Cruise Report: *R/V Oceanus* 417

Woods Hole to Woods Hole
October 12 – 18, 2005

Station W: A continuing program of ocean measurements

Background

This cruise was one element of an ongoing observational program – Station W – funded by the U. S. National Science Foundation to investigate the characteristics and consequences of interannual variations in the Northwest Atlantic's deep western boundary current (DWBC). This study is documenting for an initial 4-year period, the temperature, salinity, tracer and velocity variations of the DWBC upstream of its Gulf Stream crossunder point. Station W includes a 5-mooring array of instruments situated in the DWBC flow regime on the continental slope south of Woods Hole and is augmented by twice-yearly occupations of a hydrographic section along this line (Figure 1). A companion research program by U.K. investigators is sampling bottom pressure variability at each of our mooring sites (and an additional site shoreward of the shallowest mooring) plus two additional lines crossing the DWBC to the east of Station W. The moored array, which consists of 3 McLane profilers and 2 moorings of current meters plus T/C sensors, is designed to quantify changes in DWBC water properties, stratification (potential vorticity) and transport. A sixth mooring of current meters, deployed in the mean axis of the Gulf Stream along Line W was added in spring 2005 (This mooring, named GUSTO-05, is maintained by Dr. M. McCartney and funded by WHOI's Ocean and Climate Change Institute.) Shipboard observations using CTD, LADCP and discrete sampling for salinity, oxygen, CFCs and I^{129} measure the water column properties at high spatial resolution to help verify that the array resolves interannual signals.

Cruise Summary

R/V Oceanus cruise # 417
Departed Woods Hole on 12 October 2005.
Returned to Woods Hole on 18 October 2005.
Number of CTD/LADCP/Rosette stations occupied: 16 (of 22 planned).
Weather was a major factor limiting the ability to acquire data.

Science party

Chief Scientist: Ruth Curry (WHOI)
CTD operations: Terry Joyce, Beatriz Pena-Molino, Jane Dunworth-Baker (WHOI)
LADCP : Dan Torres, Craig Marquette (WHOI)
CFC chemistry: Eugene Gorman, Guy Matthieu (LDEO), Nina Young (MIT undergrad)
Hydrography (salts and oxygens): George Tupper (WHOI)
Observers: Julia Whitty (Author), Tina Bell (Univ. of Georgia graduate student)

Cruise Narrative

The cruise tracked along a line between the continental shelf south of Woods Hole and Bermuda (Figure 1). Of 22 proposed stations, only 16 were successfully occupied (see Table 1). Weather was a limiting factor: a line of stationary low pressures centers dominated the entire northwest Atlantic spawning gale force winds and heavy seas for the duration of the field work. A Seabird 911 CTD system equipped with dual temperature/conductivity sensors and 1- dissolved oxygen sensor was used for all casts. A rosette sampler and 21 four-liter bottles were used to obtain water samples at discrete depths; these were subsequently analyzed for salinity, oxygen and CFC concentrations. Between stations 8-17, one liter samples were collected for shore-based analysis of Iodine-129 in the deep overflow waters. The LADCP consisted of a pair of upward/downward looking, 300 kHz ADCP transducers from RDI. Between casts, data were downloaded from the instruments. Underway ADCP data were collected with an RDI 75 kHz system. No IMET data were available due to equipment problems.

Stations 1-3 were acquired on the continental shelf in water depths < 200 m. Problems arose with the CTD Deck Unit at the start of **Station 5**, and were ultimately resolved after a three hour delay. The north wall of the Gulf Stream was situated at **Station 10** (see Figure 2). Heavy weather forced suspension of operations after **Station 12** (mid Gulf Stream) at which time we steamed southward. Casts were resumed beginning with **Station 18** and steaming northwestward to complete the intervening stations. **Station 18** had to be repeated as a result of the binary data file being corrupted (operator error). Upon completion of **Station 15**, time ran short and weather conditions deteriorated causing a premature end to data acquisition. The southern region of the Gulf Stream, **Stations 13 & 14**, were not occupied.

Acknowledgements

The fact that we successfully completed 16 casts in unrelentingly rough conditions is a tribute to the dedication of both the ship and science crews. We greatly appreciate the Captain (L.T. Bearse) and crew of *R/V Oceanus* who made every effort to obtain as many casts as possible. Special thanks go to the Bos’n (Leo Byckovas) who personally oversaw deployment and recovery operations for nearly every cast − especially in the heaviest weather − and the Shipboard Tech, Patrick Rowe, who cheerfully fixed equipment when it broke and kept things running in a few truly difficult moments. The science team of Terry Joyce, Beatriz Pena-Molino, Craig Marquette, Jane Dunworth-Baker, Dan Torres, George Tupper, Eugene Gorman, Guy Matthieu, and Nina Young safely deployed, recovered, sampled the CTD/rosette package, and analysed water samples amidst crashing waves, pitching decks, and generally uncomfortable conditions. Thanks to all for their perseverence and good humor in completing this job. Station W is supported by the National Science Foundation (grant no. OCE-0241354) and contributes to the U.S. CLIVAR and U.K. RAPID programs.

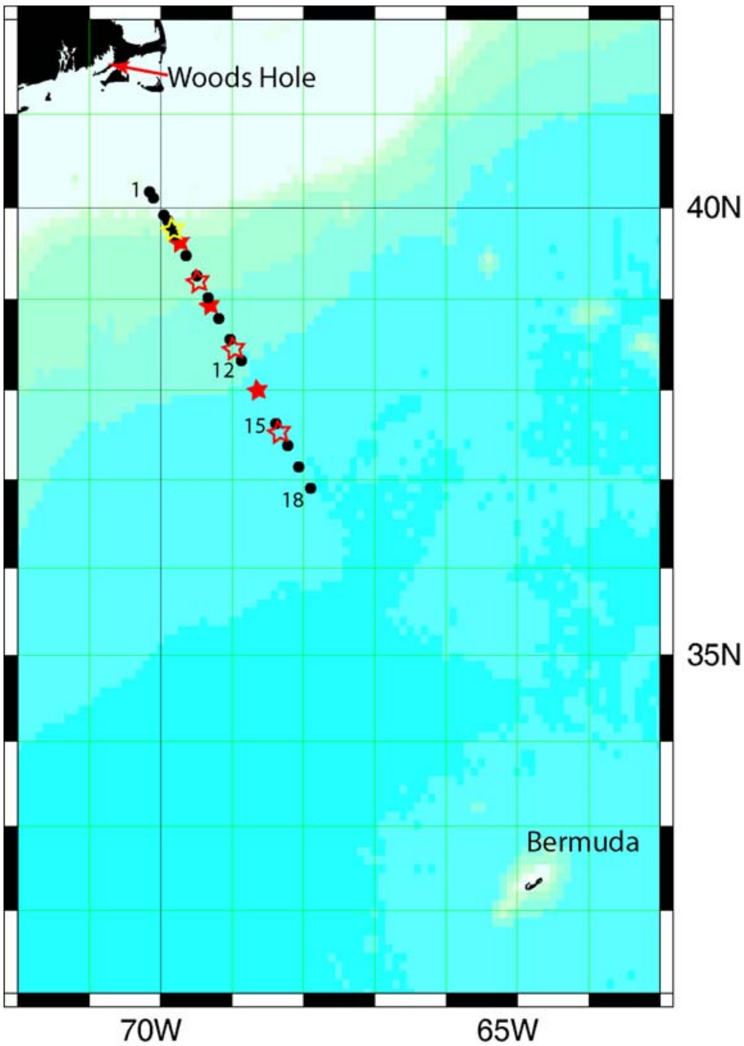

Figure 1.
Locations of CTD stations (black circles and numbers), and Station W moorings: Moored profilers (red filled stars), current meters (red outlined stars), and bottom pressure gauge (yellow star). Bathymetry (1000 meter contours) is depicted by background color.

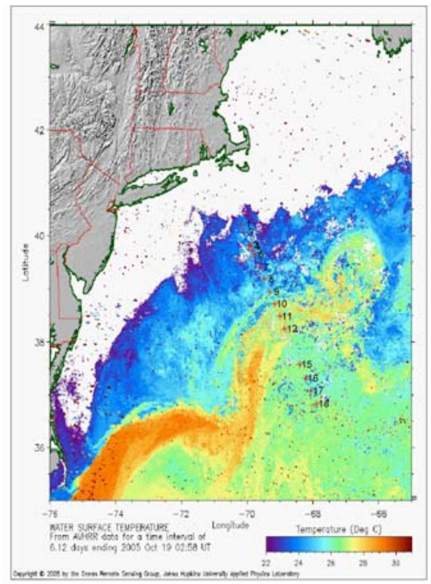

Figure 2.
SST from AVHRR data for the time interval Oct 13-19, 2005 shows the position of the Gulf Stream and Slope Waters relative to OC417 CTD casts.

Table 1. List of hydrographic stations occupied on OC417

		STN	DATE	TIME		LAT	LON		DPTH	WIRE OUT	PMAX	# of BOTTLES
32OC417	W	1	101305	1352	BE	40 17.07 N	-70 10.68 W	GPS	86			
32OC417	W	1	101305	1354	BO	40 17.07 N	-70 10.67 W	GPS		-9	79	3
32OC417	W	1	101305	1457	EN	40 17.09 N	-70 10.65 W	GPS				
32OC417	W	2	101305	1535	BE	40 08.62 N	-70 06.10 W	GPS	115			
32OC417	W	2	101305	1538	BO	40 08.65 N	-70 06.06 W	GPS		110	105	3
32OC417	W	2	101305	1543	EN	40 08.71 N	-70 05.99 W	GPS				
32OC417	W	3	101305	1822	BE	39 53.99 N	-69 57.13 W	GPS	465			
32OC417	W	3	101305	1833	BO	39 54.08 N	-69 57.11 W	GPS		462	454	6
32OC417	W	3	101305	1849	EN	39 54.22 N	-69 56.97 W	GPS				
32OC417	W	4	101305	2017	BE	39 51.97 N	-69 55.57 W	GPS	1100			
32OC417	W	4	101305	2045	BO	39 52.48 N	-69 55.41 W	GPS		1119	1051	12
32OC417	W	4	101305	2116	EN	39 52.99 N	-69 55.15 W	GPS				
32OC417	W	5	101405	1311	BE	39 48.12 N	-69 51.57 W	GPS	1277			
32OC417	W	5	101405	1333	BO	39 48.49 N	-69 51.66 W	GPS		1212	1180	11
32OC417	W	5	101405	1406	EN	39 48.98 N	-69 51.94 W	GPS				
32OC417	W	6	101405	1530	BE	39 42.90 N	-69 47.80 W	GPS	2026			
32OC417	W	6	101405	1624	BO	39 42.70 N	-69 46.97 W	GPS		2272	1180	18
32OC417	W	6	101405	1720	EN	39 43.45 N	-69 46.94 W	GPS				
32OC417	W	7	101405	2015	BE	39 28.45 N	-69 38.46 W	GPS	2418			
32OC417	W	7	101405	2111	BO	39 29.09 N	-69 37.50 W	GPS		2674	2414	21
32OC417	W	7	101405	2206	EN	39 29.81 N	-69 36.52 W	GPS				
32OC417	W	8	101505	0114	BE	39 15.49 N	-69 29.48 W	GPS	2650			
32OC417	W	8	101505	0159	BO	39 15.67 N	-69 29.22 W	GPS		2652	2657	21
32OC417	W	8	101505	0253	EN	39 15.59 N	-69 29.05 W	GPS				
32OC417	W	9	101505	0504	BE	39 01.18 N	-69 19.57 W	GPS	3066			
32OC417	W	9	101505	0613	BO	39 01.88 N	-69 18.14 W	GPS		3236	3048	21
32OC417	W	9	101505	0719	EN	39 02.18 N	-69 17.04 W	GPS				
32OC417	W	10	101505	0919	BE	38 47.64 N	-69 10.35 W	GPS	3290			
32OC417	W	10	101505	1035	BO	38 47.40 N	-69 08.69 W	GPS		3347	3294	21
32OC417	W	10	101505	1151	EN	38 47.09 N	-69 07.34 W	GPS				
32OC417	W	11	101505	1343	BE	38 33.46 N	-69 00.69 W	GPS	3733			
32OC417	W	11	101505	1441	BO	38 33.79 N	-68 58.59 W	GPS		3753	3503	21
32OC417	W	11	101505	1554	EN	38 34.12 N	-68 56.61 W	GPS				
32OC417	W	12	101505	1808	BE	38 19.37 N	-68 52.03 W	GPS	3793			
32OC417	W	12	101505	1917	BO	38 18.58 N	-68 50.17 W	GPS		4364	3861	21
32OC417	W	12	101505	2046	EN	38 17.78 N	-68 48.38 W	GPS				
32OC417	W	15	101705	1048	BE	37 38.23 N	-68 24.88 W	GPS	4535			
32OC417	W	15	101705	1243	BO	37 38.74 N	-68 26.47 W	GPS		4679	4623	21
32OC417	W	15	101705	1506	EN	37 38.23 N	-68 27.83 W	GPS				
32OC417	W	16	101705	0311	BE	37 22.76 N	-68 13.15 W	GPS	4709			
32OC417	W	16	101705	0449	BO	37 21.87 N	-68 14.67 W	GPS		5079	4806	21
32OC417	W	16	101705	0644	EN	37 20.38 N	-68 16.25 W	GPS				
32OC417	W	17	101605	1418	BE	37 08.37 N	-68 03.82 W	GPS	4860			
32OC417	W	17	101605	1541	BO	37 07.74 N	-68 04.15 W	GPS		4984	4978	21
32OC417	W	17	101605	1721	EN	37 06.72 N	-68 04.58 W	GPS				
32OC417	W	18	101605	1913	BE	36 53.69 N	-67 53.39 W	GPS	4892			
32OC417	W	18	101605	2100	BO	36 52.14 N	-67 52.92 W	GPS		5349	5014	21
32OC417	W	18	101605	2240	EN	36 50.81 N	-67 52.73 W	GPS				