CLIVAR Mode Water Dynamics Experiment (CLIMODE)
Fall 2007 R/V Oceanus Voyage 442
November 5, 2007 – November 19, 2007

Mooring Recovery Cruise

by

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Abstract

The main objective of the November 2007 CLIMODE cruise aboard *R/V Oceanus* was to recover the remaining four moorings deployed on earlier CLIMODE cruises as part of the instrument array aimed at understanding the formation of Eighteen Degree Water (EDW). Also accomplished on the cruise were CTD casts, hydrographic sampling, and drifter launches.

This report documents the work done on this cruise, the condition of the instruments recovered, and a preliminary look at some of the data collected.

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I. Project Background and Purpose

CLIMODE (CLIVAR Mode Water Experiment) is a multi-investigator project to study the formation of 'Eighteen Degree Water' (EDW). EDW is the subtropical mode water of the North Atlantic. Study of the EDW and its formation will improve understanding of this mode water as well as others that form adjacent to strong baroclinic fronts in other locations around the world. These formation regions have energetic air-sea interaction. EDW is created in the winter just south of the Gulf Stream, by convection in the presence of strong shear, with competing effects of vertical/lateral mixing and advection/stirring colluding to set its properties (e.g. Worthington 159, 1976; Schroeder et al, 1959; Ebbesmeyer and Lindstrom, 1986)

In order to better study these processes several scientific cruises were conducted in which numerous observations and scientific instruments were deployed. The November 2007 cruise of the *R/V Oceanus* concludes the field measurement program. Instruments deployed on the two–year mooring array were recovered. A final hydrographic survey was conducted. This report documents the work done during this final cruise, OC442.

II. CLIMODE Fall 2007 Cruise Overview

Many tasks were completed during the CLIMODE Fall 2007 Cruise aboard the *R/V Oceanus* including:

1. Four mooring recovery operations
2. The shut down and data back up of all mooring instruments
3. Three deployments of float triplicates (9 floats) for Dr. Rick Lumpkin
4. CTD casts were conducted and salinity and oxygen samples were processed
5. Water samples were collected and prepared for later DIC and nutrient processing
6. Underway data was collected including IMET and ADCP
7. 150 gallons of clean sea water were colleted for Dan Repeta

This cruise departed from and returned to Woods Hole, MA aboard *R/V Oceanus* (Voyage 442). Table 1 and Table 2 list the scientific participants and the crew members aboard the cruise, respectively. Figure 1 shows the ship's track during the cruise. Figure 2 shows the mooring and station locations.

Table 1: CLIMODE Fall 2007 science party

Name	*Affiliation*	*Responsibility*
Dr. David Fratantoni	WHOI	Chief Scientist / mooring ops
Jim Dunn	WHOI	Mooring operations
Ian Fenty	MIT	CTD watch / mooring ops
Tom Fitzpatrick	SIO	CTD watch / mooring ops
Stephan Gary	Duke	CTDwatch / nutrients
Dr. Ben Hodges	WHOI	CTD watch leader / moorings
John Lund	WHOI	Mooring instrumentation
Will Ostrom	WHOI	Deck boss
Dave Wellwood	WHOI	CTD watch leader / hydrography

Table 2. CLIMODE Fall 2007 Ship's crew

R/V Oceanus Crew OC442	
Master	Larry Bearse
2nd Mate	Ethan Galac
2nd Mate	Paul Carty
Bosun	Pimenio (Clindor) Cacho
AB	Leo Fitz
AB	Alex Buchanan
OS	John Gaylord
Chief Engineer	Richard Morris (Moose)
Jr. Engineer	Nelson Botsford
Jr. Engineer	Sheikh Uddin
Steward	Joseph Harte
Messman	Colin (Leroy) Walcott
SSSG Tech	Alexander Dorsk

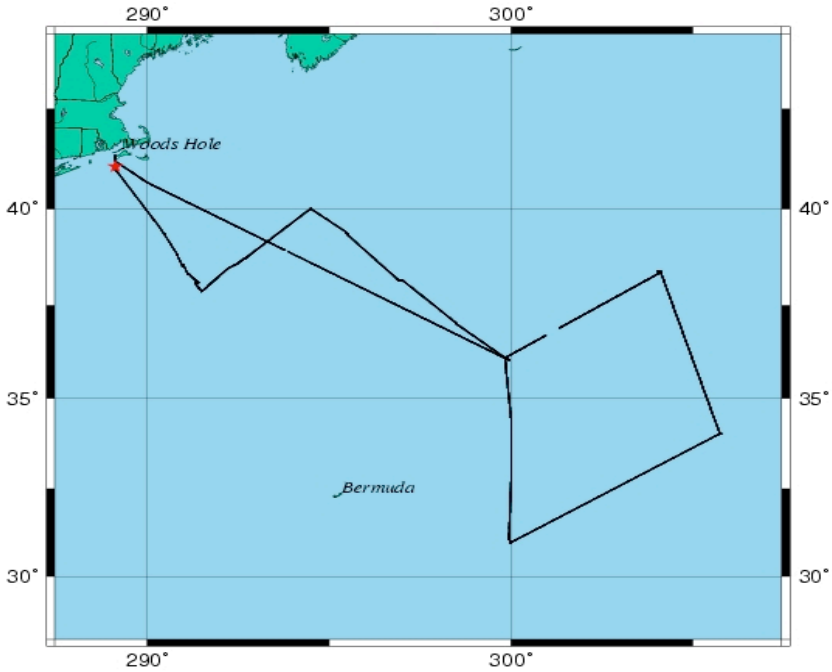

Figure 1: The CLIMODE Fall 2007 cruise track.

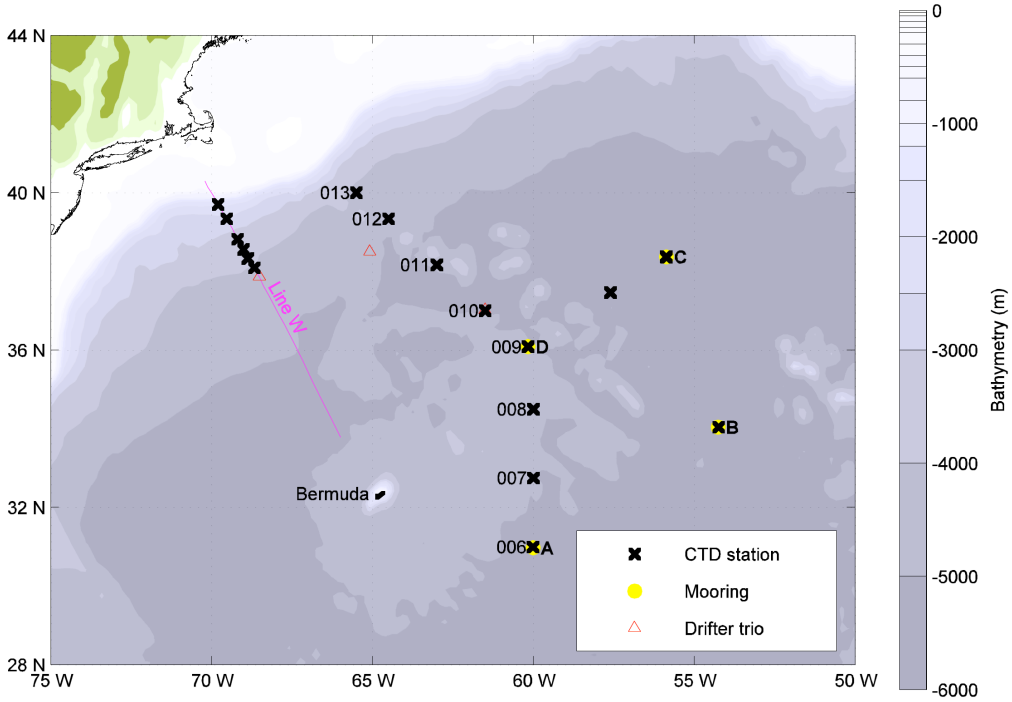

Figure 2. OC442 mooring and station locations. The four recovered moorings are labeled A-D; CTD stations 006 through 013 are labeled by station number.

III. Mooring Recovery

<u>**Mooring D** – Released 19:01 GMT, November 7, 2007</u>

The ball was sighted at the surface approximately over the mooring location. The strobe light was off but there was enough daylight to keep it off. Argos transmissions were received approximately 10 minutes after sighting. The strobe light started once the Argos ball and light were placed in the wet lab for cleaning.

Growth on the ball consisted of green and red-brown slime. There were a number of attached animals that were the shape of fish fins.

ADCP – Batteries are still functional and ADCP was heard pinging. Transducer heads had some hard growth but were for the most part clean.

Figure 3. Mooring D Argos/Strobe with fish fin-like shells.

SBE – 37 - Similar brown algae on the CTD.

Figure 4. Growth on SBE-37 Mooring D.

MMP (113) – Top bumper covered in growth. Wire did not appear slimy and some fish bite was observed near the top. The MMP was covered in a brown slime but appeared intact. Current profile fingers, spring tab, and CTD appeared fine. MMP was observed attempting a profile several hours after recovery (approx 19:30 EST).

SBE – 37 (w/o pressure) – Virtually clean with no growth.

Aanderraa Current Meter – Virtually clean. No means of determining if the instrument was functioning.

Sound Source (#23) – Recovered safely; end caps stayed in place. Source electronics were stable on deck and the cable from the source electronics to the resonator was separated from the strength cable. The resonator pulled the connection off the electronics pressure case.

Communication with the source electronics confirmed there was still an internal vacuum and battery voltage was good. The resonator clock was noted to be 29 seconds faster than the ship GPS clock. The pong power and the deck test power were changed to 0% and the mission was set to indefinite sleep mode. The USB serial cable was unplugged so that the spacebar would not be hit accidentally, waking the sound source.

SBE-37 SN2139 and 1645 were soaked in an ice bath. Both sensors were dropped into the bath at 01:41:00 November 8, 2007 GMT and removed at 02:08:00 (day 312).

SN2139 uses RS485 communication protocol. A capture file of data communications using SeaTerm Version 1.5 was made and is located on Fiamma's computer in the mydocs folder. SN2139 was stopped at 02:33 plus a few seconds because the command sequence was typed incorrectly. The capture file was stopped and data upload was started (approximately 21:35 EST). Data appeared on the computer screen with some odd characters similar to the upload during 2006.

Mooring C – Released 11:00 GMT, November 9, 2007

The ball was sighted at approximately 11:15 GMT near the mooring location. The Argos signal was detected but the strobe light did not flash most likely because it was day. Sea state was rougher than during the first recovery. Swell from two different directions caused the ship to roll more than during the previous mooring recovery. Waves were 10 to 12 feet.

Growth on the ball consisted of a brown fuzzy algae and a few limpets. There were no fin shellfish similar to mooring D.

ADCP – The ADCP transducer faces were clean and free of shellfish. The same brown algae grew on the case of the ADCP and was easily washed off. The ADCP was not heard pinging. Communication with the ADCP was initiated after re-securing the external power cable. Once the break command was accepted the data were uploaded.

There were two files on board. The first file, C002_0000.000, ended on July 4, 2007. The second and unexpected file, _RDI_000.000, started on 7/4/2007 and continued until 9/23/2007. It appears the record length is approximately a month and a half short due to a dead battery.

SBE – 37 – The top microcat was covered in the same brown algae. The conductivity tube looked clear.

MMP112 – The MMP appeared to be in good shape. The top cover protecting the instrument and data logger cables was loose and dangling on the wire. The data logger end cap was not covered with the brown algae and it appears that the cowling was knocked off during recovery.

Figure 5. Photo showing MMP 112 during recovery. Note dangling cover that was most likely knocked off during the recovery.

The MMP was covered in the same algae that grew on the other surface instruments. The condition of the MMP looks good. The spring, tab, and current meter fingers were all intact. The drive wheel did not spin freely, indicating the brake was set. The cable was clear of algae and had some fish bite.

Figure 6. Photo showing the condition of the instruments and algae growth on MMP 112.

The MMP drive motor was not observed moving but an indicator mark on the drive shaft showed that the motor did move.

The top bumper was covered in brown algae. The bottom bumper was clean. The foam stuffing in the tire was hanging out of the bottom bumper.

SBE-37 (w/o pressure) – Virtually clean and had no brown algae.

Aanderra Current Meter – Clean and free of algae growth. Paint appears to be blistering and is a known problem.

Sound Source #24 – Recovered safely. The source electronics were separated from the resonator on deck prior to recovering the resonator pipe. Dummy plugs were put on the source electronics end cap and the cable to the resonator.

The sound source pong parameters were changed so that maximum pong power was set to 0% for both the pong and the test pong. Vacuum, battery and temperature parameters were all good. Time drift was noted to be +5 seconds faster than the ship GPS time. The source was put into indefinite sleep mode and will not pong until it is restarted.

Mooring B – Released 18:55 GMT, November 10, 2007

The mooring was sighted approximately ½ mile from the ship. No Argos transmission was observed on the Argos uplink. The ball float and light were lightly covered in brown algae fuzz. The light was dimmed slightly by growth and did not flash until it was out of the sunlight.

SBE39 S/N 0080 - Mounted next to the strobe light; covered in hairy brown algae.

VACM S/N 0015 – Brown hairy algae grew on all parts of the VACM. The rotor and vane had growth but did not seem to be restricted in motion.

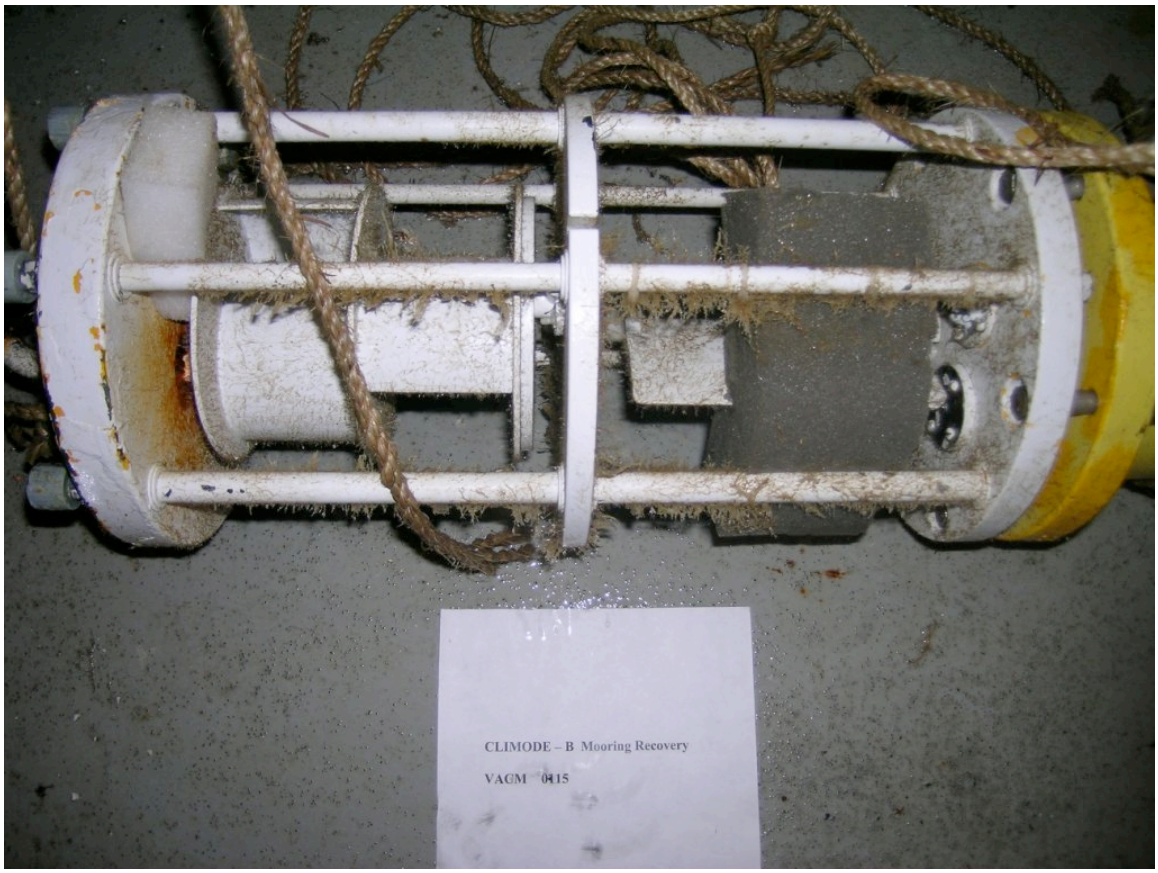

Figure 7. Photo of VACM 115 showing the extent of algae growth.

Sound Source #21 – Similar amounts of brown growth on the sound source electronics. End caps and vacuum plug were in place. The sound source resonator had some growth found on the inside of the tube and on the transducer. Again growth was light on the outside of the resonator. Chain shackles and anodes all looked very good and it was speculated would have lasted another year of deployment with little risk.

SBE39 – Sensors S/N 339, 333, 334, 337 were all clean and did not have any growth. All sensors were recovered in good shape.

Mooring A – Released 11:00 GMT, November 12, 2007

The mooring was not spotted for some time. Jim Dunn interrogated the release and determined that the range was increasing. The ship turned around and headed back to the mooring location. Ranging on the release confirmed we were closing on the releases. We did not receive an argos hit on the uplink. When the floatation balls were sighted the Argos locator was upside down.

Surface floats and all instruments were virtually clear of growth. The floatation balls, Argos, strobe light, and SBE37 S/N 0078, had minimal brown algae and much less than Mooring B.

VACM S/N 589 – Had very little algae and all moving parts were free to move.

Sound Source #22 – Sound source electronics were in good shape. Anodes and shackles on both the electronics and the resonator were all in good shape. There was no growth on or in the sound source.

SBE39 – Sensors 262, 261, 341, 336 were all clear of algae and were recovered in good condition.

VACM S/N 179 – Clean, no growth, and rotor and vane still in good working order.

Mooring Instrumentation Summary

Full-length data records were collected for all the SeaBird sensors and moored profilers. The ADCP on Mooring C had a reset in July, 2007 but resumed the mission. The second data file appears to have stopped approximately a month prior to recovery. The early termination of the data record may be the result of a dead battery. The ADCP on Mooring D returned a full data set. The RDI winADCP viewing software showed the ADCP data looked reasonable. Communication with the VACM's and Aanderra current meters (ACM) was not possible and data backup and processing will be done at WHOI.

With the exception of the sound sources, mooring instruments were shut down and backed up at the earliest convenient time, generally the day after the recovery. Sound sources had to be shut down shortly after being secured on deck so that the transducers would not be damaged by a full power pong in air. Clock drifts were noted for all instruments as they were shut down. Table 3 contains all the clock drifts for the mooring instrumentation.

Table 3. Instrument clock drift

CLIMODE Instrument Recovery Table					
Oceanus 442	Nov 5 -19, 2007				
Mooring A					
Realeased	12-Nov-07	11:00			
Instrument	Recovery		Stopped		Time drift
SBE39 sn 0078	11:55		13-Nov-07	13:52:49	- 46 sec
VACM sn 589	12:12				- 11 m 27s
Sound Source #22	12:30		12-Nov-07	15:40	+ 43 sec
SBE39 sn 262	12:34		13-Nov-07	14:13:07	+ 24 sec
SBE39 sn 261	12:44		13-Nov-07	14:27:46	+ 7 sec
SBE39 sn 341	12:49		13-Nov-07	14:41:33	- 21 sec
SBE39 sn 336	12:57		13-Nov-07	14:55:37	- 53 sec
VACM sn 179	13:08				- 8 m 10s
Mooring B					
Realeased	10-Nov-07	18:55			
Instrument	Recovery		Stopped		Time drift
SBE39 sn 0080	19:33		11-Nov-07	14:02:00	- 36 sec
VACM sn 0015	19:52				- 53 sec
Sound Source #21	20:07		10-Nov-07	23:20	- 14 sec
SBE39 sn 339	20:16		11-Nov-07	16:22:37	- 1 sec
SBE39 sn 333	20:21		11-Nov-07	16:30:02	- 69 sec
SBE39 sn 334	20:25		11-Nov-07	19:25:02	- 27 sec
SBE39 sn 337	20:28		11-Nov-07	19:47:00	- 7 sec
Mooring C					
Realeased	9-Nov-07	11:00			
Instrument	Recovery		Stopped		Time drift
ADCP sn 2222	11:35		11-Nov-07	18:10	+ 4:55
SBE37 sn 2140	11:48		9-Nov-07	18:42:30	+ 1:05
MMP 112	12:10		10-Nov-07	14:51:00	+ 2:27
SBE37 sn 2031	12:10		10-Nov-07	03:18	+ 1:12
ADCM sn 148	12:15				
Sound Source #24	12:15		9-Nov-07	16:41	+ 5 sec
Mooring D					
Realeased	7-Nov-07	19:01			
Instrument	Recovery		Stopped		Time drift
ADCP sn 2225	19:15		8-Nov-07	23:55	+ 7:25
SBE37 sn 2139	19:32		8-Nov-07	02:33:00	+ 26 sec
MMP 113	20:00		8-Nov-07	21:40:00	- 11:14
SBE37 sn 1645	20:00		8-Nov-07	14:02	+ 48 sec
ADCM sn 149	20:09				
Sound Source #23	20:18		7-Nov-07	23:25	+ 29 sec

IV. Raw instrument data

Below are figures of raw data that were uploaded from the mooring instruments.

A. SBE37 / SBE39 / MMP

The time series of temperature and pressure recorded by the SeaBird sensors and McLean Moored Profilers (MMPs) give some insight into what happened to the mooring during the deployment. Mooring C was subjected to a very different current regime than mooring D (Figures 8 and 9); several high current blow-down events occurred at mooring C. The SeaBird SBE37, located at a nominal depth of 66 meters (see mooring diagrams Appendix A), was blown down to a depth greater than 500 meters multiple times. These events greatly impacted the ability of the moored profiler to crawl up and down the wire. The time series of pressure (bottom panel in Figure 8) show that the profiler was not able to profile when the mooring was blown over.

Temperature records from the 10 SBE39's on Moorings A and B are plotted in Figures 10 and 11.

Data from the SBE37 instruments with pressure on both moorings C and D display an unknown sampling scheme. The instruments were set to sample every 300 seconds. The data returned show that the instrument appears to have burst sampled, sampling every 300 seconds for approximately 21 hours and then turning off for an equivalent time interval. The manufacturer has the instruments and is looking into the issue. Unfortunately the data sets were cleared from the instrument before the data gaps were noticed.

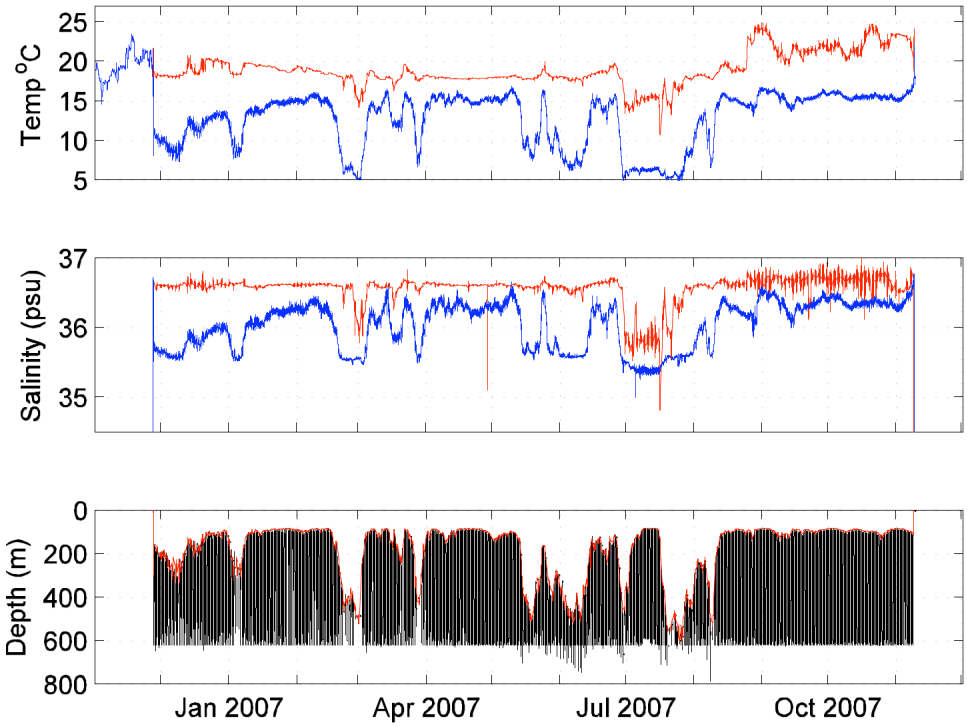

Figure 8. Mooring C temperature (top panel) salinity (middle) and pressure (bottom). Seabird SBE37, nominally 66 meters deep, plotted in red; Seabird SBE39 (no pressure), nominally 630 meters, plotted in blue. Moored profiler pressure data plotted in black.

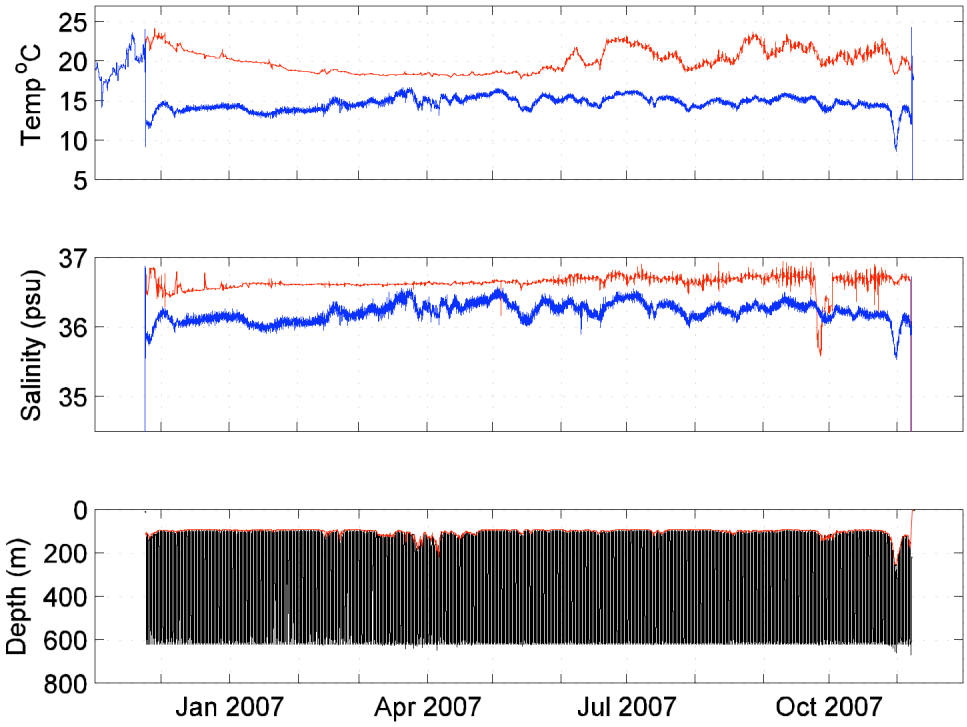

Figure 9. As in Figure 8, Mooring D.

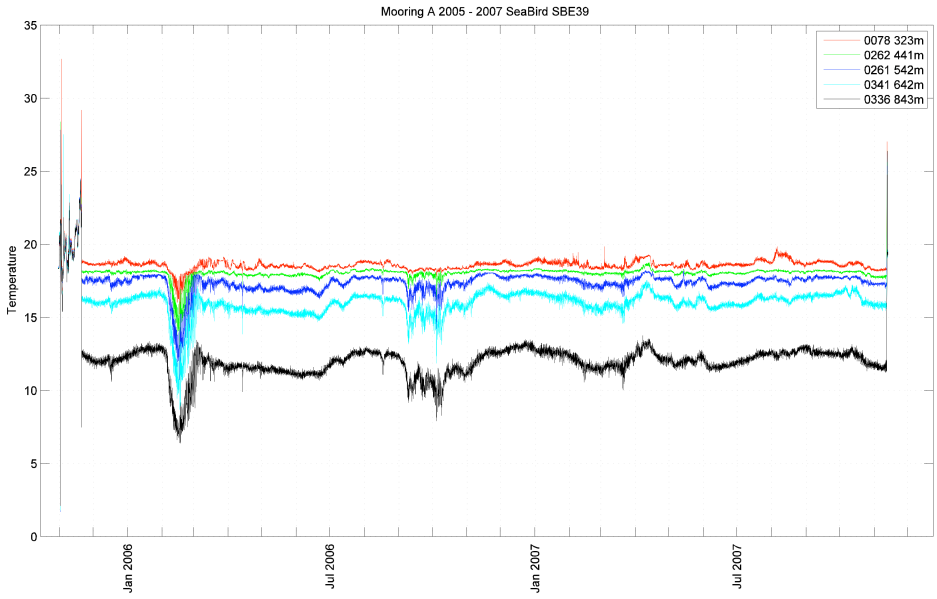

Figure 10. SBE39 temperature data from Mooring A.

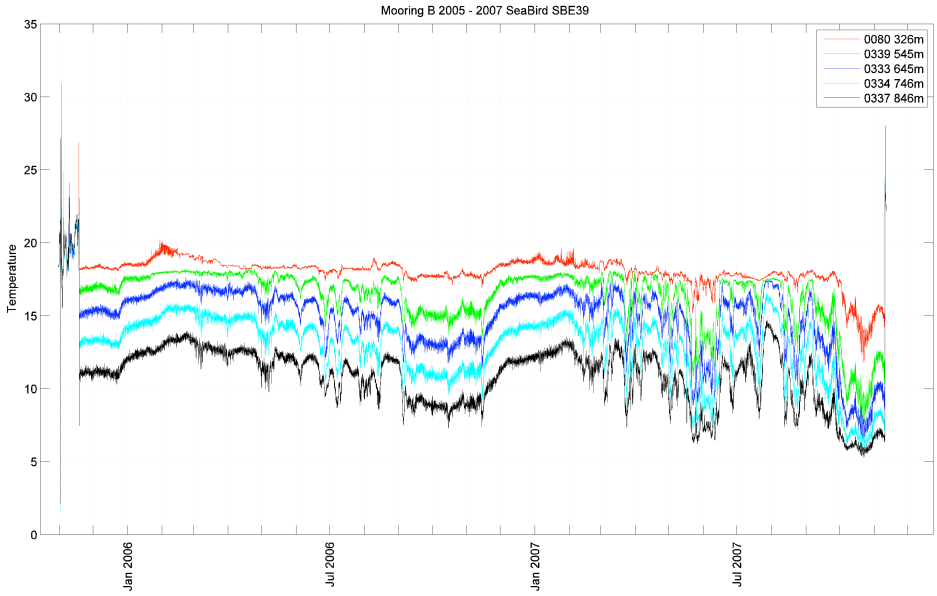

Figure 11. SBE39 temperature data from Mooring B.

B. VACM

Two Vector Averaging Current Meters (VACMs) recorded current on Mooring A at depths of approximately 240 meters (Current Meter # 589P, Filename ID 11662) and 920 meters (Current Meter # 179P, Filename ID 11667). One VACM on Mooring B was located at a depth of approximately 240 meters (Current Meter # 115P, Filename ID 11672). Figure 12 shows progressive vector diagrams for the current measured by all three instruments. Too small to see in the diagram are near-inertial loops, present in all three records. In addition to current, the VACMs recorded temperature and pressure. About 40% of the way through the deployment, the shallow VACM on Mooring A stopped recording temperature and pressure. The temperature and pressure records from the other instruments, as well as all the current records, are complete (Figure 13).

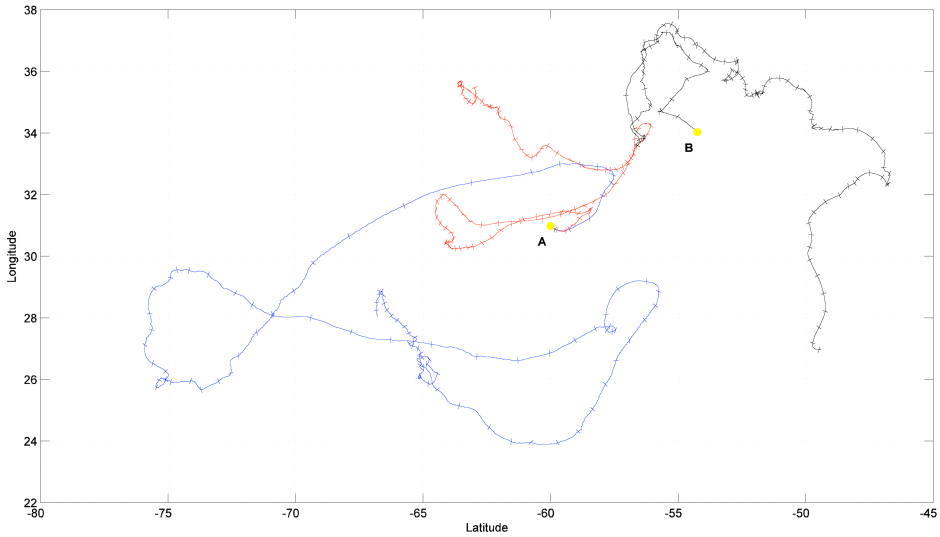

Figure 12. Progressive vector diagram for currents measured by VACM's on Mooring A (blue, 240m blue; red, 920m) and Mooring B (black, 240m). Hash marks denote one-week intervals.

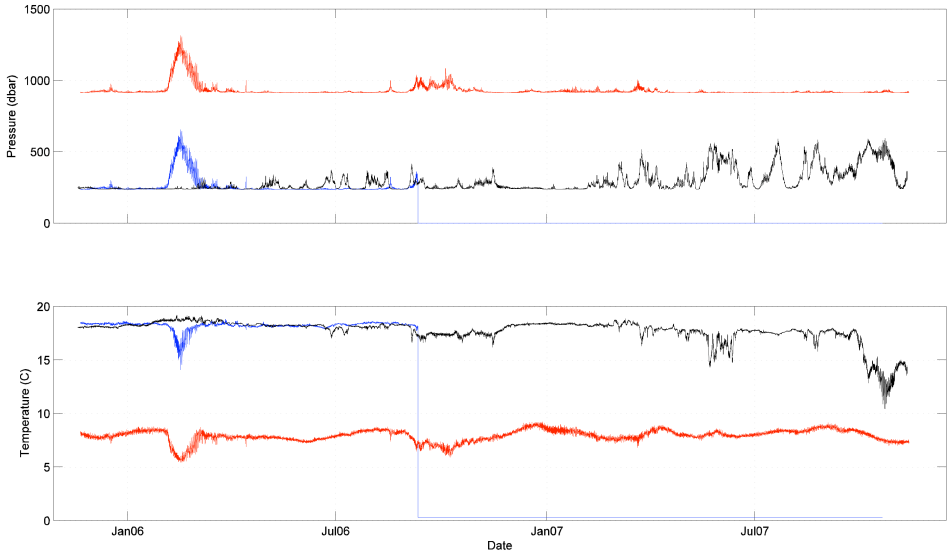

Figure 13. VACM pressure and temperature; colors as in Figure 12. Note pressure and temperature failed mid way through the deployment on the shallow Mooring A VACM. Colors as in Figure 12.

V. CTD operations

During OC442, 19 CTD casts were carried out, ranging in depth from approximately 2000 to 4000 m. The locations of the casts are plotted in Fig. 2. In situ measurements included conductivity, temperature, pressure, chlorophyll fluorescence, and dissolved oxygen. Water samples were taken with a 24-bottle rosette, from which samples were drawn for laboratory analysis of oxygen and salinity (all depths), dissolved inorganic carbon (upper 1000 m), and nutrients (all depths through CTD station 013, upper 1000 m thereafter).

During the first three CTD casts, the Niskin bottles did not fire consistently due to a faulty connection between the Seabird 911 and the cable termination. Bottle data from CTD station 001 is therefore sporadic, and there is no bottle data from stations 002 and 003. The connection was repaired prior to cast 004, and, with the exception of occasional glitches with individual bottles, firing proceeded normally for the remainder of the cruise. Casts 015-019 were done using the backup CTD winch due to problems with the turning block that redirects the cable from the winch to the squirt boom.

A. Salinity and Dissolved Oxygen - David Wellwood

1. Summary

Water samples were collected from virtually every bottle during this cruise for the determination of salinity and dissolved oxygen. A total of 19 stations were occupied using a CTD/Rosette system with 24 niskin bottles. The primary purpose of these measurements were to accurately calibrate the sensors on the CTD.

2. Salinity

Water was collected in 200 ml glass bottles. The bottles were rinsed twice, and then filled to the neck. After the samples reached the lab temperature, they were analyzed for salinity using a Guildline Autosal Model 8400B salinometer (WHOI #11, serial #59210). The salinometer's bath temperature was set to either 24C or 27C, depending on the ship's ambient lab temperature, and was standardized once a day using IAPSO Standard Seawater Batch P-147 (dated June-2006). Conductivity readings were logged automatically to a computer, salinity was calculated and merged with the CTD data, and finally used to update the CTD calibrations. Accuracies of salinity measurements were ±0.002 psu.

3. Dissolved Oxygen

Measurements were made using a modified Winkler technique similar to that described by Strickland and Parsons (1972). Each seawater sample was collected in a 150 ml brown glass Tincture bottle. When reagents were added to the sample, iodine was liberated which is proportional to the dissolved oxygen in the sample. A carefully measured 50-ml aliquot was collected from the prepared oxygen sample and titrated for total iodine content. Titration was automated using a PC controller and a Metrohm Model 665 Dosimat buret. The titration endpoint was determined amperometrically using a dual plate platinum electrode, with a resolution better than 0.001 ml. Accuracy

was about 0.02 ml/l, with a standard deviation of replicate samples of 0.005. This technique is described more thoroughly by Knapp et al (1990). Calculated oxygen was merged with the CTD data, and used to update the CTD calibrations. Standardization of the sodium thiosulphate titrant was performed daily.

B. Dissolved Inorganic Carbon (DIC)

Water samples from 1000 m and shallower were collected for DIC analysis. Each 200 ml glass bottle was rinsed 3 times before filling. It was filled with a short piece of Tygon tube which slipped over the peckock on the Niskin bottle and was fed into the bottom of the sample bottle to minimize gas exchange. After allowing at least 200 ml of water to overflow and ensuring the absence of bubbles, the tube was pinched off and withdrawn from the sample bottle, leaving a consistent headspace. Subsequently, 100 µl of mercuric chloride was added to each sample, halting biological processes.

C. Nutrients – Stephan Gary

ISUS 78 was redeployed in scheduled data collection mode so it would turn on and collect nitrate concentration data several times each day. The instrument logged the date and time of each measurement interval and logged the nitrate concentration, root mean square error in nitrate, instrument internal temperature, spectrometer and lamp temperature, internal humidity, battery voltage, and various intermediate spectrometer parameters that were used by the instrument to compute the nitrate concentration. During this most recent deployment, 149913 separate measurements were made over 344 days of deployment. The instrument failed to wake up and take data for seven days for unknown reasons. These no-data days were also observed during the previous deployment of ISUS 78.

Before cleaning the exterior or downloading data from the instrument, an attempt was made to calibrate the ISUS for potential drift by submerging the probe tip in a small sample of de-ionized water for 2 minutes of continuous data collection. As suggested by Satlantic technical support, the probe tip was not cleaned before this operation and no bubbles were present on the probe tip as the drift-correction calibration was made. Since the instrument was still operating under its deployment battery power, the data logs were downloaded with the instrument still hooked up to its battery. A serial connection to a Dell laptop, controlled by the Hyperterminal program, was used to communicate with the instrument. As with the previous deployment of the ISUS, a bug in the instrument firmware prevented lengthy batch downloads of the data logs. After the first 100 files were downloaded, the remaining 317 files were downloaded one by one. Of the 417 data log files downloaded from the instrument, 344 represent the current deployment, 67 were log files from the previous deployment accidentally left on the instrument when it was redeployed, and 6 files are logs that were made during various drift calibrations of the instrument. Once the downloading process was complete, the instrument was unhooked from its battery, removed from the tension bar, and thoroughly cleaned with freshwater.

Once downloaded, the data files had to be converted from binary format to ASCII in order to be loaded into plotting software. The conversion was performed using SatCon, a utility created by Satlantic, the manufacturer of the ISUS. Satlinatic also provided a telemetry definition format file which is an instrument-specific file used for translating the data from binary to ASCII. The data were translated by SatCon in batch mode and then loaded into MATLAB where the 417 files were concatenated into a single time series. A plot of the nitrate concentration and internal instrument temperature logged by the ISUS is in Figure 14. It is important to note that the negative nitrate concentrations are due to the use of an outdated calibration in translating the ISUS data. A more updated calibration is necessary. The following analysis will assume that although the actual values of nitrate will change to more reasonable values with more accurate calibration, the calibration itself will be linear. The time series starts with the earliest data recovered from the ISUS; as noted above, this data was collected during its previous deployment. The vertical black line indicates the end of the first deployment and the beginning of the second deployment. The vertical red line is the transition from Dec. 31, 2006 to Jan.1, 2007.

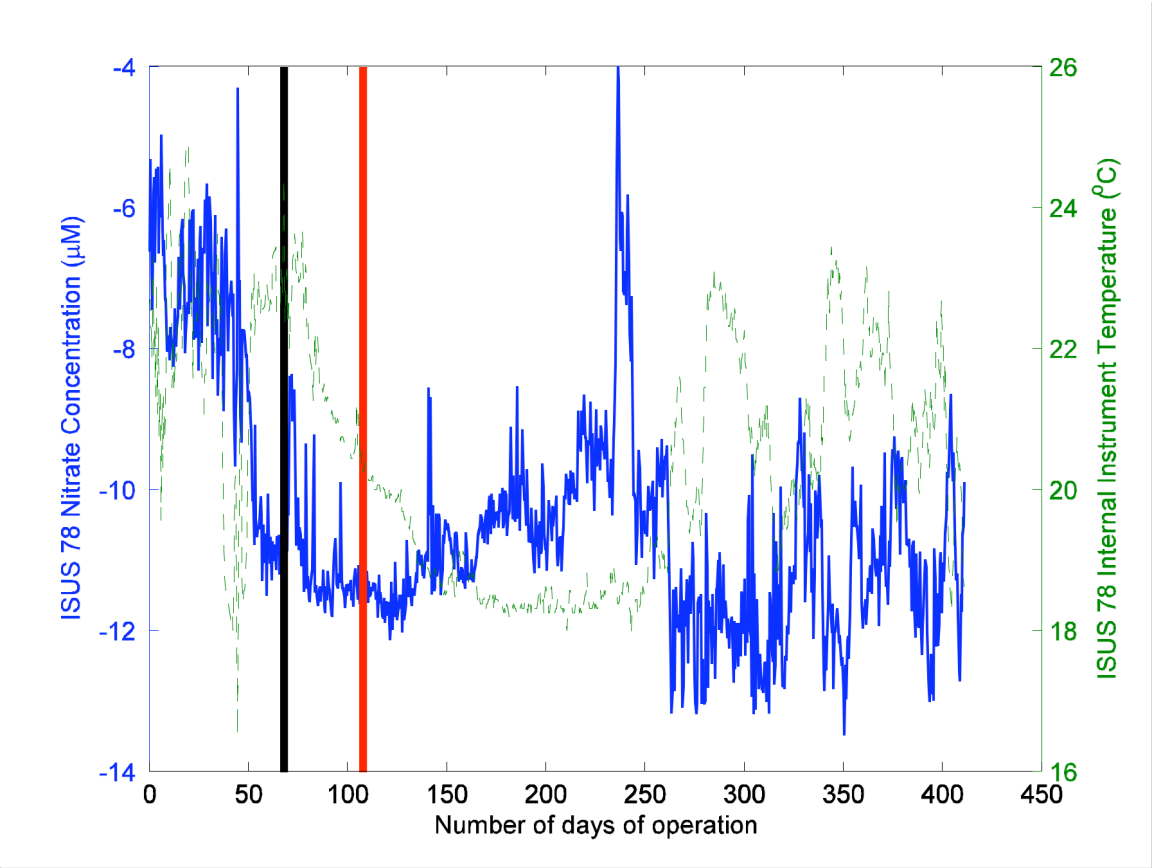

Figure 14. Nitrate concentration and ISUS internal temperature data from nominally 66 meters' depth on Mooring C. Black line denotes the mooring turnaround in November 2006 and red line marks Jan 1, 2007.

There are two salient features of this time series: lack of linear drift and the nitrate-

temperature relation. During the previous deployment of the ISUS, a distinct linear drift in the recovered data was observed over one year. The downward tend in the 67 days of data from the first deployment (to the left of the black line) reflects this trend. Once the ISUS was redeployed, however, this linear trend seems to have disappeared and the data from this most recent deployment show a very strong seasonal signal. Despite the difference between the first and second deployments, it appears that the nitrate concentrations and temperature curves are continous across the deployment change date. It seems unlikely, therefore, that there was an instantaneous change in the character of the instrument due to redeployment.

Finally, it is interesting to compare the time series of nitrate concentration and instrument internal temperature. It appears that the internal instrument temperature is consistently low when the ISUS measures high nutrient concentrations. For low nutrient concentrations, the instrument temperature is higher.

VI. Hydrographic data

A hydrographic section showing the upper 2000 m of the water column was constructed from CTD stations 006 to 013 (numbered in Fig. 2) using a ridge regression algorithm to generate a smooth surface approximating the data with a grid size of 25 km horizontally by 5 m vertically. Horizontal distance is measured in kilometers from CTD station 009, with locations to the south indicated by negative values.

In the southern part of the section, from –300 km to +200 km, a 300-500 m thick layer of 18-degree water was present (Fig. 15). This water mass was also uniform in salinity and oxygen (Fig. 16). The volume of 18-degree water significantly decreased north of station 10 at about 200 km except for a 100-km stretch in the vicinity of a warm-core ring near station 12. The Gulf Stream proper, identified by sharp gradients in all of the properties, was approached at station 13, but not contained within the section.

Profiles from the furthest offshore stations displayed a fairly tight TS signature. At the shallower stations, approaching the continental shelf, more variability in TS structure was evident, and the upper water column was fresher (Fig. 17).

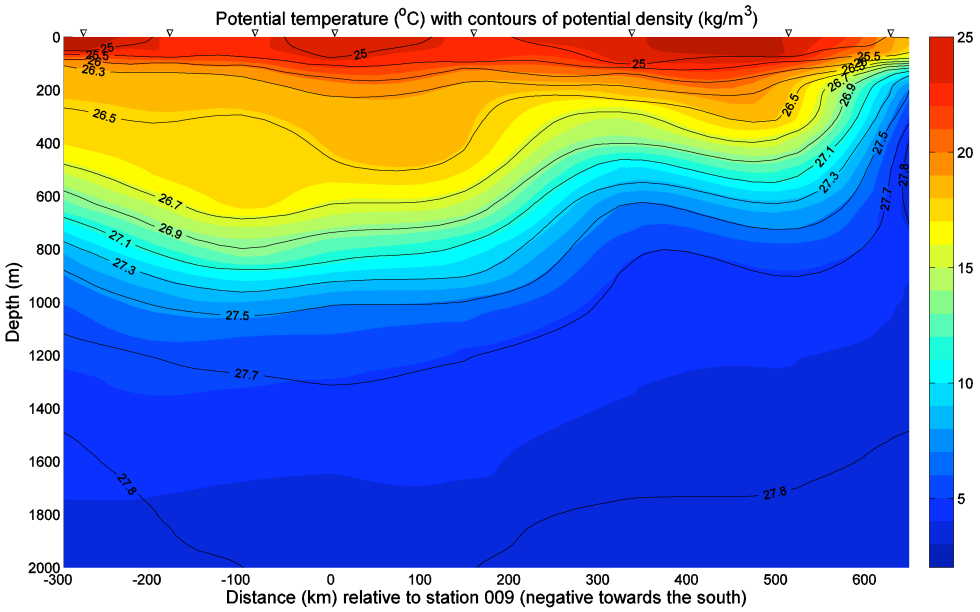

Figure 15. Potential temperature (color, ˚C) and potential density (contours, kg/m^3 in excess of 1000) of the upper 2000 m. Stations 006 to 013 are included in the section, with station positions indicated at the top of the figure by triangles.

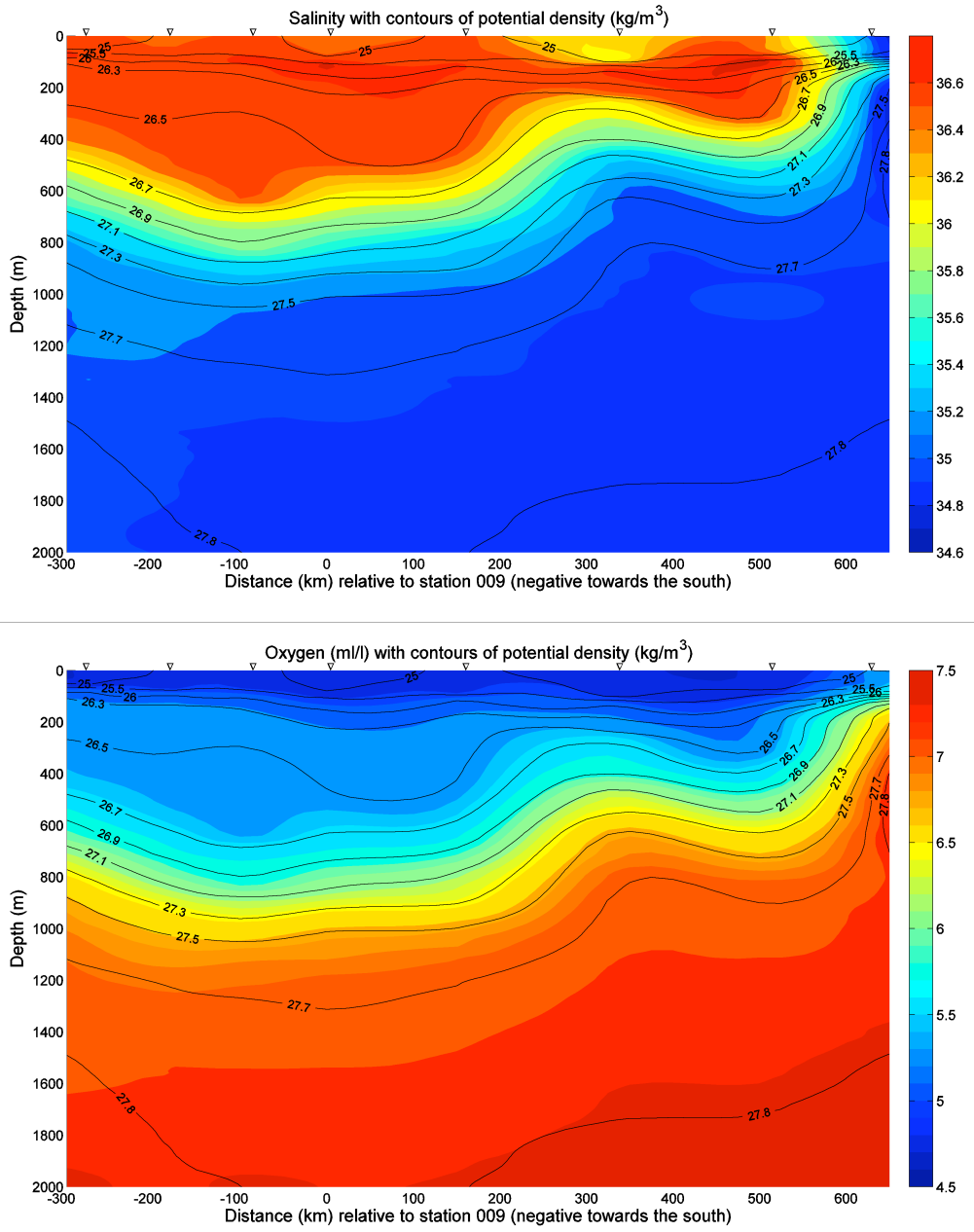

Figure 16. As in Fig. 15, for salinity (upper panel, psu) and oxygen (lower panel, ml/l).

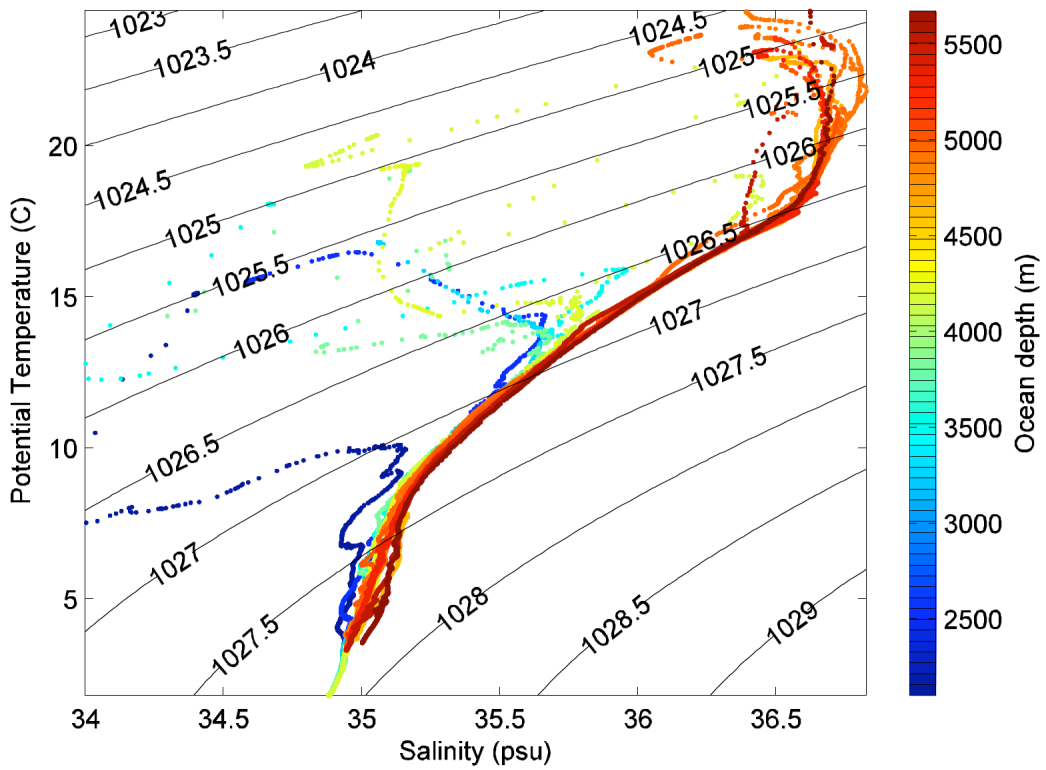

Figure 17. Potential temperature versus salinity for all 19 CTD stations occupied during OC442. Color indicates the ocean depth at the station location. Contours are potential density, labeled in kg/m^3. Fresher continental shelf water is evident at the shallower stations.

VII. Drifters

Nine Argos-tracked surface drifters were deployed in order to measure mixed layer currents and sub-skin SST. The Global Drifter Program drifters, with 15-meter holey sock drogues, were launched as trios whose positions are marked by triangles in Figure 2. Dr. Rick Lumpkin asked that the trios be distributed in the core of the Gulf Stream and immediately to the south, in the anticyclonic recirculation region. Underway sea surface temperature measurements and shipboard ADCP currents were used to help determine the deployment locations. Table 4 lists the drifter deployment times and locations.

Table 4. Drifter deployment locations

Drifter Deployment Log							
CLIMODE OC442 Nov 5-19 2007							
ID	Date	Time	LAT	lat	LON	lon	Surface Temp C
71193	6-Nov-07	20:42	38	29.79	65	5.07	25.19
71186	6-Nov-07	20:42	38	29.79	65	5.07	25.19
72036	6-Nov-07	20:42	38	29.79	65	5.07	25.19
71191	14-Nov-07	15:08	37	1.00	61	30.00	22.54
71183	14-Nov-07	15:08	37	1.00	61	30.00	22.54
71178	14-Nov-07	15:08	37	1.00	61	30.00	22.54
72037	16-Nov-07	23:03	37	51.63	68	30.73	24.53
72038	16-Nov-07	23:03	37	51.63	68	30.73	24.53
71179	16-Nov-07	23:03	37	51.63	68	30.73	24.53

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Acknowledgements

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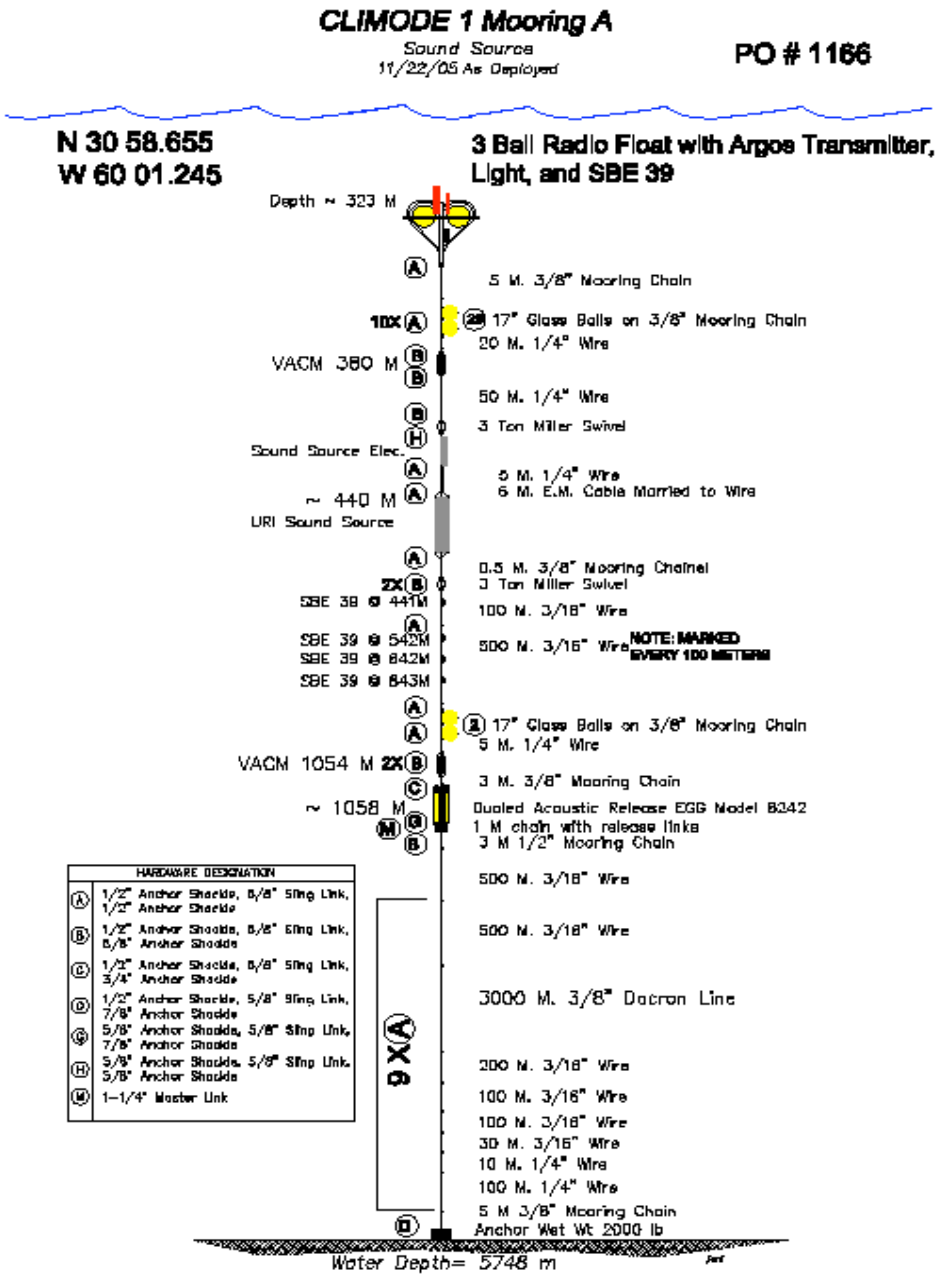
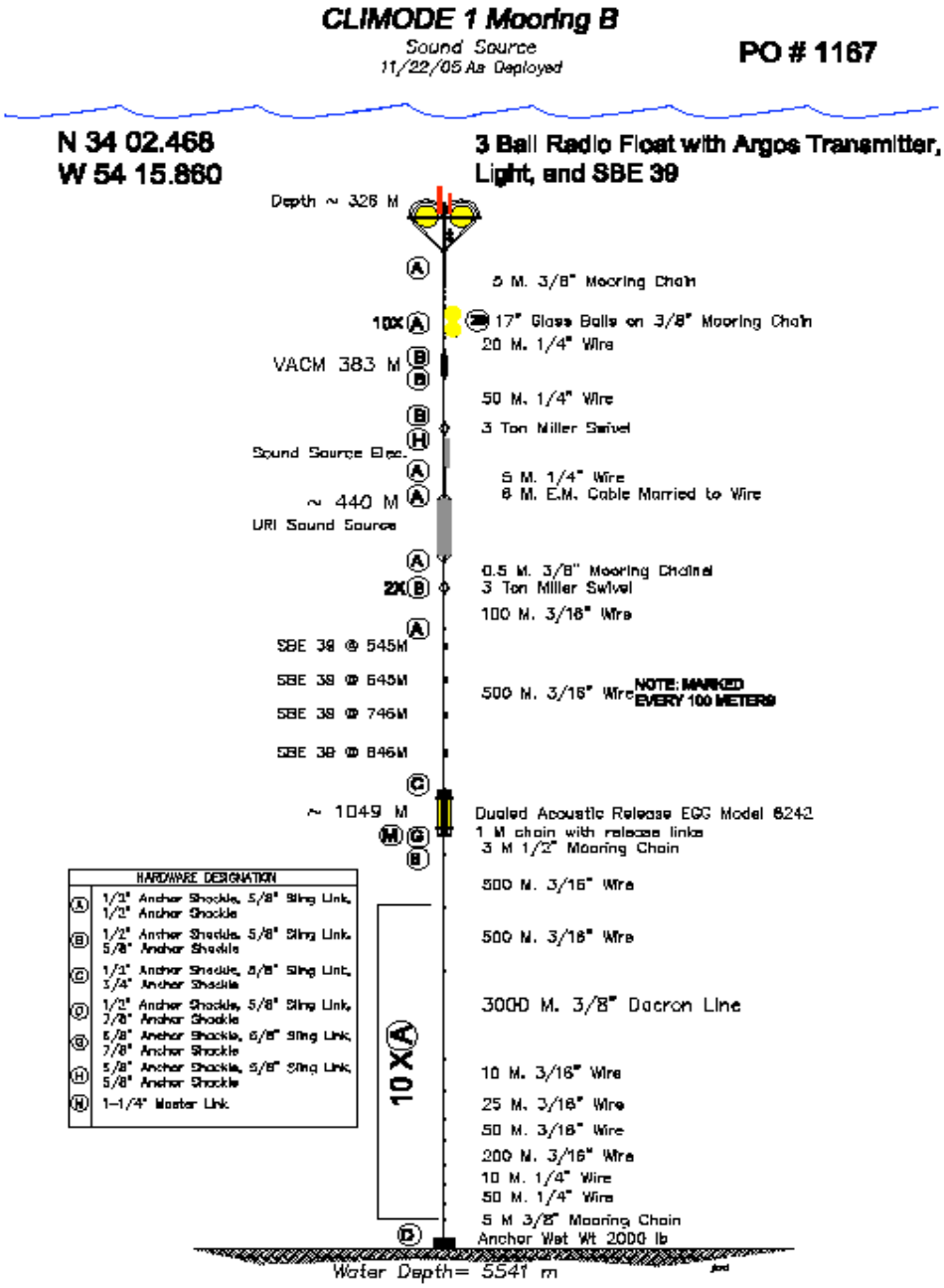
The CLIMODE group would like to thank the crew of the *R/V Oceanus* for their knowledgeable help during the CLIMODE 2007 cruise.

Appendix A. Mooring Diagrams

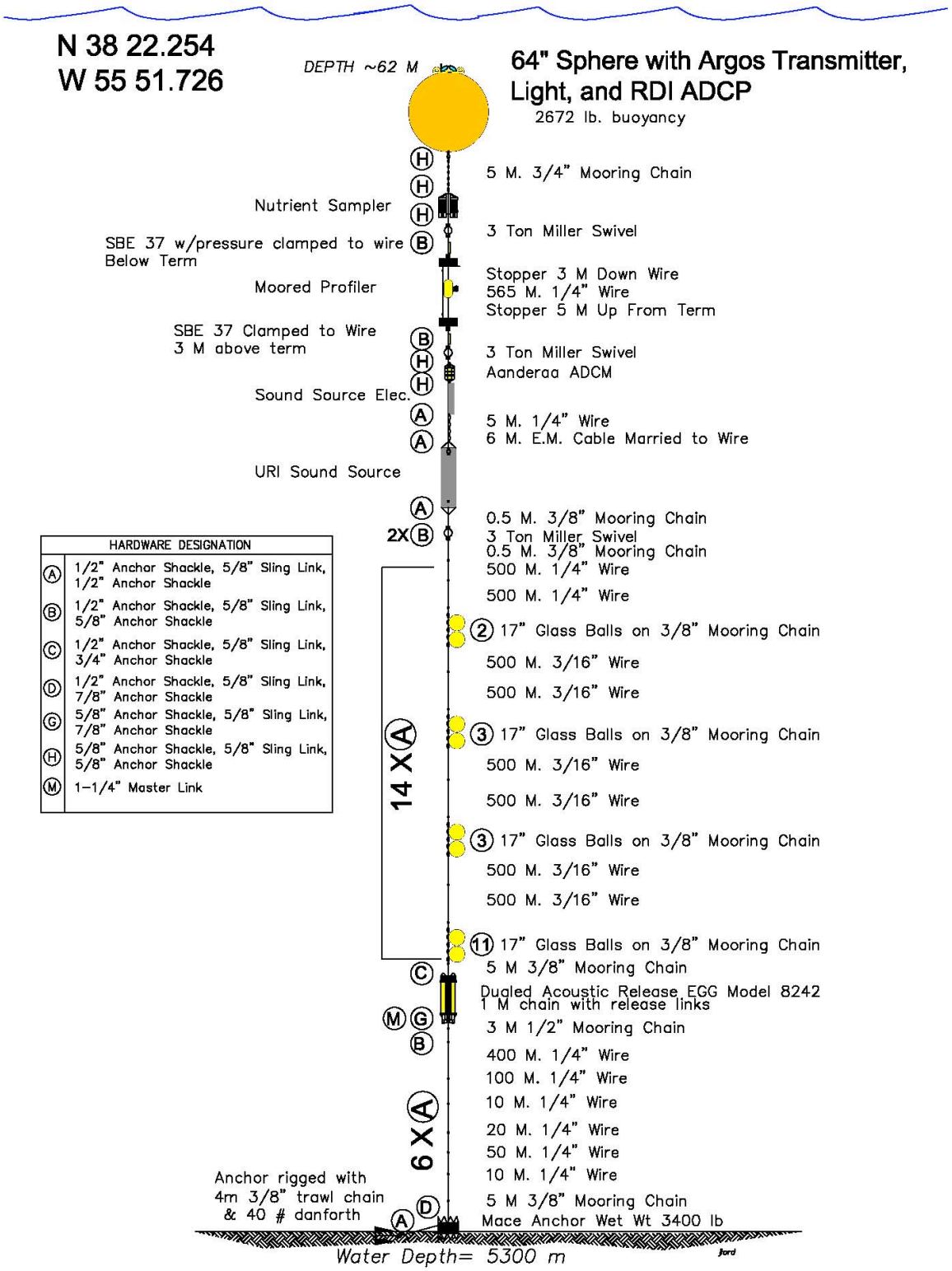



CLIMODE 1 Mooring B
Sound Source
11/22/05 As Deployed
PO # 1167
N 34 02.468
W 54 15.860
3 Ball Radio Float with Argos Transmitter, Light, and SBE 39
Depth ~ 326 M
5 M. 3/8" Mooring Chain
10X
17" Glass Balls on 3/8" Mooring Chain
20 M. 1/4" Wire
VACM 383 M
50 M. 1/4" Wire
3 Ton Miller Swivel
Sound Source Elec.
5 M. 1/4" Wire
6 M. E.M. Cable Married to Wire
~ 440 M
URI Sound Source
0.5 M. 3/8" Mooring Chainel
2X
3 Ton Miller Swivel
100 M. 3/16" Wire
SBE 39 @ 545M
SBE 39 @ 645M
500 M. 3/16" Wire
NOTE: MARKED EVERY 100 METERS!
SBE 39 @ 746M
SBE 39 @ 846M
~ 1049 M
Dualed Acoustic Release EGG Model 8242
1 M chain with release links
3 M 1/2" Mooring Chain
500 M. 3/16" Wire
500 M. 3/16" Wire
3000 M. 3/8" Dacron Line
10 X
10 M. 3/16" Wire
25 M. 3/16" Wire
50 M. 3/16" Wire
200 M. 3/16" Wire
10 M. 1/4" Wire
50 M. 1/4" Wire
5 M 3/8" Mooring Chain
Anchor Wet Wt 2000 lb
Water Depth= 5541 m
HARDWARE DESIGNATION
A 1/2" Anchor Shackle, 5/8" Sling Link, 1/2" Anchor Shackle
B 1/2" Anchor Shackle, 5/8" Sling Link, 5/8" Anchor Shackle
C 1/2" Anchor Shackle, 5/8" Sling Link, 3/4" Anchor Shackle
D 1/2" Anchor Shackle, 5/8" Sling Link, 7/8" Anchor Shackle
G 5/8" Anchor Shackle, 5/8" Sling Link, 7/8" Anchor Shackle
H 5/8" Anchor Shackle, 5/8" Sling Link, 5/8" Anchor Shackle
M 1-1/4" Master Link

CLIMODE 1 Mooring C

Sound Source and MMP
11/22/05 As Deployed

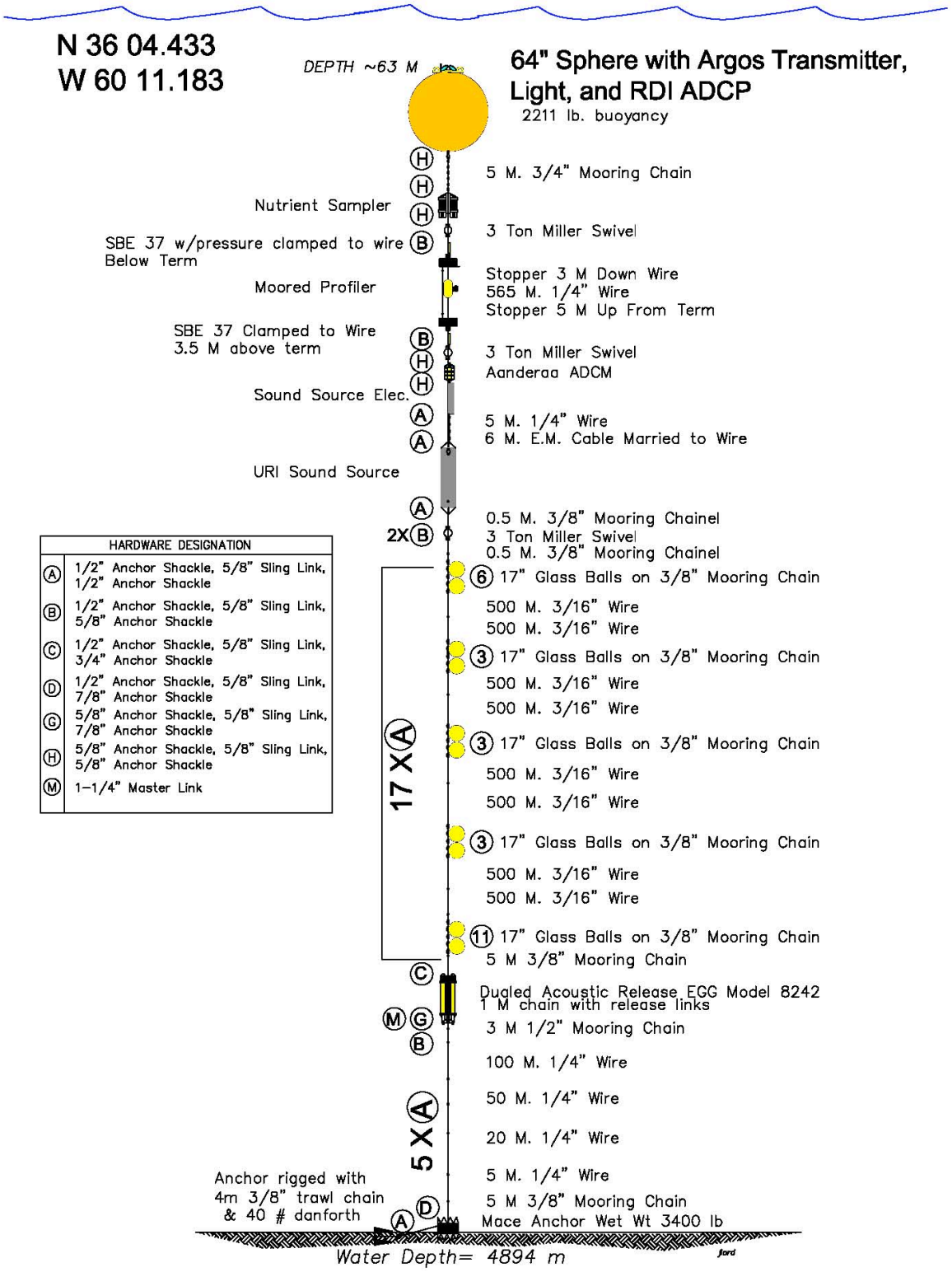
PO # 1168



CLIMODE 1 Mooring D

Sound Source and MMP
11/22/05 As Deployed

PO # 1169



Appendix B. Mooring Logs

Moored Station Log

(fill out log with black ball point pen only)

ARRAY NAME AND NO. CLIMODE A MOORED STATION NO. 1166

Launch (anchor over)

Date (day-mon-yr) 20 Nov 2005 Time 21:43 UTC

Latitude (N/S, deg-min) 30° 59.1521 N Longitude (E/W, deg-min) 60° 00.497'

Deployed by Kemp Recorder/Observer Hutto

Ship and Cruise No. Oceanus 419 Intended Duration 730 days

At drop site:

Depth Recorder Reading 5679 m Correction Source Matthew's Table

Depth Correction 69 m

Corrected Water Depth 5748 m Magnetic Variation (E/W) 16° 10' W

Argos Platform ID No. 5629 Additional Argos Info on pages 2 and 3

Surveyed Anchor Position

Lat (N/S) 30° 58.500 N Long. (E/W) 60° 00.673 W

Acoustic Release Model EGG Model 8242

Release No. 28289, 26338 Tested to 2,000 m

Receiver No. 028143 Release Command 353605, 342600

Enable Disable

Interrogate Freq. 11 KHz Reply Freq. 12 KHz

Recovery (release fired)

Date (day-mon-yr) 12 Nov 2007 Time 1100 UTC

Latitude (N/S, deg-min) Longitude (E/W, deg-min)

Recovered by Ostrom Recorder/Observer DF

Ship and Cruise No. OC 442 Actual duration days

Distance from actual waterline to buoy deck m

1

4

Moored Station Number 1166

Item No.	Length (m)	Item	Inst No.	Time Over	Notes	Data No.	Depth (m)	Time Back	Notes
1		3-ball float		17:42			323	1155	
2		Strobe light	M08-032	17:42			323		
3		SBE39	0078	17:42			323		
4		Argos	5629	17:42					
5	5	3/8" chain		17:42					
6		(29) Glass balls		17:44					
7	20	1/4" wire		17:58				1208	
8		VACM	589	18:05	18:01 foam out		380	1212	
9	50	1/4" wire		18:05				1217	
10		Miller Swivel		18:19					
11		Source Electronics	22	18:19				1220	
12	5	1/4" wire		18:19	married		440		
13	6	E.M. cable		18:19					
14		Rafos source	22	18:25				1230	
15	0.5	3/8" chain		18:25					
16		miller swivel		18:25					
17	100	3/16" wire		18:28					
18		SBE39	262	18:28	directly under term		441	1234	
19	500	3/16" wire		18:31					
20		SBE39	261	18:31	directly under term		542	1244	
21		SBE39	341	18:34	100 m mark		642	1249	
22		SBE39	336	18:39	300 m mark		~~834~~ 843	1257	

Item No.	Length (m)	Item	Inst No.	Time Over	Notes	Data No.	Depth (m)	Time Back	Notes
23		(2) Glass balls		18:48				1304	
24	5	1/4" wire		18:49					
25		VACM	179	18:54	18:47 foam out		1,053	1308	
26	3	3/8" chain		18:54					
27		Dual releases		18:57			1,058	1310	
28	3	1/2" chain		18:57					
29	500	3/16" wire		18:57					
30	500	3/16" wire							
31	3000	3/8" dacron		19:15					
32	200	3/16" wire		20:40					
33	100	3/16" wire		20:43					
34	100	3/16" wire		20:45					
35	30	3/16" wire		20:47					
36	10	1/4" wire		20:48					
37	100	1/4" wire							
38	5	3/8" chain							
39		Anchor			2,000 lb wet wt.				
40									
41									
42									
43									
44									
45									

Moored Station Log

(fill out log with black ball point pen only)

ARRAY NAME AND NO. CLIMODE B MOORED STATION NO. 1167

Launch (anchor over)

Date (day-mon-yr) 18 Nov 2005 Time 16:19 UTC

Latitude (N/S, deg-min) 34° 02.109' N Longitude (E/W, deg-min) 54° 15.236' W

Deployed by Kemp Recorder/Observer Hutto

Ship and Cruise No. Oceanus 419 Intended Duration 730 days

At drop site:

Depth Recorder Reading 5480 m Correction Source Matthew's Table

Depth Correction 61 m

Corrected Water Depth 5541 m Magnetic Variation (E/W) 17° 1' W

Argos Platform ID No. 23912 Additional Argos Info on pages 2 and 3

Surveyed Anchor Position

Lat (N/S) 34° 02.468' N Long. (E/W) 54° 15.860' W

Acoustic Release Model EGG Model 8242

Release No. 26353, 26355 Tested to 2,000 m

Receiver No. 028143 Release Command 343175, 343234

Enable Disable

Interrogate Freq. 11 KHz Reply Freq. 12 KHz

Recovery (release fired)

Date (day-mon-yr) 10 Nov 2007 Time 1855 UTC

Latitude (N/S, deg-min) Longitude (E/W, deg-min)

Recovered by Ostrom Recorder/Observer DF

Ship and Cruise No. OC 442 Actual duration days

Distance from actual waterline to buoy deck m

1

4

Moored Station Number 1167

Item No.	Length (m)	Item	Inst No.	Time Over	Notes	Data No.	Depth (m)	Time Back	Notes
1		3-ballfloat		12:51			326	1933	heavy fouling (soft)
2		Strobe	6427	12:51					strobe flashing
3		SBE39	080	12:51			326		
4		Argos	23912	12:51	12:45 Argos turned on				
5	5	3/8" chain		12:51					
6		(24) glass balls		12:52					
7	20	1/4" wire							
8		VACM	0115	13:12	13:04 foam out		383	1952	heavy fouling (soft
9	50	1/4" wire							
10		Miller swivel		13:25					
11		Source electronics	21	13:25				1959	fouled (soft)
12	5	1/4" wire		13:25	married				
13	6	E.M. cable		13:25	married				
14		Rafos source	21	13:30				2007	
15	0.5	3/8" chain		13:30					
16		miller swivel		13:32					
17	100	3/16" wire		13:32				2014	
18	500	3/16" wire							
19		SBE39	339	13:36	Ø Mark		545	2016	cracked clamp
20		SBE39	333	13:38	100 Mark		645	2021	
21		SBE39	334	13:40	200 Mark		746	2025	
22		SBE39	337	13:43	300 Mark		846	2028	

Item No.	Length (m)	Item	Inst No.	Time Over	Notes	Data No.	Depth (m)	Time Back	Notes
23		Dual releases	26353/ 26355	13.51			1049	2035	
24	3	1/2" chain		13:51					
25	500	3/16" wire		13:51					
26	500	3/16" wire		13:59					
27	3000	3/8" dacron		14:16					
28	10	3/16" wire		15:32					
29	25	3/16" wire		15:33					
30	50	3/16" wire		15.34					
31	200	3/16" wire		15.36					
32	50	1/4" wire							
33	10	1/4" wire		15.49					
34	5	3/8" chain							
35		Anchor			2,000 lb wet wt.				
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									

Moored Station Log

(fill out log with black ball point pen only)

ARRAY NAME AND NO. Climate 2-C MOORED STATION NO. 1185

Launch (anchor over)

Date (day-mon-yr) 11-26-06 Time 20:41:46 UTC

Latitude (N/S, deg-min) 38° 22'.267 Longitude (E/W, deg-min) 55° 51'.483

Deployed by Kemp/Lord Recorder/Observer Bigelow

Ship and Cruise No. OC 434 Intended Duration 1yr

Depth Recorder Reading 5245 m Correction Source Matthew's table

Depth Correction 53 m

Corrected Water Depth 5298 m Magnetic Variation (E/W)

Argos Platform ID No. 5662 Additional Argos Info on pages 2 and 3

Surveyed Anchor Position

Lat (N/S) 38 22.264 Long. (E/W) 55 52.238

Acoustic Release Model 8242X tandem

Release No. 27687 / 30555 Tested to 1500 m

Receiver No. Release Command 447661 / 134224

Enable 471277 / 121062 Disable 471306 / 121113

Interrogate Freq. 11 kHz Reply Freq. 12 kHz

Recovery (release fired)

Date (day-mon-yr) ~~11-27-06~~ 11-09-07 Time 1100 UTC

Latitude (N/S, deg-min) Longitude (E/W, deg-min)

Recovered by Ostrom Recorder/Observer DF

Ship and Cruise No. OC 434 Actual duration days

Distance from actual waterline to buoy deck m

1

Surface Components

Buoy Type_____ Color(s) Hull _____ Tower_____

Buoy Markings_____

Surface Instrumentation

Item	ID #	Height*	Comments
			Argos PTT 5662
			on spkr

*Height above buoy deck in centimeters

2

Moored Station Number 1185

Item No.	Length (m)	Item	Inst No.	Time Over	Notes	Data No.	Depth (m)	Time Back	Notes
1		64" sphere	017	11:50				1135	
2		Argos Transmitter	5662	11:50					
3		~~RDI~~ ADCP	2222	11:50					
4		light		11:50					
5	5	3/4" chain							
6	1	~~Nathiest chain~~ ~~sampler~~							
7		3 ton miller swivel							
8		SBE 37 with press	2140	11:53				~~1210~~	1148
9		stopper						1210	
10	565	1/4" wire							
11		profiler	112	12:20				1210	
12		stopper							
13		SBE 37 data pocket	~~2045~~ 2031	13.14					
14		3 ton miller swivel							
15		Aanderaa ADCM	148	13:14				1215	
16		Sound source electronics	24	13:14				1215	
17	5	1/4" wire							
18	6	MEM cable							
19		Reefer sound source	24	13:19				1220	
20	0.5	3/8" chain							
21		3 ton miller swivel							
22	0.5	3/8" chain							

Item No.	Length (m)	Item	Inst No.	Time Over	Notes	Data No.	Depth (m)	Time Back	Notes
23	500	1/4" wire		13:52					
24	500	1/4" wire							
25		17" glass balls (2)		14:22				1300	
26	500	3/16" wire							
27	500	3/16" wire							
28		17" glass balls (3)		15:27				1330	
29	500	3/16" wire							
30	500	3/16" wire							
31		17" glass balls (3)		16:23				1405	
32	500	3/16" wire		16:53					
33	500	3/16" wire							
34		17" glass balls (4)		17:23				1435	
35	5	3/8" chain						X	no 5m chain!
36		Acoustic Release		17:25				1441	
37	1	1/2" trawler chain							
38	3	1/2" chain							
39	500	1/4" wire		~~17:26~~					
40	50	1/4" wire							
41	20	1/4" wire							
42	20	1/4" wire							
43	5	3/8" chain							
44		Sea Anchor		20:41	wet wt = 3400 lbs				
45									

8

Moored Station Number _____

Item No.	Length (m)	Item	Inst No.	Time Over	Notes	Data No.	Depth (m)	Time Back	Notes
91									
92									
93									
94									
95									
96									
97									
98									
99									

Date/Time	Comments
11.27.06	Nutrients sampler #79 was defectuous after 1yr recovery and was not included
	on 2nd yr mooring → replaced by 1m chain
27 Nov 06 1320Z	- Towing mooring for 4.2 miles to anchor drop site

03-50063

Moored Station Log

(fill out log with black ball point pen only)

ARRAY NAME AND NO. Clmodez-D MOORED STATION NO. 1186

Launch (anchor over)

Date (day-mon-yr) 23 Nov. 2006 Time 21:24:15 UTC

Latitude (N/S, deg-min) 36° 05'.290 N Longitude (E/W, deg-min) 60° 10'.462 W

Deployed by Kemp / Lord Recorder/Observer Bigorre

Ship and Cruise No. OC 434 Intended Duration 1yr

Depth Recorder Reading 4859 m Correction Source Matthew's table

Depth Correction + 41 m

Corrected Water Depth 4900 m Magnetic Variation (E/W)

Argos Platform ID No. 27330 (Subsurface Sphere) Additional Argos Info on pages 2 and 3

Surveyed Anchor Position using Acoustic Survey Software

Lat (N/S) 36° 05.239' N Long. (E/W) 60° 10.178' W

Acoustic Release Model

Release No. ~~44771~~ 31333 / 32480 Tested to 1500 m

Receiver No. Release Command 447710 / 132111

Enable 471325 / 114556 Disable 471340 / 114575

Interrogate Freq. 11 kHz Reply Freq. 12 kHz

Recovery (release fired)

Date (day-mon-yr) 7 Nov 2007 Time 1901 UTC

Latitude (N/S, deg-min) 36 05.94 Longitude (E/W, deg-min) 60 10.15

Recovered by Ostrom Recorder/Observer DF

Ship and Cruise No. OC 442 Actual duration days

Distance from actual waterline to buoy deck m

1

4

Moored Station Number 1186

Item No.	Length (m)	Item	Inst No.	Time Over	Notes	Data No.	Depth (m)	Time Back	Notes
1		64" Sphere	008	13:04				1915	Substantial fouling
2		ADCP	2225	13:04					One xducer had growth
3		Argos transmitter	27330	13:04	Turned on at 12:53				first xmit 1910 Z
4		Probe light		13:04					
5	5	3/4" chain							
6		Nutrient sampler	78	13:04				1930	fuzzy
7		3 ton Miller swivel							
8		SBE 37	2139	13:04				1932	fuzzy
9		Stopper						1942	
10	565	1/4" wire							
11		Profiler	113	13:41				2000	light fuzz
12		stopper		14:20					
13		SBE 37	1645	14:28					clean
14		3 ton Miller swivel							
15									
16		Aanderaa ADCP	149	14:30	head up			2009	clean
17		Sound sound electronics						2015	orange slime on tubing
18	5	1/4" wire							
19	6	EM cable		14:45					cable disconnected during recovery
20		Rafos sound source	23	14:47				2018	
21	0.5	3/8" chain							
22		3 ton Miller swivel							

married

Item No.	Length (m)	Item	Inst No.	Time Over	Notes	Data No.	Depth (m)	Time Back	Notes
23	0.5	3/8" chain							
24		17" glass balls (6)						2021	
25	500	3/16" wire							
26	500	3/16" wire							
27		17" glass balls (3)		16:05				2055	
28	500	3/16" wire		16:35				2115	
29	500	3/16" wire							
30		17" glass balls (3)		17:05				2128	
31	500	3/16" wire		17:35					
32	500	3/16" wire							
33		17" glass balls (3)		18:10				2201	
34	500	3/16" wire		18:40					
35	500	3/16" wire							
36		17" glass balls (11)		19:15				2230	
37	5	3/8" chain							
38		Acoustic Releaser	31333 32480	19.23				2235	
39	1	1/2" trawler chain							
40	3	1/2" chain							
41	100	1/4" wire		19.41					
42	50	1/4" wire							
43	20	1/4" wire							
44	5	1/4" wire		19.54					
45	5	3/8" chain							

6

Moored Station Number _____

Item No.	Length (m)	Item	Inst No.	Time Over	Notes	Data No.	Depth (m)	Time Back	Notes
46		Plow Anchor			wet wt 3400 lbs				
47									
48									
49									
50									
51									
52									
53									
54									
55									
56									
57									
58									
59									
60									
61									
62									
63									
64									
65									
66									
67									

Appendix C. Event Log

CLIMODE . /ent Log

Vessel/Platform Oceanus 442 Start Date: 11/05/07

MM / DD	GMT	Latitude +/- DDD MM.mm	Longitude +/- DDD MM.mm	Responsible Investigator	Activity /Description (ie CTD sta 11)	Comment
11/06/07	20:42	+38° 29.74'	−65° 05.07'	DF	Drifter trio deployment	SNs 71193, 71186, 72036
11/07/07	1900			DF	Arrived @ D, released mooring, start recovery	
11/07/07	2235	36 02.39	60 03.06	DF	Mooring D recovery complete	
11/08/07	0000	36 05.34	60 10.08	BH	Start CTD #1	
11/08/07	0155				CTD #1 on deck	Ugly.
11/08/07	0300	36 06.87	60 08.107	BH	Attempt repeat cast	No comms with CTD (termination)??
11/08	1949	37 27.74	57 36.34	DF	on station for CTD #2 - test cast after re-term.	
11/09	0830	38 21.18	C 55 52.07		Arrived @ C, started CTD cast #3	
11/09	~1030		C		start recovery, mooring C	
11/09	1545	38 22.37	C 55 52.29		Recovery complete (C) Start repeat CTD* (no bottles fire	→ (#4)
11/10			B		Arrived @ B, start recovery	on previous cast
11/10	2148	34 02.50	B 54 15.79		Start CTD #5	
11/10			B		Fill barrels with FSW for Repeta	
11/12	0825	30 59.67	A 60 00.84		Arrived at A, start CTD #6	
11/12	1445	31 03.66	60 03.20		Mooring A recovery complete	
11/13	00:54	32 44.94	60 00.08		Start CTD #7	
11/14	13:36	34 29.70	60 00.15		Start CTD #8	
11/14	01:02	36 04.89	60 09.98		Start CTD #9	
11/14	12:42	37 00.077	61 29.967		Start CTD #10	
11/14	15:08	37 01.00	61 30.00	DF/JL	DRIFTER TRIO	SN 71191, 71183, 71178
11/15	00:37	38 9.95	68 0.12		Start CTD #11	
	11:17	39 20.16	64 30.06	DF	Start CTD #12	Very stg current
11/15	18:11	39 59.97	65 29.97	BH	Start CTD #13	
11/16	2307	37 51.63	68 30.73	DF	deploy drifters 72037, 72038, 71179 in GS	

CLIMODE . /ent Log

Vessel/Platform_____ Start Date:_____

MM / DD	GMT	Latitude +/- DDD MM.mm	Longitude +/- DDD MM.mm	Responsible Investigator	Activity /Description (ie CTD sta 11)	Comment
11/17	0225	38 05.3	68 41.7		start CTD #14 at W14	
11/17	14:32 ~~16:04~~	38 19.7	68 52.6		start CTD #15 at W13	
11/17/07	20:52	38N 32.517	69 W 1.077		Start CTD #16	
11/18	2:34	38N 49.183	69 W 11.039		Start CTD #17	38 N 49.183
11/18	9:06	39 N 20.978	69W 32.258		start CTD #18 W9	
11/18	13:59	39 N 42.05	69W 48.14		start CTD #19 W7	

Appendix D. Instrument setup files

Mooring A SBE

```
S>ds
SBE 39 V 1.7   SERIAL NO. 00078    13 Nov 2007  13:52:49
logging data
sample interval = 1800 seconds
samplenumber = 35692, free = 263901
serial sync mode disabled
real-time output disabled
SBE 39 configuration = temperature only
binary upload does not include time
temperature = 20.48 deg C
S>stop
S>

S>ds
SBE 39 V 1.7   SERIAL NO. 00262    13 Nov 2007  14:13:07
```

```
logging data
sample interval = 1800 seconds
samplenumber = 35693, free = 263900
serial sync mode disabled
real-time output disabled
SBE 39 configuration = temperature only
binary upload does not include time
temperature = 20.28 deg C
S>stop
S>

S>ds
SBE 39 V 1.7   SERIAL NO. 00261    13 Nov 2007  14:27:46
logging data
sample interval = 1800 seconds
samplenumber = 35693, free = 263900
serial sync mode disabled
real-time output disabled
SBE 39 configuration = temperature only
binary upload does not include time
temperature = 20.20 deg C
S>stop
S>

S>ds
SBE 39 V 1.7   SERIAL NO. 00341    13 Nov 2007  14:41:27
logging data
sample interval = 1800 seconds
samplenumber = 35694, free = 263899
serial sync mode disabled
real-time output disabled
SBE 39 configuration = temperature only
binary upload does not include time
temperature = 19.72 deg C
S>stop

S>ds
SBE 39 V 1.7   SERIAL NO. 00336    13 Nov 2007  14:55:31
logging data
sample interval = 1800 seconds
samplenumber = 35694, free = 263899
serial sync mode disabled
real-time output disabled
SBE 39 configuration = temperature only
binary upload does not include time
temperature = 20.05 deg C
S>stop
```

Mooring B

```
S>ds
SBE 39 V 1.7   SERIAL NO. 00080    11 Nov 2007  14:00:44
logging data
sample interval = 1800 seconds
samplenumber = 35596, free = 263997
serial sync mode disabled
```

```
real-time output disabled
SBE 39 configuration = temperature only
binary upload does not include time
temperature = 25.27 deg C
S>stop
S>

S>ds
SBE 39 V 1.7   SERIAL NO. 00339    11 Nov 2007  16:21:59
logging data
sample interval = 1800 seconds
samplenumber = 35601, free = 263992
serial sync mode disabled
real-time output disabled
SBE 39 configuration = temperature only
binary upload does not include time
temperature = 23.32 deg C
S>stop

S>ds
SBE 39 V 1.7   SERIAL NO. 00333    11 Nov 2007  17:21:51
logging data
sample interval = 1800 seconds
samplenumber = 35603, free = 263990
serial sync mode disabled
real-time output disabled
SBE 39 configuration = temperature only
binary upload does not include time
temperature = 23.77 deg C
S>stop

S>ds
SBE 39 V 1.7   SERIAL NO. 00334    11 Nov 2007  19:24:33
logging data
sample interval = 1800 seconds
samplenumber = 35607, free = 263986
serial sync mode disabled
real-time output disabled
SBE 39 configuration = temperature only
binary upload does not include time
temperature = 22.47 deg C
S>stop

S>ds
SBE 39 V 1.7   SERIAL NO. 00337    11 Nov 2007  19:46:53
logging data
sample interval = 1800 seconds
samplenumber = 35608, free = 263985
serial sync mode disabled
real-time output disabled
SBE 39 configuration = temperature only
binary upload does not include time
temperature = 23.05 deg C
S>stop
```

Mooring C

```
@@#10ds
SBE37-SM 485 V 2.2a  SERIAL NO. 2140    09 Nov 2007  18:41:45
logging data
sample interval = 300 seconds
samplenumber = 100116, free = 90534
store time with each sample
output salinity with each sample
do not output sound velocity with each sample
do not output density with each sample
output depth with each sample
latitude to use for depth calculation = 40.00 deg
A/D cycles to average = 4
temperature = 18.72 deg C
S>@@#10stop
S>@@#10ds
SBE37-SM 485 V 2.2a  SERIAL NO. 2140    09 Nov 2007  18:42:30
not logging: received stop command
sample interval = 300 seconds
samplenumber = 100116, free = 90534
store time with each sample
output salinity with each sample
do not output sound velocity with each sample
do not output density with each sample
output depth with each sample
latitude to use for depth calculation = 40.00 deg
A/D cycles to average = 4
temperature = 18.71 deg C
S>

S>
ds
SBE37-SM V 2.6b  SERIAL NO. 2031    10 Nov 2007  03:18:12
logging data
sample interval = 300 seconds
samplenumber = 107752, free = 125264
do not transmit real-time data
output salinity with each sample
do not output sound velocity with each sample
store time with each sample
number of samples to average = 4
reference pressure = 0.0 db
serial sync mode disabled
wait time after serial sync sampling = 30 seconds
internal pump not installed
temperature = 18.26 deg C
S>
x stop
```

Mooring D

```
S>@@#09ds
SBE37-SM 485 V 2.3a  SERIAL NO. 2139    08 Nov 2007  02:26:08
logging data
```

```
sample interval = 300 seconds
samplenumber = 100788, free = 89862
store time with each sample
output salinity with each sample
do not output sound velocity with each sample
do not output density with each sample
output depth with each sample
latitude to use for depth calculation = 40.00 deg
A/D cycles to average = 4
internal pump not installed
temperature = 12.09 deg C
S>@@#09ds
SBE37-SM 485 V 2.3a  SERIAL NO. 2139    08 Nov 2007  02:27:26
logging data
sample interval = 300 seconds
samplenumber = 100788, free = 89862
store time with each sample
output salinity with each sample
do not output sound velocity with each sample
do not output density with each sample
output depth with each sample
latitude to use for depth calculation = 40.00 deg
A/D cycles to average = 4
internal pump not installed
temperature = 12.33 deg C
S>#09stop
@@#09stop
S>@@#09ds
SBE37-SM 485 V 2.3a  SERIAL NO. 2139    08 Nov 2007  02:34:31
not logging: received stop command

SBE 37-SM
S>ds
SBE37-SM V 2.6b  SERIAL NO. 1645    08 Nov 2007  13:59:21
logging data
sample interval = 300 seconds
samplenumber = 107304, free = 125712
do not transmit real-time data
output salinity with each sample
do not output sound velocity with each sample
store time with each sample
number of samples to average = 4
reference pressure = 0.0 db
serial sync mode disabled
wait time after serial sync sampling = 10 seconds
internal pump not installed
temperature = 18.09 deg C
S>
ds
SBE37-SM V 2.6b  SERIAL NO. 1645    08 Nov 2007  14:00:12
logging data
sample interval = 300 seconds
samplenumber = 107304, free = 125712
do not transmit real-time data
output salinity with each sample
do not output sound velocity with each sample
```

```
store time with each sample
number of samples to average = 4
reference pressure = 0.0 db
serial sync mode disabled
wait time after serial sync sampling = 10 seconds
internal pump not installed
temperature = 18.09 deg C
S>
ds
SBE37-SM V 2.6b  SERIAL NO. 1645    08 Nov 2007  14:00:48
logging data
sample interval = 300 seconds
samplenumber = 107304, free = 125712
do not transmit real-time data
output salinity with each sample
do not output sound velocity with each sample
store time with each sample
number of samples to average = 4
reference pressure = 0.0 db
serial sync mode disabled
wait time after serial sync sampling = 10 seconds
internal pump not installed
temperature = 18.08 deg C
S>
stop
S>
ds
SBE37-SM V 2.6b  SERIAL NO. 1645    08 Nov 2007  14:03:05
not logging: received stop command
sample interval = 300 seconds
samplenumber = 107304, free = 125712
do not transmit real-time data
output salinity with each sample
do not output sound velocity with each sample
store time with each sample
number of samples to average = 4
reference pressure = 0.0 db
serial sync mode disabled
wait time after serial sync sampling = 10 seconds
internal pump not installed
temperature = 18.05 deg C
S>
```

Appendix E. Deck layout - Will Ostrom