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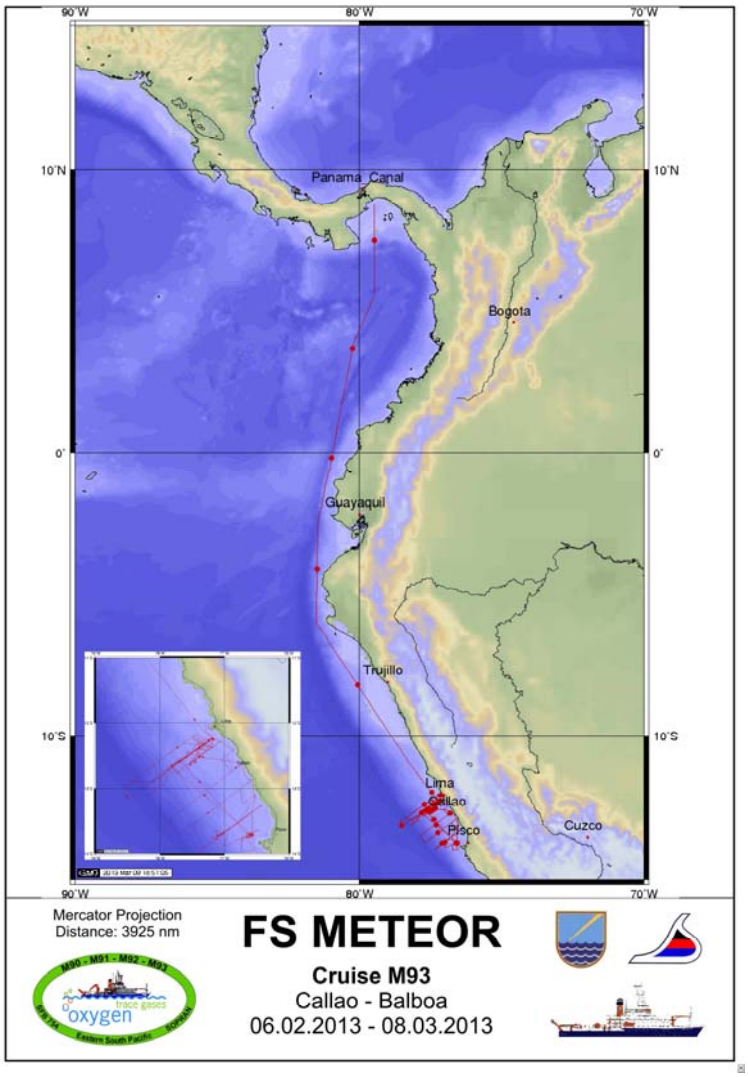
Short Cruise Report
Meteor Cruise M93

Callao, Peru- Balboa, Panama
07.02.2013-09.03.2013
Chief Scientist: Dr. Gaute Lavik
Captain: Klaus Bergmann



Objectives

The main aim of M93 was to study the coupling between near-coastal physical and biological / biogeochemical processes in the productive and dynamic frontal area of the OMZ off the coast Peru. Nutrient loss in OMZ-waters exceeds the nutrient regeneration by nitrogen fixation, resulting in fixed inorganic nitrogen being the main limiting factor for phytoplankton growth in the ocean. Total nutrient regeneration in the OMZ depends on nitrogen fixation and the supply of oxygen and organic matter (OM) as well as benthic nutrient fluxes. The Benthic nutrient fluxes in the same region was covered by the previous cruise M92 and the evaluated data will be combined to get a quantitative estimate of the relative importance of the water column and sedimentary processes for the nutrient regeneration. Similar, the open ocean water column, where there is no contact between the sediments and the OMZ-waters was covered by M90.
Both downward fluxes of OM and oxygen, and upward fluxes of nutrients are mainly governed by physical processes. Consequently our focus was to compare the fluxes (nutrients, oxygen and OM) to the measured biological activity (primary production, N-loss, nutrient regeneration, oxygen consumption) in a quantitative manner including speciation and quantification of involved microbes.

To achieve this we designed an integrated measurement approach using: (i) high-spatiotemporal-resolution 3-d observations of hydrographical parameters, current velocities, oxygen, and chlorophyll using 7 autonomous gliders and (ii) vessel-based sampling of biological and chemical parameters as well a experimentally determined microbial activity at the sites defined by the physical data. In addition to the physically induced vertical mixing, diurnal migration of zooplankton may contribute significantly to vertical transport of OM and was studied in detail at all major stations. A major stations included a high resolution profile of nutrients; sampling for all parameters; using all gears and diurnal sampling for zooplankton migration.

Studying sub mesoscale changes requires high spatial and temporal resolution of both glider as well as shipboard measurements and sampling, and we decided on two main working areas with seemingly different upwelling dynamics. The northern working area off Callao (12°S) was predefined based on the available long term monitoring data from our collaboration institute in Peru, Institudo del Mar del Peru (IMARPE). This area is one of the most highly productive at the centre of the Peru OMZ, despite the apparent lack of strong local winds that is generally believed to be the main physical forcing of coastal upwelling. Our southern working areas off Pisco (14°S) was finally defined after evaluation of the glider data transmitted via satellite during M92. Off Pisco the local “upwelling“ winds are generally stronger and we could also observe the formation of filaments of saline waters from the surface of the ocean being advected into the OMZ waters with important implications for the biogeochemical processes In the zone between the two main working areas (12°s-14°S) covered by gliders, the presence of free hydrogen sulphide in the water column has been reported and was sampled extensively with normal Rosette CTD and multinet.

Narrative

We left the harbour of Callao one and a half day later than planned at 19:00 on February 07. The delay was related to that the containers for the previous cruise (M92) did not arrive on time so that we started more than 2 days late with unpacking and setting up our own equipment. For the port call in Callao, two representatives from the Leibniz Institute for Baltic Sea research was flown in to install the pump-CTD system on board the vessel and we needed to stay in the harbour until this was finalized.

Shortly after leaving Callao we started the station work in our working area just off Callao. In total we did 160 normal CTD cast where of 140 was sampled for nutrients, 270 Micro structure (MSS) profiles, 80 casts for zooplankton catches, and 15 In Situ pump deployments (3 or 4 pumps each) and 12 Pump-CTD stations with high resolution nutrient profiles (1 or 2m). At 39 stations, selected by the daily transmitted data from the gliders and satellite observations and modelling, detailed sampling for various biological, chemical, microbial and biogeochemical parameters where done. Particularly the tracking of advection of surface water high in Oxygen and Organic matter into the OMZ waters by salinity anomalies as well as determining frontal zones by satellite images was very successful. In Figure 1 temporal changes in salinity at off Pisco is shown. The advection of saline surface waters into the deeper layer of the OMZ might be an important, but yet poorly described, source of organic matter and oxygen for microbial activity in the OMZ waters. This information enabled us to sample the near coastal waters off Peru from 12-14°S systematic in terms of water column structure and take sample for molecular ecology, chemical characterisation, organic matter and combined with biogeochemical rate determinations.

Planning and changing the station work by the daily transmitted data led to frequent and short term changes in cruise schedule and positions. At three occasions we had to interrupt on going station work to recover gliders with technical problems. Two of these searches led to successful recovery of the gliders and on glider is considered as missing or lost.

Continuous measurements of CO_2 and N_2O from the surface waters as well as ADCP to determining current speeds and direction was performed along the whole cruise track of the Working area (2677 nM). Both N_2O and CO_2 were particularly high in areas of high upwelling intensity as well as the area where we detected free Hydrogen Sulphide in the water column. At the end of our sampling campaign we recovered 9 moorings and 6 out of the 7 gliders that was deployed during M92.

The collaboration and communication between the crew of Meteor and scientists worked very well leading to efficient use of the available ship time and a pleasant working atmosphere. All together we achieved all of our main aims and in addition we were able to do significantly more i.e. MSS profiling, which are important for calculating realistic fluxes, than planned. The only negative thing of matter to report was the port calls and logistics, with even more problems in Panama than in Peru, with my recommendation of looking for an alternative to “Boyd Steamship Coperation” for future cruises passing through Panama.

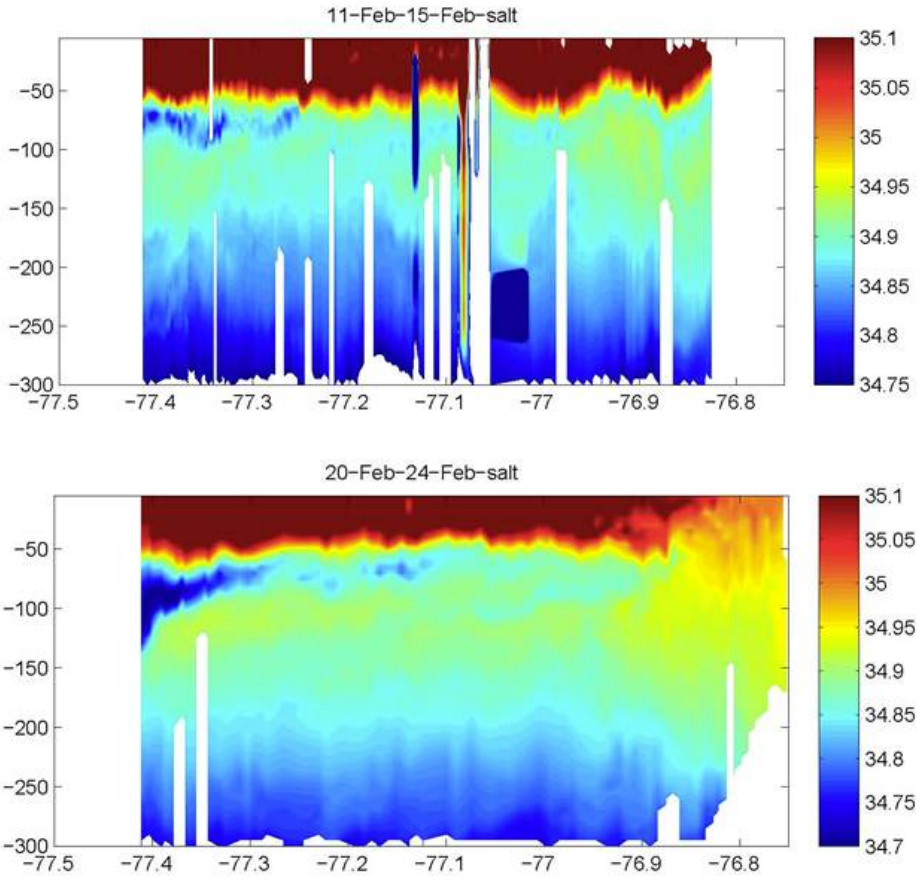


Figure 1

Glider profiles from our southern working area off Pisco (14°S), showing salinity distribution in the upper 300 m of the water column. The change in salinity can be used to backtrack and quantify advective transport from saline surface waters into the core of the OMZ. These surface waters will contain both organic matter and oxygen with potentially high impact on the microbial activity and biogeochemical cycling in the OMZ waters.

Acknowledgements

First of all I would like to thank Captain Klaus Bergmann and the crew on RV/Meteor for their efforts to make everything work and a contributing to a very pleasant atmosphere during the whole ship. The ships operator Briese Schiffahrts GmbH is acknowledged for their support, in particular their efforts in solving problems related to harbour access in Balboa, Panama. The “Leitstelle” in Hamburg are appreciated for their support, advice and patience throughout the whole process of getting this cruise to become successful. Klaus Bohn (LPL Logistics, Hamburg) was together with the logistic section at the Max Planck Institute in Bremen and GEOMAR in Kiel of invulnerable help and support in the rather problematic logistic operation in both harbours. The German Embassy in Lima was of great support when solving the logistic matters in Peru. The cruise leader of M94, Prof. Dr. Christian Hübscher, for allowing us to leave our cooled sample freight on board the ship as our refer containers did not arrive in time and his crew members for helping to unload this freight safely in Cuba. Siegfried Krüger and Peter Wlost from the Leibnitz Institute for Baltic Sea research (IOW) for their help of setting up the Pump-CTD system in Callao, and the Oceanographic section of the IOW for making the pump CTD system available for this cruise. The Peruvian authorities we sincerely thank for allowing us to work in their waters including the inner 3 nautical miles of the coastal waters as well as allowing all our deployments over a three month period.

Teilnehmerliste/ *Participants* METEOR M 93

Fahrt / Cruise M 93

1	Lavik, Gaute Dr.	Chief Scientist	MPI-Bremen
2	Klockgether, Gabriele	Nutrients	MPI-Bremen
3	Lam, Phyllis Dr.	Molecular ecology	MPI-Bremen
4	Kanzow, Torsten Prof. Dr.	Co-Chief Scientist/ Physical Oceanogr.	GEOMAR
5	Tippenhauer, Sandra	CTD/ Glider/ MSS	GEOMAR
6	Papenburg, Uwe	P-CTD, technician, moorings	GEOMAR
7	Müller, Mario	Glider / ADCP / PCTD	GEOMAR
8	Thomsen, Sören	CTD/ Glider/ MSS	GEOMAR
9	Schaffer, Janin	CTD / ADCP	GEOMAR
10	Rieck, Jan-Klaus	CTD / ADCP	GEOMAR
11	Loginova, Alexandra	DOM	GEOMAR
12	Flerus, Ruth	DOM, technician	GEOMAR
13	Callbeck, Cameron	N-Cycling	MPI-Bremen
14	Dekaezemacker, Julien Dr.	Hetherotrophic N2 fixation	MPI-Bremen
15	Kalvelage, Tim	Oxygen experiments	MPI-Bremen
16	Reichel, Anna Franziska	Phytoplankton	GEOMAR
17	Meyer, Judith	Phytoplankton	GEOMAR
18	Hauss, Helena	Zooplankton physiology	GEOMAR
19	Kiko, Rainer Dr.	Zooplankton ecology	GEOMAR
20	Schunck, Harald	Nitrogen Fixation (15N exp)	CAU-Kiel
21	Diercks, Susan	Nitrogen Fixation (Mol. biol.)	CAU-Kiel
22	Arevalo-Martinez, Damian	Nitrous oxide (N2O)	GEOMAR
23	Lutterbeck, Hannah	Hydrazine/Nitric Oxide (NO)	GEOMAR
24	Grasse, Patricia Dr.	Si/N-Isotopes	GEOMAR
25	Mages, Calin	DOM	GEOMAR
26	Hach, Philipp	Particle Fluxes	MPI-Bremen
27	Pizarro, Luis	Observer Peru	IMARPE
28	Hempelt, Juliane	Meteorology	DWD
29	Anett Mickoleit	Meteorology	DWD

Stationsliste/ Station list M93

Station	Date	Time UTC	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
ME930/290-1	08.02.2013	04:12	12° 22,61' S	77° 27,95' W	286,8	CTD/RO
ME930/292-1	08.02.2013	10:13	12° 41,91' S	77° 35,70' W	1163,3	CTD/RO
ME930/293-1	08.02.2013	12:07	12° 36,02' S	77° 27,04' W	664,1	CTD/RO
ME930/294-1	08.02.2013	13:00	12° 34,03' S	77° 24,44' W	485,0	GLIDER
ME930/295-1	09.02.2013	01:10	12° 22,83' S	77° 11,46' W	138,2	CTD/RO
ME930/295-2	09.02.2013	01:51	12° 22,82' S	77° 11,46' W	137,9	PCTD/RO
ME930/295-3	09.02.2013	09:05	12° 22,82' S	77° 11,43' W	137,6	CTD/RO
ME930/295-4	09.02.2013	09:44	12° 22,82' S	77° 11,43' W	137,9	MSN
ME930/296-1	09.02.2013	10:41	12° 25,46' S	77° 15,07' W	183,4	CTD/RO
ME930/297-1	09.02.2013	12:08	12° 14,54' S	77° 11,05' W	86,3	ADCP
ME930/298-1	09.02.2013	19:01	12° 54,18' S	78° 05,80' W	3743,5	CTD/RO
ME930/299-1	09.02.2013	22:13	12° 52,99' S	78° 25,03' W	5698,2	CTD/RO
ME930/300-1	09.02.2013	23:58	12° 48,67' S	78° 19,10' W	5206,2	CTD/RO
ME930/301-1	10.02.2013	01:42	12° 44,39' S	78° 13,24' W	4161,0	CTD/RO
ME930/302-1	10.02.2013	03:52	12° 40,07' S	78° 07,26' W	3295,2	CTD/RO
ME930/303-1	10.02.2013	05:36	12° 35,80' S	78° 01,37' W	2655,4	PLA
ME930/303-2	10.02.2013	05:52	12° 35,79' S	78° 01,37' W	2659,1	CTD/RO
ME930/304-1	10.02.2013	08:36	12° 31,47' S	77° 55,44' W	1723,8	CTD/RO
ME930/305-1	10.02.2013	10:18	12° 27,15' S	77° 49,55' W	1240,7	CTD/RO
ME930/306-1	10.02.2013	11:56	12° 22,82' S	77° 43,56' W	951,3	CTD/RO
ME930/307-1	10.02.2013	13:55	12° 18,55' S	77° 37,70' W	482,7	CTD/RO
ME930/308-1	10.02.2013	16:01	12° 14,21' S	77° 31,77' W	196,5	CTD/RO
ME930/309-1	10.02.2013	17:24	12° 09,88' S	77° 25,89' W	147,8	CTD/RO
ME930/310-1	10.02.2013	20:13	12° 22,80' S	77° 11,46' W	138,1	CTD/RO
ME930/310-2	10.02.2013	20:54	12° 22,80' S	77° 11,46' W	138,1	MSN
ME930/310-3	10.02.2013	21:28	12° 22,82' S	77° 11,46' W	138,7	MSS
ME930/311-1	10.02.2013	23:35	12° 19,22' S	77° 06,46' W	101,0	CTD/RO
ME930/312-1	11.02.2013	00:44	12° 16,11' S	77° 02,15' W	72,7	CTD/RO
ME930/313-1	11.02.2013	02:16	12° 22,80' S	77° 11,44' W	138,2	CTD/RO
ME930/313-2	11.02.2013	02:48	12° 22,80' S	77° 11,44' W	138,3	MSN
ME930/314-1	11.02.2013	03:48	12° 25,47' S	77° 15,07' W	182,6	CTD/RO
ME930/315-1	11.02.2013	04:51	12° 28,61' S	77° 19,41' W	270,9	CTD/RO
ME930/316-1	11.02.2013	05:59	12° 31,71' S	77° 23,70' W	401,1	CTD/RO
ME930/317-1	11.02.2013	07:13	12° 34,83' S	77° 28,03' W	634,1	CTD/RO
ME930/318-1	11.02.2013	08:46	12° 37,98' S	77° 32,24' W	1056,4	MSN
ME930/318-2	11.02.2013	10:13	12° 38,33' S	77° 31,87' W	1057,5	CTD/RO
ME930/318-3	11.02.2013	11:46	12° 38,32' S	77° 31,87' W	1056,8	PCTD/RO
ME930/318-4	11.02.2013	19:38	12° 38,32' S	77° 31,87' W	1057,1	CTD/RO
ME930/318-5	11.02.2013	20:12	12° 38,32' S	77° 31,87' W	1058,1	MSN

CTD/RO=CTD with Rosette water sampler, PCTD/RO=Pump CTD with Rosette Water sampler, MSS, Micro Structure Probe, ADCP=Acoustic Doppler Current Profile, MSN=Multinet, PLA=Plankton Net, MOR=Mooring, ISP=In Situ Pump, LANDRE= Benthich ADCP Lander, POZ =POZ Lander. GLIDER=Glider recovery

Station	Date	Time UTC	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
ME930/318-6	11.02.2013	21:50	12° 38,30' S	77° 31,89' W	1057,5	CTD/RO
ME930/318-7	11.02.2013	22:45	12° 38,33' S	77° 31,89' W	1058,9	MSS
ME930/318-8	12.02.2013	00:44	12° 38,31' S	77° 31,88' W	1059,9	PLA
ME930/318-9	12.02.2013	01:06	12° 38,32' S	77° 31,89' W	1058,3	ISP
ME930/319-1	12.02.2013	06:26	12° 24,61' S	77° 23,41' W	257,8	CTD/RO
ME930/320-1	12.02.2013	07:34	12° 25,04' S	77° 25,43' W	293,6	CTD/RO
ME930/321-1	12.02.2013	08:33	12° 26,03' S	77° 27,49' W	336,5	CTD/RO
ME930/322-1	12.02.2013	09:32	12° 27,49' S	77° 30,00' W	426,1	CTD/RO
ME930/323-1	12.02.2013	10:18	12° 29,05' S	77° 31,29' W	474,6	CTD/RO
ME930/324-1	12.02.2013	15:31	12° 37,43' S	76° 44,03' W	81,0	CTD/RO
ME930/325-1	12.02.2013	16:36	12° 41,35' S	76° 49,15' W	120,7	CTD/RO
ME930/326-1	12.02.2013	17:37	12° 45,24' S	76° 54,25' W	156,2	CTD/RO
ME930/327-1	12.02.2013	18:48	12° 49,15' S	76° 59,35' W	275,3	CTD/RO
ME930/328-1	12.02.2013	20:05	12° 53,09' S	77° 04,43' W	411,3	CTD/RO
ME930/329-1	12.02.2013	21:16	12° 56,99' S	77° 09,50' W	823,1	CTD/RO
ME930/330-1	12.02.2013	22:36	13° 00,90' S	77° 14,61' W	1283,0	CTD/RO
ME930/331-1	13.02.2013	00:34	13° 08,73' S	77° 24,78' W	1381,6	CTD/RO
ME930/332-1	13.02.2013	02:44	13° 16,53' S	77° 34,95' W	2572,8	CTD/RO
ME930/333-1	13.02.2013	03:30	13° 16,54' S	77° 34,94' W	2575,6	ADCP
ME930/334-1	13.02.2013	09:05	13° 30,62' S	77° 25,25' W	3143,9	CTD/RO
ME930/334-2	13.02.2013	10:03	13° 30,62' S	77° 25,25' W	3142,3	PLA
ME930/334-3	13.02.2013	10:18	13° 30,62' S	77° 25,25' W	3146,6	PLA
ME930/335-1	13.02.2013	11:53	13° 22,59' S	77° 14,96' W	1469,2	CTD/RO
ME930/336-1	13.02.2013	13:54	13° 15,33' S	77° 05,07' W	1325,3	CTD/RO
ME930/337-1	13.02.2013	15:27	13° 11,55' S	77° 00,00' W	810,9	CTD/RO
ME930/338-1	13.02.2013	16:52	13° 07,65' S	76° 54,95' W	361,7	CTD/RO
ME930/338-1	13.02.2013	17:04	13° 07,65' S	76° 54,95' W	361,3	CTD/RO
ME930/338-2	13.02.2013	17:40	13° 07,65' S	76° 54,95' W	361,1	PLA
ME930/339-1	13.02.2013	19:02	13° 03,84' S	76° 49,91' W	221,1	CTD/RO
ME930/340-1	13.02.2013	20:14	13° 00,01' S	76° 44,88' W	133,6	CTD/RO
ME930/341-1	13.02.2013	21:22	12° 56,21' S	76° 39,81' W	113,8	CTD/RO
ME930/342-1	13.02.2013	22:34	12° 52,38' S	76° 34,75' W	55,8	CTD/RO
ME930/342-2	13.02.2013	23:00	12° 52,38' S	76° 34,75' W	54,9	PLA
ME930/342-2	13.02.2013	23:07	12° 52,38' S	76° 34,75' W	55,2	PLA
ME930/343-1	14.02.2013	00:07	12° 51,33' S	76° 33,35' W	37,4	CTD/RO
ME930/344-1	14.02.2013	04:40	13° 32,00' S	76° 47,67' W	268,8	CTD/RO
ME930/345-1	14.02.2013	05:43	13° 35,44' S	76° 51,83' W	413,5	CTD/RO
ME930/346-1	14.02.2013	06:50	13° 38,31' S	76° 56,11' W	516,8	CTD/RO
ME930/347-1	14.02.2013	08:40	13° 43,79' S	77° 05,99' W	2169,3	MSN
ME930/347-2	14.02.2013	09:50	13° 43,79' S	77° 05,99' W	2174,0	CTD/RO

CTD/RO=CTD with Rosette water sampler, PCTD/RO=Pump CTD with Rosette Water sampler, MSS, Micro Structure Probe, ADCP=Acoustic Doppler Current Profile, MSN=Multinet, PLA=Plankton Net, MOR=Mooring, ISP=In Situ Pump, LANDRE= Benthich ADCP Lander, POZ =POZ Lander. GLIDER=Glider recovery

Station	Date	Time UTC	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
ME930/347-3	14.02.2013	11:01	13° 43,79' S	77° 05,99' W	2170,0	PCTD/RO
ME930/347-4	14.02.2013	18:25	13° 43,79' S	77° 05,99' W	2169,4	CTD/RO
ME930/347-5	14.02.2013	18:58	13° 43,79' S	77° 05,99' W	2172,9	MSN
ME930/347-6	14.02.2013	20:07	13° 43,79' S	77° 05,99' W	2171,4	CTD/RO
ME930/347-7	14.02.2013	21:02	13° 43,80' S	77° 05,99' W	2169,5	MSS
ME930/347-8	14.02.2013	23:10	13° 43,80' S	77° 06,02' W	2171,1	ISP
ME930/347-9	15.02.2013	02:22	13° 43,80' S	77° 06,02' W	2170,7	PLA
ME930/348-1	15.02.2013	02:36	13° 43,80' S	77° 06,01' W	2170,8	ADCP
ME930/349-1	15.02.2013	04:38	13° 56,98' S	77° 22,52' W	4164,9	PLA
ME930/349-2	15.02.2013	04:45	13° 56,97' S	77° 22,51' W	4171,8	PLA
ME930/349-3	15.02.2013	04:58	13° 56,97' S	77° 22,52' W	0,0	CTD/RO
ME930/350-1	15.02.2013	06:58	13° 53,13' S	77° 15,74' W	3439,0	CTD/RO
ME930/351-1	15.02.2013	09:02	13° 46,25' S	77° 06,52' W	2271,2	CTD/RO
ME930/352-1	15.02.2013	13:50	13° 33,81' S	76° 52,68' W	1253,5	GLIDER
ME930/353-1	15.02.2013	14:45	13° 34,73' S	76° 51,13' W	1176,0	ADCP
ME930/354-1	15.02.2013	18:27	13° 15,51' S	76° 25,08' W	59,2	CTD/RO
ME930/355-1	15.02.2013	19:29	13° 15,51' S	76° 25,08' W	59,8	PLA
ME930/356-1	15.02.2013	20:46	13° 22,22' S	76° 34,36' W	122,6	CTD/RO
ME930/357-1	15.02.2013	21:56	13° 25,66' S	76° 38,96' W	143,4	CTD/RO
ME930/358-1	15.02.2013	23:11	13° 29,08' S	76° 43,53' W	180,0	CTD/RO
ME930/359-1	16.02.2013	00:18	13° 32,01' S	76° 47,67' W	269,1	PLA
ME930/359-2	16.02.2013	00:34	13° 32,00' S	76° 47,68' W	269,5	CTD/RO
ME930/360-1	16.02.2013	02:28	13° 35,42' S	76° 51,84' W	830,2	CTD/RO
ME930/361-1	16.02.2013	03:55	13° 38,31' S	76° 56,08' W	514,5	PLA
ME930/361-2	16.02.2013	04:22	13° 38,31' S	76° 56,08' W	515,4	CTD/RO
ME930/362-1	16.02.2013	06:40	13° 52,92' S	76° 59,87' W	2078,5	ADCP
ME930/363-1	16.02.2013	10:38	13° 40,89' S	76° 33,13' W	149,9	CTD/RO
ME930/364-1	16.02.2013	11:28	13° 42,38' S	76° 36,35' W	186,7	CTD/RO
ME930/365-1	16.02.2013	12:31	13° 43,83' S	76° 39,59' W	232,6	CTD/RO
ME930/366-1	16.02.2013	13:58	13° 45,98' S	76° 43,86' W	397,9	CTD/RO
ME930/367-1	16.02.2013	16:02	13° 58,16' S	76° 44,21' W	765,1	CTD/RO
ME930/367-2	16.02.2013	17:53	13° 58,16' S	76° 44,21' W	768,3	PLA
ME930/368-1	16.02.2013	19:27	13° 57,23' S	76° 36,78' W	361,5	CTD/RO
ME930/368-2	16.02.2013	21:21	13° 57,23' S	76° 36,78' W	362,6	PLA
ME930/368-3	16.02.2013	21:43	13° 57,23' S	76° 36,78' W	363,7	CTD/RO
ME930/369-1	16.02.2013	23:31	13° 56,51' S	76° 30,73' W	177,6	CTD/RO
ME930/369-3	17.02.2013	00:40	13° 56,51' S	76° 30,73' W	181,7	PLA
ME930/369-4	17.02.2013	00:51	13° 56,51' S	76° 30,73' W	180,8	CTD/RO
ME930/370-1	17.02.2013	02:46	13° 45,84' S	76° 38,81' W	234,9	ADCP
ME930/370-1	17.02.2013	20:15	13° 43,54' S	76° 33,20' W	159,3	ADCP

CTD/RO=CTD with Rosette water sampler, PCTD/RO=Pump CTD with Rosette Water sampler, MSS, Micro Structure Probe, ADCP=Acoustic Doppler Current Profile, MSN=Multinet, PLA=Plankton Net, MOR=Mooring, ISP=In Situ Pump, LANDRE= Benthich ADCP Lander, POZ =POZ Lander. GLIDER=Glider recovery

Station	Date	Time UTC	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
ME930/371-1	17.02.2013	20:30	13° 43,07' S	76° 33,41' W	159,4	MSS
ME930/372-1	18.02.2013	01:15	13° 44,96' S	76° 39,50' W	241,4	ADCP
ME930/373-1	18.02.2013	02:49	13° 42,86' S	76° 33,01' W	153,5	MSS
ME930/374-1	18.02.2013	07:15	13° 45,09' S	76° 39,48' W	241,9	ADCP
ME930/375-1	18.02.2013	11:07	13° 43,06' S	76° 33,43' W	158,1	MSS
ME930/376-1	18.02.2013	11:44	13° 43,27' S	76° 34,07' W	162,3	PCTD/RO
ME930/376-2	18.02.2013	14:11	13° 43,27' S	76° 34,07' W	163,9	CTD/RO
ME930/376-3	18.02.2013	14:56	13° 43,27' S	76° 34,07' W	162,0	MSN
ME930/377-1	18.02.2013	16:02	13° 44,64' S	76° 38,23' W	218,0	MSS
ME930/378-1	18.02.2013	17:17	13° 44,75' S	76° 38,57' W	223,8	PCTD/RO
ME930/378-2	18.02.2013	19:48	13° 44,75' S	76° 38,57' W	224,1	CTD/RO
ME930/378-3	18.02.2013	20:26	13° 44,75' S	76° 38,57' W	225,5	MSN
ME930/379-1	18.02.2013	21:30	13° 46,36' S	76° 43,44' W	387,3	MSN
ME930/380-1	18.02.2013	22:12	13° 47,85' S	76° 43,43' W	463,5	MSN
ME930/380-2	18.02.2013	22:55	13° 47,85' S	76° 43,43' W	468,5	PCTD/RO
ME930/380-3	19.02.2013	01:25	13° 47,85' S	76° 43,43' W	516,8	CTD/RO
ME930/380-4	19.02.2013	02:14	13° 47,87' S	76° 43,43' W	940,3	MSS
ME930/381-1	19.02.2013	03:44	13° 47,85' S	76° 43,42' W	463,3	MSN
ME930/381-2	19.02.2013	04:19	13° 47,88' S	76° 43,41' W	468,7	CTD/RO
ME930/382-1	19.02.2013	05:24	13° 44,73' S	76° 38,59' W	223,5	CTD/RO
ME930/382-2	19.02.2013	05:53	13° 44,72' S	76° 38,59' W	225,3	MSN
ME930/383-1	19.02.2013	14:19	12° 34,93' S	77° 43,81' W	957,3	GLIDER
ME930/384-1	19.02.2013	19:32	13° 06,57' S	78° 10,05' W	6581,8	CTD/RO
ME930/384-2	20.02.2013	00:03	13° 06,57' S	78° 10,05' W	5602,9	CTD/RO
ME930/385-1	20.02.2013	02:28	12° 57,50' S	77° 57,81' W	3488,8	CTD/RO
ME930/386-1	20.02.2013	05:44	12° 40,07' S	77° 49,28' W	1654,5	CTD/RO
ME930/386-2	20.02.2013	07:23	12° 40,07' S	77° 49,28' W	1652,5	MSN
ME930/386-3	20.02.2013	08:22	12° 40,07' S	77° 49,28' W	1652,0	PLA
ME930/387-1	20.02.2013	09:28	12° 37,32' S	77° 43,83' W	1156,8	CTD/RO
ME930/388-1	20.02.2013	11:00	12° 35,89' S	77° 41,91' W	1022,2	CTD/RO
ME930/389-1	20.02.2013	13:17	12° 29,27' S	77° 32,70' W	524,3	CTD/RO
ME930/390-1	20.02.2013	14:40	12° 26,27' S	77° 28,34' W	363,6	CTD/RO
ME930/391-1	20.02.2013	18:04	12° 40,10' S	77° 49,26' W	1655,3	MSN
ME930/391-2	20.02.2013	19:00	12° 40,10' S	77° 49,26' W	1653,9	CTD/RO
ME930/391-3	20.02.2013	20:10	12° 40,10' S	77° 49,26' W	1654,8	MSN
ME930/391-4	20.02.2013	21:15	12° 40,10' S	77° 49,26' W	1654,4	PCTD/RO
ME930/391-5	21.02.2013	03:33	12° 39,99' S	77° 49,32' W	1657,5	CTD/RO
ME930/391-6	21.02.2013	03:52	12° 40,00' S	77° 49,32' W	1654,6	MSS
ME930/391-7	21.02.2013	05:16	12° 40,08' S	77° 49,27' W	1654,6	ISP
ME930/391-8	21.02.2013	08:12	12° 40,08' S	77° 49,28' W	1655,7	PLA

CTD/RO=CTD with Rosette water sampler, PCTD/RO=Pump CTD with Rosette Water sampler, MSS, Micro Structure Probe, ADCP=Acoustic Doppler Current Profile, MSN=Multinet, PLA=Plankton Net, MOR=Mooring, ISP=In Situ Pump, LANDRE= Benthich ADCP Lander, POZ =POZ Lander. GLIDER=Glider recovery

Station	Date	Time UTC	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
ME930/391-9	21.02.2013	08:42	12° 40,08' S	77° 49,28' W	1656,3	MSN
ME930/391-10	21.02.2013	09:49	12° 40,08' S	77° 49,28' W	1654,6	PCTD/RO
ME930/391-12	21.02.2013	12:53	12° 40,10' S	77° 49,28' W	1656,1	MSS
ME930/392-1	21.02.2013	16:00	12° 29,28' S	77° 32,69' W	523,5	CTD/RO
ME930/393-1	21.02.2013	19:05	12° 24,62' S	77° 26,04' W	296,8	CTD/RO
ME930/394-1	21.02.2013	19:39	12° 22,62' S	77° 23,30' W	223,1	CTD/RO
ME930/394-2	21.02.2013	21:26	12° 22,62' S	77° 23,30' W	222,2	CTD/RO
ME930/394-3	21.02.2013	22:34	12° 22,64' S	77° 23,31' W	222,9	MSS
ME930/395-1	22.02.2013	03:09	12° 18,71' S	77° 17,79' W	144,8	PLA
ME930/396-1	22.02.2013	03:54	12° 17,49' S	77° 16,37' W	133,1	PLA
ME930/397-1	22.02.2013	04:50	12° 18,77' S	77° 17,82' W	144,1	MSS
ME930/398-1	22.02.2013	08:13	12° 34,98' S	77° 39,85' W	1008,6	MSS
ME930/399-1	22.02.2013	09:46	12° 31,53' S	77° 35,80' W	822,2	MSN
ME930/399-2	22.02.2013	10:39	12° 31,53' S	77° 35,80' W	822,0	CTD/RO
ME930/399-3	22.02.2013	11:32	12° 31,54' S	77° 35,80' W	822,1	MSS
ME930/399-4	22.02.2013	12:43	12° 31,52' S	77° 35,80' W	822,1	PCTD/RO
ME930/399-5	22.02.2013	19:56	12° 31,52' S	77° 35,80' W	821,0	CTD/RO
ME930/399-6	22.02.2013	20:56	12° 31,52' S	77° 35,80' W	820,9	MSN
ME930/399-7	22.02.2013	21:56	12° 31,52' S	77° 35,80' W	821,3	CTD/RO
ME930/399-8	22.02.2013	23:09	12° 31,52' S	77° 35,80' W	821,7	ISP
ME930/400-1	23.02.2013	05:27	12° 54,39' S	78° 08,46' W	3448,5	ADCP
ME930/401-1	23.02.2013	11:39	12° 13,89' S	77° 10,99' W	79,7	ADCP
ME930/402-1	23.02.2013	12:58	12° 22,84' S	77° 22,88' W	221,2	ADCP
ME930/403-1	23.02.2013	13:33	12° 25,91' S	77° 17,27' W	211,7	ADCP
ME930/404-1	23.02.2013	14:46	12° 33,39' S	77° 27,36' W	534,0	CTD/RO
ME930/404-2	23.02.2013	15:34	12° 33,42' S	77° 27,36' W	534,8	MSS
ME930/405-1	23.02.2013	17:16	12° 35,11' S	77° 29,76' W	698,4	CTD/RO
ME930/405-2	23.02.2013	18:27	12° 35,13' S	77° 29,76' W	699,5	MSS
ME930/406-1	23.02.2013	20:14	12° 37,52' S	77° 33,01' W	1061,9	CTD/RO
ME930/407-1	23.02.2013	21:55	12° 41,72' S	77° 40,07' W	1361,1	MSS
ME930/407-1	23.02.2013	22:37	12° 42,27' S	77° 39,94' W	1377,3	MSS
ME930/407-2	23.02.2013	22:48	12° 42,48' S	77° 39,90' W	1389,1	CTD/RO
ME930/408-1	24.02.2013	00:01	12° 43,59' S	77° 41,40' W	1523,3	CTD/RO
ME930/409-1	24.02.2013	01:23	12° 45,30' S	77° 43,78' W	1727,9	MSS
ME930/409-2	24.02.2013	02:52	12° 45,30' S	77° 43,80' W	1732,0	CTD/RO
ME930/409-2	24.02.2013	03:40	12° 45,30' S	77° 43,80' W	1733,1	CTD/RO
ME930/409-3	24.02.2013	03:53	12° 45,30' S	77° 43,80' W	1731,5	CTD/RO
ME930/410-1	24.02.2013	04:46	12° 41,10' S	77° 48,86' W	1711,5	ADCP
ME930/411-1	24.02.2013	07:42	12° 22,63' S	77° 23,29' W	222,5	MSN
ME930/411-2	24.02.2013	08:16	12° 22,63' S	77° 23,29' W	222,1	CTD/RO

CTD/RO=CTD with Rosette water sampler, PCTD/RO=Pump CTD with Rosette Water sampler, MSS, Micro Structure Probe, ADCP=Acoustic Doppler Current Profile, MSN=Multinet, PLA=Plankton Net, MOR=Mooring, ISP=In Situ Pump, LANDRE= Benthich ADCP Lander, POZ =POZ Lander. GLIDER=Glider recovery

Station	Date	Time UTC	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
ME930/411-3	24.02.2013	08:51	12° 22,63' S	77° 23,29' W	221,8	PLA
ME930/411-4	24.02.2013	09:27	12° 22,63' S	77° 23,29' W	222,0	ISP
ME930/411-5	24.02.2013	12:03	12° 22,64' S	77° 23,29' W	221,6	MSS
ME930/411-6	24.02.2013	13:40	12° 22,62' S	77° 23,30' W	222,2	PCTD/RO
ME930/411-7	24.02.2013	20:52	12° 22,62' S	77° 23,30' W	222,9	CTD/RO
ME930/411-8	24.02.2013	21:20	12° 22,62' S	77° 23,30' W	222,6	MSN
ME930/411-9	24.02.2013	21:50	12° 22,62' S	77° 23,30' W	222,4	CTD/RO
ME930/412-1	24.02.2013	23:06	12° 18,75' S	77° 17,79' W	144,4	CTD/RO
ME930/413-1	25.02.2013	00:40	12° 13,50' S	77° 10,50' W	74,1	CTD/RO
ME930/413-2	25.02.2013	01:18	12° 13,50' S	77° 10,50' W	72,7	PLA
ME930/414-1	25.02.2013	03:33	12° 25,06' S	76° 51,50' W	81,5	CTD/RO
ME930/414-2	25.02.2013	04:11	12° 25,06' S	76° 51,50' W	80,8	PLA
ME930/415-1	25.02.2013	05:14	12° 29,23' S	76° 56,59' W	120,1	CTD/RO
ME930/415-2	25.02.2013	05:45	12° 29,23' S	76° 56,59' W	126,1	PLA
ME930/416-1	25.02.2013	06:52	12° 33,44' S	77° 02,13' W	152,5	CTD/RO
ME930/416-2	25.02.2013	07:38	12° 33,43' S	77° 02,13' W	152,5	PLA
ME930/417-1	25.02.2013	09:50	12° 45,20' S	76° 54,23' W	157,2	CTD/RO
ME930/418-1	25.02.2013	11:25	12° 41,34' S	76° 49,12' W	120,8	CTD/RO
ME930/419-1	25.02.2013	12:54	12° 37,41' S	76° 44,01' W	82,0	CTD/RO
ME930/420-1	25.02.2013	16:10	12° 52,37' S	76° 34,70' W	53,8	CTD/RO
ME930/420-2	25.02.2013	16:49	12° 52,37' S	76° 34,70' W	54,7	PLA
ME930/421-1	25.02.2013	17:41	12° 56,28' S	76° 39,81' W	113,7	CTD/RO
ME930/421-2	25.02.2013	18:18	12° 56,28' S	76° 39,81' W	113,5	PLA
ME930/422-1	25.02.2013	19:10	13° 00,01' S	76° 44,85' W	134,5	CTD/RO
ME930/422-2	25.02.2013	19:50	13° 00,01' S	76° 44,85' W	133,6	PLA
ME930/423-1	25.02.2013	21:23	13° 14,10' S	76° 43,13' W	133,4	CTD/RO
ME930/424-1	25.02.2013	22:45	13° 09,51' S	76° 36,83' W	117,0	CTD/RO
ME930/425-1	26.02.2013	00:03	13° 05,23' S	76° 30,64' W	72,6	CTD/RO
ME930/426-1	26.02.2013	02:12	13° 22,20' S	76° 34,34' W	123,2	CTD/RO
ME930/426-2	26.02.2013	03:45	13° 22,20' S	76° 34,34' W	122,7	PLA
ME930/427-1	26.02.2013	05:06	13° 28,99' S	76° 43,47' W	179,0	CTD/RO
ME930/428-1	26.02.2013	07:12	13° 31,99' S	76° 47,63' W	267,6	CTD/RO
ME930/429-1	26.02.2013	09:34	13° 35,40' S	76° 51,85' W	413,8	CTD/RO
ME930/430-1	26.02.2013	12:47	13° 46,23' S	77° 06,53' W	2273,0	CTD/RO
ME930/430-2	26.02.2013	13:41	13° 46,25' S	77° 06,53' W	2269,0	MSS
ME930/431-1	26.02.2013	16:23	13° 38,32' S	77° 08,27' W	2181,5	GLIDER
ME930/432-1	26.02.2013	17:26	13° 44,02' S	77° 04,18' W	1981,7	GLIDER
ME930/432-1	26.02.2013	17:36	13° 43,99' S	77° 04,24' W	1985,0	GLIDER
ME930/433-1	26.02.2013	17:55	13° 43,78' S	77° 06,05' W	2174,2	CTD/RO
ME930/433-2	26.02.2013	19:25	13° 43,82' S	77° 06,02' W	2172,6	MSS

CTD/RO=CTD with Rosette water sampler, PCTD/RO=Pump CTD with Rosette Water sampler, MSS, Micro Structure Probe, ADCP=Acoustic Doppler Current Profile, MSN=Multinet, PLA=Plankton Net, MOR=Mooring, ISP=In Situ Pump, LANDRE= Benthich ADCP Lander, POZ =POZ Lander. GLIDER=Glider recovery

Station	Date	Time UTC	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
ME930/434-1	26.02.2013	22:20	13° 35,39' S	76° 51,83' W	493,3	CTD/RO
ME930/434-2	26.02.2013	23:25	13° 35,44' S	76° 51,84' W	414,4	MSS
ME930/435-1	27.02.2013	01:49	13° 29,05' S	76° 43,52' W	181,0	CTD/RO
ME930/435-2	27.02.2013	02:37	13° 29,08' S	76° 43,52' W	181,1	MSS
ME930/436-1	27.02.2013	05:09	13° 22,20' S	76° 34,33' W	122,9	CTD/RO
ME930/436-2	27.02.2013	06:18	13° 22,30' S	76° 34,33' W	122,8	MSS
ME930/437-1	27.02.2013	09:23	13° 43,26' S	76° 34,07' W	164,1	MSN
ME930/437-2	27.02.2013	09:51	13° 43,26' S	76° 34,07' W	163,8	CTD/RO
ME930/437-3	27.02.2013	10:10	13° 43,26' S	76° 34,07' W	166,0	PLA
ME930/438-1	27.02.2013	10:44	13° 42,84' S	76° 32,94' W	152,2	MSS
ME930/439-1	27.02.2013	16:24	13° 43,27' S	76° 34,11' W	162,7	CTD/RO
ME930/439-2	27.02.2013	17:14	13° 43,27' S	76° 34,10' W	165,7	MSN
ME930/440-1	27.02.2013	18:24	13° 41,16' S	76° 37,05' W	185,7	GLIDER
ME930/441-1	27.02.2013	20:29	13° 31,97' S	76° 47,68' W	268,4	MSN
ME930/441-2	27.02.2013	21:21	13° 31,98' S	76° 47,66' W	267,9	PCTD/RO
ME930/441-3	28.02.2013	01:37	13° 31,97' S	76° 47,66' W	267,3	CTD/RO
ME930/441-4	28.02.2013	02:53	13° 31,98' S	76° 47,66' W	268,7	CTD/RO
ME930/441-5	28.02.2013	03:13	13° 31,98' S	76° 47,66' W	268,0	CTD/RO
ME930/441-6	28.02.2013	03:55	13° 31,99' S	76° 47,67' W	268,3	MSS
ME930/441-7	28.02.2013	05:28	13° 31,96' S	76° 47,67' W	267,5	MSN
ME930/441-8	28.02.2013	06:07	13° 31,98' S	76° 47,66' W	267,9	PLA
ME930/441-9	28.02.2013	06:28	13° 31,98' S	76° 47,66' W	268,2	ISP
ME930/442-1	28.02.2013	15:26	12° 40,88' S	77° 48,72' W	0,0	MOR
ME930/443-1	28.02.2013	18:26	12° 30,76' S	77° 34,57' W	0,0	MOR
ME930/444-1	28.02.2013	19:38	12° 26,35' S	77° 34,22' W	485,3	GLIDER
ME930/445-1	28.02.2013	20:33	12° 28,94' S	77° 32,10' W	0,0	LANDER
ME930/446-1	28.02.2013	22:05	12° 23,52' S	77° 27,29' W	0,0	MOR
ME930/447-1	28.02.2013	23:50	12° 25,44' S	77° 15,08' W	182,9	CTD/RO
ME930/448-1	01.03.2013	01:22	12° 22,76' S	77° 11,44' W	137,9	CTD/RO
ME930/448-2	01.03.2013	02:09	12° 22,80' S	77° 11,44' W	138,9	MSS
ME930/448-3	01.03.2013	03:35	12° 22,79' S	77° 11,45' W	138,5	ISP
ME930/448-4	01.03.2013	05:50	12° 22,78' S	77° 11,46' W	137,9	PLA
ME930/448-5	01.03.2013	06:23	12° 22,78' S	77° 11,46' W	137,6	CTD/RO
ME930/449-1	01.03.2013	08:56	12° 32,62' S	77° 26,87' W	489,4	MSS
ME930/450-1	01.03.2013	12:55	12° 30,28' S	77° 24,36' W	1136,7	GLIDER
ME930/451-1	01.03.2013	13:55	12° 24,61' S	77° 25,99' W	0,0	POZ
ME930/452-1	01.03.2013	15:11	12° 23,08' S	77° 19,97' W	0,0	MOR
ME930/453-1	01.03.2013	16:41	12° 19,20' S	77° 24,78' W	0,0	MOR
ME930/454-1	01.03.2013	17:50	12° 18,49' S	77° 17,75' W	0,0	LANDER
ME930/455-1	01.03.2013	19:11	12° 13,25' S	77° 10,45' W	0,0	LANDER

CTD/RO=CTD with Rosette water sampler, PCTD/RO=Pump CTD with Rosette Water sampler, MSS, Micro Structure Probe, ADCP=Acoustic Doppler Current Profile, MSN=Multinet, PLA=Plankton Net, MOR=Mooring, ISP=In Situ Pump, LANDRE= Benthich ADCP Lander, POZ =POZ Lander. GLIDER=Glider recovery

Station	Date	Time UTC	PositionLat	PositionLon	Depth [m]	Gear Abbreviation
ME930/456-1	01.03.2013	19:57	12° 13,42' S	77° 10,67' W	0,0	CTD/RO
ME930/457-1	01.03.2013	21:47	12° 18,13' S	77° 16,99' W	137,2	CTD/RO
ME930/458-1	01.03.2013	23:19	12° 25,41' S	77° 15,10' W	0,0	CTD/RO
ME930/459-1	02.03.2013	01:04	12° 31,69' S	77° 23,69' W	400,6	CTD/RO
ME930/460-1	02.03.2013	03:10	12° 37,49' S	77° 33,01' W	1061,0	CTD/RO
ME930/460-2	02.03.2013	05:04	12° 37,49' S	77° 33,01' W	1059,0	CTD/RO
ME930/460-3	02.03.2013	06:07	12° 37,49' S	77° 33,01' W	1059,0	ISP
ME930/460-3	02.03.2013	08:39	12° 37,49' S	77° 33,01' W	1061,5	ISP
ME930/460-4	02.03.2013	08:48	12° 37,49' S	77° 33,01' W	1059,1	PLA
ME930/461-1	02.03.2013	12:26	12° 14,89' S	77° 12,65' W	102,7	CTD/RO
ME930/462-1	02.03.2013	13:54	12° 16,73' S	77° 08,30' W	90,0	CTD/RO
ME930/463-1	02.03.2013	15:07	12° 15,25' S	77° 09,15' W	82,1	CTD/RO
ME930/463-2	02.03.2013	16:04	12° 15,25' S	77° 09,15' W	82,4	PCTD/RO
ME930/463-3	02.03.2013	22:17	12° 15,25' S	77° 09,15' W	81,1	MSN
ME930/463-4	02.03.2013	22:45	12° 15,25' S	77° 09,15' W	81,7	CTD/RO
ME930/463-5	02.03.2013	23:04	12° 15,25' S	77° 09,15' W	82,6	ISP
ME930/463-6	03.03.2013	00:47	12° 15,27' S	77° 09,16' W	83,2	MSS
ME930/463-7	03.03.2013	01:36	12° 15,25' S	77° 09,15' W	82,3	CTD/RO
ME930/463-8	03.03.2013	02:03	12° 15,25' S	77° 09,16' W	82,4	PLA
ME930/463-9	03.03.2013	02:22	12° 15,25' S	77° 09,15' W	82,6	MSN
ME930/464-1	03.03.2013	03:10	12° 14,10' S	77° 11,63' W	86,1	ADCP
ME930/464-2	03.03.2013	11:51	13° 9,21' S	78° 30,55' W	4967,3	ADCP
ME930/464-3	03.03.2013	12:55	12° 58,04' S	78° 33,68' W	5174,1	ADCP
ME930/465-1	03.03.2013	13:56	12° 52,95' S	78° 25,04' W	5691,1	ADCP
ME930/464-3	03.03.2013	13:56	12° 52,95' S	78° 25,04' W	5691,1	CTD/RO
ME930/465-1	03.03.2013	14:19	12° 52,95' S	78° 25,00' W	6532,9	CTD/RO
ME930/465-2	03.03.2013	14:57	12° 53,07' S	78° 24,99' W	7548,6	MSS
ME930/466-1	03.03.2013	16:18	12° 52,97' S	78° 25,05' W	5849,8	CTD/RO
ME930/467-1	03.03.2013	20:24	12° 35,75' S	78° 01,39' W	2657,2	CTD/RO
ME930/468-1	04.03.2013	00:35	12° 18,51' S	77° 37,70' W	482,8	CTD/RO
ME930/469-1	04.03.2013	04:03	12° 22,82' S	77° 11,47' W	137,7	CTD/RO
ME930/469-2	04.03.2013	04:51	12° 22,82' S	77° 11,47' W	137,6	PLA
ME930/469-3	04.03.2013	05:14	12° 22,86' S	77° 11,46' W	137,7	MSS
ME930/469-4	04.03.2013	06:07	12° 23,61' S	77° 11,26' W	141,7	PLA
ME930/470-1	04.03.2013	07:13	12° 16,42' S	77° 10,70' W	99,1	PLA
ME930/471-1	04.03.2013	08:16	12° 13,49' S	77° 10,50' W	73,7	CTD/RO
ME930/471-2	04.03.2013	09:30	12° 13,49' S	77° 10,50' W	73,6	CTD/RO

CTD/RO=CTD with Rosette water sampler, PCTD/RO=Pump CTD with Rosette Water sampler, MSS, Micro Structure Probe, ADCP=Acoustic Doppler Current Profile, MSN=Multinet, PLA=Plankton Net, MOR=Mooring, ISP=In Situ Pump, LANDRE= Benthich ADCP Lander, POZ =POZ Lander. GLIDER=Glider recovery