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December 7, 2004

Cruise Report

Ship Names: M/V *Playing Hooky* (trips 1-6, 9-10), M/V *Boomerang* (trip 7) and M/V *La Vita* (trip 8).

Dates: December 9, 2003; December 16, 2003; January 9, 2004; January 13, 2004; May 7, 2004; May 24, 2004; June 7, 2004; June 11, 2004; August 24, 2004; and September 1, 2004.

Chief Scientists: Molly Baringer and Christopher Meinen

Foreign Participants: None

Operating Institution: NOAA/AOML

Cruise Report by: Christopher Meinen and Rigoberto Garcia

Project Title: Atlantic Climate Change Program: Volunteer Observing Ship High Resolution XBT line AX7 and Direct Observations in Support of Operational Monitoring in the Straits of Florida.

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 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 the velocity values has yielded calibration values for remote cable transport measurements. Cable voltages have been monitored and daily total transport values obtained since 1982.

The cable calibration effort has recently been 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 using the vessels charted through Sailfish Marina, the dropsonde measurements are augmented by XBT casts at all nine of the nominal station locations to measure the vertical temperature profile. Two crossings are typically attempted during each quarterly AX7 cruise, roughly one week apart, in an attempt to capture an estimate of the mean transport of the Florida Current that is not contaminated by the seven to ten day waves observed in the Straits.

Data Observations and Samples Collected:

This report refers to the last 10 cruises performed in the Florida Current (note, two extra cruises were done this year due to the loss of a dropsonde during the previous year, which resulted in postponing two cruises into this year). On a typical cruise a single AOML participant drives to Palm Beach the evening prior to the departure. The boat departs Palm Beach at 0500, conducts a total of seven hours of work at the nine stations plus five hours of steaming time, and returns to Palm Beach at 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 profiles are shown in the Appendix.

The GPS/dropsonde used in all 9 stations is a glass tube housing a Geologger 8 portable GPS receiver/logger, RDF beacon, pinger, and batteries. A second Magellan 5000 Pro GPS receiver is used to determine the ship positions on all cruises. Positions are logged on the PC every 30 seconds. These provide a backup for deployment positions. In addition to vertically integrated velocities, after surfacing the GPS/dropsonde was 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:
Throughout the early part of the fiscal year we had sporadic dropouts of dropsonde measurements (e.g. site 2 on Dec. 9, 2003; site 7 on Dec. 16, 2003); this problem was traced to the practice of shutting off the dropsonde between casts, which at times resulted in the GPS instrument failing to get a good measurement prior to submerging. The procedure was changed after the January cruises, and the problem has not recurred. The other major problem that occurred during this fiscal year resulted due to a poor design issue with a newly-built dropsonde. A short antenna was used in the new design, and as a result during the September cruise the instrument generally failed to get proper GPS fixes either before or after casts. Finally, during the May 7th cruise the XBT computer failed, and no XBT data was gathered on that cruise.

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

Acknowledgements: A very sincere thanks to Jeffrey Kelley, Benjamin Kates, and Ulises Rivero for their participation in these cruises and to the crew of the vessels M/V *Playing Hooky*, M/V *Boomerang* and M/V *La Vita* for their reliable assistance.

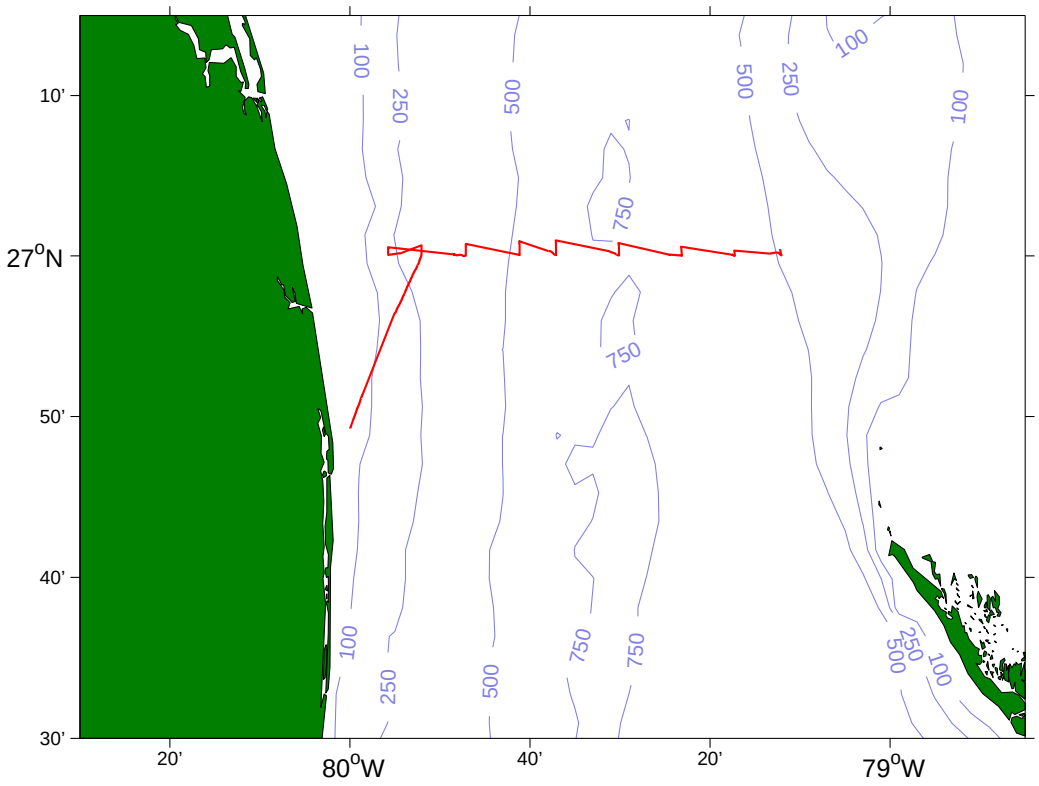


Figure 1: Cruise track for June 7, 2004

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
December 9, 2003								
0	12:20:11	-79.9304	26.9984	12:32:21	-79.9311	27.0007	-10.06	35.35
1	12:54:20	-79.8668	26.9994	13: 4: 3	-79.8670	27.0022	-3.71	53.33
2	13:26:41	-79.7831	26.9990	13:40:39	-79.7832	27.0072	-999.00	-999.00
3	14: 4:21	-79.6836	26.9993	14:24:21	-79.6835	27.0081	0.32	81.40
4	14:43:47	-79.6172	26.9995	15: 6:45	-79.6165	27.0101	3.70	82.64
5	15:34:41	-79.5005	26.9998	16: 1:27	-79.5002	27.0097	1.67	68.38
6	16:30:21	-79.3836	26.9996	16:54:21	-79.3837	27.0061	-0.49	49.85
7	17:18:36	-79.2838	26.9990	17:41:39	-79.2847	27.0040	-3.99	36.62
8	18: 1:22	-79.1999	27.0000	18:18:45	-79.2015	27.0045	-15.57	47.83
December 16, 2003								
0	12:14:43	-79.9312	27.0020	12:20: 0	-79.9314	27.0044	-5.48	85.78
1	12:38:10	-79.8671	26.9995	12:47:33	-79.8676	27.0039	-9.34	85.71
2	13: 7: 0	-79.7835	27.0003	13:21: 3	-79.7845	27.0092	-11.11	116.12
3	13:45:21	-79.6836	27.0006	14: 4:51	-79.6847	27.0143	-9.46	129.32
4	14:24:45	-79.6170	27.0002	14:47:44	-79.6180	27.0144	-6.86	113.64
5	15:15: 4	-79.5001	27.0004	15:42:38	-79.5005	27.0136	-2.43	88.48
6	16: 7:49	-79.3833	26.9999	16:33: 3	-79.3836	27.0084	-2.09	62.64
7	16:55:50	-79.2001	26.9995	17:16:52	-79.2841	27.0056	-999.00	-999.00
8	17:35:58	-79.2001	26.9995	17:52: 9	-79.2013	27.0032	-12.26	42.00
January 9, 2004								
0	12: 5:24	-79.9296	27.0005	12:10:51	-79.9299	27.0045	-8.23	138.93
1	12:25:31	-79.8663	27.0003	12:34:57	-79.8662	27.0062	1.53	114.39
2	12:52:29	-79.7832	27.0000	13: 5:45	-79.7829	27.0077	2.79	107.07
3	13:25:24	-79.6833	26.9995	13:45:27	-79.6828	27.0103	3.59	100.26
4	14: 0:57	-79.6167	26.9999	14:23: 9	-79.6166	27.0100	0.79	83.90
5	14:45: 2	-79.5002	27.0000	15:11:51	-79.5000	27.0100	0.57	68.54
6	15:34:16	-79.3826	26.9991	15:57:33	-79.3825	27.0059	1.52	53.66
7	16:15:46	-79.2833	27.0003	16:37:28	-79.2838	27.0061	-999.00	-999.00
8	16:54:16	-79.1998	26.9999	17:11:15	-79.2008	27.0037	-9.31	40.20
January 13, 2004								
0	12:11:15	-79.9303	27.0003	12:16:29	-79.9299	27.0050	-999.00	-999.00
1	12:29: 8	-79.8666	27.0000	12:38:27	-79.8665	27.0056	3.87	106.66
2	12:55:38	-79.7835	27.0003	13: 9:51	-79.7836	27.0077	-1.11	99.21
3	13:29:30	-79.6835	26.9996	13:47:45	-79.6836	27.0105	-1.21	110.53
4	14: 4:22	-79.6167	27.0004	14:26:38	-79.6165	27.0122	1.31	97.62
5	14:48:32	-79.4999	27.0000	15:16:39	-79.5000	27.0120	-0.41	79.01
6	15:38:46	-79.3835	26.9994	16: 3:27	-79.3836	27.0077	-0.53	61.97
7	16:22:24	-79.2835	27.0000	16:44:27	-79.2840	27.0053	-4.07	46.26
8	17: 0:28	-79.1997	27.0000	17:19: 9	-79.2013	27.0039	-999.00	-999.00

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

Sta	Deployed			Surfaced			Mean Velocities	
	Time (GMT)	Lon	Lat	Time (GMT)	Lon	Lat	U cm/s	V cm/s
May 7, 2004								
0	11: 6:40	-79.9302	27.0003	11:12:21	-79.9302	27.0026	-0.44	74.46
1	11:31:22	-79.8666	27.0000	11:41: 8	-79.8663	27.0037	6.28	71.61
2	12: 0:29	-79.7832	27.0003	12:14:26	-79.7831	27.0064	1.40	81.38
3	12:35:48	-79.6830	27.0000	12:54:45	-79.6830	27.0092	0.38	89.16
4	13:11:46	-79.6162	27.0005	13:36:38	-79.6167	27.0107	-2.99	76.15
5	14: 0:29	-79.5001	27.0004	14:30:57	-79.5005	27.0125	-2.21	73.85
6	14:53:26	-79.3830	27.0002	15:18:15	-79.3834	27.0081	-2.37	59.01
7	15:38:58	-79.2831	26.9998	16: 0:15	-79.2836	27.0056	-4.26	50.51
8	16:19:33	-79.2003	26.9996	16:35:39	-79.2015	27.0034	-12.20	42.93
May 24, 2004								
0	11: 1: 9	-79.9301	27.0004	11: 6:35	-79.9304	27.0033	-7.54	100.38
1	11:22:27	-79.8667	27.0004	11:32: 9	-79.8673	27.0048	-10.09	83.44
2	11:51: 3	-79.7834	27.0003	12: 5: 3	-79.7840	27.0061	-8.00	77.06
3	12:27: 5	-79.6836	26.9998	12:46:51	-79.6843	27.0106	-6.01	101.56
4	13: 3:52	-79.6170	27.0000	13:30: 3	-79.6182	27.0127	-7.76	89.70
5	13:53:10	-79.5001	27.0000	14:20:51	-79.5019	27.0119	-10.45	79.97
6	14:44:41	-79.3834	26.9999	15: 9:21	-79.3847	27.0086	-8.24	64.90
7	15:29:50	-79.2830	26.9999	15:52:21	-79.2843	27.0068	-9.94	56.70
8	16:11:21	-79.1999	26.9998	16:27:32	-79.2013	27.0036	-13.70	43.28
June 7, 2004								
0	11:47: 0	-79.9292	27.0020	11:52:42	-79.9292	27.0045	-0.10	81.82
1	11:20:33	-79.8674	27.0032	11:29:51	-79.8672	27.0070	3.55	75.24
2	12:24:47	-79.7856	27.0008	12:39: 8	-79.7854	27.0073	2.99	83.69
3	13: 6:57	-79.6860	27.0017	13:25:45	-79.6859	27.0110	0.35	91.52
4	13:45:40	-79.6185	27.0014	14: 9:15	-79.6185	27.0124	-0.41	86.45
5	14:41:14	-79.5018	27.0007	15: 8: 3	-79.5021	27.0110	-1.37	71.18
6	15:37:32	-79.3854	27.0006	16: 2:57	-79.3862	27.0081	-4.84	54.69
7	16:28:18	-79.2873	27.0000	16:50:27	-79.2881	27.0047	-5.51	38.84
8	17:12:30	-79.2015	27.0008	17:32:15	-79.2032	27.0053	-13.83	42.51
June 11, 2004								
0	10:57:36	-79.9299	27.0002	11: 3:21	-79.9296	27.0026	8.66	78.64
1	11:21:30	-79.8658	27.0013	11:31:45	-79.8645	27.0075	20.42	113.17
2	11:53:54	-79.7833	27.0006	12: 7:57	-79.7819	27.0097	16.27	120.37
3	12:30: 0	-79.6833	27.0007	12:51: 9	-79.6815	27.0136	14.28	112.90
4	13: 8:48	-79.6152	27.0170	13:32:45	-79.6135	27.0290	11.46	92.29
5	14: 1:25	-79.4988	26.9996	14:30:15	-79.4976	27.0110	7.27	73.18
6	14:57: 7	-79.3823	26.9997	15:21:33	-79.3823	27.0070	0.43	54.76
7	15:44:32	-79.2818	26.9998	16: 8:21	-79.2828	27.0063	-6.48	50.44
8	16:25:24	-79.1992	27.0000	16:42:45	-79.1999	27.0027	-6.83	29.03

Table 2: Continued.

Sta	Deployed			Surfaced			Mean Velocities	
	Time (GMT)	Lon	Lat	Time (GMT)	Lon	Lat	U cm/s	V cm/s
August 24, 2004								
0	11: 2:53	-79.9293	27.0001	11: 9:28	-79.9295	27.0048	-4.01	131.75
1	11:22:46	-79.8667	27.0004	11:32:21	-79.8668	27.0066	-1.98	120.20
2	11:49:43	-79.7832	27.0005	12: 3:57	-79.7828	27.0098	3.96	121.66
3	12:24:15	-79.6834	26.9999	12:44:57	-79.6826	27.0135	6.22	122.35
4	12:59:11	-79.6167	27.0000	13:23:39	-79.6153	27.0145	9.26	109.71
5	13:43:37	-79.5002	26.9999	14:15: 3	-79.4997	27.0152	2.77	90.11
6	14:34:46	-79.3835	26.9997	14:59:20	-79.3837	27.0094	-1.31	73.55
7	15:19:33	-79.2837	26.9996	15:42:15	-79.2844	27.0068	-5.12	58.69
8	15:58:45	-79.2002	26.9999	16:15:39	-79.2007	27.0034	-5.48	38.21
September 1, 2004								
0	11: 6:49	-79.9297	27.0006	11:14: 3	-79.9300	27.0069	-999.00	-999.00
1	11:27:12	-79.8671	27.0000	11:39: 3	-79.8672	27.0101	-1.04	158.37
2	11:54: 3	-79.7836	26.9996	12: 7:56	-79.7839	27.0103	-999.00	-999.00
3	12:28:45	-79.6834	26.9998	12:48: 3	-79.6837	27.0136	-999.00	-999.00
4	13: 0: 6	-79.6167	26.9998	13:23: 3	-79.6169	27.0144	-999.00	-999.00
5	13:42:57	-79.4999	27.0001	14:10:58	-79.5006	27.0131	-999.00	-999.00
6	14:29:50	-79.3835	26.9998	14:53: 3	-79.3841	27.0077	-999.00	-999.00
7	15: 9:24	-79.2838	26.9998	15:32:45	-79.2852	27.0062	-999.00	-999.00
8	99:99: 0	-79.2000	27.0000	99:99: 0	-79.2000	27.0000	-999.00	-999.00

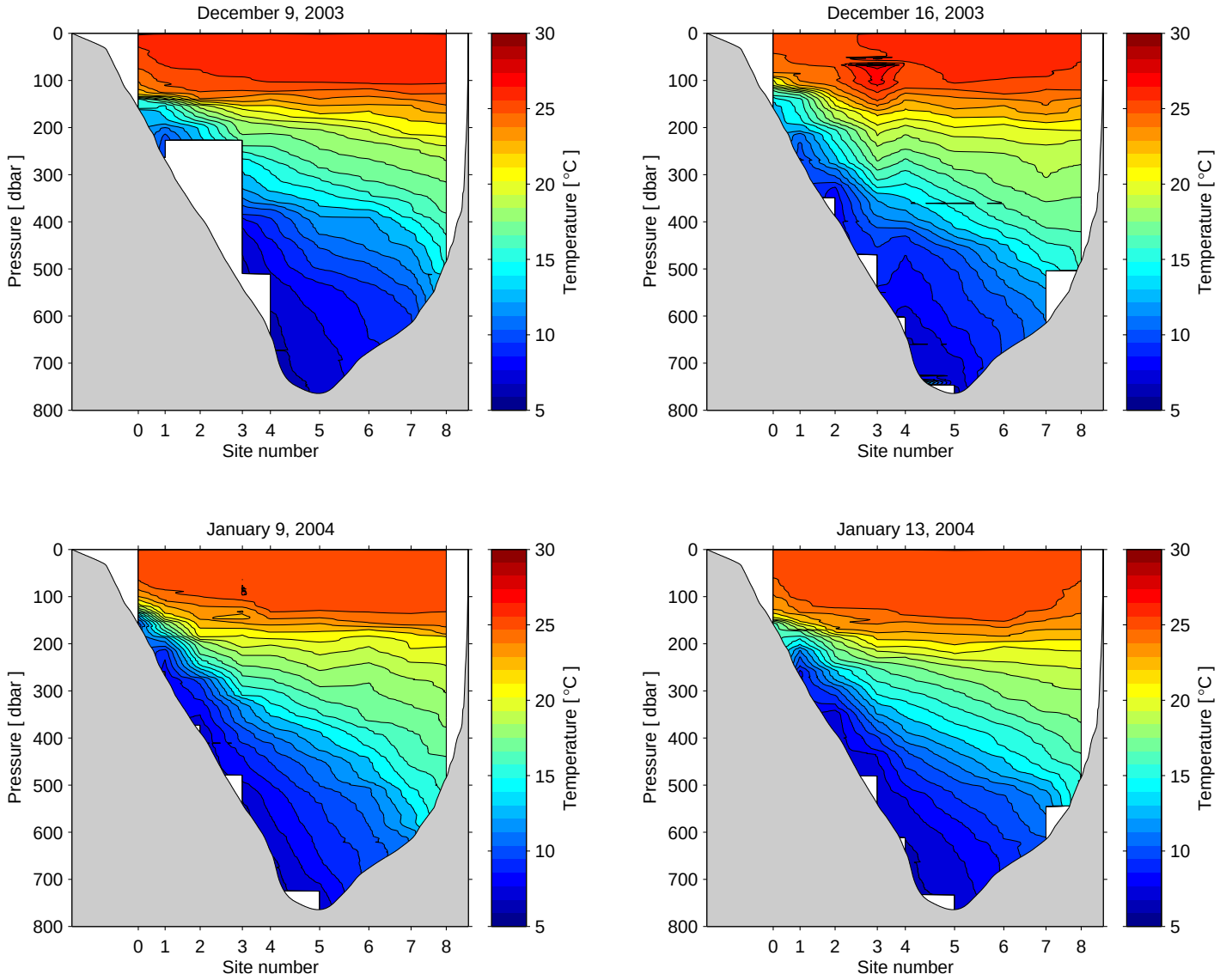
Table 2: Continued.

Date	Station #								
	0	1	2	3	4	5	6	7	8
December 9, 2003	80.90	79.43	52.00	115.34	100.68	108.58	85.76	83.20	85.06
December 16, 2003	156.00	154.22	162.25	215.30	191.37	168.83	91.98	32.65	7.04
January 9, 2004	186.45	177.76	168.00	149.58	148.91	103.34	73.92	63.41	34.35
January 13, 2004	143.14	150.24	155.94	146.07	122.76	104.39	79.67	57.69	9.97
May 7, 2004	82.80	137.41	169.15	156.93	150.28	126.52	143.26	78.66	1.75
May 24, 2004	184.01	198.34	204.91	44.46	157.72	121.28	97.59	43.61	-1.23
June 7, 2004	213.88	215.07	120.06	151.15	84.75	93.06	60.64	31.66	63.88
June 11, 2004	183.41	227.02	220.45	198.94	163.47	105.21	51.38	39.23	8.26
August 24, 2004	211.49	222.24	234.19	214.47	210.29	144.58	108.73	65.72	31.54
September 1, 2004	-999.00	-999.00	-999.00	-999.00	-999.00	-999.00	-999.00	-999.00	-999.00

Table 3: Meridional Surface Velocities in cm/s. Values of -999 indicate instrument failure.

.

APPENDIX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January 9, 2004
January 13, 2004
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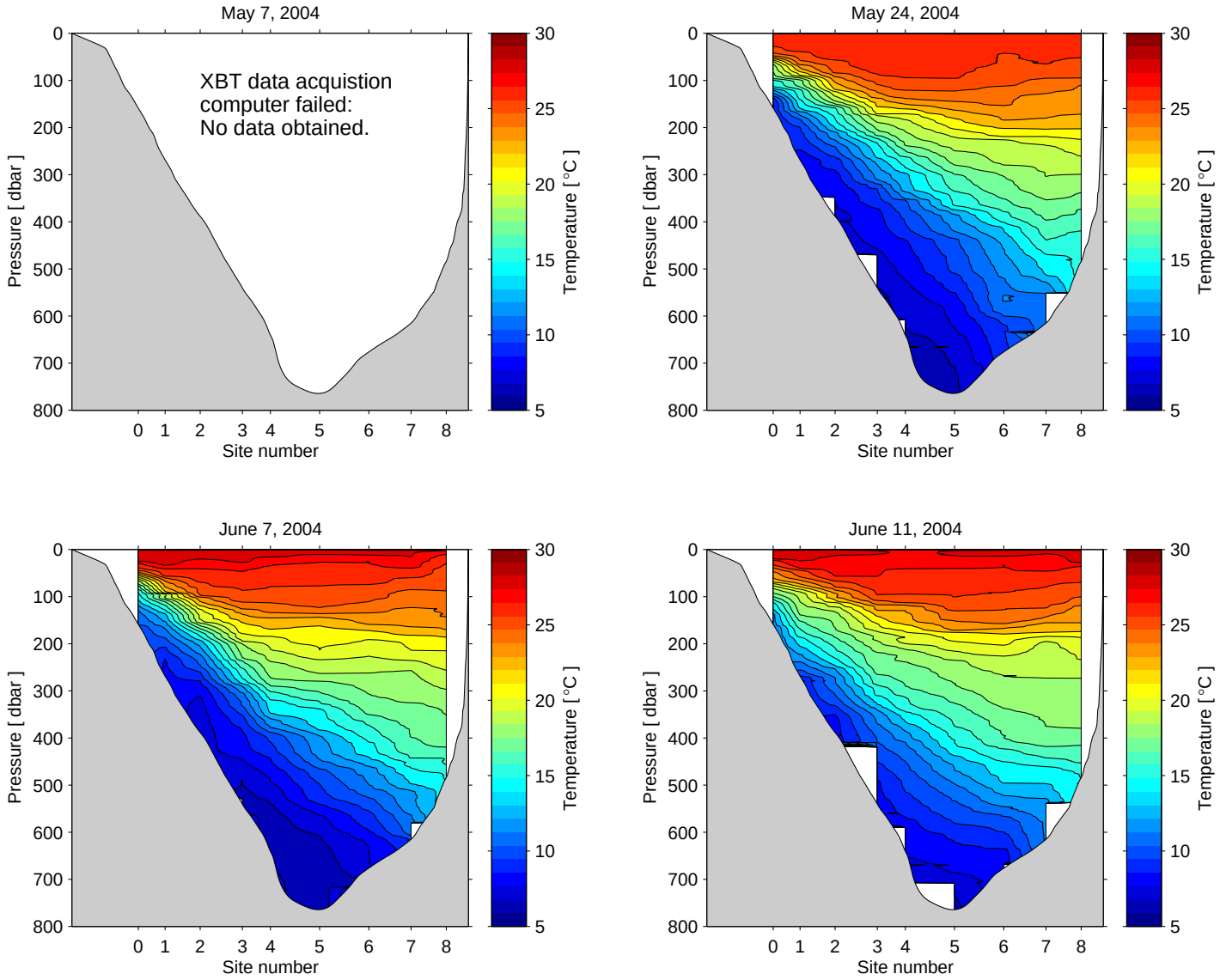
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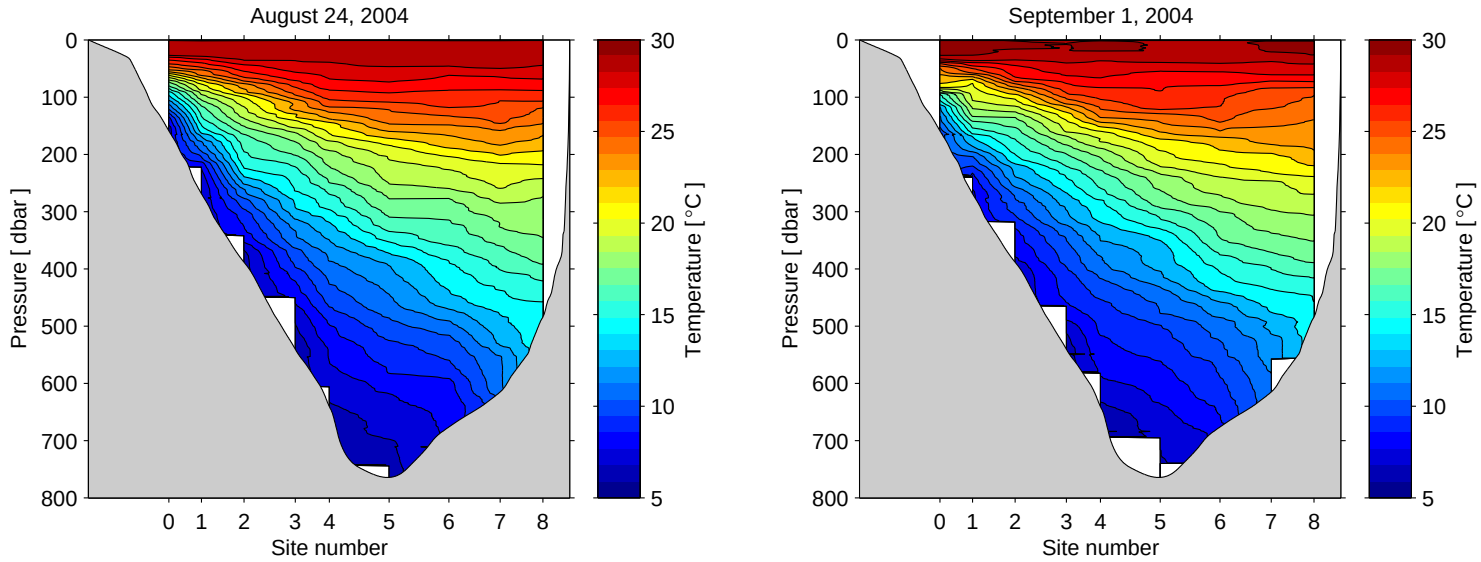
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