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

December 15, 2014

Final Cruise Report

U.S. Dept. of State Cruise No: F2013-108.

Ship Names: R/V Ooids (trips 1-8).

Dates: January 28, 2014; February 6, 2014; April 25, 2014; May 23, 2014; July 15, 2014; July 24, 2014; August 8, 2014; August 21, 2014.

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 8 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:

No serious issues occurred during last year.

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

Acknowledgements: A sincere thanks to Pedro Pena, Andy Stefanick and Kyle Seaton for their participation in these cruises and to the crew of the R/V Ooids for their reliable assistance.

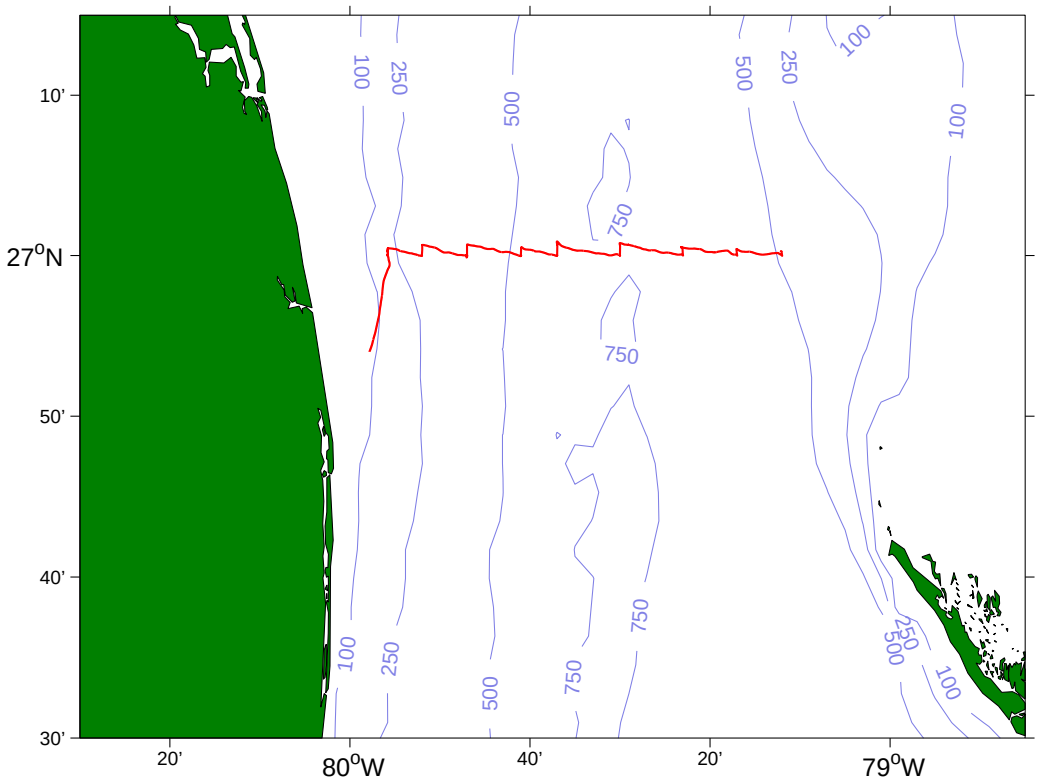


Figure 1: Typical cruise track

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
January 28, 2014								
0	14:35:19	-79.9296	27.0003	14:42:57	-79.9299	27.0004	-5.42	2.19
1	14:59: 7	-79.8664	27.0007	15:12:23	-79.8671	27.0034	-8.20	35.92
2	15:32: 4	-79.7834	27.0013	15:51:58	-79.7839	27.0106	-3.97	84.76
3	16:15:43	-79.6834	27.0006	16:42:53	-79.6839	27.0156	-3.55	101.00
4	16:59:56	-79.6165	27.0005	17:34:28	-79.6178	27.0197	-5.53	102.32
5	17:57:24	-79.4995	27.0011	18:38:36	-79.5009	27.0205	-5.98	86.68
6	19: 2: 7	-79.3830	27.0006	19:38: 0	-79.3847	27.0138	-8.32	68.87
7	20: 3:36	-79.2831	27.0001	20:34:49	-79.2852	27.0096	-10.92	56.78
8	20:56:10	-79.1996	27.0002	21:21: 8	-79.2016	27.0064	-13.87	47.01
February 6, 2014								
0	12:12:37	-79.9299	27.0004	12:20:17	-79.9298	27.0047	3.13	102.38
1	12:36: 4	-79.8669	27.0008	12:49:18	-79.8668	27.0072	1.78	88.83
2	13: 9: 3	-79.7835	27.0004	13:29:23	-79.7844	27.0110	-10.02	94.35
3	13:51: 3	-79.6831	27.0006	14:18: 3	-79.6831	27.0156	0.37	102.54
4	14:35:23	-79.6166	27.0003	15: 7:55	-79.6165	27.0151	1.42	85.00
5	15:30:46	-79.4999	27.0004	16: 9:13	-79.5002	27.0130	-1.47	60.31
6	16:28:48	-79.3832	27.0001	17: 2:37	-79.3836	27.0096	-2.23	51.44
7	17:22: 5	-79.2833	27.0002	17:53:19	-79.2845	27.0087	-7.23	50.04
8	18:10:41	-79.1999	27.0002	18:34:49	-79.2017	27.0059	-12.64	43.63
April 25, 2014								
0	11:13:23	-79.9300	26.9999	11:21: 6	-79.9298	27.0009	3.58	23.63
1	11:36:57	-79.8665	27.0002	11:50:13	-79.8657	27.0052	10.50	70.05
2	12:10:19	-79.7834	27.0003	12:30: 0	-79.7818	27.0102	13.10	90.88
3	12:51:51	-79.6832	27.0004	13:18:46	-79.6821	27.0159	6.65	105.54
4	13:39:53	-79.6167	27.0002	14:12:59	-79.6154	27.0167	5.82	91.98
5	14:44:50	-79.4998	27.0020	15:24:27	-79.5002	27.0171	-2.07	70.14
6	15:53: 3	-79.3830	27.0003	16:26: 2	-79.3826	27.0099	1.57	53.64
7	16:48:29	-79.2833	27.0001	17:19:48	-79.2832	27.0077	-0.07	44.69
8	17:40:22	-79.1998	27.0001	18: 4:24	-79.2003	27.0038	-4.12	28.55
May 23, 2014								
0	12:10:54	-79.9300	27.0014	12:18:42	-79.9299	27.0064	0.32	116.34
1	12:36:55	-79.8666	27.0007	12:50:13	-79.8665	27.0083	0.45	105.03
2	13: 9:34	-79.7832	27.0008	13:28:55	-79.7834	27.0124	-2.66	109.62
3	13:50:23	-79.6829	27.0007	14:19:19	-79.6833	27.0190	-2.96	116.67
4	14:37: 1	-79.6163	27.0008	15: 9:53	-79.6169	27.0200	-3.10	108.10
5	15:33:27	-79.4998	27.0005	16:13:13	-79.5003	27.0194	-2.36	87.41
6	16:39: 0	-79.3830	27.0004	17:13: 6	-79.3834	27.0104	-1.25	55.01
7	17:35:32	-79.2832	27.0000	18: 7:13	-79.2838	27.0066	-3.95	38.75
8	18:26:32	-79.1996	27.0003	18:52:46	-79.2009	27.0054	-8.63	35.95

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
July 15, 2014								
0	12:14:41	-79.9296	27.0015	12:22:19	-79.9296	27.0058	0.96	105.93
1	12:41:27	-79.8667	27.0010	12:54:40	-79.8666	27.0076	1.67	90.36
2	13:17:30	-79.7834	27.0006	13:37:40	-79.7834	27.0104	0.56	88.64
3	14:45:22	-79.6828	27.0022	15:12:14	-79.6826	27.0166	1.30	96.74
4	15:36:29	-79.6173	27.0016	16: 9:18	-79.6172	27.0191	0.96	97.56
5	16:40: 2	-79.5001	27.0006	17:18: 4	-79.5007	27.0181	-2.26	84.37
6	17:42:17	-79.3835	27.0006	18:17:31	-79.3843	27.0126	-4.61	62.38
7	18:42:38	-79.2837	27.0004	19:14:42	-79.2851	27.0088	-7.35	47.80
8	19:36: 9	-79.1997	27.0004	20: 0:22	-79.2005	27.0048	-4.63	33.42
July 24, 2014								
0	12:20:44	-79.9298	27.0014	12:28:26	-79.9297	27.0037	0.92	53.90
1	12:51:41	-79.8663	27.0015	13: 4:54	-79.8659	27.0066	4.01	70.48
2	13:36:14	-79.7833	26.9998	13:55:53	-79.7822	27.0104	8.33	97.18
3	14:23:59	-79.6831	27.0006	14:50:28	-79.6822	27.0168	5.36	111.90
4	15: 8:19	-79.6163	27.0003	15:41:25	-79.6156	27.0201	3.20	110.08
5	16: 6:46	-79.4998	27.0007	16:43:49	-79.4998	27.0191	-0.38	91.13
6	17:16: 4	-79.3831	27.0003	17:50:13	-79.3835	27.0140	-1.85	73.62
7	18:12:34	-79.2831	27.0002	18:42:46	-79.2839	27.0101	-4.30	59.98
8	19: 1:31	-79.1999	27.0001	19:25:28	-79.2010	27.0048	-8.26	36.13
August 8, 2014								
0	11:58:17	-79.9301	27.0003	12: 6:51	-79.9308	27.0028	-12.10	54.14
1	12:22:53	-79.8669	27.0001	12:37:25	-79.8676	27.0045	-6.10	55.66
2	12:55:34	-79.7835	27.0006	13:15:22	-79.7846	27.0099	-9.76	85.53
3	13:41:56	-79.6835	27.0002	14: 9:28	-79.6848	27.0169	-7.99	110.97
4	14:31:56	-79.6171	27.0005	15: 5:16	-79.6182	27.0205	-5.61	110.53
5	15:35:36	-79.4998	27.0018	16:14:16	-79.5020	27.0220	-8.94	96.42
6	16:37:51	-79.3835	27.0005	17:12: 7	-79.3864	27.0145	-13.73	74.97
7	17:34:25	-79.2832	27.0001	18: 6:12	-79.2858	27.0110	-13.60	63.19
8	18:23:16	-79.1999	27.0001	18:47:40	-79.2028	27.0080	-19.62	60.32
August 21, 2014								
0	12:15: 3	-79.9357	26.9878	12:22:31	-79.9357	26.9896	0.75	41.55
1	12:43: 8	-79.8665	27.0006	12:56:38	-79.8666	27.0054	-1.47	64.00
2	13:17:15	-79.7832	27.0005	13:36:53	-79.7829	27.0111	2.05	98.84
3	13:54:16	-79.6833	27.0004	14:21:22	-79.6825	27.0164	6.05	108.58
4	14:36:20	-79.6168	27.0006	15: 9:34	-79.6160	27.0186	3.72	99.23
5	15:30:53	-79.5000	27.0001	16: 9:21	-79.4996	27.0172	1.53	81.87
6	16:33:12	-79.3832	27.0002	17: 9:46	-79.3831	27.0142	-0.18	70.19
7	17:27:14	-79.2832	26.9999	17:58: 6	-79.2840	27.0094	-3.32	56.59
8	18:21:48	-79.1998	27.0001	18:46:33	-79.2014	27.0064	-11.01	46.95

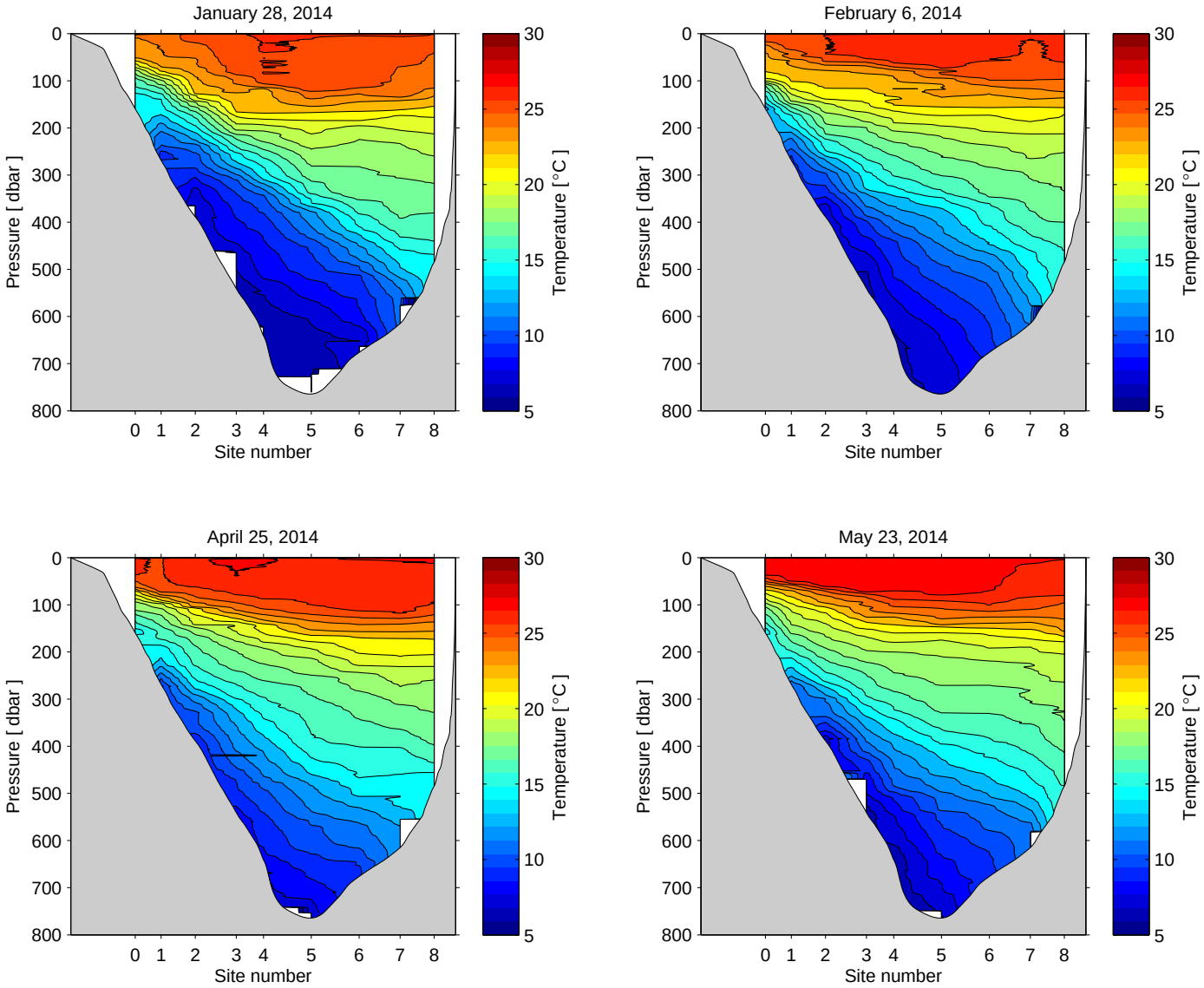
Table 2: Continued.

Table 3: Dropsonde Data: Values of -999 indicate instrument failure.

Date	Station #								
	0	1	2	3	4	5	6	7	8
January 28, 2014	11.83	135.02	191.41	156.52	159.36	122.99	32.26	15.73	1.33
February 6, 2014	164.59	166.31	186.60	155.93	31.19	94.74	71.69	57.96	55.32
April 25, 2014	62.44	105.97	181.30	168.95	121.28	102.84	91.54	48.87	14.49
May 23, 2014	184.01	186.90	164.00	153.10	118.24	127.21	22.17	25.59	34.48
July 15, 2014	2.84	196.95	181.30	222.91	194.97	150.09	93.97	76.30	47.22
July 24, 2014	171.79	214.47	244.94	200.32	159.69	150.99	112.37	86.92	51.26
August 8, 2014	125.46	123.37	175.04	190.58	158.12	118.76	131.43	91.08	66.64
August 21, 2014	223.43	194.38	174.77	165.28	167.38	134.34	111.72	80.65	50.61

Table 4: Meridional Surface Velocities in cm/s. Values of -999 indicate instrument failure.

APPENDIX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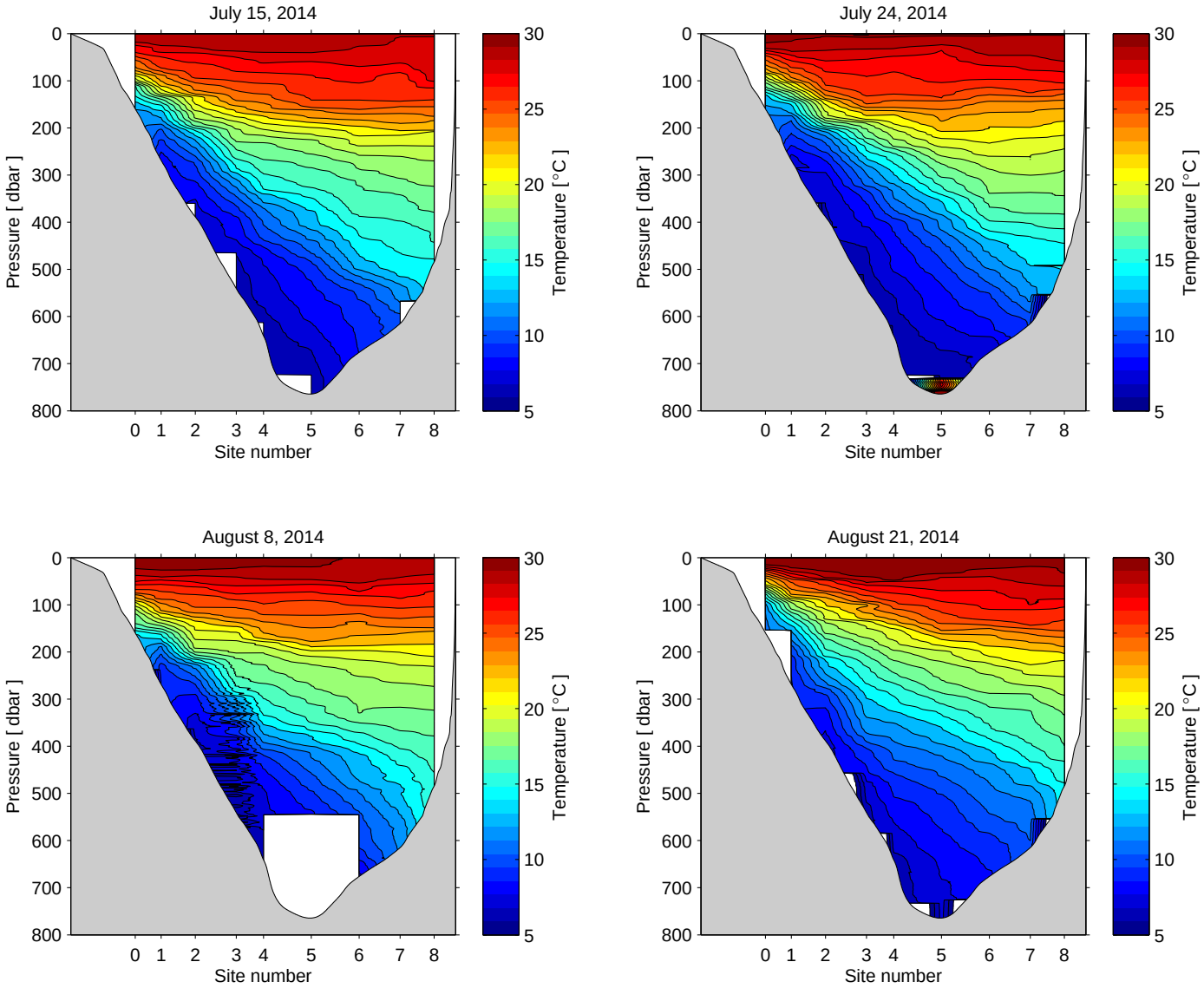
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