National Oceanic and Atmospheric Administration
Atlantic Oceanographic and Meteorological Laboratory
4301 Rickenbacker Causeway
Miami, FL 33149-1097

November 20, 2013

Final Cruise Report

U.S. Dept. of State Cruise No: F2012-075.

Ship Names: R/V Ooids (trips 1-5).

Dates: October 18, 2012; May 24, 2013; June 27, 2013; August 2, 2013; August 30, 2013.

Chief Scientists: Molly Baringer and Christopher Meinen

Foreign Participants: None

Operating Institution: NOAA/AOML

Cruise Report by: Rigoberto Garcia, Christopher Meinen, Molly Baringer.

Project Title: Western Boundary Time Series.

Clearance Countries: Bahamas

Port Calls: West Palm Beach, FL to West Palm Beach, FL.

Description of the Scientific Program:

Voltages induced on a submarine cable by the Florida Current have been shown to be proportional to the total current transport. In order to calibrate the cable measurements, direct transport observations are needed at a few times during each year. A dropsonde is an instrument consisting of an expendable weight and a glass tube or sphere containing electronic sensors, including a Global Positioning System (GPS) receiver. The instruments determine vertically-averaged horizontal velocity by sinking to the ocean bottom, dropping the weight, and then rising to the ocean surface, with the GPS providing an accurate location for the start and end of the profile. Using the dropsonde technique, horizontal velocity is estimated at nine stations across the Straits. AOML has obtained these vertically-averaged velocities across the Strait of Florida on several cruises during this year, and horizontal-integration of the velocity values has yielded calibration values for submarine cable transport measurements. Cable voltages have been monitored and daily total transport values obtained since 1982.

Beginning in 1995 the cable calibration effort was augmented in support of the Volunteer Observing Ship Program (VOS) that deploys expendable bathythermographs (XBTs) in the interior Atlantic. The goal of this VOS/XBT program is to study the upper ocean thermal structure of the subtropical North Atlantic using volunteer observing merchant ships. Repeat XBT sections, approximately every 3 months, have been conducted since October 1984 with the intent of determining and monitoring the seasonal-to-interannual variability of the upper ocean heat content. The ship-track, which roughly follows along 30°N, is designated as AX7 and it is ideal for monitoring heat flux variability in the Atlantic because it lies near the center of the subtropical gyre, which has been shown to be the latitude of the maximum heat flux in the ocean. The upper ocean thermal structure obtained using the expendable temperature probes (XBTs) is being used to correlate the subtropical gyre intensity with atmospheric forcing as well as for determining the heat transport.

Essential to the goal of monitoring the meridional heat transport is a measure of the heat content and transport within the Florida Straits. Therefore, on each of the cable calibration cruises completed as part of this project, the dropsonde measurements are augmented by XBT casts at all nine of the nominal station locations to measure the vertical temperature profile.

Data Observations and Samples Collected:

This report refers to the last 5 cruises performed in the Florida Current. On a typical cruise a single AOML participant drives to Palm Beach the evening prior to the departure. The boat departs Palm Beach at about 0600, conducts a total of seven hours of work at the nine stations plus five hours of steaming time, and returns to Palm Beach at roughly 1700. The AOML participant then returns to Miami that same day. Expendable Bathythermographs (XBTs) are launched at each station to obtain temperature profiles of the water column beneath the ship. The XBTs are numbered as the station numbers, whose positions are given in Table 1. Plots of the XBT temperature sections are shown in the Appendix.

The GPS/dropsonde used in all 9 stations is a glass sphere housing a Garmin GPS 18x PC receiver/logger (or equivalent), RDF beacon, pinger, and batteries. A second Magellan 5000 Pro GPS receiver (or equivalent) is used to determine the ship positions on all cruises. In addition to vertically integrated velocities, after surfacing the GPS/dropsonde is allowed to drift for five minutes to obtain a surface velocity estimate.

The station locations are listed in Table 1 and a typical cruise trackline is shown in Figure 1. Table 2 lists the dropsonde deployment and surface time positions, and the computed vertically integrated velocities for each cruise. Surface positions are determined using the dropsonde GPS record. The midpoint time for all profiles is used as the time for the cruise. Table 3 lists the observed meridional surface velocities for each station.

Problems/issues observed during cruises:

Serious issues with both instruments, dropsonde and XBT, occurred during the year. Problems with the dropsondes used on October 18, 2012 were observed during the processing of the data. These electronics issues resulted in the failure of the velocity estimates at all of the stations. During the cruises of May 24, 2013 and August 30, 2013 the dropsonde instruments used were lost at station number 1 and station number 4, respectively. During the cruises of October 2012, and August 2013 (both) the XBT system failed to record data in at least one of the stations as shown in the figures in the Appendix.

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Schedule of Delivery of Data and Reports: All data are contained herein. No further report is planned.

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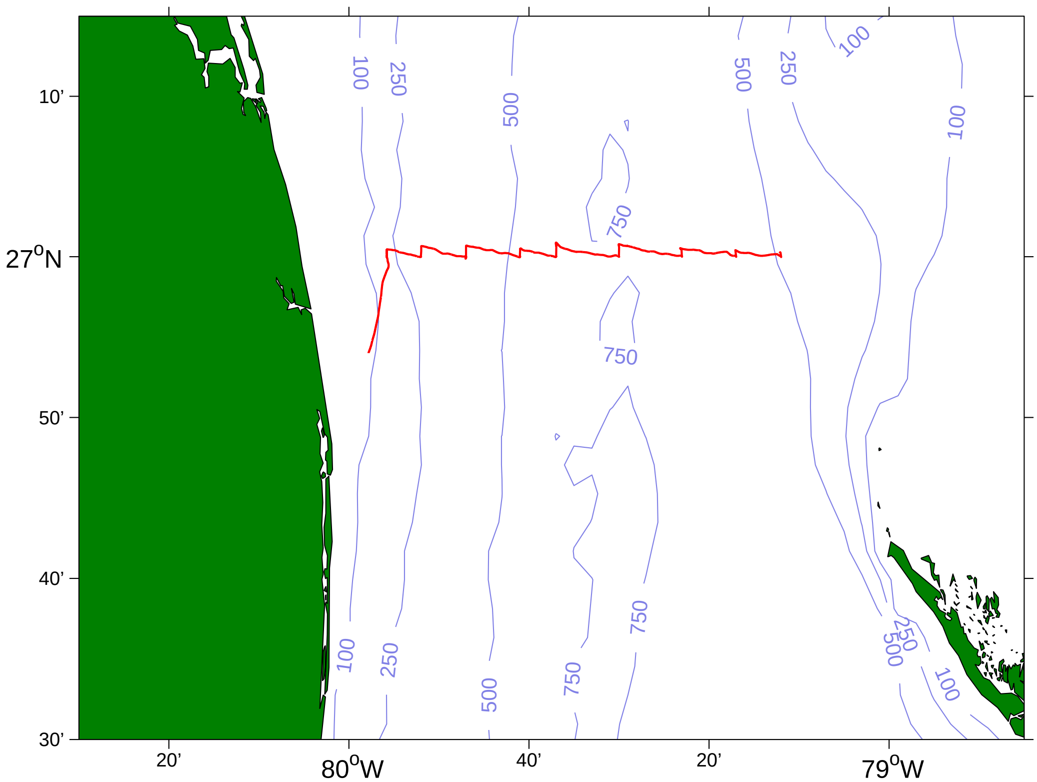


Figure 1: Typical cruise track

Station	Latitude	Longitude	Depth
0	27 00.00 N	79 55.80 W	139 M
1	27 00.00 N	79 52.00 W	261 M
2	27 00.00 N	79 47.00 W	389 M
3	27 00.00 N	79 41.00 W	540 M
4	27 00.00 N	79 37.00 W	661 M
5	27 00.00 N	79 30.00 W	783 M
6	27 00.00 N	79 23.00 W	708 M
7	27 00.00 N	79 17.00 W	624 M
8	27 00.00 N	79 12.00 W	485 M

Table 1: Station Locations.

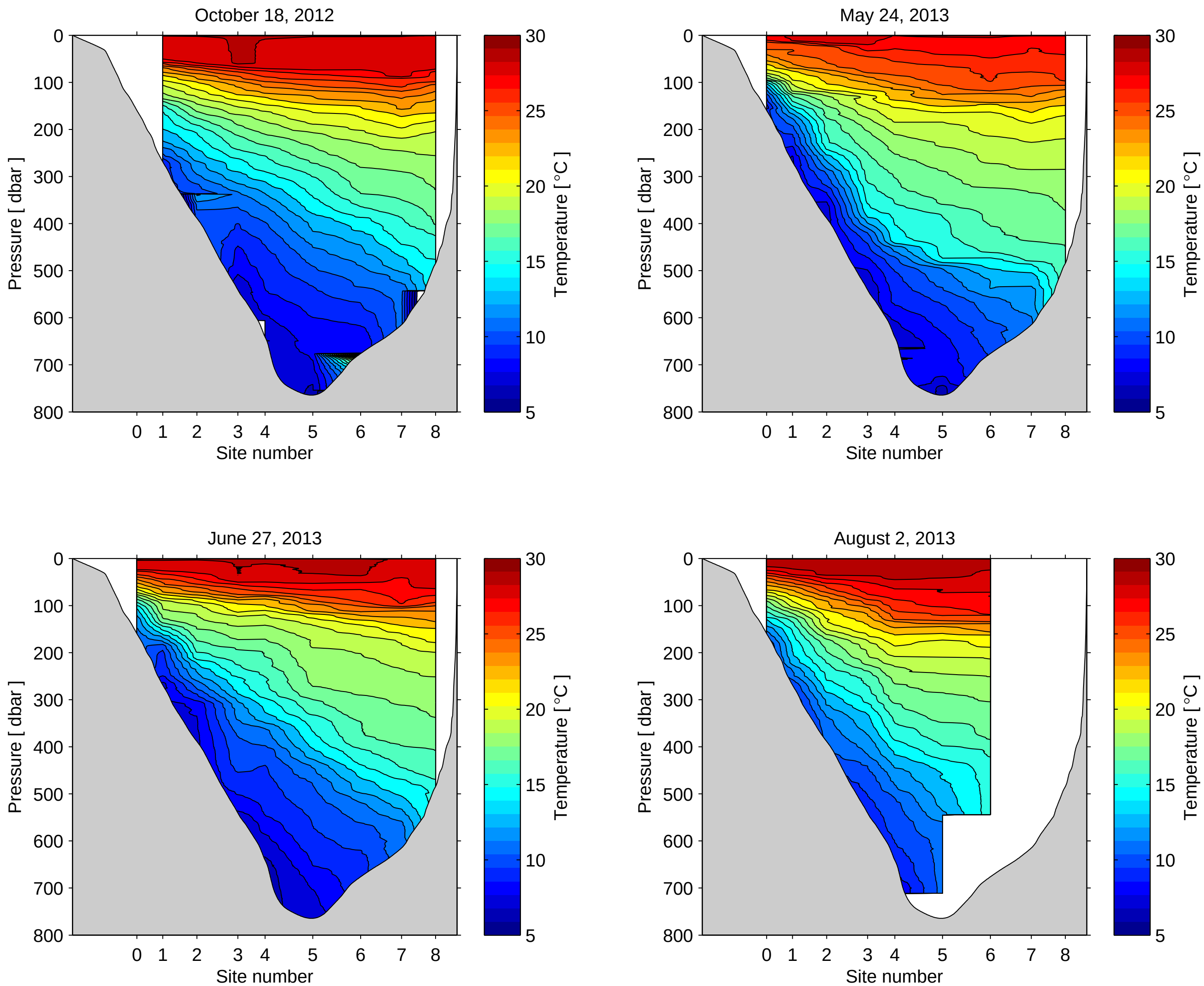
Sta	Deployed			Surfaced			Mean Velocities	
	Time (GMT)	Lon	Lat	Time (GMT)	Lon	Lat	U cm/s	V cm/s
June 27, 2013								
0	21:54:18	-79.9301	27.0005	22: 1:35	-79.9299	27.0031	5.64	63.73
1	21:25: 4	-79.8665	27.0010	21:37:49	-79.8658	27.0075	10.72	91.93
2	20:48:27	-79.7840	27.0010	21:10:43	-79.7822	27.0176	17.62	134.81
3	20: 2:23	-79.6834	27.0006	20:28:26	-79.6821	27.0169	9.74	114.62
4	19:13:55	-79.6168	27.0008	19:44:15	-79.6159	27.0169	4.25	96.67
5	18:14:55	-79.5002	27.0007	18:50:24	-79.5003	27.0151	0.07	74.41
6	17:16: 9	-79.3832	27.0005	17:49:32	-79.3844	27.0119	-6.41	63.81
7	16:21:58	-79.2833	27.0005	16:52:39	-79.2846	27.0089	-6.84	49.49
8	15:39:48	-79.2002	27.0010	16: 2: 2	-79.2016	27.0057	-10.78	38.81
August 2, 2013								
0	13:16:38	-79.9293	27.0016	13:24:26	-79.9288	27.0051	10.11	80.75
1	13:45:39	-79.8665	27.0011	13:58:41	-79.8655	27.0070	12.52	81.26
2	14:18:38	-79.7821	27.0005	14:36:22	-79.7809	27.0092	10.24	90.23
3	15: 3:12	-79.6831	27.0009	15:28: 4	-79.6817	27.0134	8.79	91.40
4	15:52:25	-79.6162	27.0005	16:25: 5	-79.6148	27.0165	6.69	89.03
5	16:56:38	-79.5000	27.0007	17:31:49	-79.5007	27.0149	-4.67	73.69
6	99:99: 0	-79.3833	27.0000	99:99: 0	-79.3833	27.0000	-999.00	-999.00
7	19:18:38	-79.2834	27.0016	19:50:36	-79.2853	27.0146	-9.58	74.95
8	20:13: 0	-79.1995	27.0007	20:37: 0	-79.2015	27.0090	-14.88	64.36

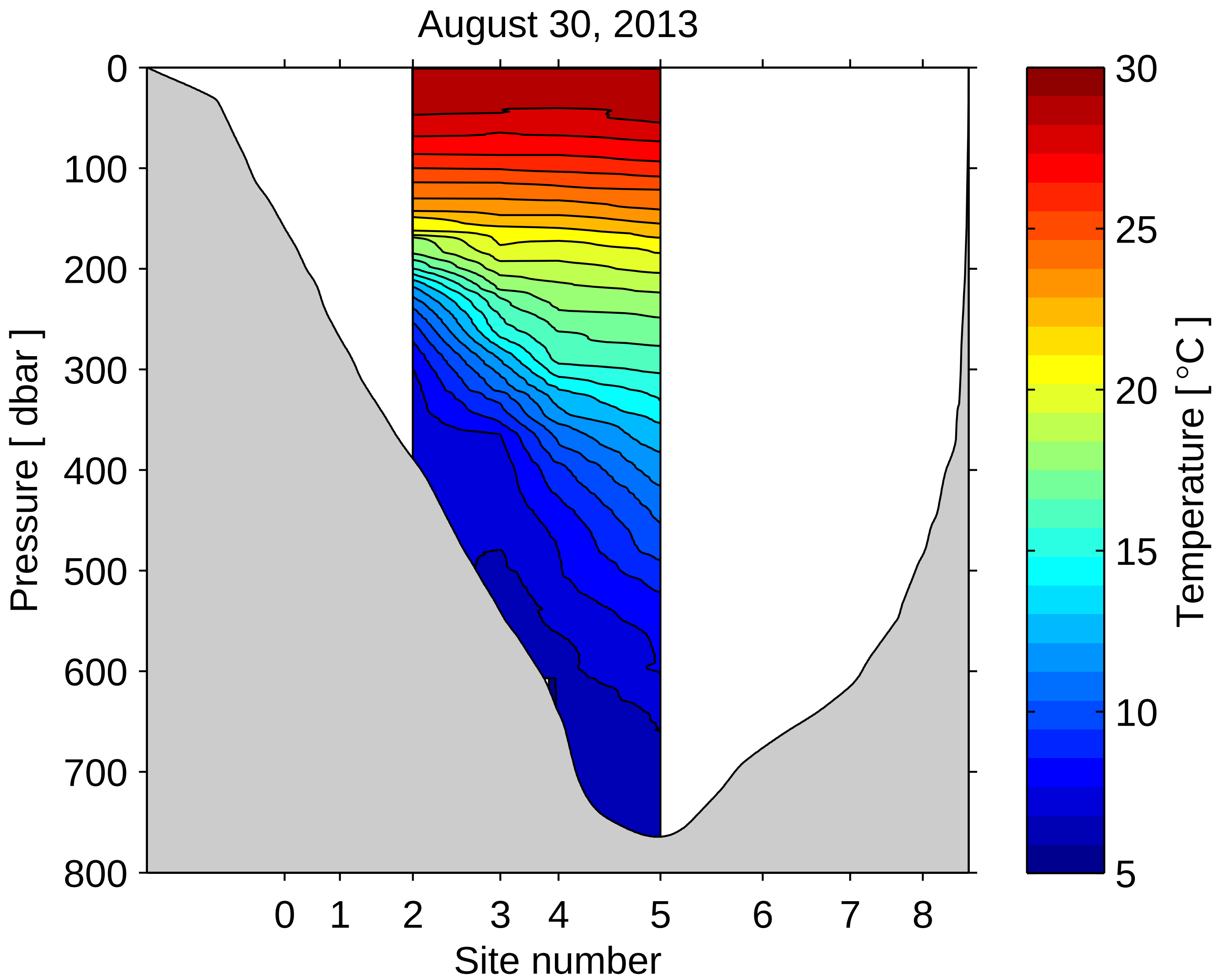
Table 2: Dropsonde Data: Values of -999 indicate instrument failure.

Date	Station #								
	0	1	2	3	4	5	6	7	8
June 27, 2013	173.28	215.18	331.74	166.02	230.08	132.27	129.63	113.00	67.42
August 2, 2013	227.07	160.18	152.34	257.39	189.98	140.76	-999.00	95.46	71.69

Table 2: Meridional Surface Velocities in cm/s. Values of -999 indicate instrument failure.

APPENDIX


October 18, 2012
May 24, 2013
June 27, 2013
August 2, 2013
Pressure [dbar]
Site number
Temperature [°C]
0
100
200
300
400
500
600
700
800
0 1 2 3 4 5 6 7 8
5
10
15
20
25
30



August 30, 2013
0
100
200
300
400
500
600
700
800
Pressure [dbar]
0
1
2
3
4
5
6
7
8
Site number
30
25
20
15
10
5
Temperature [°C]