funk)

Current measurements have been performed continuously throughout the whole cruise using the two RDI Ocean Surveyor (OS) instruments (38kHz and 75 kHz) of the ship. The OS75 was configured in broadband mode using 4m bin size during the first day and then changed to 5m bin size. Its measurements covered a range between 550m and 640m. The OS38 was configured to use 32m bins in narrowband mode. It had a range between 1200 m and 1600m depending on sea state and ship's speed.

It was determined during a recent R/V METEOR cruise that the simultaneous use of these instruments causes interference when installed with the same alignment angle. This is also true for the two ADCPs aboard R/V MARIA S. MERIAN, which were both mounted at an angle of 45 degrees as recommended by RDI. However, a 45-degrees rotation of the 38kHz ADCP in the moon pool done by the ship's crew on May 16th reduced the interference of the 75kHz instrument by the 38kHz instrument only slightly, probably due to a smaller separation distance between both instruments of R/V MARIA S. MERIAN compared to R/V METEOR. The performance of the OS38 was not affected by this rotation.

The ping rates were 2 seconds for the OS75 and a little less than 4 seconds for the OS38 resulting in approximately 15 destroyed bins of the OS75 every second ping, thus reducing the amount of usable data of the OS75 by about 5 percent. A reliable algorithm for removing the bad bins still has to be developed. During the second transect from 23°W to 10°W the OS38 was switched off in order to get clean OS75 data without interference from the OS38. The setup of navigational input was the same as for the cruises before and worked flawlessly, except for one approximately 40 minute breakdown of the ship's Sea Path Unit.

Simultaneous use of the ship’s Doppler log or the 38 kHz SIMRAD should be avoided as it degrades the velocity data. Thruster usage significantly reduces data quality.

5.2.2 Lowered ADCP sampling

(Gerd Krahmann)

During this cruise a new setup for lowered ADCP current measurements was tested. IFM-GEOMAR had recently acquired three 150 kHz workhorse quartermaster ADCPs (SN #14910, #14911, #14912) from Teledyne RDI. These differ from the previously used 300kHz systems in frequency and thus also in expected measurement range, one of the most relevant parameters for successful post processing. The expectation was that the new systems could be used to obtain full water depth current profiles more reliably than the existing 300 kHz systems. Before the cruise IFM-GEOMAR's rosette frame had been modified to hold the new instruments which are significantly larger than the older 300 kHz systems.

Starting from CTD profile #1 we installed SN #14910 as down-looking and SN #14911 as up-looking instrument, running them in a master-slave configuration with 2 second periodicity and interleaved pinging. This configuration used significantly more power than the old 300kHz units, requiring a battery replacement after about 5 deep profiles. During the third profile the up-looking instrument developed a bad beam and was replaced by SN #14912. We kept this configuration with reasonable results until CTD profile #22 when the SN #14912 also developed a bad beam. This instrument was then removed and we tried a single instrument configuration. Running a single instrument we were able to increase the sample rate to one profile per 0.6 seconds. The higher ping rate led to an even larger energy consumption. For the shallow profiles on the 2 degree South section this configuration proved to be fine. It was, however, not giving good results when employed during deep CTD casts. Starting from CTD profile #31 we installed a 300 kHz instrument as up-looking ADCP (SN #11436) and switched to a synchronous (non-interleaved) pinging first at a 0.8 second rate, later at 0.9 and then 1.0 seconds. This configuration resulted in reliable and good data and was maintained until the end of the cruise.

Data processing took place during the cruise with the IFM-GEOMAR LADCP processing software V10.12, which includes both shear and inversion methods to derive an absolute velocity profile. As additional data necessary for the processing the corresponding pre processed CTD files for the cast P T S, time and navigation data were used.

5.3 Zonal Currents and Oxygen

(Andreas Funk, Sven-Helge Didwischus)

The zonal velocity field along 23°W between 5°N and 5°S was derived by combining data sets measured with the two (upward and downward looking) LADCPs as well as the 38kHz and the 75kHz vessel mounted ADCPs. The strongest current in this section is the eastward flowing Equatorial Undercurrent (EUC) at the equator with velocities up to 0.7 m/s at its core depths of about 60m. The EUC transports water with higher oxygen concentrations and high salinities from the western boundary regime toward east. Below the EUC vertically alternating Equatorial Deep Jets (EDJ) were measured between about 1°N and 1°S. North and south of the EDJ the almost barotropic eastward tall jets can be identified at about 2°N and 2°S. South of 4°S at about 100-350m the measurements show the eastward flowing SEUC that was not completely covered be the acquired section. Highest oxygen concentration was found in the lower NADW south of 1°S with up to 260 µmol/kg. A second oxygen maximum of about 250 µmol/kg appears in the upper NADW with its largest vertical range at the position of the southern tall jet. Below 4000 m, south of the Mid-Atlantic Ridge, Antarctic Bottom Water was transported westward, characterized by low oxygen and low salinities. Lowest oxygen concentrations were found between 100 and 500m, which represent the depth range of the tropical oxygen minimum zones north and south of the equator.

5.4 Mooring Operations

(Rainer Zantopp, Uwe Papenburg, Gerd Niehus)

Mooring operations during cruise MSM18/2 consisted of the recovery of 8 moorings and the re-deployment of 4 of them (Tab. 5.2). Mooring IDs, locations and dates are listed below.
Two aspects should be noted:

1. The TENATSO mooring north of the Cape Verde islands could not be redeployed immediately after recovery because two of the crucial instruments had not yet been delivered when the ship departed Mindelo. The instruments were picked up near the end of the cruise, and the TENATSO mooring was subsequently deployed, resulting in a 40-day gap in data coverage.
2. The moored profiler on the 0°45’N mooring (KPO_1045) was lost entirely during recovery. The mooring itself was released successfully, and the top 1000m of wire and instruments were also retrieved without problems. However, there was a sudden loss of wire tension during the recovery process, leading us to suspect that the wire had broken. After several hours of careful attempts to “salvage” the situation, we were only able to find the “bitter” end of the wire, and no profiler. Our review of the recovery procedure indicated that the 2.5 km wire likely twisted after release, and when tension was applied with the spill during recovery, a kink must have developed and the wire broke under otherwise normal tension.

All other mooring operations went smoothly and without a hitch.

Recoveries

Mooring	**New ID**	**Latitude**	**Longitude**	**Deployment Date**	**Recovery Date**
23W 2S	KPO_1042	2S 00.03	22W 59.97	11-Nov-09	1-Jun-11
0:45S	KPO_1043	0S 44.95	22W 59.74	12-Nov-09	2-Jun-11
23W 0N	KPO_1044	0N 00.16	23W 06.84	5-Nov-09	2-Jun-11
0:45N	KPO_1045	0N 45.13	22W 59.30	3-Nov-09	4-Jun-11
23W 2N	KPO_1046	2N 02.43	23W 01.93	2-Nov-09	5-Jun-11
23W 5N	KPO_1047	5N 00.90	23W 00.00	31-Oct-09	15-May-11
23W 8N	KPO_1048	8N 01.06	22W 58.99	18-Nov-09	14-May-11
Cape Verde	KPO_1041	17N 36.40	24W 14.98	27-Oct-09	11-May-11

Deployments

Mooring	**New ID**	**Latitude**	**Longitude**	**Deployment Date**	**Recovery Date**
Cape Verde	KPO_1060	17N 36.40	24W 14.98	18-Jun-11	
23W 8N	KPO_1061	8N 01.01	22W 58.97	14-May-11	
23W 5N	KPO_1062	5N 00.90	23W 00.00	15-May-11	
23W 0N	KPO_1063	0N 00.16	23W 06.78	3-Jun-11	

Table 5.2 Mooring operations.

Mooring & Instrument Performance:

Below is a summary of the instrument performance from the recovered moorings (Tab. 5.3). A comparison with the outcome of the previous deployment periods shows a slightly lower performance rate for all parameters except oxygen.

In fact, the newly developed units with hardware and software versions delivered a 100% data return on the moored O_2 loggers (Aanderaa optodes). Another positive development was the use of the protective cages around the O_2 logger/Microcat combination. Despite heavy entanglement with fishing line (at the 8°N and 5°N moorings) and serious deformation of the cages (perhaps also due to fishing activity), none of the instruments were damaged indicating a vast improvement over past deployments. Recovered O_2 loggers were always deployed together with Microcats to enable O_2 analysis on density surfaces.

	2009-2011		2008-2009		2006-2008	
	All instr. (%)	**Moored Profiler (%)**	**Standard Instr. (%)**	**Moored Profiler (%)**	**Standard Instr. (%)**	**Moored Profiler (%)**
Moorings	100.0	100.0	100.0	100.0	100.0	100.0
Currents	85.5	61.3	98.5	7.1	95.0	31.2
Temperature	92.7	61.3	98.8	7.1	92.7	31.2
Conductivity	82.4	61.3	100.0	7.1	93.8	31.2
Pressure	87.5	61.3	90.9	7.1	87.0	31.2
Oxygen	92.6	61.3	72.1	7.1	0.0	0.0

Table 5.3 **I**nstrument performance.

All of the Argonaut current meters worked well and without noticeable problems. Unfortunately, the same can't be said for the Aanderaa RCM-8 current meters. We saw various rotor count problems, prolonged periods of zero speed, after which the instrument worked fine without problems. Half of the instruments (6 of 12) had extended periods of zero rotor count. This is a problem that needs to be addressed for future deployments!

All MiniTDs worked well without any problems.

The Microcats encountered a number of problems, including 2 bad memory cards which led to zero data, two bad conductivity cells, and 1 defective pressure sensor, plus excessive pressure drifts over time in 3 sensors. Unfortunately, the newly purchased units (incl. pressure sensors, s/n 68nn) have performed rather poorly, with 5 of 10 delivering unsatisfactory results.

All but one ADCP delivered excellent data throughout the deployment.

The results from the moored profilers (MMP) were a mixed bag. One instrument developed a leak through the optode and stopped working after one month only. Three instruments delivered a complete data set, covering the depth range 1000-3500m for the entire 18 months! Unfortunately, one instrument (presumably carrying a full data set) was lost during the recovery operation when the 2.5 km-long wire section broke and the untethered instrument floated away at depth due to its near-neutral buoyancy.

CTD cast calibrations were performed for all Microcats, MiniTDs and O_2 loggers, either as pre- or post-deployment calibrations. In general, calibration stops of more than 2 min were done to ensure equilibrated calibration points. New fitting routines will be tested to improve the T/S properties of the Microcats. O_2 loggers show reduced calibration errors when calibration stops were done. Even though oxygen time constants were included in the calibration procedure, calibration stops should be still kept in future CTD casts calibrations.

The onboard calibration procedure included oxygen measurements with the O_2 loggers in water baths of 0% and 100% O_2-saturated water, as described in the Aanderaa optode manual. However, measurements in 100%-saturated water showed substantial variability likely due to variable oxygen concentration in the water bath.

Overall, pre- and post deployment calibrations from CTD casts as well as 0%-lab calibrations were used to maximize the number of independent calibration points and to achieve one final calibration for each O_2 logger. Oxygen errors against calibration points were generally lower than 5 µM/kg.

O_2-loggers were also analysed with respect to their oxygen time constant via spectral analysis and reached values in an interval of 12s to 25s. This information is very useful for post processing of oxygen data from profiling applications.

5.5 Glider operations

(Gerd Krahmann)

During the cruise five of IFM-GEOMAR's nine autonomous gliders were deployed (ifm05, ifm07, ifm08, ifm09, ifm11) to participate in a swarm experiment for the study of the hydrographic structure during the onset of equatorial upwelling. Two more were deployed during or shortly before the cruise by the French N/O LE SUROIT at 0°N, 10°W (deepy) and 0N, 0E (ifm10). A french glider (bonpland) was also deployed at 0°N, 0°E. Six of the gliders on board (ifm03, ifm05, ifm06, ifm07, ifm08, ifm09) had been shipped to Cape Verde one month before the cruise for shake-down trials. During these tests ifm06 was found not operable because of an un-identified leak in the housing. The other gliders were deployed and recovered after a few days of testing. The tests showed two leakage failures likely because of faulty o-ring seals (ifm05, ifm08) and one failure because of a leak in the tail fin of the glider (ifm03). Glider ifm09 had problems with its navigational pressure sensor (possibly a loose connector) and was switched to the science pressure sensor. It operated fine after this switch. Glider ifm07 passed the trials without a problem. Because of the sometimes late detection of the leaks during glider missions an extension of the gliders' leak sensors was developed and installed in all gliders that were opened for maintenance on board (deepy, ifm05, ifm08, ifm09, ifm11). One more glider that was deployed from the ship (ifm11) had been at the manufacturer (Teledyne Webb Research) for inspection and was shipped to Cape Verde together with the main shipment for the cruise. This glider thus was not run through the Cape Verde tests. During the cruise ifm09 was deployed on May 16 at 2°N, 23°W and was programmed to travel eastward. On May 18 ifm07 was deployed at 0°N, 18°W, programmed to travel southward. An attempted deployment of ifm08 had to be interrupted and the glider recovered after one of the newly installed leak detect sensors came loose and indicated a (non-existent) leak.

On May 18 a voltage drop in the battery voltage measured by deepy indicated a problem with the attached microrider system. It was thus decided to send this glider westward from 0°N 10°W to allow an earlier recovery. The oceanographic sensors were turned off to conserve energy as the battery appeared to drain rapidly. During the same day ifm09 (deployed two days before) reported a leak and it was decided to return and recover the glider which otherwise would have been lost due to a strong westward drift. It was recovered on May 19 near its deployment location. The inspection after the recovery showed that the glider appeared to have a leak in the tail fin assembly. Also on May 18 ifm10 reported a leak and was left drifting as no ship was nearby for recovery.

On May 21 ifm11 was deployed at 0°N, 15.5°W and programmed to travel southward. At the same location we deployed again ifm08 (with reinstalled leak detect sensors) and got a leak report during the first dive to 150 m. Inspection after recovery showed a leak in the o-ring seals of the chlorophyll sensor. On May 22 deepy reported a leak and was recovered after nightfall without major difficulties. Inspection showed another failure of the o-rings around the chlorophyll sensor. As already expected the earlier voltage drop was caused by the attached microrider which had developed a leak in its forward compartment. This also explained the tendency of the glider to be front heavy during the mission.

Between the shakedown trials and the start of the cruise the manufacturer of the gliders (Teledyne Webb Research) had sent a replacement tail fin and we decided to install this fin in glider ifm09 instead of ifm03 for which it was intended. We also removed the chlorophyll sensor from ifm03 and installed it in deepy. A new set of batteries was installed in deepy. On May 25 ifm10 was recovered by N/O LE SUROIT. On May 26 deepy with microrider and ifm05 were deployed at 0°N 10°W with deepy being programmed to circle the PIRATA buoy at that location and ifm05 to head northward. On May 27 ifm09 was deployed at 2°S, 13.5°W with a northward heading.

On June 8 we met with N/O LE SUROIT and transferred three glider transport boxes and equipment as well as glider ifm10. Ifm10 was opened and inspected and we found another leak in the tail fin. On June 9 ifm07 was recovered at 1°S, 18°W as the glider's speed had reduced to a crawl. Substantial amounts of bio-fouling were responsible and the experimental anti-fouling of motor-cycle chain fat with very strong chili powder had not had the desired effect. The same day the intact science bay from ifm10 was transferred to ifm08. Additional leak detect sensors were also installed. On June 11 conventional anti-fouling was painted onto the wing holders and front cap of ifm07. Teflon tape was used to cover seems between the glider's segments, which are one of the locations most likely to attract barnacles. On June 12 deepy was again recovered and the batteries exchanged for new ones. On the same day ifm07 and ifm08 were deployed at 0°N, 10°W. Ifm07 was later programmed to move northward and ifm08 to move southward. On June 13 deepy was deployed at 0°N, 10°W. Deepy was programmed to circle the PIRATA buoy. A short boat trip was necessary to remove some Teflon tape from ifm07 as it covered the science pressure sensor.

All gliders that were left in the water at the end of MSM18/2 were recovered during the following leg MSM18/3 (Fig. 5.1).

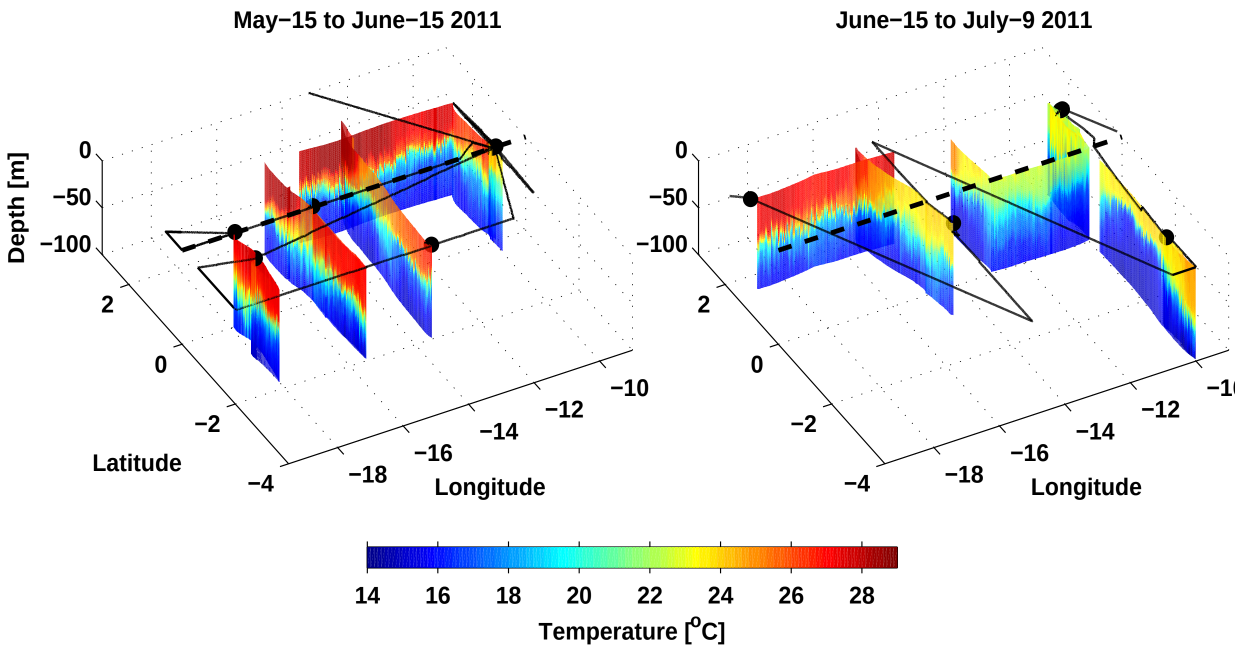

Fig. 5.1 3-d view on the temperature field observed by the different gliders participating in the swarm experiment. Temperature profiles acquired from May 15 to June 15 with cruise track of MSM18/2 (a) and from June 15 to July 15 with cruise track of MSM18/3 (b) during which all gliders were successfully recovered. Clearly visible is the drop in temperature from the first to the second period indicating the onset of upwelling.

5.6 Autonomous and shipboard microstructure measurements

(Marcus Dengler, Tim Fischer)

An extensive microstructure measurement program was carried out aiming to quantify diapycnal fluxes of heat and solutes during the onset of equatorial upwelling and to identify the dominant processes responsible for elevated mixing in the upper ocean. It combined the research objectives of two projects: Subproject AP1.2 of the BMBF joint project NORDATLANTIK aiming at quantifying the variability of the mixed layer heat content in the cold tongue during its development, and Theme 3.4 of the BMBF joint project SOPRAN, which focuses on diapycnal fluxes and subsequent out-gassing of the trace gas N_2O.

Sampling and technical aspects

The measurement program consisted of autonomous microstructure sampling by a glider which was equipped with a MicroRider microstructure instrument package (Rockland Scientific), and of shipboard microstructure profiling system (Sea & Sun Technology). The MicroRider is attached to the top of a glider and allows sampling of autonomous microstructure profiles for periods of up to 4 weeks per deployment without requiring additional ship time except for glider deployment and recovery. Altogether, the MicroRider/Glider package was deployed for three missions circling the equatorial PIRATA mooring in the equatorial Atlantic at 10°W (Tab. 5.4). While four deployment/recovery operations were performed during MSM18/2, the deployment for the first mission was carried out from N/O Le Suroit on May 8 and the recovery of the package after mission 3 was completed during the MSM18/3.

Unfortunately, the MicroRider malfunctioned during the first two missions. Due to a nose cone leakage, the microstructure shear data collected during the first mission are erroneous as sensitivity of the shear sensors decreased after the first few profiles due to water in the electric circuits. During the second deployment, data recording stopped after 6.5 days due to a failure of the flash card in the MicroRider. Nevertheless, 244 high-quality microstructure data were collected during glider decent and ascent in the 2nd mission. During the last mission, data were recorded over the whole time span, but only during the glider's downcasts. During all missions, the MicroRider was equipped with two shear sensors (airfoil). Two fast thermistors (FP07) where attached during the first and third mission, while only one fat thermistor was used during the second mission. Additionally, a pressure sensor and accelerometers which record pitch, roll and hive of the system were attached. The microstructure data are recorded at a rate of 512 Hz.

Glider Mission	Date and time (UTC)	MicroRider recording duration (UTC)	No. of micro-structure profiles	Shear sensors	Temperature sensors
1	8 May, 16:44† – 22 May 12:16	8 May, 16:44 – 18 May 16:13	252††††	S1: M616 S2: M613	T1: T503 T2: T505
2	26 May 09:13 – June 12, 14:10	26 May 09:13 – June 1, 21:55†††	244	S1: M707 S2: M711	T1: T442 T2: not used
3	June 13, 12:12 – July 9, 7:58††	June 13, 12:12 – July 9, 7:58	384	S1: M709 S2: M618	T1: T501 T2: T502

† Deployed by N/O LE SUROIT
†† Recovered during MSM18/3
††† MicroRider stopped recording due to disk failure
†††† Bad data due to nose cone leakage

Table 5.4 Deployment schedule and configuration of MicroRider/Glider package.

The ship-based microstructure measurements were performed using a MSS90-D profiler (S/N 32), a winch and a data interface. The profilers were equipped with four shear sensors, a fast-response temperature sensor, and an acceleration sensor all sampling at 1024Hz, and two tilt sensors and conductivity, temperature, depth sensors sampling at a lower frequency (24 Hz). The loosely-tethered profiler was optimized to sink at a rate of 0.55 ms^{-1}. In total, 232 profiles were collected during 84 microstructure stations which translate into a total profiling period of 3.2 days. Several of those profiles were collected simultaneously to Glider-MicroRider measurements to assess the level of agreement between both microstructure platforms.

Preliminary results

The 6.5-day microstructure time series (Fig.5.2) convincingly shows the occurrence of elevated mixing patches in the upper ocean. Turbulent bursts extend from the surface mixed layer well into the region of high stratification. During the latter part of the time series (May 30 to June 1), this seems to occur predominately in the early morning (8:00-10:00 local time), when the upper ocean is least stratified. At the beginning of the time series, however, a clear diurnal cycle of the turbulence below the mixed layer is not evident.

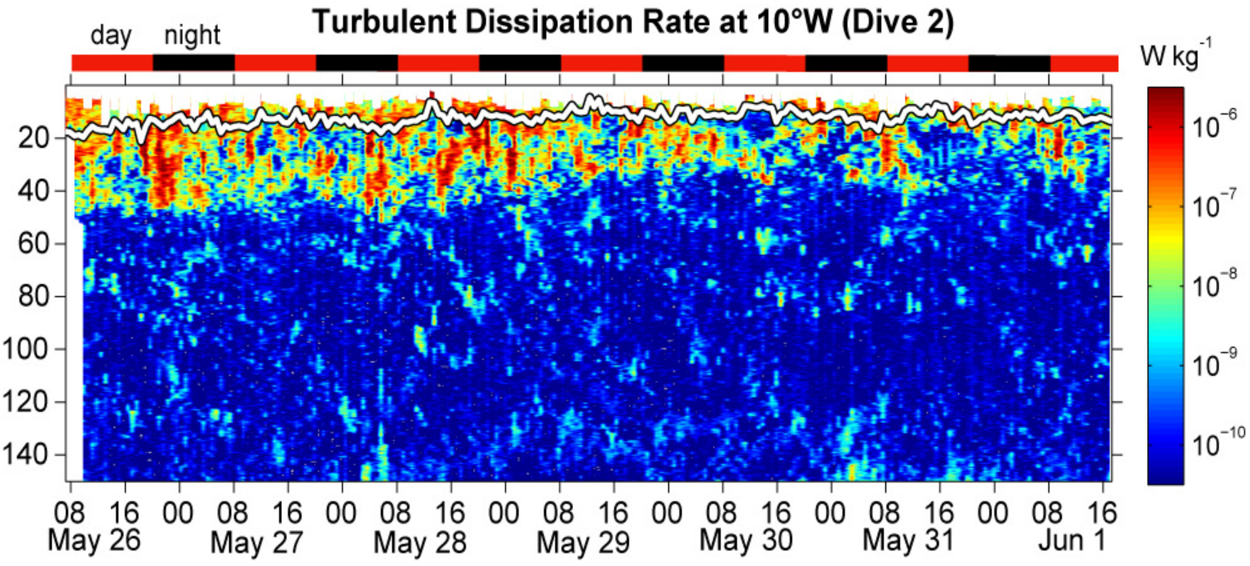

Fig. 5.2 Dissipation rate of turbulent kinetic energy measured by the MicroRider/Gleiter package during the second mission. The white line indicates the depth of the mixed layer.

5.7 In-situ light measurement

(Tronje Kemena)

For the in-situ light measurement on the MSM18/2 we used a RAMSES irradiance sensor (SAMIP 5044) from TriOS with a wavelength range of 320 – 950 nm and an integrated pressure and inclination sensor. The irradiance sensor select the integration time (depending on the light intensity) in the range from 4ms to 8s automatically. The sensor was calibrated before the cruise.

Distributed over the whole cruise we had 20 light stations and at every station we measured a profile with 16 2-minute-stops down to 40 dbar (stops: surface, 2, 4, 6, 8, 10, 12.5, 15, 17.5, 20, 22.5, 25, 30, 35, 40 dbar).

The goal of this experiment was to investigate the influence of chlorophyll on the light attenuation with depth. For this we took at the same day and location chlorophyll samples from the CTD bottles and we will also use the fluorescence measurements from the CTD cast for comparison and analysis.

5.8 Chemical Measurements

(Anette Kock)

Oxygen and Nutrient Sampling

Discrete samples from selected depths were analyzed for oxygen at the majority of the stations. Bubble free samples were taken in 100 mL ground flasks, treated with alkaline sodium iodide and manganese chloride solutions and analyzed within eight hours after oxygen fixation using the Winkler method. Samples for nutrient analysis were taken at the majority of the stations and kept frozen at -20 °C until analysis. Part of the samples were analyzed for nitrate, nitrite, phosphate and silicate using a QuAAtro (Seal Analytical, Norderstedt, Germany) segmented flow analyzer during the following cruise leg MSM18/3, and the remaining frozen samples were transported to IFM-GEOMAR and analyzed in October 2011 using the same system. A detailed overview of the sampled oxygen and nutrient stations is given in Tab. 5.5.

Sampled CTD casts (oxygen)	Sampled CTD casts (N_2O)	Sampled CTD casts (nutrients)	
		Analyzed onboard	Analyzed at IFM-GEOMAR
2-8, 10-11, 13-19, 22-23, 27-28, 30-42, 44-46, 51, 54-68, 70-85, 87	2-8, 10-18, 22-23, 30-38, 40, 42, 44, 51, 56, 59, 62, 64, 66, 68, 70-84	8, 10-11, 13-17, 30-37, 71-84	9, 12, 22-23, 27-28, 38, 40, 42, 44, 51, 56, 59, 62, 64, 66, 68

Table 5.5 Nutrient and oxygen sampling during MSM18/2

Nitrous Oxide Depth Profiles

Discrete samples of nitrous oxide were measured on board using a GC/ECD system and a static equilibration method. After triplicates of bubble free samples were drawn from the rosette, a 10 mL helium headspace and 50 µL of a saturated mercuric chloride solution were added to each sample within two hours after the sampling. The headspace was analyzed for nitrous oxide after overnight equilibration. The GC was calibrated on a daily basis using four dilutions of a standard gas mixture and an internal standard of compressed air. In total, N_2O was sampled at 52 stations (Section 7.2, Station List), with focus on the upper 100 m: depth profiles of the upper 100 m were obtained during the zonal sections at every station, deeper profiles were obtained at selected stations along the zonal and meridional transects.

Underway Nitrous Oxide/Carbon Monoxide and LICOR pCO_2 measurements

Underway measurements of surface water pN_2O and pCO_2 were performed using a OA-ICOS N_2O Analyzer (DLT,Los Gatos Reserch, Mountain View, CA) and a NDIR Analyzer (LI-COR Biosciences, Lincoln, NE) in conjunction with a Weiss type equilibrator. In parallel, pCO_2 was additionally measured using an independent pCO_2 measuring system (General Oceanics, Miami, FL).

Seawater was taken from the ship's underway seawater supply (centrifugal pump) and pumped through the equilibrator. ~200 mL of the equator's headspace were continuously pumped in a closed circuit through the DLT, the LICOR and back to the equilibrator. The air flow was dried before entering the DLT using a cold trap and a Nafion drier to minimize interferences with water vapor. Control measurements using four different standard gas mixtures with different partial pressures of N_2O, CO and CO_2 and measurements of ambient air, pumped from the ship's compass deck were performed every six hours. Additionally, the LI-COR was calibrated every 24 hours to correct for sensor drift. The equilibration temperature was recorded using a temperature sensor placed in the equilibrator. To compare the underway measurements with discrete measurements, discrete samples were taken from the continuous seawater supply on a daily basis and analyzed using an ECD system as described above.

N_2O and CO_2 followed closely water temperature changes with highest concentrations being found on mid June towards the end of the cruise. This seemed to be consistent with the onset of the upwelling season as it is suggested by the observed decrease in sea surface temperature.

Helium

During the cruise about 310 Helium samples in copper tubes were taken above, in and below the thermocline. Additionally we took water samples in glass ampules. During the cruise this recently developed technique was tested for the first time outside the laboratory. A good working procedure for the handling of samples was developed, and we were able to take about 240 samples in glass amules for comparision with the copper tube – method. The samples will be measured at the Bremen Helium Isotope Laboratory.

5.9 Thermosalinograph Measurements

(Michael Schlundt)

During the cruise sea surface temperature (SST) and sea surface salinity (SSS) were measured autonomously with a Thermosalinograph. The Thermosalinograph measurements on R/V MARIA S. MERIAN are carried out using two independent Measurement Container (MC1 and MC2). Both containers worked well during the whole cruise. Every container works for about twelve hours and is cleaned after the automatic switch to the other container. This cleaning avoids biofouling with the disadvantage that the first few measurements after restarting the measurements cannot be used. So the first ten minute-by-minute values are discarded in the postprocessing. For the final SST and SSS records we use only one of the different measurements, namely the one which is taken at the inflow of the containers. Two additional records in the interior are discarded, because of the long path of the seawater yielding to significant changes for SST and SSS.

The final time series are calibrated against calibrated CTD data from 6 m water depth (the depth of the intake of the thermosalinograph), which has been revealed a sufficient procedure during previous cruises.

6 Meteorological measurements

(Michael Schlundt)

Additional to the usual meteorological measurements from the shipboard weatherstation we derived meteorological parameters with four different measurement systems. A turbulence measurement system composed of a sonic anemometer (USA-1) build by METEK, Pinneberg, and a hygrometer (M100 manufactured by Analytical Application, Boulder) was installed at the railing on the elevated compass deck. This system measured sonic temperature, u-, v- and w-components of the wind in a 30 Hz rate and humidity in a 10 Hz resolution. A system of oil damped pendulums recorded the ship's motions due to waves and swell. With these high-frequency measurements it is possible to derive latent and sensible heat flux and momentum flux.

Nearby to the turbulence measurement system an optical disdrometer was mounted, measuring the distribution of the rain-drop sizes and rain rate. The measurements agree very well to the shipboard raingauge. Both systems (turbulence and disdrometer) were initially fixed at the monkey deck but moved to the new position after three days. The disdrometer and the turbulence measurements allow for determining local freshwater fluxes, important for changes of surface salinity.

Shortwave and longwave downwelling radiation were obtained at the monkey deck using a pyranometer and a pyrgeometer, both manufactured by Kipp&Zonen. Alongside a full sky imager was mounted, taking self-releasing every 15 seconds (at daytime; during the night every 15 minutes) a whole-sky image with a fish-eye lens to derive total cloudiness and cloud type. Together with the radiation measurements, the turbulence measurements and the general measurements from the weatherstation delivers important information required to determine the energy budget at the air-sea interface and to investigate the relevant physical processes at work.

7 Lists MSM18/2

7.1 Station List

Station No. MSM Ship/Science		Latitude	Longitude	Time	Work
615-1	KPO_1041	17°36.40'N	24°14.98' W	11.05. 13:30-18:50	**Mooring** recovery
615-2	CTD_1	17°29 'N	24°20'W	11.05. 19:15-19:35	**CTD/LADCP** station (200m, cable problems)
615-3	MSS_1	17°29'N	24°20'W	11.05. 19:45-20:45	**Microstructure**
615-4	CTD_2	17°29'N	24°20'W	11.05. 21:00-22:00	**CTD/LADCP** station (1000m), calibration of optode and microcat
615-5	MSS_2	17°29'N	24°20'W	11.05. 22:35-23:55	**Microstructure**
615-5	CTD_3	17°29'N	24°20'W	12.05. 00:00-3:20	**CTD/LADCP** station (3580m), water sampling for salinometer substandard
		15°N	23°W		Start meridional section along 23°W
616-1	CTD_4	11°30'N	23°W	13.05. 8:00-9:00	**CTD/LADCP** station (1000m), calibration of microcats, optodes, release test
617-1	MSS_3	8°N	23°W	14.05. 2:50-5:35	**Microstructure**
617-2	KPO_1048	8°01.06'N	22°58.99'W	14.05. 6:00-9:20	**Mooring recovery**
617-3	CTD_5	8°N	23°W	14.05. 11:20-12:20	**CTD/LADCP** station (1000m), calibration of microcats, optodes
617-4	LS_1	8°N	23°W	14.05. 12:40-13:20	**Light profiler**
617-5	KPO_1061	8°01.01'N	22°58.97'W	14.05. 15:00-18:20	Drift test, **mooring** deployment, submerge of top element observed
618-1	618-1 KPO_1047	5°00.90'N	23°00'W	15.05. 8:10-11:10	**Mooring recovery**
618-2	MSS_4	5°N	23°W	15.05. 11:40-13:00	**Microstructure**
618-3	CTD_6	5°N	23°W	15.05. 13:20-15:20	**CTD/LADCP** station (1000m), calibration of microcats, optodes
618-4	KPO_1062	5°00.90'N	23°00.00'W	15.05. 16:20-19:40	Drift test, **mooring** deployment
619-1	ifm09	2°N	23°W	16.05. 10:30-11:20	**Glider** deployment
619-2	MSS_5	2°N	23°W	16.05. 12:00-13:20	**Microstructure**
619-3	LS_2	2°N	23°W	16.05. 13:30-14:00	**Light profiler**
619-4	CTD_7	2°N	23°W	16.05. 14:20-16:30	**CTD/LADCP** station (1000m)
620-1	CTD_8	0°N	21°30'W	17.05. 4:30-5:30	**CTD/LADCP** station (1000m)
620-2	MSS_6	0°N	21°30'W	17.05. 5:30-6:30	**Microstructure**
		0°N	21°30'W	17.05. 6:30	Start **Underway CTD** in between station work
621-1	LS_3	0°N	20°50'W	17.05. 10:30-	**Light profiler**

				11:20	
621-2	CTD_9	0°N	20°50'W	17.05. 11:30-11:40	**CTD/LADCP** station (100m)
623-1	CTD_10	0°N	20°W	17.05. 16:40-17:50	**CTD/LADCP** station (1000m)
623-2	MSS_7	0°N	20°W	17.05. 17:50-18:50	**Microstructure**
624-1	CTD_11	0°N	18°30'W	18.05. 3:10-4:10	**CTD/LADCP** station (1000m)
624-2	MSS_8	0°N	18°30'W	18.05. 4:30-5:30	**Microstructure**
625-1	ifm07, ifm08	0°N	17°52'W	18.05. 9:10-10:10	**2 Glider** deployment
625-2	LS_4	0°N	17°52'W	18.05. 10:30-11:20	**Light profiler**
625-3	CTD_12	0°N	17°52'W	18.05. 11:30-12.20	**CTD/LADCP** station (1000m), calibration of both UCTDs
625-4	ifm08	0°N	17°52'W	18.05. 13:10-13:30	**Glider** recovery (leak detect)
		0°25'N	18°58'W	18.05. 18:50	End **Underway CTD**
627-1	ifm09	2°N	23°W	19.05. 12:50-13:00	**Glider** recovery (leak detect)
628-1	CTD_13	0°N	17°W	20.05. 23:10-24:00	**CTD/LADCP** station (1000m)
628-2	MSS_9	0°N	17°W	21.05. 00:00-1:10	**Microstructure**
629-1	ifm08, ifm11	0°N	15°30'W	21.05. 8:30-9:30	2 **Glider** deployments
629-2	CTD_14	0°N	15°30'W	21.05. 9:40-10:30	**CTD/LADCP** station (1000m)
629-3	LS_5	0°N	15°30'W	21.05. 10:30-11:10	**Light profiler**
629-4	ifm08	0°N	15°30'W	21.05. 11:20-11:40	**Glider** recovery (leak detect)
629-5	MSS_10	0°N	15°30'W	21.05. 11:50-12:40	**Microstructure**
630-1	CTD_15	0°N	14°W	21.05. 20:10-20:50	**CTD/LADCP** station (1000m)
630-2	MSS_11	0°N	14°W	21.05. 21:00-21:50	**Microstructure**
631-1	CTD_16	0°N	12°30'W	22.05. 5:00-5:50	**CTD/LADCP** station (1000m)
631-2	MSS_12	0°N	12°30'W	22.05. 6:00-7:00	**Microstructure**
632-1	CTD_17	0°N	11°W	22.05. 13:50-14:40	**CTD/LADCP** station (1000m)
632-2	MSS_13	0°N	11°W	22.05. 14:40-15:20	**Microstructure**
633-1	ifm02	0°19'N	10°24'W	22.05. 18:40-19:20	**Glider** recovery
634-1	CTD_18	0°N	10°W	22.05. 22:00-0:50	**CTD/LADCP** station (4600m)
634-2	MSS_14	0°N	10°W	23.05. 0:50-1:50	**Microstructure**
635-1	CTD_19	0°20'N	10°W	23.05. 3:30-	**CTD/LADCP** station (4560m)

				6:10	
635-2	MSS_15	0°20’N	10°W	23.05. 6:30-7:20	**Microstructure**
636-1	CTD_20	0°40’N	10°W	23.05. 9:00-11:50	**CTD/LADCP** station (4440m)
636-2	LS_6	0°40’N	10°W	23.05. 11:50-12:40	**Light profiler**
636-3	MSS_16	0°40’N	10°W	24.05. 12:40-13:30	**Microstructure**
637-1	ifm05	1°00’N	10°W	23.05. 15:10-16:10	**Glider** deployment
637-2	CTD_21	1°00’N	10°W	23.05. 16:20-16:30	**CTD/LADCP** station (170m, stopped due to glider problems)
637-3	ifm05	1°00’N	10°W	23.05. 16:30-16:50	**Glider** recovery (corrupted flash card)
637-4	CTD_22	1°00’N	10°W	23.05. 17:00-19:40	**CTD/LADCP** station (4450m, LADCP in bb mode not usable)
637-5	MSS_17	1°00’N	10°W	23.05. 19:50-20:40	**Microstructure**
638-1	CTD_23	1°30’N	10°W	23.05. 23:00-2:10	**CTD/LADCP** station (5000m)
638-2	MSS_18	1°30’N	10°W	24.05. 2:20-3:00	**Microstructure**
639-1	CTD_24	0°00’S	9°55’W	24.05. 14:00-17:30	**CTD/LADCP** station (5000m)
640-1	CTD_25	0°20’S	10°W	25.05. 0:30-3:00	**CTD/LADCP** station (3900m)
640-2	MSS_19	0°20’S	10°W	25.05. 3:10-4:00	**Microstructure**
641-1	CTD_26	0°40’S	10°W	25.05. 5:50-8:30	**CTD/LADCP** station (3900m)
641-2	MSS_20	0°40’S	10°W	25.05. 8:30-9:20	**Microstructure**
642-1	LS_7	1°00’S	10°W	25.05. 11:20-12:10	**Light profiler**
642-2	CTD_27	1°00’S	10°W	25.05. 12:30-14:50	**CTD/LADCP** station (4100m)
642-3	MSS_21	1°00’S	10°W	25.05. 15:00-15:40	**Microstructure**
643-1	CTD_28	1°30’S	10°W	25.05. 18:20-21:10	**CTD/LADCP** station (4620m)
643-2	MSS_22	1°30’S	10°W	25.05. 21:10-22:00	**Microstructure**
644-1	MSS_23	0°00’N	9°55’W	26.05. 5:20-6:50	**Microstructure**
644-2	ifm02, ifm05	0°00’N	9°55’W	26.05. 7:10-8:20	**Glider** deployment
644-3	CTD_29	0°00’N	9°55’W	26.05. 8:50-11:50	**CTD/LADCP** station (4990m)
644-4	LS_8	0°00’N	9°55’W	26.05. 12:10-13:00	**Light profiler**
644-5	MSS_24	0°00’N	9°55’W	26.05. 13:10-13:50	**Microstructure**
645-1	CTD_30	2°00’S	11°W	26.05. 0:40-1.30	**CTD/LADCP** station (1000m)

645-2	MSS_25	2°00’S	11°W	27.05. 1:40-2:30	**Microstructure**
646-1	CTD_31	2°00’S	12°30’W	27.05. 9:20-10:10	**CTD/LADCP** station (1000m)
646-2	MSS_26	2°00’S	12°30’W	27.05. 10:10-11:00	**Microstructure**
646-3	LS_9	2°00’S	12°30’W	27.05. 11:10-11:50	**Light profiler**
647-1	ifm09	2°00’S	13°30’W	27.05. 16:10-16:50	**Glider** deployment
647-2	CTD_32	2°00’S	13°30’W	27.05. 17:00-17:40	**CTD/LADCP** station (1000m)
647-3	MSS_27	2°00’S	13°30’W	27.05. 17:50-18:30	**Microstructure**
648-1	CTD_33	2°00’S	15°30’W	28.05. 3:30-4:20	**CTD/LADCP** station (1000m)
648-2	MSS_28	2°00’S	15°30’W	28.05. 4:30-5:10	**Microstructure**
649-1	LS_10	2°00’S	17°W	28.05. 12:30-13:10	**Light profiler**
649-2	CTD_34	2°00’S	17°W	28.05. 13:20-14:00	**CTD/LADCP** station (1000m)
649-3	MSS_29	2°00’S	17°W	28.05. 14:10-14:50	**Microstructure**
650-1	CTD_35	2°00’S	18°30’W	28.05. 21:50-22:40	**CTD/LADCP** station (1000m)
650-2	MSS_30	2°00’S	18°30’W	28.05. 22:50-23:30	**Microstructure**
651-1	CTD_36	2°00’S	20°W	29.05. 6:30-7:20	**CTD/LADCP** station (1000m)
651-2	MSS_31	2°00’S	20°W	29.05. 7:20-8:00	**Microstructure**
652-1	CTD_37	2°00’S	21°30’W	29.05. 15:10-16:00	**CTD/LADCP** station (1000m)
652-2	MSS_32	2°00’S	21°30’W	29.05. 16:00-16:40	**Microstructure**
653-1	CTD_38	5°00’S	23°W	30.05. 9:30-12:30	**CTD/LADCP** station (5000m)
653-2	LS_11	5°00’S	23°W	30.05. 12:50-13:30	**Light profiler**
654-1	CTD_39	4°30’S	23°W	30.05. 16:00-19:30	**CTD/LADCP** station (5000m)
654-2	MSS_33	4°30’S	23°W	30.05. 19:40-20:10	**Microstructure**
655-1	CTD_40	4°00’S	23°W	30.05. 23:00-2:10	**CTD/LADCP** station (5000m)
655-2	MSS_34	4°00’S	23°W	31.05. 2:10-3:00	**Microstructure**
656-1	CTD_41	3°30’S	23°W	31.05. 5:50-9:00	**CTD/LADCP** station (5000m)
656-2	MSS_35	3°30’S	23°W	31.05. 9:00-9:40	**Microstructure**
657-1	LS_12	3°00’S	23°W	31.05. 12:30-13:10	**Light profiler**
657-2	CTD_42	3°00’S	23°W	31.05. 13:30-	**CTD/LADCP** station (5000m)

				16:30	
657-3	MSS_36	3°00’S	23°W	31.05. 16:40-17:20	**Microstructure**
658-1	CTD_43	2°30’S	23°W	31.05. 20:00-23:10	**CTD/LADCP** station (5000m)
658-2	MSS_37	2°30’S	23°W	31.05. 23:10-0:00	**Microstructure**
659-1	CTD_44	2°00’S	23°W	01.06. 2:30-5:40	**CTD/LADCP** station (5000m)
659-2	MSS_38	2°00’S	23°W	01.06. 5:40-6:20	**Microstructure**
659-3	KPO_1042	2°00.03’S	22°59.97W	01.06. 6:50-9:30	**Mooring** recovery
660-1	LS_13	1°40’S	23°W	01.06. 11:40-12:30	**Light profiler**
660-2	MSS_39	1°40’S	23°W	01.06. 12:50-13:30	**Microstructure**
660-3	CTD_45	1°40’S	23°W	01.06. 13:40-16:50	**CTD/LADCP** station (4800m)
661-1	CTD_46	1°20’S	23°W	01.06. 18:40-21:40	**CTD/LADCP** station (4680m)
662-1	CTD_47	1°00’S	23°W	01.06. 23:20-0:20	**CTD/LADCP** station (630m, CTD with spikes)
662-2	MSS_40	1°00’S	23°W	02.06. 0:20-0:40	**Microstructure**
662-3	CTD_48-50	1°00’S	23°W	02.06. 1:00-1:10	**CTD/LADCP** station (280m, CTD with spikes, repair)
662-4	MSS_40	1°00’S	23°W	02.06. 1:20-1:50	**Microstructure**
662-5	CTD_51	1°00’S	23°W	02.06. 1:50-6:00	**CTD/LADCP** station (3900m)
663-1	KPO_1043	0°44.95’S	22°59.74’W	02.06. 7:30-9:50	**Mooring** recovery
664-1	KPO_1044	0°00.16’N	23°06.84’W	02.06. 13:50-17:10	**Mooring** recovery
665-1,2,4	CTD_52-53	0°40’S	23°W	02.06. 21:00	**CTD** station (CTD with spikes, repair)
665-3	MSS_41	0°40’S	23°W	02.06. 21:40-22:40	**Microstructure**
665-5	CTD_54	0°40’S	23°W	02.06. 23:40-2:30	**CTD/LADCP** station (3400m, CTD probe changed)
666-1	CTD_55	0°20’S	23°W	03.06. 4:10-7:20	**CTD/LADCP** station (4450m)
666-2	MSS_42	0°20’S	23°W	03.06. 7:30-8:10	**Microstructure**
667-1	KPO_1063	0°00.16’N	23°06.78’W	03.06. 10:10-13:50	**Mooring** deployment, submerge of top element observed
667-2	LS_14	0°00’N	23°W	01.06. 13:50-14:30	**Light profiler**
667-3	MSS_43	0°00’N	23°W	03.06. 14:40-15:50	**Microstructure**
668-1	CTD_56	0°00’N	23°W	03.06. 17:40-20:00	**CTD/LADCP** station (3780m)
669-1	CTD_57	0°20’N	23°W	03.06. 22:00-0:30	**CTD/LADCP** station (3750m)

669-2	MSS_44	0°20'N	23°W	04.06. 0:30-1:30	**Microstructure**
670-1	CTD_58	0°40'N	23°W	04.06. 3:10-5:40	**CTD/LADCP** station (3730m)
670-2	MSS_45	0°40'N	23°W	04.06. 5:40-7:10	**Microstructure**
671-1	KPO_1045	0°45.13'N	22°59.30'W	04.06. 7:40-12:10	**Mooring** recovery, wire broke, loss of MMP
672-1	LS_15	1°00'N	23°W	04.06. 13:20-14:10	**Light profiler**
672-2	CTD_59	1°00'N	23°W	04.06. 14:10-16:10	**CTD/LADCP** station (3050m)
672-3	MSS_46	1°00'N	23°W	04.06. 16:30-18:20	**Microstructure**
673-1	CTD_60	1°20'N	23°W	04.06. 19:20-22:10	**CTD/LADCP** station (4540m)
673-2	MSS_47	1°20'N	23°W	04.06. 22:20-23:10	**Microstructure**
674-1	CTD_61	1°40'N	23°W	05.06. 1:00-3:40	**CTD/LADCP** station (3960m)
674-2	MSS_48	1°40'N	23°W	05.06. 3:40-5:10	**Microstructure**
675-1	CTD_62	2°00'N	23°W	05.06. 7:00-9:30	**CTD/LADCP** station (4170m)
675-2	KPO_1046	2°02.43'N	23°01.93'W	05.06. 10:40-13:40	**Mooring** recovery
676-1	CTD_63	2°30'N	23°W	05.06. 17:00-19:50	**CTD/LADCP** station (4560m)
676-2	MSS_49	2°30'N	23°W	05.06. 19:50-20:40	**Microstructure**
677-1	CTD_64	3°00'N	23°W	05.06. 22:40-1:50	**CTD/LADCP** station (4490m)
677-2	MSS_50	3°00'N	23°W	06.06. 2:00-3:00	**Microstructure**
678-1	CTD_65	3°30'N	23°W	06.06. 5:40-8:10	**CTD/LADCP** station (4230m)
678-2	MSS_51	3°30'N	23°W	06.06. 8:20-9:00	**Microstructure**
679-1	CTD_66	4°00'N	23°W	06.06. 11:40-14:10	**CTD/LADCP station** (4050m)
679-2	MSS_52	4°00'N	23°W	06.06. 15:20-16:00	**Microstructure**
680-1	CTD_67	4°30'N	23°W	06.06. 18:30-21:00	**CTD/LADCP station** (3950m)
680-2	MSS_53	4°30'N	23°W	06.06. 21:10-22:00	**Microstructure**
681-1	CTD_68	5°00'N	23°W	07.06. 0:30-3:10	**CTD/LADCP station** (4040m)
681-2	MSS_54	5°00'N	23°W	07.06. 3:20-3:50	**Microstructure**
682-1	LS_16	3°17'N	23°W	07.06. 12:30-13:20	**Light profiler**
682-2	CTD_69	3°17'N	23°W	07.06. 13:20-13:40	**CTD** station (200m)
683-1	MSS_55	2°00'N	23°W	07.06. 20:30-	**Microstructure**

				21:20	
684-1	CTD_70	0°00’N	23°W	08.06. 7:20-7:50	**CTD** station (500m)
684-2	MSS_56	0°00’N	23°W	08.06. 8:00-8:40	**Microstructure**
		0°00’N	23°W	08.06. 9:00-12:00	Meeting with **N/O Le Suroit**
684-3	LS_17	0°00’N	23°W	08.06. 12:10-13:20	**Light profiler**
685-1	CTD_71	0°20’S	21°W	08.06. 23:20-23:50	**CTD** station (500m)
685-2	MSS_57	0°20’S	21°W	08.06. 23:50-0:30	**Microstructure**
686-1	CTD_72	0°40’S	19°W	09.06. 10:40-11:00	**CTD** station (500m)
686-2	MSS_58	0°40’S	19°W	09.06. 11:00-11:30	**Microstructure**
686-3	LS_18	0°40’S	19°W	09.06. 11:40-12:30	**Light profiler**
687-1	ifm07	0°50’S	18°W	09.06. 18:00-18:20	**Glider** recovery (reduced glider speed due to biofouling)
687-2	CTD_73	0°50’S	18°W	09.06. 18:20-18:50	**CTD** station (500m)
687-3	MSS_59	0°50’S	18°W	09.06. 18:50-	**Microstructure**
688-1	MSS_60	0°48’S	17°40’W	09.06. 21:20-21:50	**Microstructure**
689-1	CTD_74	0°46’S	17°20’W	09.06. 23:40-0:10	**CTD** station (500m)
689-2	MSS_61	0°46’S	17°20’W	10.06. 0:20-0:50	**Microstructure**
690-1	MSS_62	0°44’S	17°W	10.06. 2:30-3:00	**Microstructure**
691-1	CTD_75	0°42’S	16°40’W	10.06. 4:50-5:20	**CTD** station (500m)
691-2	MSS_63	0°42’S	16°40’W	10.06. 5:20-5:50	**Microstructure**
692-1	MSS_64	0°40’S	16°20’W	10.06. 7:40-8:10	**Microstructure**
693-1	CTD_76	0°37’S	16°W	10.06. 10:10-10:40	**CTD** station (500m)
693-2	MSS_65	0°37’S	16°W	10.06. 10:40-12:10	**Microstructure**
694-1	MSS_66	0°35’S	15°40’W	10.06. 13:20-13:50	**Microstructure**
695-1	CTD_77	0°33’S	15°20’W	10.06. 15:50-16:20	**CTD** station (500m)
695-2	MSS_67	0°33’S	15°20’W	10.06. 16:30-17:00	**Microstructure**
696-1	MSS_68	0°31’S	15°W	10.06. 18:50-19:30	**Microstructure**
697-1	CTD_78	0°29’S	14°40’W	10.06. 21:20-21:50	**CTD** station (500m)
697-2	MSS_69	0°29’S	14°40’W	10.06. 22:00-22:10	**Microstructure**
698-1	MSS_70	0°27’S	14°20’W	11.06. 0:10-	**Microstructure**

				0:40	
699-1	CTD_79	0°25'S	14°W	11.06. 2:30-3:00	**CTD** station (500m)
699-2	MSS_71	0°25'S	14°W	11.06. 3:00-3:50	**Microstructure**
700-1	MSS_72	0°23'S	13°40'W	11.06. 5:20-5:50	**Microstructure**
701-1	CTD_80	0°21'S	13°20'W	11.06. 7:40-8:00	**CTD** station (500m)
701-2	MSS_73	0°21'S	13°20'W	11.06. 8:10-8:30	**Microstructure**
702-1	MSS_74	0°19'S	13°W	11.06. 10:30-11:00	**Microstructure**
703-1	LS_19	0°18'S	12°50'W	11.06. 12:10-12:50	**Light profiler**
704-1	CTD_81	0°17'S	12°40'W	11.06. 14:00-14:30	**CTD** station (500m)
704-2	MSS_75	0°17'S	12°40'W	11.06. 14:30-15:10	**Microstructure**
705-1	MSS_76	0°15'S	12°20'W	11.06. 17:00-17:30	**Microstructure**
706-1	CTD_82	0°12'S	12°00'W	11.06. 19:20-19:50	**CTD** station (500m)
706-2	MSS_77	0°12'S	12°00'W	11.06. 19:50-20:20	**Microstructure**
707-1	MSS_78	0°10'S	11°40'W	11.06. 22:10-22:40	**Microstructure**
708-1	CTD_83	0°08'S	11°20'W	12.06. 0:30-1:00	**CTD** station (500m)
708-2	MSS_79	0°08'S	11°20'W	12.06. 1:00-1:40	**Microstructure**
709-1	MSS_80	0°06'S	11°00'W	12.06. 3:20-3:50	**Microstructure**
710-1	CTD_84	0°04'S	10°40'W	12.06. 5:40-6:10	**CTD** station (500m)
710-2	MSS_81	0°04'S	10°40'W	12.06. 6:10-6:40	**Microstructure**
711-1	MSS_82	0°02'S	10°20'W	12.06. 8:30-9:00	**Microstructure**
712-1	ifm07, ifm08	0°N	10°W	12.06. 10:30-11:20	**Glider** deployment
713-1,2	MSS_83	0°N	10°W	12.06. 11:40-12:20	**Microstructure**
713-3	LS_20	0°N	10°W	12.06. 12:30-13:20	**Light profiler**
714-1	ifm02	0°00'S	9°50'W	12.06. 14:40-15:10	**Glider** recovery
715-1	CTD_85	0°00'S	9°53'W	12.06. 16:40-19:10	**CTD/LADCP** station (3500m), instrument calibration
716-1	CTD_86	1°00'N	10°00'W	13.06. 0:10-3:10	**CTD/LADCP** station (4500m)
713-1	ifm02	0°03'N	9°53'W	13.06. 10:20-11:00	**Glider** deployment
713-2	CTD_87	0°03'N	9°53'W	13.06. 11:20-14:10	**CTD/LADCP** station (5000m)

		16°53.0‘N	25°00.0‘W	18.06. 8:00-10:00	**Port of Mindelo**
720-1	CTD_88	17°31.9’N	24°14.0’W	18.06. 14:10-14:40	**CTD** station (100m)
720-2	KPO_1060	17°36.40’N	24°14.98’W	18.06. 15:40-20:10	Drift test, **mooring** deployment
720-3	CTD_89	17°36.2’N	24°15.6’W	18.06. 20:40-22:50	**CTD/LADCP** station (3600m or 150m above bottom)
720-4	MSS_84	17°36.2’N	24°15.6’W	18.06. 23:30-0:50	**Microstructure**

7.2 Moorings

Mooring Recoveries:

Mooring Deployment Cape Verde V440-03					**Notes:** **KPO_1041**
Vessel:	Meteor				
Deployed:	27-Oct	2009	15:31		
Vessel:	Merian				
Recovered:	11-May	2011	14:40		
Latitude:	17	36.400	N		
Longitude:	24	14.980	W		
Water depth:	3603	Mag Var:	-10.6		
ID	**Depth**	**Instr. type**	**s/n**		**Remarks**
KPO_1041_01	21	Microcat	922		dead battery, ends 08/2010
KPO_1041_02	30	Microcat	925		complete, numerous write errors
KPO_1041_03	40	Microcat	381		bad conductivity cell
KPO_1041_04	54	O2 Logger	206		complete & clean record
KPO_1041_05	54	Microcat	1316		complete, numerous write errors
KPO_1041_06	69	Microcat /p	3414		complete, numerous write errors
KPO_1041_07	89	Microcat	1317		complete, numerous write errors
KPO_1041_08	119	ADCP WH up	2140		complete & clean record
	119	Watchdog	12618		xxx
KPO_1041_09	181	SAMI	36		flooded, no data
KPO_1041_10	182	O2 Logger	219		complete & clean record
KPO_1041_11	182	Microcat	1288		complete, numerous write errors
KPO_1041_12	299	Microcat /p	2271		complete & clean record
KPO_1041_13	399	Microcat	940		complete, numerous write errors
KPO_1041_14	598	RCM-8	11441		complete & clean record
KPO_1041_15	600	Microcat /p	2488		complete & clean record
KPO_1041_16	850	Microcat	1322		complete, numerous write errors
KPO_1041_17	1075	Microcat	952		complete, numerous write errors
KPO_1041_18	1300	Sediment Trap	910004		(data not read yet)
KPO_1041_19	1330	RCM-8	11621		complete & clean record
KPO_1041_20	1500	Microcat /p	3754		complete, numerous write errors
KPO_1041_21	1751	Microcat	938		complete, numerous write errors
KPO_1041_22	1752	Mini-TD	39		complete & clean record
KPO_1041_23	2000	Microcat	942		complete, numerous write errors
KPO_1041_24	2001	Mini-TD	23		complete & clean record
KPO_1041_25	2700	Microcat	941		complete, numerous write errors
KPO_1041_26	2701	Mini-TD	47		complete & clean record
KPO_1041_27	3449	Sediment Trap	910014		(who knows?)
KPO_1041_28	3483	RCM-8	9831		speed failed after Dec 2009
KPO_1041_29	3485	Microcat /p	2717		pressure sensor defective
	3568	Release	190	Code:	
	3568	Release	633	Code:	

Mooring Deployment Equatorial Atlantic 23W 2S						**Notes:** **KPO_1042**
Vessel:	Meteor					
Deployed:	11-Nov	2009		17:29		
Vessel:	Merian					
Recovered:	1-Jun	2011		7:52		
Latitude:	2	0.035	S			
Longitude:	22	59.975	W			
Water depth:	5220	Mag Var:		-17.0		
ID	**Depth**	**Instr. type**		**s/n**	**Startup**	
		Argos		7373		worked OK
KPO_1042_01	293	ADCP NB up		267		complete & clean record
KPO_1042_02	293	MiniTD		63		complete & clean record
KPO_1042_03	389	Argonaut		182		complete & clean record
KPO_1042_04	543	RCM-8		10501		complete & clean record
KPO_1042_05	698	RCM-8		10664		complete & clean record
KPO_1042_06	854	Argonaut		329		complete & clean record
KPO_1042_07	1485	M-CTD MMP		11617		failed after 1 month
	4122	Release		52	Code:	
	4122	Release		221	Code:	

Mooring Deployment Equatorial Atlantic 23W 0:45S						**Notes:** **KPO_1043**
Vessel:	Meteor					
Deployed:	12-Nov	2009		11:33		
Vessel:	Merian					
Recovered:	2-Jun	2011		8:44		
Latitude:	0	44.954	S			
Longitude:	22	59.743	W			
Water depth:	3685	Mag Var:		-16.1		
ID	**Depth**	**Instr. type**		**s/n**	**Startup**	
		Argos		5361		no signal received
KPO_1043_01	545	ADCP LR up		12538		complete & clean record
KPO_1043_02	690	RCM-8		9818	**x**	clean record, 35 day speed gap
KPO_1043_03	845	Argonaut		299	**x**	complete & clean record
KPO_1043_04	1496	M-CTD MMP		106		complete & clean record !!!
	3548	Release		821	Code:	
	3548	Release		110	Code:	

Mooring Deployment Equatorial Atlantic 23W 0:00N						**Notes:** **KPO_1044**
Vessel:	Meteor					
Deployed:	5-Nov	2009		18:44		Top part retrieved on 13-Nov-09
Vessel:	Merian					
Recovered:	2-Jun	2011		14:00		
Latitude:	0	0.200	N			
Longitude:	23	6.800	W			
Water depth:	3935	Mag Var:		-16.1		
ID	**Depth**	**Instr. type**		**s/n**	**Startup**	
		Argos		7372		
KPO_1044_01	~~15~~	~~ADCP 1200 dn~~		~~7279~~		clean, full record
KPO_1044_02	~~15~~	~~MiniTD~~		~~57~~		clean, full record
KPO_1044_03	~~15~~	~~MiniTD~~		~~70~~		clean, full record
KPO_1044_04	~~25~~	~~RDI DVS~~		~~11028~~		clean, full record
KPO_1044_05	213	ADCP up		8237		complete & clean record

KPO_1044_06	213	MiniTD	61		complete & clean record
KPO_1044_07	218	ADCP LR dn	2627		complete & clean record
KPO_1044_08	300	O2 Logger	135		complete & clean record
KPO_1044_09	300	Microcat	52		complete & clean record
KPO_1044_10	506	O2 Logger	1143		complete & clean record
KPO_1044_11	506	Microcat	958		complete & clean record
KPO_1044_12	759	RCM-8	10810		complete & clean record
KPO_1044_13	843	Argonaut	188		complete & clean record
KPO_1044_14	928	RCM-8	10075		speed problems after May 2010
KPO_1044_15	980	RCM-8	11618		major speed problems
KPO_1044_16	1489	M-CTD MMP	114		complete & clean record
	3614	Release	271	Code:	
	3614	Release	122	Code:	

Mooring Deployment Equatorial Atlantic 23W 0:45N					**Notes:** **KPO_1045**
Vessel:	Meteor				
Deployed:	3-Nov	2009	18:29		
Vessel:	Merian				
Recovered:	4-Jun	2011	9:04		
Latitude:	0	45.129 N			
Longitude:	22	59.301 W			
Water depth:	4310	Mag Var:	-15.5		
ID	**Depth**	**Instr. type**	**s/n**	**Startup**	
		Argos	5367		worked?
KPO_1045_01	553	ADCP LR up	2330		complete & clean record
KPO_1045_02	698	RCM-8	10077		speed dropouts
KPO_1045_03	844	Argonaut	183		some noise near the end?
KPO_1045_04	1485	M-CTD MMP	110		Instrument lost during recovery
	4012	Release	861 # 107	Code:	
	4012	Release	661 # 350	Code:	

Mooring Deployment Equatorial Atlantic 23W 2N					**Notes:** **KPO_1046**
Vessel:	Meteor				
Deployed:	2-Nov	2009	12:42		
Vessel:	Merian				
Recovered:	5-Jun	2011	11:51		
Latitude:	2	2.430 N			
Longitude:	23	1.930 W			
Water depth:	4373	Mag Var:	-15.0		
ID	**Depth**	**Instr. type**	**s/n**	**Startup**	
		Argos	5481		
KPO_1046_01	296	MiniTD	52		complete & clean record
KPO_1046_02	296	ADCP NB up	589		complete & clean record
KPO_1046_03	300	O2 Logger	1140		complete & clean record
KPO_1046_04	300	Microcat	6863		temperature sensor bad
KPO_1046_05	394	Argonaut	145		complete & clean record
KPO_1046_06	496	O2 Logger	1141		complete & clean record
KPO_1046_07	496	Microcat	1318		short in battery package???
KPO_1046_08	549	RCM-8	10550		complete & clean record
KPO_1046_09	704	RCM-8	2317		some speed dropouts
KPO_1046_10	860	Argonaut	184		complete & clean record
KPO_1046_11	1481	M-CTD MMP	116		complete & clean record
	4062	Release	235	Code:	
	4062	Release	54	Code:	

Mooring Deployment Equatorial Atlantic 23W 5N					**Notes:**	**KPO_1047**
Vessel:	Meteor					
Deployed:	31-Oct	2009				
Vessel:	Merian					
Recovered:	15-May	2011	9:00			
Latitude:	5	0.900 N				
Longitude:	23	0.000 W				
Water depth:	4210	Mag Var:	-14.1			
ID	**Depth**	**Instr. type**	**s/n**	**Startup**		
		Argos	2267			
KPO_1047_01	97	MiniTD	29		complete, pressure drift	
KPO_1047_02	99	O2 Logger	1138		complete & clean record	
KPO_1047_03	99	Microcat	6859		complete & clean record	
KPO_1047_04	200	O2 Logger	1160		complete & clean record	
KPO_1047_05	200	Microcat	1323		complete & clean record	
KPO_1047_06	296	O2 Logger	1136		complete & clean record	
KPO_1047_07	296	Microcat	6860		complete & clean record	
KPO_1047_08	398	O2 Logger	1071		complete & clean record	
KPO_1047_09	396	Microcat	936		complete & clean record	
KPO_1047_10	500	O2 Logger	1142		complete & clean record	
KPO_1047_11	500	Microcat	6861		complete, pressure drift	
KPO_1047_12	595	O2 Logger	1144		complete & clean record	
KPO_1047_13	595	Microcat	1321		complete & clean record	
KPO_1047_14	697	O2 Logger	1132		complete & clean record	
KPO_1047_15	697	Microcat	6862		complete, pressure drift	
KPO_1047_16	799	ADCP LR up	2395		complete & clean record	
KPO_1047_17	801	O2 Logger	1070		complete & clean record	
KPO_1047_18	801	Microcat	946		no data	
	4210	Release	460	Code:		
	4210	Release	270	Code:		

Mooring Deployment Equatorial Atlantic 23W 8N					**Notes:**	**KPO_1048**
Vessel:	Meteor					
Deployed:	18-Nov	2009	13:47			
Vessel:	Merian					
Recovered:	14-May	2011	7:01			
Latitude:	8	1.065 N				
Longitude:	22	58.990 W				
Water depth:	4485	Mag Var:	-12.7			
ID	**Depth**	**Instr. type**	**s/n**	**Startup**		
		Argos	2255		OK	
KPO_1048_01	101	MiniTD	64		complete & clean record	
KPO_1048_02	102	O2 Logger	145		complete & clean record	
KPO_1048_03	102	Microcat /p	6856		complete & clean record	
KPO_1048_04	204	O2 Logger	144		complete & clean record	
KPO_1048_05	204	Microcat /p	6854		complete & clean record	
KPO_1048_06	299	O2 Logger	1135		complete & clean record	
KPO_1048_07	299	Microcat /p	6855		complete & clean record	
KPO_1048_08	401	O2 Logger	1074		complete & clean record	
KPO_1048_09	401	Microcat	3196		complete & clean record	
KPO_1048_10	503	O2 Logger	1073		complete & clean record	
KPO_1048_11	503	Microcat /p	6858		complete, pressure drift	
KPO_1048_12	599	O2 Logger	1134		complete & clean record	
KPO_1048_13	599	Microcat	1682		no data	

KPO_1048_14	701	O2 Logger	1133		complete & clean record
KPO_1048_15	701	Microcat	6857		bad conductivity cell
KPO_1048_16	803	ADCP LR up	12530		short, failed after ???
KPO_1048_17	805	O2 Logger	1139		complete & clean record
KPO_1048_18	805	Microcat	2247		complete & clean record
	3387	Release	95	Code:	
	3387	Release	121	Code:	

Mooring Deployments:

Mooring Deployment Cape Verde V440-04						**Notes:**	**KPO_1060**
Vessel:	Merian						
Deployed:	18-Jun		2011	21:13			
Vessel:							
Recovered:							
Latitude:			17	36.400	N		
Longitude:			24	14.980	W		
Water depth:			3603	Mag Var:	-10.3		
ID	**Depth**	**Instr. type**		**s/n**	**Start-up**	**Remarks**	
		Watchdog		5510			
KPO_1060_01	19	Microcat		949	x		
KPO_1060_02	27	Microcat		954	x		
KPO_1060_03	37	Microcat		961	x		
KPO_1060_04	53	O2 Logger		937	x		
KPO_1060_05	53	Microcat		278	x		
KPO_1060_06	53	Fluorometer		1833	x		
KPO_1060_07	67	Microcat		910	x		
KPO_1060_08	87	SAMI		25	x		
KPO_1060_09	89	Microcat		934	x		
KPO_1060_10	119	ADCP WH 300 up		1972	x		
KPO_1060_11	181	SAMI		37	x		
KPO_1060_12	181	O2 Logger		946	x		
KPO_1060_13	182	Microcat /p		2488	x		
KPO_1060_14	299	Microcat		921	x		
KPO_1060_15	399	Microcat		929	x		
KPO_1060_16	598	RCM-8 Temp LR + p		10501	x		
KPO_1060_17	600	Microcat /p		2263	x		
KPO_1060_18	849	Microcat		780	x		
KPO_1060_19	1075	Microcat		55	x		
KPO_1060_20	1300	Sediment Trap		89008	**ready**		
KPO_1060_21	1330	RCM-8 Temp LR		9726	x		
KPO_1060_22	1500	Microcat /p		2712	x		
KPO_1060_23	1750	Microcat		937	x		
KPO_1060_24	1751	Mini-TD		48	x		
KPO_1060_25	2000	Microcat		939	x		
KPO_1060_26	2001	Mini-TD		58	x		
KPO_1060_27	2700	Microcat		935	x		
KPO_1060_28	2701	Mini-TD		67	x		
KPO_1060_29	3449	Sediment Trap		910015	**ready**		
KPO_1060_30	3483	RCM-8 Temp AR + p		11442	x		
KPO_1060_31	3485	Microcat		933	x		
KPO_1060_32	3486	Mini-TD		69	x		
	3568	Release AR861		1256	Code:		
	3568	Release AR661		235	Code:		

Mooring Deployment Equatorial Atlantic 23W 8N						**Notes:**	**KPO_1061**
Vessel:	Merian						
Deployed:	14-May	2011					
Vessel:							
Recovered:							
Latitude:	8	1.010	N				
Longitude:	22	58.970	W				
Water depth:	4485	Mag Var:		-12.4			
ID	**Depth**	**Instr. type**		**s/n**	**Startup**		
		Argos		2255	turned around		
KPO_1061_01	101	MiniTD		56	x		
KPO_1061_02	102	O2 Logger		1072	x		
KPO_1061_03	102	Microcat /p		6854	x		
KPO_1061_04	204	O2 Logger		375	x		
KPO_1061_05	204	Microcat /p		6858	x		
KPO_1061_06	299	O2 Logger		216	x		
KPO_1061_07	299	Microcat /p		6856	x		
KPO_1061_08	401	O2 Logger		214	x		
KPO_1061_09	401	Microcat		1583	x		
KPO_1061_10	503	O2 Logger		379	x		
KPO_1061_11	503	Microcat		2247	x		
KPO_1061_12	599	O2 Logger		1069	x		
KPO_1061_13	599	Microcat		1287	x		
KPO_1061_14	701	O2 Logger		219	x		
KPO_1061_15	701	Microcat /p		6855	x		
KPO_1061_16	803	ADCP LR up		3173	x		
KPO_1061_17	805	O2 Logger		206	x		
KPO_1061_18	805	Microcat		1319	x		
	3847	Release AR861		1255	Code:		
	3847	Release AR661		190	Code:		

Mooring Deployment Equatorial Atlantic 23W 5N						**Notes:**	**KPO_1062**
Vessel:	Merian						
Deployed:	15-May	2011					
Vessel:							
Recovered:							
Latitude:	5	0.900	N				
Longitude:	23	0.000	W				
Water depth:	4210	Mag Var:		-13.5			
ID	**Depth**	**Instr. type**		**s/n**	**Startup**		
		Argos		2267			
KPO_1062_01	97	MiniTD		66	x		
KPO_1062_02	99	O2 Logger		1074	x		
KPO_1062_03	99	Microcat /p		6859	x		
KPO_1062_04	200	O2 Logger		217	x		
KPO_1062_05	200	Microcat		1281	x		
KPO_1062_06	296	O2 Logger		148	x		
KPO_1062_07	296	Microcat /p		6860	x		
KPO_1062_08	398	O2 Logger		147	x		
KPO_1062_09	396	Microcat		2614	x		
KPO_1062_10	500	O2 Logger		215	x		
KPO_1062_11	500	Microcat /p		6861	x		
KPO_1062_12	595	O2 Logger		1135	x		

KPO_1062_13	595	Microcat	1282	**x**	
KPO_1062_14	697	O2 Logger	1073	**x**	
KPO_1062_15	697	Microcat /p	6862	**x**	
KPO_1062_16	799	ADCP LR up	2290	**x**	
KPO_1062_17	801	O2 Logger	1134	**x**	
KPO_1062_18	801	Microcat	3196	**x**	
	4210	Release AR661	460	Code:	
	4210	Release AR661	822	Code:	

Mooring Deployment Equatorial Atlantic 23W 0:00N						**Notes:**	**KPO_1063**
Vessel:	Merian						
Deployed:	3-Jun	2011		14:28			
Vessel:							
Recovered:							
Latitude:	0	0.160	N				
Longitude:	23	6.780	W				
Water depth:	3930	Mag Var:		-15.6			
ID	**Depth**	**Instr. type**		**s/n**	**Startup**		
		Argos		7372			
KPO_1063_01	209	ADCP up		8237	**x**		
KPO_1063_02	209	MiniTD		57	**x**		
KPO_1063_03	215	ADCP LR dn		1181	**x**		
KPO_1063_04	297	O2 Logger		145	**x**		
KPO_1063_05	297	Microcat		1316	**x**		
KPO_1063_06	503	O2 Logger		1139	**x**		
KPO_1063_07	503	Microcat		1288	**x**		
KPO_1063_08	756	RCM-8		11348	**x**		
KPO_1063_09	840	Argonaut		187	**x**		
KPO_1063_10	926	RCM-8		9833	**x**		
KPO_1063_11	983	RCM-8		8349	**x**		
KPO_1063_12	1000	M-CTD MMP		12201	**x**		
	3674	Release AR861		110	**x**	Code:	
	3674	Release RT661		108	**x**	Code:	

7.3 CTD Station list

Stat.	Date	Time	Latitude	Longitude	Depth	max. p [db]	Btls	samples
2	2011/05/11	21:54	17 29.37N	24 19.54W	3569	1008	6	2 3 6
3	2011/05/12	00:58	17 29.95N	24 19.18W	3573	3629	21	2 3 6
4	2011/05/13	08:45	11 29.77N	22 59.97W	4410	1008	14	2 3 6
5	2011/05/14	12:06	8 01.00N	22 59.02W	4863	1008	13	2 3 6
6	2011/05/15	14:17	5 01.60N	22 59.35W	4200	1008	13	2 3 6
7	2011/05/16	15:17	1 59.47N	23 00.06W	4310	1006	21	1 2 3 5 6
8	2011/05/17	05:15	0 00.03S	21 30.07W	NaN	1310	24	1 2 3 4 6
9	2011/05/17	12:25	0 00.01S	20 49.38W	NaN	101	8	1 4 5
10	2011/05/17	17:41	0 00.03N	19 59.98W	2577	1007	21	1 2 3 4 6
11	2011/05/18	04:26	0 00.00S	18 30.04W	3690	1007	24	1 2 3 4 6
12	2011/05/18	12:31	0 00.10S	17 52.96W	NaN	1008	21	1 3 4 5 6
13	2011/05/21	00:10	0 00.46N	17 00.10W	NaN	1008	21	1 2 3 4 6
14	2011/05/21	10:42	0 00.58N	15 30.13W	NaN	1006	21	1 2 3 4 5 6
15	2011/05/21	21:03	0 00.28N	14 00.19W	3765	1008	21	1 2 3 4 6
16	2011/05/22	05:57	0 00.04N	12 30.03W	NaN	1008	24	1 2 3 4 6
17	2011/05/22	14:49	0 00.01N	11 00.04W	3993	1008	21	1 2 3 4 6
18	2011/05/22	23:02	0 00.09N	10 00.09W	4749	4664	21	1 2 3 4 6
19	2011/05/23	04:30	0 20.02N	10 00.03W	4673	4632	24	1 2 6
20	2011/05/23	10:04	0 40.03N	9 59.96W	4580	4503	21	1 5 6
21	2011/05/23	17:15	1 00.46N	10 00.79W	4675	167	0	
22	2011/05/23	18:00	1 01.12N	10 01.59W	4594	4520	21	1 2 3 4 6
23	2011/05/23	23:58	1 30.07N	10 00.04W	5223	5085	21	1 2 3 4 6
24	2011/05/24	15:00	0 00.00S	9 54.98W	5196	5085	16	1 6
25	2011/05/25	01:29	0 20.01S	10 00.03W	4051	3957	21	1 6
26	2011/05/25	06:52	0 40.00S	9 59.98W	4015	3957	21	1 5 6
27	2011/05/25	13:25	1 00.34S	10 00.25W	4266	4163	21	1 2 4 6
28	2011/05/25	19:14	1 30.00S	10 00.01W	4785	4693	21	1 2 4 6
29	2011/05/26	09:46	0 01.11N	9 55.05W	5189	5075	21	1 5 6
30	2011/05/27	01:41	1 59.98S	11 00.04W	3849	1009	21	1 2 3 4 6
31	2011/05/27	10:24	1 59.98S	12 30.03W	3680	1007	21	1 2 3 4 5 6
32	2011/05/27	17:59	2 00.01S	13 30.57W	NaN	1007	21	1 2 3 4 6
33	2011/05/28	04:34	2 00.01S	15 30.00W	3761	1010	21	1 2 3 4 6
34	2011/05/28	14:21	2 00.09S	17 00.07W	4498	1007	21	1 2 3 4 5 6
35	2011/05/28	22:53	1 59.96S	18 30.00W	NaN	1011	21	1 2 3 4 6
36	2011/05/29	07:25	1 59.95S	20 00.37W	4467	1008	21	1 2 3 4 6
37	2011/05/29	16:09	1 59.98S	21 30.03W	4349	1007	21	1 2 3 4 6
38	2011/05/30	10:27	5 00.04S	23 00.04W	5180	5078	21	1 2 3 4 5 6
39	2011/05/30	17:04	4 30.00S	23 00.01W	5160	5089	16	1 2 6
40	2011/05/30	23:58	4 00.03S	23 00.04W	5843	5084	21	2 3 4 6
41	2011/05/31	06:46	3 30.03S	23 00.03W	5439	5082	21	1 2 6
42	2011/05/31	14:24	3 00.10S	23 00.64W	5517	5083	21	1 2 3 4 5 6
43	2011/05/31	20:59	2 30.00S	22 59.98W	5755	5077	21	1 6
44	2011/06/01	03:24	2 01.47S	22 59.95W	5228	5085	21	1 2 3 4 6
45	2011/06/01	14:39	1 40.27S	22 59.47W	4959	4878	21	1 2 5 6
46	2011/06/01	19:35	1 19.99S	22 59.98W	4827	4754	21	1 2 6
51	2011/06/02	04:34	0 59.65S	22 58.60W	4032	3956	21	1 2 3 4 6
54	2011/06/03	00:37	0 39.74S	22 59.07W	3565	3448	18	1 2 6

Stat.	Date	Time	Latitude	Longitude	Depth	max. p [db]	Btls	samples
55	2011/06/03	05:04	0 19.99S	23 00.03W	4609	4520	21	1 2 6
56	2011/06/03	18:38	0 00.28S	22 59.49W	3940	3835	21	1 2 3 4 5 6
57	2011/06/03	23:00	0 20.07N	22 59.98W	3907	3805	21	1 2 6
58	2011/06/04	04:07	0 39.99N	23 00.04W	3890	3784	21	1 2 6
59	2011/06/04	15:18	1 00.01N	23 00.76W	3210	3088	20	1 2 3 4 5 6
60	2011/06/04	20:16	1 20.02N	23 00.04W	4700	4615	7	2 6
61	2011/06/05	02:00	1 39.99N	23 00.03W	4112	4021	21	1 2 6
62	2011/06/05	07:58	2 00.03N	23 00.00W	4322	4234	19	1 2 3 4 5 6
63	2011/06/05	17:56	2 30.04N	22 59.98W	4701	4626	21	1 2 6
64	2011/06/05	23:57	3 00.03N	23 00.04W	4634	4561	22	1 2 3 4 6
65	2011/06/06	06:35	3 30.01N	23 00.01W	4375	4292	21	1 2 6
66	2011/06/06	12:36	4 00.16N	23 00.07W	4205	4110	20	1 2 3 4 5 6
67	2011/06/06	19:30	4 29.98N	23 00.00W	4104	4007	21	1 2 6
68	2011/06/07	01:32	4 58.56N	23 00.01W	4190	4099	21	1 2 3 4 6
69	2011/06/07	14:24	3 17.01N	23 01.90W	NaN	108	21	1 5
70	2011/06/08	08:21	0 00.04N	23 00.00W	3948	504	21	1 2 3 5 6
71	2011/06/09	00:16	0 19.96S	20 59.95W	NaN	503	21	1 2 3 5 6
72	2011/06/09	11:34	0 39.97S	19 00.00W	NaN	505	21	1 2 3 5 6
73	2011/06/09	19:19	0 49.78S	17 59.01W	NaN	504	21	1 2 3 6
74	2011/06/10	00:45	0 46.03S	17 19.99W	NaN	504	21	1 2 3 6
75	2011/06/10	05:47	0 42.01S	16 40.02W	NaN	504	21	1 2 3 5 6
76	2011/06/10	11:08	0 37.08S	16 00.06W	NaN	506	21	1 2 3 6
77	2011/06/10	16:47	0 33.10S	15 19.90W	NaN	504	21	1 2 3 6
78	2011/06/10	22:21	0 29.05S	14 39.99W	NaN	503	21	1 2 3 6
79	2011/06/11	03:29	0 25.00S	14 00.01W	NaN	503	21	1 2 3 6
80	2011/06/11	08:38	0 21.03S	13 19.96W	NaN	504	21	1 2 3 6
81	2011/06/11	14:54	0 17.01S	12 40.00W	NaN	503	21	1 2 3 5 6
82	2011/06/11	20:21	0 12.00S	11 59.95W	NaN	504	21	1 2 3 6
83	2011/06/12	01:29	0 08.01S	11 20.01W	NaN	504	21	1 2 3 6
84	2011/06/12	06:35	0 04.01S	10 39.94W	NaN	604	21	1 2 3 6
85	2011/06/12	17:38	0 00.01N	9 52.99W	5190	3538	5	1 2 5 6
86	2011/06/13	01:10	1 00.00N	10 00.03W	4650	4573	21	1 6
87	2011/06/13	12:25	0 04.06N	9 53.32W	5179	5083	21	1 2 5 6
88	2011/06/18	15:12	17 31.87N	24 19.53W	NaN	121	16	
89	2011/06/18	21:36	17 36.21N	24 15.64W	3586	3499	0	

1 Helium
2 O_2
3 N_2O
4 Nutrient
5 Chlorphyll
6 Salinity

8 Data and Sample Storage and Availability

The data were collected within the Kiel Collaborative Research Centre SFB 754. In Kiel a joint Datamanagement-Team is active, which stores the data from the Kiel SFB 574, the Kiel SFB 754 and the Kiel Excellenzcluster in a webbased multi-user-system. In a first phase the data are only available to the user groups. After a three year proprietary time these data will be made public by distributing them to national and international data archives through the GEOMAR data management team, i.e. the data will be submitted to PANGEA no later than November 13, 2013. When the data sets will be archived in the PANGEA Open Access library digital object identifiers (DOIs) will be assigned.
All meta-data are available here https://portal.geomar.de/metadata/leg/show/307306 . And a kml (Google Maps) link is here https://portal.geomar.de/metadata/leg/kmlexport/307306 .

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