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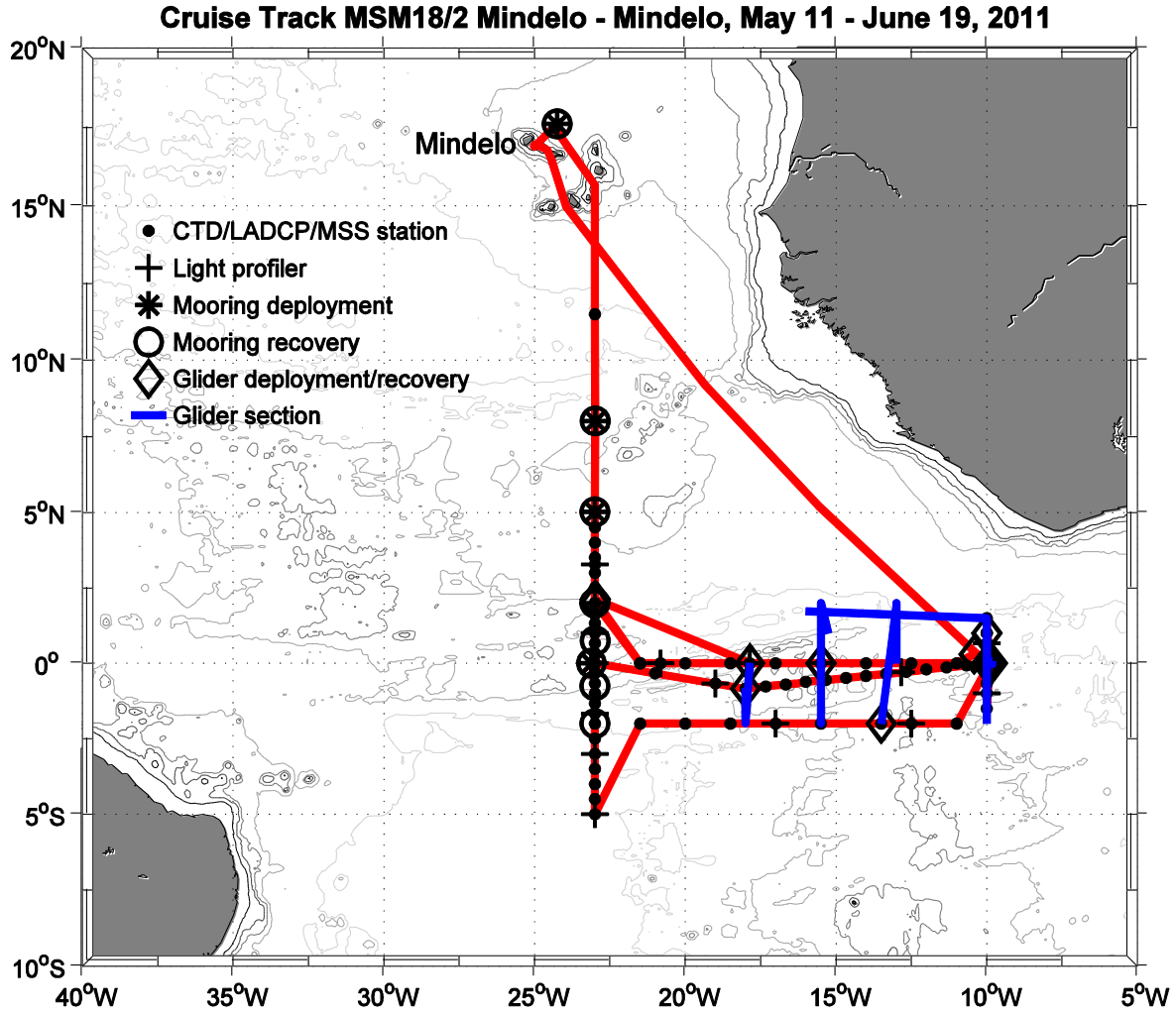
Short Cruise Report
R/V MARIA S. MERIAN MSM18/2 Mindelo - Mindelo
11th May – 19th June 2011
Chief Scientist: Peter Brandt
Captain: Ralf Schmidt



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.

Objectives

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 modelling, predictable and non-predictable elements of the TAV will be identified. The primary research objectives of the observational program are:

- To quantify strength and variability of the zonal currents in the central equatorial Atlantic using moored and shipboard observations;
- To estimate zonal temperature advection supplying equatorial upwelling through the use of moored temperature and velocity measurements from subsurface and PIRATA moorings;
- To estimate the change of heat and freshwater content in the oceanic mixed layer (including changes in the mixed layer depth and variations due to tropical instability waves) during the developing phase of the equatorial cold tongue using shipboard and glider hydrographic repeat measurements;
- To estimate diapycnal fluxes across the base of the mixed layer during cold tongue development using microstructure measurements;
- To estimate the total upwelling flux using helium measurements;
- To observe changes in the chlorophyll concentration and associated light absorption.

Further objectives are the quantification of the sea-air exchange of N_2O in the upwelling region (BMBF joint project SOPRAN), the intermediate and deep circulation in the tropical Atlantic (moored observations in cooperation with WHOI, USA) relevant for the oxygen distribution and variability in the ocean using moored and shipboard current and hydrographic measurements (SFB 754).

Narrative

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_20, 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 SFB754. 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. 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. However, a 45 degree rotation of the 38kHz ADCP in the moon pool reduced the interference only slightly, probably due to a smaller separation distance between both instruments of R/V MARIA S. MERIAN compared to R/V METEOR. Simultaneous use of the ship's Doppler log or the 38kHz SIMRAD as well as the ship's thruster should be avoided as it degrades the velocity 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.

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Participants MSM18/2

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3	Zantopp, Rainer	Moorings, CTD	IFM-GEOMAR
4	Hogue, Brian	Moorings, CTD	WHOI
5	Funk, Andreas, Dr.	CTD, shipboard ADCP	IFM-GEOMAR
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13	Papenburg, Uwe	Moorings, technology	IFM-GEOMAR
14	Pinck, Andreas	Optodes, CTD, microcats	IFM-GEOMAR
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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
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Tab. 1.1: Station list of R/V MARIA S. MERIAN cruise MSM18/2.

Station 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/ 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. 10:30-11:20	**Light profiler**
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. 3:30-6:10	**CTD/LADCP** station (4560m)
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/	1°00’S	10°W	25.05.	**CTD/LADCP** station (4100m)

CTD_27			12:30-14:50	
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. 13:30-16:30	**CTD/LADCP** station (5000m)
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’S	23°W	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/	1°00’S	23°W	02.06. 0:20-	**Microstructure**

MSS_40			0:40	
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. 20:30-21:20	**Microstructure**
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/	0°20'S	21°W	08.06.	**Microstructure**

MSS_57			23:50-0:30	
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. 0:10-0:40	**Microstructure**
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/	0°03’N	9°53’W	13.06.	**CTD/LADCP** station (5000m)

CTD_87			11:20-14:10	
	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**