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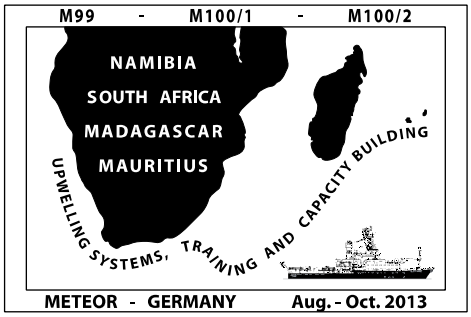
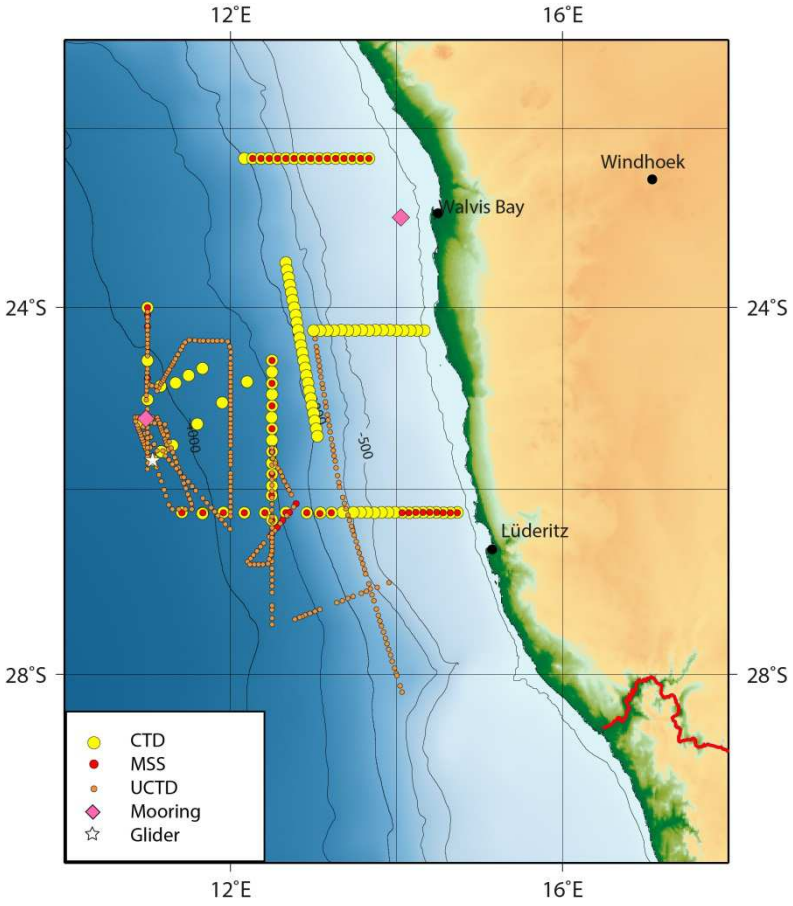


Summary Cruise Report
RV METEOR Cruise M99

Walvis Bay – Lüderitz – Walvis Bay
31. July – 23. August 2013
Chief Scientist: Detlef Quadfasel
Captain: Klaus Bergmann



RV Meteor cruise M99 in the Benguela Upwelling System with locations of moorings, CTD/lADCP and uCTD Casts (black dots) and Microstructure profiles.

Objectives

Instabilities of eastern boundary currents in upwelling regions and associated cold water filaments lead to a significant negative heat transport from the coastal region to the interior ocean. These meso- and submesoscale processes are not adequately resolved in climate models resulting in a strong temperature bias in the eastern parts of the subtropical oceans. During METEOR cruise we studied the occurrence and dynamics of the filaments and ultimately hope quantifying their role in the oceanic heat transport. A second goal was to quantify the outgassing or uptake of trace gases in an upwelling region. The cruise also contributed to the capacity building in Angola, Namibia and South Africa, which is a major part of the BMBF SPACES program.

The strategy for reaching those goals was a combination of fast underway measurements and classical station worked from a stopped vessel. The underway measurements with pumped systems gave continuous measurements of trace gases at 5 m depth in the ocean and 20 m height in the atmosphere, in addition to temperature and salinity of the water. Upper ocean currents were measured with ADCPs and a free-fall CTD covering the upper 300-400 m of the water column. The station work included profiles of hydrographic parameters and water sampling with a CTD-Rosette system and turbulence measurements with a free falling microstructure sonde (MSS).

RV Meteor cruise M99 was carried out jointly by the Institut für Meereskunde at the KlimaCampus of the University of Hamburg, the Institut für Ostseeforschung in Warnemünde and the Max-Planck-Institut für Biogeochemie in Jena. GEOMAR Kiel contributed with a glider to the measurement programme. Six students from the Universities of Hamburg and Rostock and ten from the University of Namibia in Windhoek got their first *in-situ* training.

Narrative

RV METEOR sailed from the port of Walvis Bay at 09:20 a.m on July, 31st, setting course for the centre of the Lüderitz upwelling cell. During the 20 hour transit to the working area instruments were set up and the mooring was prepared. We also discussed and defined projects to be tackled by the students during the cruise.

During the early morning of August 1st we started the first long CTD section along 27° 15'S covering the Namibian Shelf and continental slope to a water depth of 4200 m, some 200 miles offshore. Based on the data collected so far and on information about satellite derived sea surface temperatures we decided to deploy the mooring not on this section but about 60 miles further to the north. On the transit to this new position the underway CTD was run with a profile spacing of less than 3 miles. On Sunday morning we reached the mooring position and the instruments were deployed before lunch. Unfortunately the mooring was too long and the top floats stayed at the sea surface. It had to be picked up again and was then successfully redeployed during the next day. The next 48 hours were spent with a large scale survey of the hydrographic structure using the pumped systems and the uCTD. A high resolution CTD and MMS section across a near surface temperature front planned to be run during the night from Wednesday to Thursday had to be abandoned. Swell and wind waves with both about 4 m height came from different directions and made a save working with the instruments impossible. We therefore sailed towards the coast at 24° 15' S and started the second large CTD section across shelf and continental slope. Again, as during the earlier work in coastal waters, the outgassing of trace gases from the cold upwelling water was well above the levels in the open ocean. During Saturday a coast parallel uCTD section (see figures below) completed the work during the first leg. METEOR arrived in Lüderitz on August 11th at 1 p.m. to exchange the groups of students from the University of Namibia.

After sailing from Lüderitz on Monday, August 12th, at 2 p.m. we continued our filament survey with coast parallel sections. These mainly consisted of underway measurements but be also sampled one of the observed fronts with high resolution CTD and MSS profiles. During a period of bad weather on Wednesday we unfortunately lost one of our

uCTD probes, due to mishandling of the winch. The section was continued with CTD measurements alone. With the weather improving significantly during the night and next day, we decided to recover the Gilder that was deployed about three weeks ago in northern Namibian waters during the previous METEOR cruise M98. This glider, an autonomous undulating vehicle, had travelled more than 200 miles providing hydrographic and turbulence data in the upper 500 m of the water column. We reached the glider position on Friday morning and the instrument was recovered without problems using METEOR's rubber dinghy. The next 48 hours were again spent with small scale surveys of frontal features located at the outer rim of what seemed to be mesoscale eddies or meanders of the upwelling front.

From here we sailed north to run the third large scale CTD and MSS section offshore from Henties Bay. The distribution of water masses observed was similar to that of the second, central section, although the strength of the upwelling was much less than further south. This section was completed on Tuesday morning and METEOR sailed southward to recover a current meter mooring on the shelf that is maintained by our colleagues from Warnemünde. After refurbishing the instruments, this mooring will be redeployed during the next METEOR cruise M100.

The last working day of the cruise was then spent running another coast parallel CTD-section with a station resolution of five miles. The section was completed on Thursday morning and METEOR set sail for its next port Walvis Bay, where we went alongside at 8:06 a.m. on Friday, August 23rd.

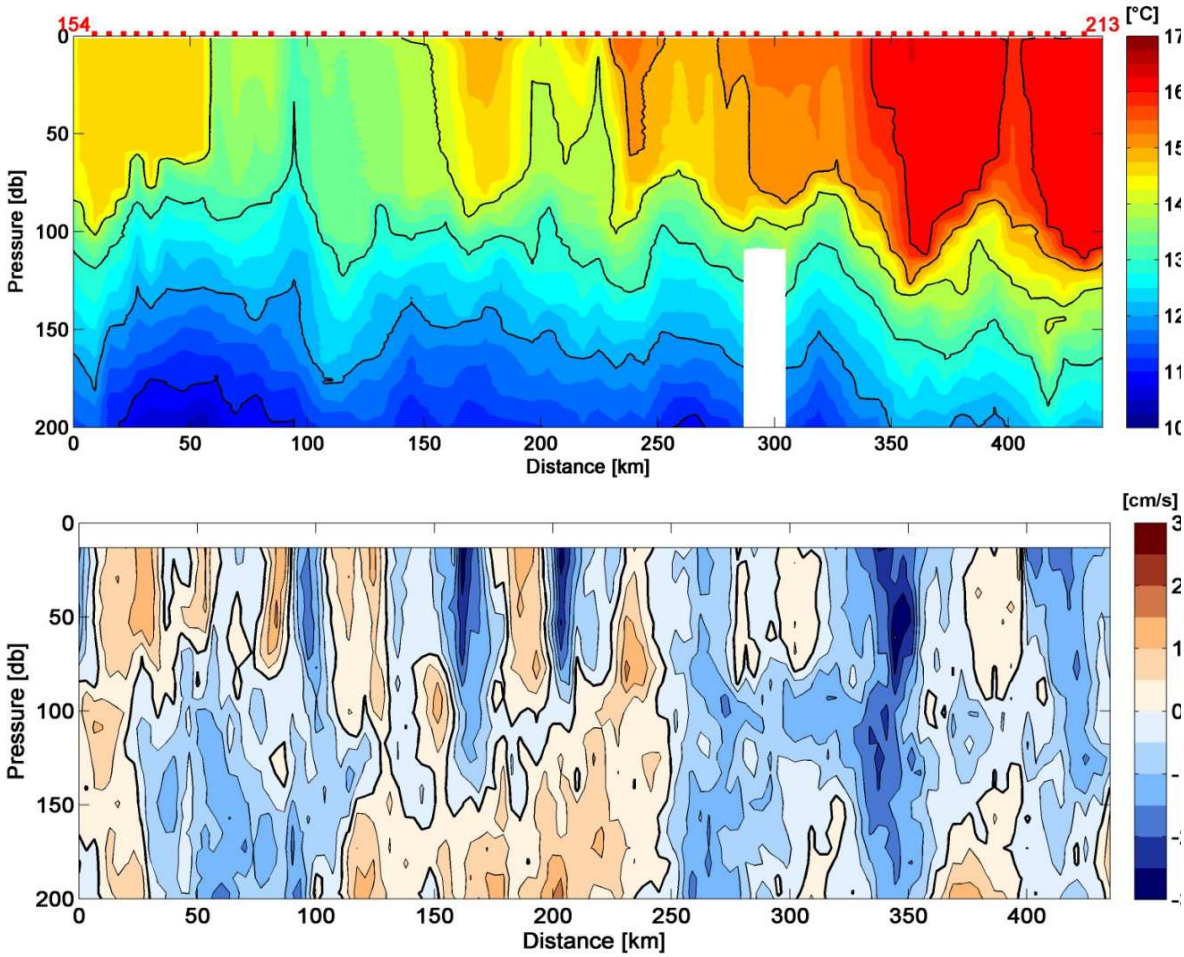
An example for a high resolution UCTD potential temperature and vessel-mounted ADCP section is given below. The section was run at the end of the first leg along the upwelling front roughly following the 1500m isobath from 24°S to 28°S, revealing meso- and submesoscale variability in the upper 200 m of the water column. On the potential temperature section the changes of colder to warmer water and vice versa on mesoscales (30-80 km scale) are easily identified. These scales agree with those of structures seen in satellite products of Sea surface temperatures in the Benguela upwelling system.

In contrast, the westward velocity section illustrates smaller scale dynamics (10-40 km scale), found in the upper 100 m especially in the northern part of the section (from km 0 to km 250). Velocities here alternate between +20 and -30 cm/s, and are therefore much less than values of 100 cm/s reported in the literature. In fact, these moderate current velocities were typical for the whole M99 cruise and in comparison to earlier studies the equatorward geostrophic surface flow of the Benguela Current was weak.

Further analysis is needed to systematically separate the different scales and to identify the specific features, as well as to understand their generation (e.g. local vs. remote forcing, due to local winds or propagating boundary waves).

Teaching and Capacity Building

Altogether ten undergraduate and graduate students of the University of Namibia (Henties Bay Campus) and six students from the Universities of Hamburg and Rostock took part in the expedition. They received an education on modern oceanographic instrumentation including conductivity-temperature-depth (CTD) probes, lowered and ship-borne acoustic Doppler current profilers, underway-CTDs and optical trace gas spectrometers. They fully took part in the scientific watch keeping plan. During their watches they participated in the collection of the data and off-watch they analysed the data using modern tools like MatLab. They participated in the on-board seminars and lectures and presented their research results both orally and by way of a poster.



Potential temperature (top) and westward velocity (bottom) sections along the Namibian upwelling front as measured during cruise M99 in August 2013 (uncalibrated data). Red dots on top of the upper figure mark the location of UCTD profiles; numbers are UCTD profile numbers. ADCP data were averaged to 10 min ensembles.

Acknowledgements

We like to thank Captain Klaus Bergmann, his officers and the crew of RV Meteor for their support of our measurement programme, and their hospitality, in particular towards the participating students. The ship time of RV Meteor was provided by the Deutsche Forschungsgemeinschaft within the core program METEOR/MERIAN. Financial support for the project was provided though the German Ministry of Education and Research (SACUS-SPACES). We also benefited from financial contributions by the research institutes involved.

Cruise participants

Quadfasel, Detlef	Chief Scientist	IfM-Univ. Hamburg
Beier, Sebastian	Microstructure	IOW
Bell, Louisa	student	Univ. Hamburg
Esters, Leonie	CTD watch leader	IfM-Univ. Hamburg
Glockzin, Michael	trace gases	IOW (leg 1 only)
Junker, Tim	Microstructure	IOW
Lenz, Stefan	student	IOW
Leverenz, Franziska	student	Univ. Hamburg
Möller, Judith	student	Univ. Hamburg
Moritz, Martin	CTD watch leader	IfM-Univ. Hamburg
Nunes, Nuno	ADCP	IfM-Univ. Hamburg
Paulsen, Hanna	CTD watch leader	IfM-Univ. Hamburg
Rheder, Gregor	Trace gases	IOW (leg 1 only)
Rühe, Sven	student	Univ. Hamburg
Seifert, Thomas	trace gases	MPI-BGC
Verch, Norbert	salinometer, oxygen	IfM-Univ. Hamburg
Wasilewski, Thomas	data management	IfM-Univ. Hamburg
Welsch, Andreas	moorings, technics	IfM-Univ. Hamburg
Raeke, Andreas	meteorology	DWD
Endjambi, Tobias	student	Univ. Namibia (leg 1)
Gozo, Takafara	student	Univ. Namibia (leg 1)
Leopold, Saara	student	Univ. Namibia (leg 1)
Mataranyika, Panashe	student	Univ. Namibia (leg 1)
Ndjoba, Linda	student	Univ. Namibia (leg 1)
Codia, Vieiora	student	Univ. Namibia (leg 2)
Kamukwanyama, John	student	Univ. Namibia (leg 2)
Liswaniso, Gadaffi	student	Univ. Namibia (leg 2)
Shikeva,Josef	student	Univ. Namibia (leg 2)
Shimooshili, Kaspar	student	Univ. Namibia (leg 2)

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MPI-BGC:	Max Planck-Institut für Biogeochemie, Jena, Germany
Univ. Namibia	University of Namibia, Windhoek, Namibia

List of Stations

Station-Cast No	Gear	Date	Time	Position		Depth	Comment
	Abbreviation		UTC	Latitude	Longitude	m	
ME991/1710-1	CTD/RO	01.08.2013	4:10	26° 15,00' S	14° 43,99' E	155,6	
ME991/1710-2	MSS	01.08.2013	4:49	26° 15,03' S	14° 43,95' E	156,5	
ME991/1711-1	CTD/RO	01.08.2013	5:57	26° 15,01' S	14° 39,01' E	214,6	
ME991/1711-2	MSS	01.08.2013	6:37	26° 15,03' S	14° 39,00' E	214,7	
ME991/1712-1	CTD/RO	01.08.2013	7:45	26° 15,03' S	14° 34,04' E	220,4	
ME991/1712-2	MSS	01.08.2013	8:44	26° 15,15' S	14° 33,85' E	220,5	
ME991/1713-1	CTD/RO/L	01.08.2013	9:44	26° 14,99' S	14° 29,00' E	205,2	
ME991/1713-2	MSS	01.08.2013	10:10	26° 14,93' S	14° 29,01' E	205,1	
ME991/1714-1	CTD/RO	01.08.2013	11:34	26° 14,97' S	14° 24,01' E	214,4	
ME991/1714-2	MSS	01.08.2013	12:07	26° 14,90' S	14° 24,01' E	214,4	
ME991/1715-1	CTD/RO	01.08.2013	13:03	26° 14,96' S	14° 19,01' E	221,3	
ME991/1715-2	MSS	01.08.2013	13:27	26° 14,91' S	14° 19,02' E	221,8	
ME991/1716-1	CTD/RO	01.08.2013	14:26	26° 14,97' S	14° 14,01' E	286,9	
ME991/1716-2	MSS	01.08.2013	15:03	26° 14,92' S	14° 13,99' E	287,5	
ME991/1717-1	CTD/RO	01.08.2013	16:47	26° 15,03' S	14° 9,00' E	318,7	
ME991/1717-2	MSS	01.08.2013	17:27	26° 15,05' S	14° 8,96' E	317,8	
ME991/1718-1	CTD/RO	01.08.2013	18:42	26° 15,00' S	14° 4,01' E	341,9	
ME991/1718-2	MSS	01.08.2013	19:17	26° 15,04' S	14° 3,98' E	341,1	
ME991/1719-1	CTD/RO	01.08.2013	20:53	26° 14,98' S	13° 58,98' E	358	
ME991/1720-1	CTD/RO	01.08.2013	22:11	26° 14,99' S	13° 54,03' E	373,7	
ME991/1721-1	CTD/RO	01.08.2013	23:13	26° 14,98' S	13° 49,02' E	388,1	
ME991/1722-1	CTD/RO/L	02.08.2013	0:13	26° 15,01' S	13° 43,98' E	409,1	
ME991/1723-1	CTD/RO/L	02.08.2013	1:25	26° 15,00' S	13° 38,99' E	541,1	
ME991/1724-1	CTD/RO/L	02.08.2013	2:31	26° 14,98' S	13° 34,02' E	756	
ME991/1725-1	CTD/RO/L	02.08.2013	3:48	26° 14,99' S	13° 28,95' E	950,8	
ME991/1726-1	CTD/RO/L	02.08.2013	5:20	26° 15,00' S	13° 21,02' E	619,2	
ME991/1727-1	CTD/RO/L	02.08.2013	7:24	26° 15,02' S	13° 13,01' E	1521,4	
ME991/1727-2	MSS	02.08.2013	8:41	26° 15,12' S	13° 12,96' E	1525	
ME991/1728-1	CTD/RO/L	02.08.2013	9:54	26° 15,06' S	13° 4,91' E	1871,1	
ME991/1728-2	MSS	02.08.2013	12:14	26° 15,76' S	13° 4,63' E	1888,3	
ME991/1729-1	CTD/RO/L	02.08.2013	13:38	26° 15,02' S	12° 55,00' E	2259,5	
ME991/1729-2	MSS	02.08.2013	15:54	26° 15,03' S	12° 55,00' E	2261,3	
ME991/1730-1	CTD/RO/L	02.08.2013	17:35	26° 14,98' S	12° 39,99' E	2779,9	
ME991/1730-2	MSS	02.08.2013	19:56	26° 15,03' S	12° 39,97' E	2775,1	
ME991/1731-1	CTD/RO/L	02.08.2013	21:54	26° 15,02' S	12° 24,92' E	3383,3	
ME991/1731-2	MSS	03.08.2013	0:07	26° 15,06' S	12° 24,94' E	3382,3	
ME991/1732-1	CTD/RO	03.08.2013	2:04	26° 15,04' S	12° 10,01' E	3658,6	
ME991/1732-2	MSS	03.08.2013	4:37	26° 15,06' S	12° 10,01' E	3656,1	
ME991/1733-1	CTD/RO/L	03.08.2013	6:28	26° 14,98' S	11° 54,98' E	3847,1	
ME991/1733-2	MSS	03.08.2013	9:10	26° 15,04' S	11° 54,98' E	3846	
ME991/1734-1	CTD/RO/L	03.08.2013	11:05	26° 15,01' S	11° 39,97' E	4058,8	
ME991/1734-2	MSS	03.08.2013	13:45	26° 15,07' S	11° 39,94' E	4062,9	

ME991/1734-3	CTD/RO	03.08.2013	14:23	26° 15,54' S	11° 39,60' E	4062,1	
ME991/1735-1	CTD/RO/L	03.08.2013	16:57	26° 14,99' S	11° 24,97' E	4251,4	
ME991/1735-2	MSS	03.08.2013	19:50	26° 15,01' S	11° 24,99' E	4244,3	
ME991/1736-1	MB	04.08.2013	4:29	25° 20,00' S	10° 55,00' E	4274	Begin
ME991/1736-1	MB	04.08.2013	5:59	25° 7,98' S	10° 55,00' E	4210,1	End
ME991/1737-1	MOR	04.08.2013	7:29	25° 13,50' S	10° 58,93' E	4217,8	Begin
ME991/1737-1	MOR	04.08.2013	17:03	25° 12,66' S	10° 50,63' E	4253,4	End
ME991/1738-1	CTD-U	04.08.2013	18:11	25° 16,09' S	10° 51,87' E	4259,2	Begin
ME991/1738-1	CTD-U	05.08.2013	10:23	25° 22,11' S	11° 0,33' E	4258,9	End Profile 1-37
ME991/1739-1	SVP	05.08.2013	11:48	25° 8,09' S	10° 52,33' E	4225,5	
ME991/1739-2	MOR	05.08.2013	12:56	25° 10,15' S	10° 59,51' E	4173,6	Begin
ME991/1739-2	MOR	05.08.2013	17:22	25° 14,23' S	10° 54,87' E	4225,5	End
ME991/1741-1	CTD/RO/L	05.08.2013	17:50	25° 16,02' S	10° 55,76' E	4234,8	
ME991/1742-1	CTD-U	05.08.2013	21:15	25° 16,45' S	11° 0,31' E	4214,5	Begin
ME991/1742-1	CTD-U	06.08.2013	10:41	25° 15,41' S	10° 55,35' E	4230,9	End Profile 38-72
ME991/1743-1	MOR	06.08.2013	11:11	25° 14,24' S	10° 54,79' E	4228,8	Position Check
ME991/1744-1	CTD-U	06.08.2013	12:15	25° 7,74' S	10° 58,91' E	4167,2	Begin
ME991/1744-1	CTD-U	07.08.2013	17:12	25° 35,68' S	11° 10,69' E	4276,1	End Profile 73-153
ME991/1745-1	CTD/RO/L	07.08.2013	17:39	25° 34,98' S	11° 10,00' E	4277,8	
ME991/1746-1	M	07.08.2013	18:55	25° 35,06' S	11° 10,18' E	4274,7	underway measurents
ME991/1746-1	M	09.08.2013	7:23	24° 15,04' S	14° 20,08' E	82,4	
ME991/1747-1	CTD/RO	09.08.2013	7:32	24° 15,05' S	14° 20,10' E	81,1	
ME991/1748-1	CTD/RO	09.08.2013	8:48	24° 14,98' S	14° 15,00' E	120,4	
ME991/1749-1	CTD/RO	09.08.2013	9:45	24° 15,01' S	14° 9,97' E	131	
ME991/1750-1	CTD/RO	09.08.2013	10:50	24° 14,99' S	14° 5,00' E	153	
ME991/1751-1	CTD/RO	09.08.2013	11:47	24° 14,98' S	13° 59,99' E	207,8	
ME991/1752-1	CTD/RO	09.08.2013	12:47	24° 14,97' S	13° 55,00' E	250,8	
ME991/1753-1	CTD/RO	09.08.2013	13:47	24° 14,97' S	13° 49,99' E	273,5	
ME991/1754-1	CTD/RO	09.08.2013	14:56	24° 14,94' S	13° 44,99' E	288,4	
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ME991/1756-1	CTD/RO	09.08.2013	16:47	24° 14,93' S	13° 34,98' E	313,4	
ME991/1757-1	CTD/RO	09.08.2013	17:46	24° 14,99' S	13° 30,00' E	314,8	
ME991/1758-1	CTD/RO	09.08.2013	18:41	24° 14,99' S	13° 24,99' E	328	
ME991/1759-1	CTD/RO	09.08.2013	19:50	24° 14,97' S	13° 19,99' E	460,5	
ME991/1760-1	CTD/RO/L	09.08.2013	21:09	24° 14,98' S	13° 14,99' E	670,9	
ME991/1761-1	CTD/RO/L	09.08.2013	22:32	24° 15,01' S	13° 9,97' E	851	
ME991/1762-1	CTD/RO/L	09.08.2013	23:59	24° 15,02' S	13° 4,98' E	1049,3	
ME991/1763-1	CTD/RO/L	10.08.2013	1:23	24° 15,03' S	12° 59,98' E	0	
ME991/1764-1	CTD-U	10.08.2013	3:03	24° 20,59' S	13° 1,00' E	1255,7	Begin
ME991/1764-1	CTD-U	11.08.2013	0:43	28° 13,75' S	14° 4,80' E	1297,7	End Profile 154 - 213
ME992/1765-1	CTD-U	12.08.2013	21:10	27° 0,55' S	13° 54,61' E	572,7	Begin

ME992/1765-1	CTD-U	13.08.2013	18:02	26° 6,27' S	12° 45,72' E	2710,1	End Profile 214 - 267
ME992/1766-1	MSS	13.08.2013	18:30	26° 9,30' S	12° 47,41' E	2499	
ME992/1767-1	CTD-U	13.08.2013	20:14	26° 11,35' S	12° 45,61' E	2543,4	
ME992/1768-1	MSS	13.08.2013	20:49	26° 14,83' S	12° 42,63' E	2652,6	
ME992/1769-1	CTD-U	13.08.2013	22:19	26° 16,92' S	12° 40,66' E	2736,3	
ME992/1770-1	MSS	13.08.2013	22:53	26° 20,10' S	12° 37,74' E	2876,1	
ME992/1771-1	CTD-U	14.08.2013	0:29	26° 22,08' S	12° 36,01' E	2940,6	
ME992/1772-1	MSS	14.08.2013	0:52	26° 24,58' S	12° 33,66' E	3027,6	
ME992/1773-1	CTD-U	14.08.2013	2:32	26° 26,68' S	12° 31,88' E	3088,1	
ME992/1774-1	MSS	14.08.2013	2:55	26° 29,18' S	12° 29,59' E	3176,4	
ME992/1775-1	CTD-U	14.08.2013	4:34	26° 30,96' S	12° 27,89' E	3245,4	
ME992/1776-1	CTD-U	14.08.2013	7:20	26° 35,00' S	12° 24,01' E	3430,9	
ME992/1777-1	CTD-U	14.08.2013	7:38	26° 37,31' S	12° 21,78' E	3496,4	
ME992/1778-1	CTD-U	14.08.2013	8:04	26° 40,18' S	12° 19,01' E	3564,8	
ME992/1779-1	CTD-U	14.08.2013	8:25	26° 42,73' S	12° 16,55' E	3616,2	
ME992/1780-1	CTD-U	14.08.2013	8:42	26° 44,87' S	12° 14,49' E	3653,6	
ME992/1781-1	CTD-U	14.08.2013	9:00	26° 47,09' S	12° 12,36' E	3694,8	Begin
ME992/1781-1	CTD-U	14.08.2013	13:20	26° 22,62' S	12° 30,00' E	3122,3	End Profile 278 - 291
ME992/1782-1	CTD/RO/L	14.08.2013	13:43	26° 19,86' S	12° 29,91' E	3234,1	
ME992/1782-2	MSS	14.08.2013	14:36	26° 19,91' S	12° 29,87' E	3237,8	
ME992/1783-1	CTD-U	14.08.2013	15:44	26° 20,40' S	12° 29,15' E	3252,7	No data, instrument loss
ME992/1783-1	CTD-U	14.08.2013	16:59	26° 5,59' S	12° 29,95' E	3118,1	
ME992/1784-1	CTD/RO/L	14.08.2013	17:31	26° 3,85' S	12° 29,71' E	3152,2	
ME992/1784-2	MSS	14.08.2013	18:22	26° 3,86' S	12° 29,70' E	3149,8	
ME992/1785-1	CTD/RO	14.08.2013	21:26	25° 57,50' S	12° 30,00' E	3090,8	
ME992/1786-1	CTD/RO	14.08.2013	23:40	25° 49,91' S	12° 30,06' E	3153,6	
ME992/1786-2	MSS	14.08.2013	23:45	25° 49,93' S	12° 30,05' E	3155,5	
ME992/1787-1	CTD/RO	15.08.2013	1:26	25° 42,51' S	12° 30,00' E	3071,8	
ME992/1788-1	CTD/RO	15.08.2013	2:55	25° 34,98' S	12° 30,01' E	3043,1	
ME992/1788-2	MSS	15.08.2013	3:33	25° 35,00' S	12° 30,00' E	3044,6	
ME992/1789-1	CTD/RO	15.08.2013	5:05	25° 27,48' S	12° 29,99' E	2932,6	
ME992/1790-1	CTD/RO	15.08.2013	6:22	25° 19,98' S	12° 29,99' E	3037,6	
ME992/1790-2	MSS	15.08.2013	7:00	25° 20,01' S	12° 29,97' E	3043,4	
ME992/1791-1	CTD/RO	15.08.2013	9:05	25° 12,48' S	12° 29,78' E	2962,5	
ME992/1792-1	CTD/RO	15.08.2013	10:40	25° 4,97' S	12° 29,94' E	2762,6	
ME992/1792-2	MSS	15.08.2013	11:18	25° 4,99' S	12° 29,93' E	2763,6	
ME992/1793-1	CTD/RO	15.08.2013	12:58	24° 57,49' S	12° 29,99' E	2761,8	
ME992/1793-2	CTD-U	15.08.2013	13:30	24° 57,61' S	12° 29,93' E	2763,5	Test
ME992/1794-1	CTD/RO	15.08.2013	14:44	24° 50,00' S	12° 29,99' E	2745,8	
ME992/1794-2	MSS	15.08.2013	15:22	24° 50,01' S	12° 29,98' E	2744,8	
ME992/1795-1	CTD/RO	15.08.2013	17:02	24° 42,49' S	12° 29,99' E	2705,2	
ME992/1796-1	CTD/RO	15.08.2013	18:22	24° 34,99' S	12° 30,00' E	2507,1	
ME992/1796-2	MSS	15.08.2013	18:57	24° 34,99' S	12° 29,99' E	2507,3	
ME992/1797-1	CTD/RO	15.08.2013	21:59	24° 48,98' S	12° 11,99' E	3146,8	

ME992/1798-1	CTD/RO	16.08.2013	0:45	25° 2,99' S	11° 54,00' E	3541,3	
ME992/1799-1	CTD/RO	16.08.2013	3:26	25° 16,99' S	11° 36,00' E	3887	
ME992/1800-1	CTD/RO	16.08.2013	6:05	25° 30,97' S	11° 18,02' E	4188,6	
ME992/1801-1	GLIDER	16.08.2013	8:37	25° 41,04' S	11° 3,65' E	4320,7	
ME992/1801-2	CTD/RO	16.08.2013	9:28	25° 40,59' S	11° 3,44' E	4326,2	
ME992/1801-3	MSS	16.08.2013	9:59	25° 40,62' S	11° 3,40' E	4324,9	
ME992/1802-1	CTD-U	16.08.2013	11:21	25° 42,55' S	11° 0,37' E	4341	Begin
ME992/1802-1	CTD-U	16.08.2013	13:53	25° 16,40' S	10° 60,00' E	4218	End Profile 293 - 300
ME992/1803-1	CTD/RO/L	16.08.2013	14:16	25° 13,98' S	11° 0,01' E	4197,9	
ME992/1804-1	CTD-U	16.08.2013	15:41	25° 12,50' S	10° 59,89' E	4188,4	Begin
ME992/1804-1	CTD-U	16.08.2013	17:15	25° 1,02' S	10° 59,89' E	4138	End Profile 301- 302
ME992/1805-1	CTD/RO/L	16.08.2013	17:55	25° 0,86' S	10° 59,90' E	4139,9	
ME992/1806-1	CTD-U	16.08.2013	19:49	25° 1,14' S	10° 59,17' E	4146,6	Begin
ME992/1806-1	CTD-U	16.08.2013	22:01	24° 38,56' S	11° 0,01' E	4077,7	End Profile 303 - 310
ME992/1807-1	CTD/RO/L	16.08.2013	22:37	24° 34,98' S	10° 59,99' E	4038,8	
ME992/1807-2	CTD/RO/L	17.08.2013	1:40	24° 34,98' S	10° 59,99' E	4037,4	
ME992/1808-1	CTD-U	17.08.2013	3:14	24° 34,57' S	10° 59,79' E	4032,2	Begin
ME992/1808-1	CTD-U	17.08.2013	6:39	24° 0,46' S	10° 59,94' E	3729,7	End Profile 311 - 321
ME992/1809-1	CTD/RO/L	17.08.2013	6:51	23° 59,97' S	10° 59,99' E	3723,4	
ME992/1809-2	MSS	17.08.2013	8:22	24° 0,00' S	10° 59,99' E	3723,3	
ME992/1810-1	MSS	17.08.2013	9:48	24° 5,00' S	10° 59,98' E	3733,3	
ME992/1811-1	MSS	17.08.2013	11:52	24° 12,56' S	10° 59,99' E	3764,9	
ME992/1812-1	MSS	17.08.2013	20:50	24° 46,65' S	10° 59,98' E	4111,1	
ME992/1813-1	CTD-U	18.08.2013	2:19	24° 51,27' S	11° 1,83' E	4091,7	Begin
ME992/1813-1	CTD-U	18.08.2013	3:13	24° 51,83' S	11° 9,04' E	4007,2	End Profile 322 - 324
ME992/1814-1	CTD/RO	18.08.2013	3:42	24° 51,95' S	11° 9,53' E	4004	
ME992/1815-1	CTD/RO	18.08.2013	5:23	24° 49,91' S	11° 20,24' E	3916,5	
ME992/1816-1	CTD/RO	18.08.2013	7:10	24° 45,01' S	11° 29,83' E	3808,7	
ME992/1817-1	CTD/RO	18.08.2013	9:06	24° 40,26' S	11° 39,60' E	3737,9	
ME992/1818-1	M	18.08.2013	11:05	24° 35,46' S	11° 49,18' E	3588,2	
ME992/1819-1	CTD/RO/L	19.08.2013	2:34	22° 19,98' S	12° 9,97' E	1980,8	
ME992/1820-1	CTD/RO/L	19.08.2013	4:43	22° 20,00' S	12° 15,99' E	1736,3	
ME992/1820-2	MSS	19.08.2013	5:59	22° 20,01' S	12° 15,99' E	1736,3	
ME992/1821-1	CTD/RO/L	19.08.2013	7:12	22° 20,04' S	12° 22,03' E	1484,2	
ME992/1821-2	MSS	19.08.2013	8:22	22° 20,08' S	12° 22,03' E	1485,3	
ME992/1822-1	CTD/RO/L	19.08.2013	9:41	22° 19,99' S	12° 27,96' E	0	
ME992/1822-2	MSS	19.08.2013	10:42	22° 20,03' S	12° 27,95' E	1258,4	
ME992/1823-1	CTD/RO/L	19.08.2013	11:47	22° 19,98' S	12° 33,99' E	1044,8	
ME992/1823-2	MSS	19.08.2013	12:43	22° 20,01' S	12° 33,99' E	1044,2	
ME992/1824-1	CTD/RO/L	19.08.2013	13:49	22° 19,96' S	12° 39,98' E	886,1	
ME992/1824-2	MSS	19.08.2013	14:37	22° 19,99' S	12° 39,98' E	888,2	
ME992/1825-1	CTD/RO/L	19.08.2013	16:04	22° 19,99' S	12° 46,01' E	493	

ME992/1825-2	MSS	19.08.2013	16:39	22° 20,02' S	12° 46,00' E	494,1	
ME992/1826-1	CTD/RO/L	19.08.2013	17:57	22° 19,99' S	12° 52,00' E	361	
ME992/1826-2	MSS	19.08.2013	18:25	22° 20,00' S	12° 51,99' E	361,2	
ME992/1827-1	CTD/RO	19.08.2013	20:00	22° 19,97' S	12° 58,03' E	284	
ME992/1827-2	MSS	19.08.2013	20:33	22° 19,98' S	12° 58,02' E	283,2	
ME992/1828-1	CTD/RO	19.08.2013	22:06	22° 20,00' S	13° 3,98' E	259,6	
ME992/1828-2	MSS	19.08.2013	22:33	22° 20,03' S	13° 3,97' E	259,4	
ME992/1829-1	CTD/RO	20.08.2013	0:09	22° 20,02' S	13° 10,01' E	244,4	
ME992/1829-2	MSS	20.08.2013	0:31	22° 20,04' S	13° 10,00' E	243,7	
ME992/1830-1	CTD/RO	20.08.2013	2:07	22° 20,00' S	13° 16,02' E	229,9	
ME992/1830-1	MSS	20.08.2013	2:29	22° 20,02' S	13° 16,02' E	229,7	
ME992/1831-1	CTD/RO	20.08.2013	3:58	22° 20,00' S	13° 22,00' E	204,9	
ME992/1831-2	MSS	20.08.2013	4:24	22° 20,01' S	13° 21,99' E	206,1	
ME992/1832-1	CTD/RO	20.08.2013	5:45	22° 20,03' S	13° 28,02' E	166,2	
ME992/1832-2	MSS	20.08.2013	6:05	22° 20,00' S	13° 28,01' E	165,3	
ME992/1833-1	CTD/RO	20.08.2013	7:23	22° 20,03' S	13° 33,96' E	135,1	
ME992/1833-2	MSS	20.08.2013	7:41	22° 20,05' S	13° 33,96' E	135,8	
ME992/1834-1	CTD/RO	20.08.2013	9:07	22° 19,99' S	13° 40,02' E	127,6	
ME992/1834-2	MSS	20.08.2013	9:29	22° 20,03' S	13° 40,00' E	129,1	
ME992/1835-1	MOR	20.08.2013	14:19	22° 59,82' S	14° 3,27' E	0	released
ME992/1835-1	MOR	20.08.2013	15:19	23° 0,02' S	14° 3,30' E	131,3	on deck
ME992/1836-1	CTD-U	20.08.2013	20:54	23° 21,60' S	13° 3,57' E	525	
ME992/1837-1	CTD/RO	20.08.2013	23:24	23° 30,00' S	12° 39,98' E	1435	
ME992/1838-1	CTD/RO	21.08.2013	0:44	23° 35,01' S	12° 40,95' E	1490,7	
ME992/1839-1	CTD/RO	21.08.2013	2:05	23° 39,99' S	12° 41,99' E	1570,9	
ME992/1840-1	CTD/RO/L	21.08.2013	3:23	23° 44,95' S	12° 42,96' E	1649,8	
ME992/1841-1	CTD/RO/L	21.08.2013	4:45	23° 50,00' S	12° 43,98' E	1643,6	
ME992/1842-1	CTD/RO/L	21.08.2013	6:03	23° 54,99' S	12° 44,99' E	1625	
ME992/1843-1	CTD/RO/L	21.08.2013	7:30	23° 59,94' S	12° 46,09' E	1637,6	
ME992/1844-1	CTD/RO/L	21.08.2013	9:05	24° 4,96' S	12° 47,05' E	1705,4	
ME992/1845-1	CTD/RO/L	21.08.2013	10:32	24° 9,99' S	12° 48,03' E	1772	
ME992/1846-1	CTD/RO/L	21.08.2013	11:53	24° 14,96' S	12° 48,99' E	1762,4	
ME992/1847-1	CTD/RO/L	21.08.2013	13:17	24° 19,98' S	12° 49,98' E	1694	
ME992/1848-1	CTD/RO/L	21.08.2013	14:39	24° 24,99' S	12° 50,99' E	1658,6	
ME992/1849-1	CTD/RO/L	21.08.2013	15:57	24° 29,98' S	12° 52,00' E	1680,3	
ME992/1850-1	CTD/RO/L	21.08.2013	17:14	24° 34,98' S	12° 52,98' E	1772,3	
ME992/1851-1	CTD/RO/L	21.08.2013	18:30	24° 39,99' S	12° 53,99' E	1886,4	
ME992/1852-1	CTD/RO/L	21.08.2013	20:02	24° 44,95' S	12° 54,97' E	1904,2	
ME992/1853-1	CTD/RO/L	21.08.2013	21:30	24° 49,96' S	12° 56,00' E	1748,4	
ME992/1854-1	CTD/RO/L	21.08.2013	22:58	24° 54,96' S	12° 56,98' E	1733,7	
ME992/1855-1	CTD/RO/L	22.08.2013	00:23	24° 59,96' S	12° 58,06' E	1833	
ME992/1856-1	CTD/RO/L	22.08.2013	01:54	25° 4,92' S	12° 58,94' E	2023,6	
ME992/1857-1	CTD/RO/L	22.08.2013	03:36	25° 9,98' S	12° 59,97' E	2097,4	
ME992/1858-1	CTD/RO/L	22.08.2013	05:23	25° 14,97' S	13° 0,97' E	2022,7	
ME992/1859-1	CTD/RO/L	22.08.2013	07:09	25° 19,94' S	13° 1,90' E	1915,9	
ME992/1860-1	CTD/RO/L	22.08.2013	08:58	25° 24,98' S	13° 2,96' E	1849,5	

CTD	Conductivity-Temperature-Depth sonde
RO	Rosette water sampler
L	lowered Acoustic Doppler Profiler
MOR	Mooring
MSS	Micro Structure-sonde
MB	Multibeam bathymetric survey