HYDROGRAPHIC SURVEY REPORT
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Convective Overturn Experiment (CONVEX) CRUISE # 7

R/V OCEANUS (OC-323) (Between 02 and 06 May 1998)

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Abstract.

This report describes a set of hydrographic measurements obtained 02 - 06 May 1998 as part of the NSF-supported "Observational / Modeling Study of Wintertime Convection and Water Mass Formation" in the western Gulf of Maine (GOM). Herein we document the seventh of seven University of New Hampshire (UNH) cruises aboard the R/Vs ENDEAVOR and OCEANUS as part of this "Convective Overturn Experiment" (CONVEX). This report and these data can be accessed through the RMRP Research Environmental Data and Information Management System (REDIMS) via the WWW address:

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1. Introduction.

Click here to read an introduction to the CONVEX program. (See: NHU-T-99-006)

2. Cruise Narrative.

The RV OCEANUS departed the dock at Woods Hole Oceanographic Institute, Woods Hole, MA at 1000L local on Saturday, 2 May 1998. After a transit through the Cape Cod Canal, arrived at the first station 2230. Completed 11 CTD stations using the OCEANUS SBE-911+ along tracks B - WB - I - H - WB (Figure 1.a).

The OCEANUS arrived at the Wilkinson Basin moorings site for instrument recovery 0700 3 May. As the main buoy (MET - "A") acoustic release would not release (see below), commenced dragging operations at 1015. Anchor was hooked on the first pass (!!) and all mooring gear was on deck by 1145. Acoustically released final guard buoy "G" at 1210 and all equipment on board by 1300.

Returned to hydrographic survey and completed total of 52 CTD stations on legs J - A - WB - F - E - WB - C - D - WB - G - F. Broke off survey at 1745 on 5 May for transit to outer Georges Bank.

Deployed J. Irish buoy 0700 6 May and recovered A. Girard bottom instrument package without incident. A CTD profile was observed at the J. Irish mooring. The Oceanus returned to WHOI via Nantucket Shoals, arriving at 2110 6 May 1998. Total distance covered was 827 nm in 109 hrs.

Prelog: On March 2, 1998, we were informed by a fisherman that one of our buoys was adrift east of Chatham, MA. A fisherman was contracted to find it, to no avail. After receiving an updated position from ARGOS, the NMFS RV Delaware recovered guard buoy "E" on March 5 and returned it to Woods Hole.

With the loss of guard buoy "E," we became concerned that our main mooring ("A") was taking a beating. Weather equipment was reported broken and paint was peeling from the tower. On March 17, F. Bub and K. Morey chartered the RV Gulf Challenger for an inspection and/or recovery trip. We determined the systems should be removed and data retrieved before they sustained further damage. After a CTD cast, the Aanderaa thermister strings "B" and "C" were released and recovered at 1230 and 1300L, respectively. The main instrument buoy "A" acoustic release would not answer or release, however. We then tied the buoy alongside and attempted but were unable to download data. As weather deteriorated, the bottom equipment from guard bouy "E" was recovered (it appears to have been cut) and new ARGOS locators placed on bouys "A" and the last guard buoy "G" before we headed for home.

2.a. Scientific Party:

F.L. Bub (Chief Scientist), W.S. Brown, K. Morey, K. Garrison, P. Mupparapu, S. Fisher, J. Irish (WHOI), J. Lord (WHOI), A. Girard (WHOI), M. Bellerman.

2.b. Cruise Photos

Click here to see GIF photos of the OC-323 scientific party and cruise work.

3. Data.

3.a. Hydrographic Data Acquisition.

The R/V OCEANUS' SeaBird SBE 911 Plus CTD Profiler was used to measure vertical profiles of electrical conductivity and temperature versus pressure at 53 hydrographic stations during 02 - 06 May 1998 (Figure 1.a).

Sensors on the CTD were factory calibrated on 9 October 1996. This CTD samples at a rate of 24 scans per second. Salinity profiles were computed from these data using SeaBird software. Additional sensors on the SBE-911 also recorded data for the measurement of dissolved oxygen, water transmissivity, fluorescence (Chl-a), and irradiance (PAR). See Figure 3.a. for a composite of profiles. CTD data acquisition, display and storage were managed by an on-board computer using the SeaBird software package SEASOFT.

At each station, the CTD was lowered at a rate of approximately 30 meters per minute to depths within 5-10 meters of the bottom. Three to eight water samples were collected with a rossette of 5-liter Niskin bottles, and specimens for nutrient and oxygen isotope analyses were gathered. At selected stations, the condutivity of one water sample was determined using the UNH Guildline 8400A Autosal and the corresponding salinities were used to correct salinity values derived from the raw CTD measurements.

3.b. Data Processing.

The CTD data were processed using a series of SeaBird SEASOFT programs (listed in parentheses) in which:

a. Raw hexidecimal CTD output is converted into engineering units (DATCNV). Only downcast data were used to produce station profiles. Bottles samples were taken during upcasts and average CTD data at each bottle depth were stored (ROSSUM).

b. Noise contamination greater than 2 standard deviations from 50 point sections was removed (WILDEDIT). In addition, CTD downcast data associated with downward velocities of less than 25 cm/s (due to looping) were discarded (LOOPEDIT).

c. Data were filtered to ensure consistent response times using a low pass filter with time constant 0.15 sec (FILTER).

d. Data were averaged into 1 decibar (dbar) bins (BINAVG) to produce profiles of temperature, salinity, etc., versus pressure from the unequally-spaced cast data from each station.

e. These profile data were stored as ASCII files on floppy disks for post-processing and plotting.

3.c. Data Descriptions, Corrections and Estimated Accuracy / Precision.

Click here for a summary of data descriptions, corrections and estimated accuracy / precision.

3.d. Data Presentations.

The corrected hydrographic data are presented as:

1. Station profile plots and property-property diagrams,
2. Vertical section contour plots, and
3. Horizontal pressure and desnity surface contour plots.

3.d.1. Vertical CTD Profile Plots.

Individual profiles may be viewed via Table 2. A composite of all CTD profiles is shown as Figure 3.a and an expanded T-S diagram as Figure 3.b. Data are presented on two pages per station:

- **Page A** - Station profiles of temperature, salinity, sigma-theta density, stability (N-squared) and a temperature-salinity diagram. The upper three plots (surface to 100 m deep) represent zoomed details of water property structure in the main thermocline (halocline, pycnocline) zone (horizontal scales vary). The middle plots present these water property structures for the entire water column. These plots are all on the same depth / property scale for intercomparison. A Brunt-Vaisaila frequency (N-squared) plot indicates water column stability.

- **Page B** - When data are available, this page shows station profiles of measured dissolved oxygen, transmissivity, fluorescence (Chl-a), solar irradiance (PAR), as well as computed sound velocity, temperature - dissolved oxygen, and salinity - dissolved oxygen diagrams.

3.d.2. Vertical Hydrographic Sections.

Potential temperature, salinity, and sigma-theta sections for the following transects are presented. Each plot spans 200 km and horizontal scales are preserved. Contour intervals are indicated on plots. The CTD station numbers are shown along the top horizontal axis and the ocean bottom (based on depths at CTD stations) is shaded.

- Point A to F, tracking southeastward through Jeffreys and Wilkinson Basins (Figure 4.a).
- Point B to G, tracking eastward through Massachusetts Bay and Wilkinson Basin (Figure 4.b).
- Point C to H, tracking northeastward from Cape Cod through Wilkinson Basin (Figure 4.c).
- Point J to D, tracking southward from Cape Porpoise, ME across Wilkinson Basin (Figure 4.d).

3.d.3. Horizontal Pressure and Density Surfaces.

Contoured surfaces may be accessed via Table 1. Contours of temperature, salinity and density fields on the 5, 25, 50, 100, 150 and 200 dbar pressure surfaces (equivalent to depth in m) and the sigma theta 26.00 density surface (mid water column) are presented for information. The 5 m field is the mean of the 0-10 m layer. Dynamic height fields indicate geostrophic shear. Cyan regions show where the ocean bottom is shallower than the plotted surface. CTD profiles at the red dots (x indicates no data). Wilkinson Basin mooring marked by the wheel. Red lines bound region of the CONVEX water mass analyses. Plotted contour intervals, along with data extrema and search

epsilon, are indicated in captions.

3.d.4. Data Files.

Profiles can be made available as (a) **ASCII files** upon request to frank.bub@unh.edu. Upon final quality control, we will provide (b) **JGOFS** default files through a ftp site.

Other OC-323 Cruise data including enroute ADCP, TSAL, navigation, bathymetry and observed weather records will also be made available upon further processing.

4. Acknowledgements.

The invaluable work of Ken Morey and Karen Garrison resulted in the successful deployment and recovery of the Wilkinson Basin buoy array and the hydrographic survey. We appreciate the efforts of the captain and crew of R/V OCEANUS as they helped us conduct this field program.J he OCEANUS cook deserves special mention. J. Irish assistance with the bouy recovery is much appreciated. L. Stein, the onboard WHOI tech, provided excellent support. We are grateful for the help provided by T. Loder and R. Clauss in processing the bottle salinities.

F. Bub, W. Brown, and P. Mupparapu are supported by NSF Grant OCE-9530249.

5. References.

Fofonoff, N. P. and R. C. Millard Jr., 1983. Algorithms for compilation of fundamental properties of seawater, UNESCO Technical Papers in Marine Science, no. 44. UNESCO, Paris, France, 53 pages.

Garrison, K. M. and W. S. Brown, 1989. Hydrographic survey in the Gulf of Maine July-August 1987, UNH Tech. Rpt. No. UNHMP-T/DR-SG-89-5, Univ. of NH, Durham, NH.

Morgan, P. P., 1994, SEAWATER Software Version 1.2b, CSIRO Division of Oceanography, Hobart, AUS.

Table 1. Surface Contours of Water Properties.

These fields are briefly described in section 3.d.3. Pressure (P), Temperature (T), Salinity (S), Density (D), and Dynamic Height (DH) are contoured at the specfied pressure or density levels.

PRESSURE SURFACE	POTENTIAL TEMPERATURE (deg C)	SALINITY (psu)	DENSITY: SIGMA-THETA (kg/m^3)	DYNAMIC HEIGHT (cm, ref surface)
05 dbar	T05	S05	D05	X X X
25 dbar	T25	S25	D25	X X X

50 dbar	T50	S50	D50	X X X
100 dbar	T100	S100	D100	DH100
150 dbar	T150	S150	D150	DH150
200 dbar	T200	S200	D200	X X X

DENSITY SURFACE (kg/m^3)	PRESSURE (dbar)	POTENTIAL TEMPERATURE (deg C)	SALINITY (psu)
26.00 sigma theta	P26.00	T26.00	S26.00

Table 2. CTD Profile Plots.

Hydrographic station information for the **R/V OCEANUS Cruise OC-323 (02 - 06 May 1998)**. Position, depth, date, and time are for the bottom of the cast. Profiles, which are described in section 3.d.1, may be viewed by clicking on ##A or ##B. See Figure 1.a for station locations.

CTD station number		Latitude (deg min N)	Longitude (deg min W)	Water Depth (meters)	Time (Z)	Date (DD/MM/YY)
01A	01B	42.5010	70.4960	085	2140	02/05/98
02A	02B	42.5485	70.2792	090	2255	02/05/98
03A	03B	42.5993	70.0655	125	0006	03/05/98
04A	04B	42.6508	69.8495	246	0117	03/05/98
05A	05B	42.7015	69.6418	265	0247	03/05/98
06A	06B	42.8520	69.5697	185	0452	03/05/98
07A	07B	43.0025	69.5002	155	0600	03/05/98
08A	08B	42.9018	69.3490	142	0708	03/05/98
09A	09B	42.8008	69.2005	132	0818	03/05/98
10A	10B	42.7512	69.4180	170	0937	03/05/98
11A	11B	42.7032	69.6282	270	1058	03/05/98
12A	12B	42.8652	69.7085	190	1916	03/05/98
13A	13B	43.0222	69.7837	175	2030	03/05/98
14A	14B	43.1805	69.8545	185	2143	03/05/98
15A	15B	43.3403	69.9283	155	2258	03/05/98
16A	16B	43.4997	70.0055	110	0007	04/05/98
17A	17B	43.2805	70.2015	105	0144	04/05/98
18A	18B	43.0993	70.4010	085	0322	04/05/98
19A	19B	43.0035	70.2048	160	0436	04/05/98
20A	20B	42.9283	70.0597	085	0540	04/05/98
21A	21B	42.8540	69.9185	220	0641	04/05/98
22A	22B	42.7767	69.7747	265	0745	04/05/98
23A	23B	42.7013	69.6337	275	0852	04/05/98
24A	24B	42.6012	69.5087	255	1000	04/05/98
25A	25B	42.5008	69.3827	250	1107	04/05/98
26A	26B	42.4028	69.2572	255	1216	04/05/98
27A	27B	42.3012	69.1277	220	1331	04/05/98
28A	28B	42.1995	69.0012	175	1440	04/05/98
29A	29B	42.0995	68.8782	143	1546	04/05/98
30A	30B	42.0015	68.7488	145	1648	04/05/98
31A	31B	42.0047	69.0025	140	1801	04/05/98
32A	32B	42.0050	69.2515	215	1916	04/05/98

33A	33B	42.0017	69.4995	210	2034	04/05/98
34A	34B	42.1833	69.3792	200	2155	04/05/98
35A	35B	42.3562	69.4633	235	2314	04/05/98
36A	36B	42.5278	69.5493	280	0038	05/05/98
37A	37B	42.7035	69.6327	275	0206	05/05/98
38A	38B	42.6015	69.7645	232	0319	05/05/98
39A	39B	42.4997	69.8915	180	0424	05/05/98
40A	40B	42.4005	70.0230	125	0525	05/05/98
41A	41B	42.2987	70.1498	65	0621	05/05/98
42A	42B	42.1003	69.8477	140	0811	05/05/98
43A	43B	42.2523	69.7948	240	0912	05/05/98
44A	44B	42.4037	69.7428	270	1046	05/05/98
45A	45B	42.5542	69.6910	255	1159	05/05/98
46A	46B	42.7042	69.6360	259	1314	05/05/98
47A	47B	42.6533	69.4148	235	1506	05/05/98
48A	48B	42.6017	69.1917	210	1630	05/05/98
49A	49B	42.5538	68.9688	215	1746	05/05/98
50A	50B	42.5015	68.7473	185	1903	05/05/98
51A	51B	42.3337	68.7463	190	2018	05/05/98
52A	52B	42.1687	68.7467	205	2137	05/05/98