NPS-68-85-017

//
NAVAL POSTGRADUATE SCHOOL
Monterey, California

METEOROLOGICAL DATA FROM THE OPTOMA PROGRAM,
OPTOMAll, Leg DII,
30 June - 10 July, 1984.

by

Marie C. Colton
Christopher N.K. Mooers

May 1985

Approved for public release; distribution unlimited.

Prepared for:
Office of Naval Research
Environmental Sciences Directorate (Code 420)
Arlington, VA 22217

FEDDOCS
D 208.14/2
NPS-68-85-017

Feddoc:
D 208.14/2
NPS-68-25-017

DUDLEY KNOX LIBRARY
NAVAL POSTGRADUATE SCHOOL
NATREY 100-101

NAVAL POSTGRADUATE SCHOOL

Rear Admiral R. H. Shumaker
Superintendent

David A. Schraday
Provost

This report is for the research project Ocean Prediction Through Observations, Modeling, and Analysis sponsored by the Physical Oceanography Program of the Office of Naval Research under Program Element 61153N. Reproduction of any or all of this report is authorized.

This report was prepared by:

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NPS-68-85-017	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) METEOROLOGICAL DATA FROM THE OPTOMA PROGRAM OPTOMAll, Leg DII 30 June - 10 July 1984		5. TYPE OF REPORT & PERIOD COVERED Report for October 1982 to May 1985.
7. AUTHOR(s) Marie C. Colton Christopher N.K. Mooers		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Department of Oceanography Monterey, CA 93943		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS Office of Naval Research Arlington, VA 22217		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 61153N N000148R24051
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE May 1985
		13. NUMBER OF PAGES 72
		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Radiosonde Data Coastal Meteorology Air/Sea Interaction Atmospheric Boundary Layer Oceanic Mixed Layer California Current System		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents the meteorological data acquired by twenty-six radiosondes launched during the hydrographic cruise OPTOMAll, Leg DII (30 June to 10 July, 1984). To compare the prevailing atmospheric and oceanic conditions the radiosonde potential temperature and specific humidity profiles are plotted with nearly coincident XBT temperature profiles. Also included are: 1) time series plots of hourly dry-bulb and wet-bulb temperatures and hourly wind velocities, 2) an AVHRR image, and 3) National Weather Service surface pressure analyses for the cruise period.		

DD FORM 1 JAN 73 1473

EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-LF-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

*Meteorological Data from the **OPTOMA** Program:*

OPTOMA11 Leg DII
30 June - 10 July, 1984

by

Marie C. Colton
Christopher N. K. Mooers

Chief Scientist:
C. N. K. Mooers

The **OPTOMA** Program is a joint program of

Department of Oceanography
Naval Postgraduate School
Monterey, CA 93943.

Center for Earth and Planetary Physics
Harvard University
Cambridge, MA 02138.

TABLE OF CONTENTS

	<i>PAGE</i>
LIST OF FIGURES	ii
LIST OF TABLES	iii
INTRODUCTION	1
DATA ACQUISITION	3
DATA PROCESSING	4
DATA PRESENTATION	4
ACKNOWLEDGEMENTS	46
APPENDIX A: NWS SURFACE PRESSURE ANALYSES	47
INITIAL DISTRIBUTION LIST	68

LIST OF FIGURES

<i>Figure No.</i>	<i>Caption</i>	<i>Page</i>
1.	The NOCAL and CENCAL subdomains of the OPTOMA Program. Isobaths are shown in meters.	2
2.	Cruise track for OPTOMA11, Leg DII. The second traversal along the interior diagonal lines is shown as a broken line.	7
3.	Radiosonde positions for OPTOMA11, Leg DII.	8
4.	Radiosonde station numbers for OPTOMA11, Leg DII.	9
5	XBT/CTD station numbers for OPTOMA11, Leg DII.	11
6(a)-(m).	Potential temperature and specific humidity profiles to 3000m from the radiosondes. The potential temperature is shown in degrees Celsius (OPTOMA11, DII).	16
7.	Profile of mean potential temperature $\bar{T}(z)$ with + and - the standard deviation (OPTOMA11,DII).	29
8(a)-(l).	Radiosonde profiles to 750m (800m) and nearly coincident XBT temperature profiles to 500m (750m) to show the air/sea interface and boundary layers (OPTOMA11, DII).	30
9.	Time-series of hourly dry-bulb and wet-bulb temperatures (OPTOMA11,DII).	42
10.	Time-series of hourly true wind speed with true wind velocity sticks below the curve to indicate wind direction. The time axis is annotated with the radiosonde station numbers at their approximate launch times (OPTOMA11, DII).	43
11.	NOAA-7 AVHRR infrared image from 7 July 84.	44
12.	NOCAL domain superposed on the salient features of the infrared image.	45

LIST OF TABLES

<i>Table No.</i>	<i>Caption</i>	<i>Page</i>
I.	Specifications and sensor accuracies of the AIR, Inc. radiosonde system.	6
II.	Radiosonde station listing for OPTOMA11, Leg DII.	10
III.	XBT/CTD station listing for OPTOMA11, Leg DII.	12

INTRODUCTION

The OPTOMA (Ocean Prediction Through Observations, Modeling and Analysis) Program, a joint NPS/Harvard program sponsored by ONR, seeks to understand the mesoscale (front, eddies, and jets) variability and dynamics of the California Current System and to determine the scientific limits to practical mesoscale ocean forecasting. To help carry out the aims of this project, a series of cruises and flights has been planned in two subdomains, NOCAL and CENCAL, shown in Figure 1. This report summarizes the meteorological data acquired during OPTOMA11, cruise Leg DII (described below), especially the atmospheric profiles from radiosondes which were recorded using a new AIR, Inc. data acquisition system.

The six cruises and one AXBT flight comprising OPTOMA11 were undertaken, during June, July, and August 1984, in the R/V ACANIA (Legs AI, AII, AIII), the USNS DE STEIGUER (Legs DI, DII, DIII) and a Navy Reserve Patrol Wing P3A aircraft (Leg P). Hydrographic data were acquired off the coast of California in an area which covered and extended the NOCAL region. The sampling was concentrated in a central 150 km square domain centered about 190 km off the coast between Pt. Reyes and Pt. Arena in the NOCAL domain.

Leg AI was carried out from 5 to 15 June, Leg AII from 21 June to 30 June and Leg AIII from 5 to 13 July. These three legs sampled the central domain with additional transects to and from the domain. Leg DI was carried out from 23 to 30 June, Leg DII from 30 June to 10 July, and DIII from 27 July to 5 August. Leg DI sampled areas to the north, south and inshore of the central domain. Leg DII sampled the central domain area with additional legs to the west and south of the area, as shown in Figure 2. Leg DIII,

Figure 1: The NOCAL and CENCAL subdomains of the OPTOMA Program. Isobaths are shown in meters.

AIRSONDE SPECIFICATIONS MODELS AS-1AT, AS-1A-TH, AS-1B-PT, AS-1C-PTH

The following performance specifications are for the sondes when used with an AIR ground station in a field environment. It includes all sources of error for digital non-baselined data.

SENSORS

Temperature (Wet and Dry Bulb)

Range:	+ 50° C to - 70° C
Precision:	0.5° C for + 40° C to - 40° C (Typical temperature accuracy is 0.2° C over this range.) 1.0° C for + 50° C to - 70° C
Thermistor Match:	0.1° C for + 35° C to - 20° C
Resolution:	0.01° C
Total System RMS Noise Noise Equivalent:	0.04° C (includes random telemetric and computational errors.)
Response Time:	Dry Bulb: 3 sec Wet Bulb: 12 sec

Humidity (From psychrometric equation)

Range:	3% to 100%
Precision:	3% for 0° C to 50° C (Typical humidity accuracy is 2% RH over this temperature range.) 5% for - 10° C to 0° C 10% for - 25° C to - 10° C

Pressure (Absolute Barometric)

Range:	1050 to 250 mb
Precision:	3 mb
Resolution:	0.1 mb
Temperature Compensation:	Bead thermistor with automatic correction computed by AIR ground station

TRANSMITTER

Carrier Frequency:	403.5 Mhz (std) 400-410 Mhz (Optional)	Deviation:	± 5 KHz
Modulation:	FM, narrow band	Tuning:	None, fixed by crystal
Audio Modulation:	1.5 KHz to 3.5 KHz	Transmitter Power:	25 milliwatts
Transmitter Type:	Crystal VCXO with 9x multiplication	Telemetry Range:	100 km (nominal)
Stability:	0.02% (+ 50° C to - 70° C)	Antenna:	¼ wave vertical monopole
		RF Polarization:	linear, vertical

Table I : Specifications and sensor accuracies of the AIR, Inc. radiosonde system.

with an intensive sampling pattern which differed from the previous cruises, covered the central and inshore domains. On each of these cruises, hydrographic stations were occupied at approximately 15 km along the track. Leg P was carried out on 18 July aboard an USNR P3A aircraft, and sampled at 35 km intervals an area approximately 250 km square. in the NOCAL area. The hydrographic data from all of the above cruises and the flight have been reported in Wittmann, et. al. (1985).

The cruise OPTOMA11, Leg DII differed from all the other OPTOMA11 cruises in that atmospheric conditions were sampled by radiosondes, in addition to the sampling of oceanic conditions by XBTs and CTDs. In this report, the data from the twenty-six radiosondes which comprise the data set are presented. Supplementary meteorological information consisting of hourly dry and wet bulb temperatures, hourly wind velocity, and surface pressure analyses are also included.

DATA ACQUISITION

The radiosondes deployed in this study (AIR Inc., Model AS-1C-PTH) measured pressure, dry-bulb and wet-bulb temperatures. The telemetered data were received and processed using an AIR, Inc. Model AIR-3 ground station. The processed data were then transferred to an OTRONA microprocessor via an IEEE-488 interface bus, and were stored on diskettes. The specifications and accuracies of the radiosonde sensors are shown in Table I.

Relative wind speed and direction readings from the ship's anemometer were logged hourly, after conversion to true wind speed and direction by adjustment for the ship's speed and heading. Dry-bulb and wet-bulb temperatures obtained from a sling psychrometer were also logged hourly.

The XBT profiles shown in Figures 8 (a)-(l) were obtained from Sippican T-4 (450m) and T-7 (750m) XBTs and were digitized using a Sippican MK9 unit. The temperature accuracy of these XBTs is 0.2C and the depth accuracy is 4.6 m or 2% of the depth, whichever is greater.

DATA PROCESSING

The initial editing of the radiosonde data (such as removal of obvious temperature spikes) was performed by Mr. Robert Sylvia at the Coastal Studies Institute, Louisiana State University. The data were then copied to diskettes and sent to NPS, where they were transferred to the IBM3033 for further processing (e.g., deletion of erroneous points, and truncation of some profiles). Of the 28 radiosondes launched, there were two failures which were removed from the data set, resulting in a retention percentage of approximately 93%.

The data have been transferred on digital tape to the National Oceanographic Data Center in Washington, DC.

DATA PRESENTATION

The OPTOMA11, Leg DII cruise track, radiosonde station positions and station numbers are shown in Figures 2, 3, and 4, respectively. These figures are followed by Table II containing a listing of the radiosonde stations, with their coordinates, the date and time at which each station was occupied, and the surface information obtained at the station. To relate the radiosonde stations to the hydrographic stations, the XBT/CTD positions are shown in Figure 5, and the XBT/CTD station information is listed in Table III.

Vertical profiles of potential temperature and specific humidity to 3000m from

the radiosondes are shown in Figures 6 (a)-(m). The positions of these profiles may be found by reference to the station number plot, Figure 4. The mean potential temperature profile from the radiosondes is shown in Figure 7.

To compare the atmospheric profiles to the oceanic profiles, the radiosondes to 700m or 800m and the XBT profiles to 500m or 750m, depending on the depth rating of the XBT, are plotted together in Figures 8 (a)-(l). The potential temperature is shown in degrees Celsius to allow the two temperature and humidity profiles to be plotted on the same abscissa. The specific humidity is in cgs units.

The hourly dry-bulb and wet-bulb temperatures plotted for the period 1 to 10 July are shown in Figure 9. A time series of the hourly true wind speed is shown in Figure 10, with true wind velocity below the curve to indicate direction. The directed segments all originate on the abscissa and they all point in the direction to which the wind is blowing.

The data presentation section concludes with a reproduction of a NOAA-7 AVHRR infrared image obtained on 7 July 84 (Figure 11), and a tracing which shows the superposition of the NOCAL domain on the salient features of the infrared image (Figure 12). The image shows the cool, offshore jet which was present in the NOCAL domain for the duration of OPTOMA11, Leg DII.

National Weather Service surface pressure analyses at synoptic times 0000Z and 1200Z for the period 1 to 10 July 84 are provided in Appendix A.

Figure 2 : The cruise track for OPTOMAl1, Leg DII. The second traversal of the interior semi-diagonals is shown as a broken line.

Figure 3 : Radiosonde positions for OPTOMAll, Leg DII.

Figure 4: Radiosonde station numbers for OPTOMAll, Leg DII.

Table II : Radiosonde Station Listing

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE PRESS (MB)	SURFACE TDRY (DEG C)	SURFACE TWET (DEG C)	MIXING RATIO (G/KG)
1	SONDE	84183	1437	36.45	122.00	1008.30	13.10	12.10	8.50
2	SONDE	84183	1746	38.11	124.26	1010.20	13.30	12.90	9.00
3	SONDE	84183	2349	38.42	124.54	1010.00	14.50	13.70	9.50
4	SONDE	84184	1321	39.13	125.14	1008.40	14.00	12.30	8.20
5	SONDE	84184	1754	38.53	125.21	1010.50	14.00	12.90	8.90
6	SONDE	84185	4	37.56	125.39	1010.70	14.60	15.40	11.30
7	SONDE	84185	605	37.24	125.32	1010.20	14.50	13.30	9.00
8	SONDE	84185	1806	38.09	125.14	1011.50	14.50	13.60	9.30
9	SONDE	84185	2348	38.23	126.15	1012.00	15.10	14.30	9.80
10	SONDE	84186	605	38.47	125.56	1011.00	14.80	13.70	9.30
11	SONDE	84186	1159	39.05	125.09	1010.20	13.20	13.10	9.30
12	SONDE	84186	1848	38.13	125.42	1011.90	14.20	14.30	10.10
13	SONDE	84187	33	38.25	126.47	1013.00	15.20	14.30	9.90
14	SONDE	84187	605	38.06	126.28	1011.40	17.00	15.00	9.80
15	SONDE	84187	1155	37.52	126.20	1009.40	14.80	13.20	8.70
16	SONDE	84187	1817	37.37	126.12	1009.20	14.00	12.00	7.90
17	SONDE	84188	35	37.19	125.57	1010.40	15.40	14.50	9.90
18	SONDE	84189	1	36.34	125.35	1009.00	14.70	13.70	9.40
19	SONDE	84189	603	36.59	125.21	1008.40	14.10	13.40	9.20
20	SONDE	84189	1922	36.40	124.19	1010.00	13.90	14.70	10.40
21	SONDE	84189	2357	36.57	124.05	1008.70	14.30	13.50	9.30
22	SONDE	84190	559	36.55	123.47	1004.30	13.60	13.30	9.30
23	SONDE	84190	1806	36.52	122.37	1006.70	11.40	11.20	8.30
24	SONDE	84191	118	36.56	122.15	1007.70	12.20	13.30	9.40
25	SONDE	84191	612	37.05	122.58	1011.30	13.60	12.30	8.30
26	SONDE	84192	606	37.53	123.04	1009.90	12.70	12.00	8.40

All values are at 2.0 meters

Figure 5 : XBT/CTD station numbers for OPTOMall, Leg DII.

Table III: Leg DII Station Listing

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
1	XBT	84183	113	36.47	122.10	11.2			
2	XBT	84183	200	36.53	122.21	11.6			
3	XBT	84183	300	36.59	122.31	11.6			
4	XBT	84183	407	37.04	122.41	11.9			
5	XBT	84183	503	37.09	122.50	11.8			
6	XBT	84183	603	37.15	122.58	12.0			
7	XBT	84183	700	37.21	123.06	12.3			
8	XBT	84183	815	37.28	123.17	12.2			
9	XBT	84183	906	37.33	123.25	12.9			
10	XBT	84183	1014	37.37	123.37	13.0			
11	XBT	84183	1105	37.42	123.45	12.6			
12	XBT	84183	1243	37.51	123.59	12.4			
13	XBT	84183	1350	37.57	124.10	12.7			
14	CTD	84183	1514	38.01	124.17	13.0	33.49	13.5	33.50
15	XBT	84183	1722	38.09	124.24	11.1			
16	XBT	84183	2036	38.28	124.38	12.0			
17	XBT	84183	2210	38.34	124.45	13.3			
18	XBT	84184	19	38.45	124.55	14.1			
19	XBT	84184	430	38.54	125.01	13.8			
20	XBT	84184	806	39.02	125.04	13.9			
21	XBT	84184	1106	39.09	125.11	14.0			
22	XBT	84184	1705	39.02	125.19	13.9			
23	XBT	84184	1800	38.52	125.21	14.0			
24	XBT	84184	1850	38.43	125.23	14.2			
25	XBT	84184	1957	38.32	125.27	13.8			
26	XBT	84184	2022	38.28	125.28	14.0			
27	XBT	84184	2102	38.20	125.28	14.0			
28	XBT	84184	2139	38.15	125.28	14.2			
29	CTD	84184	2224	38.10	125.31	13.8	32.62	14.4	*
30	XBT	84184	2344	38.00	125.36	13.8			
31	XBT	84185	228	37.30	125.43	13.6			
32	CTD	84185	335	37.20	125.43	13.2	33.44	13.5	33.04
33	XBT	84185	700	37.30	125.21	13.6			
34	XBT	84185	800	37.35	125.13	13.7			
35	XBT	84185	900	37.40	125.04	13.6			
36	XBT	84185	1000	37.46	124.52	13.7			
37	XBT	84185	1122	37.51	124.40	13.5			
38	XBT	84185	1206	37.57	124.28	13.8			
39	CTD	84185	1313	38.01	124.16	13.8	33.45	14.0	32.68
40	XBT	84185	1444	38.03	124.30	13.6			
41	XBT	84185	1544	38.03	124.44	11.8			
42	XBT	84185	1636	38.05	124.59	12.2			
43	XBT	84185	1722	38.05	125.08	13.9			
44	XBT	84185	1810	38.07	125.21	14.1			
45	CTD	84185	1938	38.10	125.31	14.1	32.65	14.4	32.69

* Data not available

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
46	XBT	84185	2158	38.14	125.54	14.2			
47	XBT	84185	2302	38.18	126.06	14.7			
48	XBT	84186	6	38.22	126.23	14.6			
49	XBT	84186	102	38.25	126.28	14.6			
50	CTD	84186	134	38.28	126.37	14.4	32.66	14.8	32.69
51	XBT	84186	248	38.31	126.32	14.5			
52	XBT	84186	426	38.38	126.15	14.9			
53	XBT	84186	514	38.43	126.05	14.7			
54	XBT	84186	619	38.49	125.54	15.1			
55	XBT	84186	739	38.55	125.42	15.1			
56	XBT	84186	850	39.00	125.31	14.7			
57	XBT	84186	930	39.03	125.20	14.5			
58	CTD	84186	1122	39.09	125.11	14.5	32.56	14.6	32.59
59	XBT	84186	1226	39.02	125.10	14.3			
60	XBT	84186	1336	38.48	125.17	14.2			
61	XBT	84186	1434	38.38	125.20	14.4			
62	XBT	84186	1534	38.28	125.24	14.2			
63	XBT	84186	1627	38.19	125.24	14.5			
64	CTD	84186	1716	38.09	125.32	14.3	32.64	14.9	*
65	XBT	84186	1910	38.13	125.46	14.1			
66	XBT	84186	2000	38.15	125.56	14.8			
67	XBT	84186	2055	38.19	126.12	14.8			
68	XBT	84186	2135	38.21	126.17	14.7			
69	XBT	84186	2230	38.25	126.28	14.9			
70	CTD	84186	2311	38.28	126.37	14.8	32.67	15.2	32.70
71	XBT	84187	44	38.25	126.49	14.9			
72	XBT	84187	138	38.18	126.58	14.6			
73	XBT	84187	221	38.14	127.02	14.7			
74	XBT	84187	319	38.13	126.50	14.5			
75	XBT	84187	430	38.10	126.35	14.4			
76	XBT	84187	517	38.08	126.23	14.4			
77	XBT	84187	621	38.05	126.30	14.1			
78	XBT	84187	722	38.01	126.43	13.9			
79	CTD	84187	800	38.00	126.50	14.1	32.63	14.4	32.64
80	XBT	84187	1021	37.55	126.38	13.4			
81	XBT	84187	1134	37.53	126.24	13.0			
82	XBT	84187	1300	37.52	126.12	14.0			
83	XBT	84187	1346	37.48	126.20	13.4			
84	XBT	84187	1427	37.44	126.29	11.9			
85	CTD	84187	1526	37.40	126.37	12.1	32.73	13.3	32.67
86	XBT	84187	1733	37.38	126.21	12.1			
87	XBT	84187	1816	37.38	126.11	11.9			
88	XBT	84187	1933	37.35	126.00	12.5			
89	XBT	84187	2013	37.32	126.08	12.3			
90	XBT	84187	2058	37.28	126.15	13.8			

* Data not available

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
91	CTD	84187	2139	37.24	126.24	13.9	33.37	14.0	*
92	XBT	84187	2344	37.21	126.10	14.2			
93	XBT	84188	36	37.20	126.00	14.0			
94	CTD	84188	144	37.19	125.46	14.0	33.39	*	*
95	XBT	84188	402	37.12	126.00	14.1			
96	XBT	84188	502	37.07	126.09	14.5			
97	XBT	84188	556	37.03	126.19	15.0			
98	CTD	84188	721	36.59	126.33	15.4	32.91	15.3	32.94
99	XBT	84188	944	36.42	126.21	15.7			
100	XBT	84188	1044	36.32	126.15	15.5			
101	CTD	84188	1134	36.24	126.13	15.5	32.88	15.4	33.33
102	XBT	84188	1328	36.17	126.06	15.5			
103	XBT	84188	1410	36.10	126.01	15.4			
104	CTD	84188	1510	36.00	125.55	15.6	32.90	15.9	32.76
105	XBT	84188	1744	36.08	125.50	15.4			
106	XBT	84188	2025	36.17	125.44	15.6			
107	XBT	84188	2308	36.29	125.39	15.5			
108	CTD	84189	100	36.39	125.34	15.5	32.88	15.8	32.91
109	XBT	84189	346	36.49	125.27	14.5			
110	XBT	84189	531	36.57	125.22	14.3			
111	CTD	84189	752	37.05	125.17	12.8	32.91	12.7	32.91
112	XBT	84189	1056	37.13	125.13	13.4			
113	CTD	84189	1300	37.20	125.11	12.8	33.25	13.0	33.28
114	XBT	84189	1436	37.12	124.59	13.1			
115	XBT	84189	1543	37.04	124.48	13.9			
116	XBT	84189	1649	36.56	124.39	14.2			
117	XBT	84189	1755	36.50	124.31	13.1			
118	CTD	84189	1919	36.39	124.16	13.4	32.97	13.7	32.98
119	XBT	84189	2136	36.51	124.12	14.1			
120	XBT	84189	2342	37.00	124.05	14.0			
121	XBT	84190	110	37.09	124.01	13.9			
122	CTD	84190	300	37.20	123.58	13.3	33.43	13.0	33.28
123	XBT	84190	440	37.10	123.53	14.4			
124	XBT	84190	534	37.01	123.49	13.9			
125	XBT	84190	634	36.49	123.45	14.7			
126	XBT	84190	731	36.41	123.40	14.6			
127	XBT	84190	923	36.50	123.34	14.7			
128	XBT	84190	1057	37.00	123.30	14.7			
129	XBT	84190	555	37.09	123.24	14.2			
130	XBT	84190	1400	37.05	123.13	14.0			
131	CTD	84190	1510	37.00	123.01	14.4	33.21	14.3	33.23
132	XBT	84190	1719	36.56	122.48	14.0			
133	XBT	84190	1814	36.52	122.37	13.3			
134	XBT	84190	1932	36.47	122.21	13.9			
135	XBT	84190	2014	36.45	122.12	14.1			

* Data not available

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)	SURFACE SALINITY (PPT)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
136	XBT	84191	55	36.52	122.09	14.2			
137	XBT	84191	202	37.00	122.19	13.4			
138	CTD	84190	247	37.02	122.23	12.5	33.70	12.8	33.47
139	XBT	84191	440	37.04	122.41	12.8			
140	XBT	84191	607	37.05	122.57	14.0			
141	CTD	84191	814	37.09	123.15	14.2	33.25	14.3	33.26
142	CTD	84191	1314	37.21	123.16	12.5	33.52	*	*
143	XBT	84191	1921	37.33	123.18	12.8			
144	XBT	84191	2239	37.47	123.23	12.4			
145	XBT	84192	122	37.59	123.21	11.7			
146	CTD	84192	318	38.08	123.21	10.6	33.73	10.2	33.75
147	CTD	84192	411	38.03	123.15	12.7	33.60	10.8	33.38
148	XBT	84192	538	37.56	123.08	11.9			
149	CTD	84192	710	37.48	123.00	11.8	33.70	12.0	*

* Data not available

Figure 6(a): Potential temperature (—) and specific humidity (---) profiles to 3000m from the radiosondes. The potential temperature is shown in degrees Celsius (OPTOMALL, Leg DII).

Figure 6(b).

Figure 6(c).

Figure 6(d).

Figure 6(e).

Figure 6(f).

Figure 6(g).

Figure 6(h).

Figure 6(i).

Figure 6(j).

Figure 6(k).

Figure 6(1).

Figure 6(m).

Figure 7 : Profile of mean potential temperature with + and - the standard deviation (OPTOMAll, DII).

Figure 8(a): Radiosonde potential temperature (—) and specific humidity (---) profiles to 750m (800m) and nearly coincident XBT temperature profiles to 500m (750m) to show the air/sea interface and boundary layers. The date, time (GMT), latitude (North) and longitude (West) of each profile is shown.

Figure 8(b).

Figure 8(c).

Figure 8(d).

Figure 8(e).

Figure 8(f).

Figure 8(g).

Figure 8(h).

Figure 8(i).

Figure 8(j).

Figure 8(k): Notice that the vertical scale has now been changed to accommodate the T-7 (750m) XBT's.

Figure 8(1).

Figure 9 : Time-series of hourly dry-bulb and wet-bulb temperatures (OPTOMall, Leg DII).

Figure 10 : Time-series of hourly true wind speed with true wind velocity sticks below the curve to indicate direction (North is given by the arrow). The time axis is annotated with the radiosonde station numbers at their approximate launch times (OPTOMALL, Leg DII).

Figure 11 : NOAA-7 AVHRR infrared
image from 2336Z, 7 July 85
(Channel 4).

Figure 12 : NOCAL domain superposed on the salient features of the infrared image (approximate positions of selected radiosondes are given for reference).

ACKNOWLEDGEMENTS

This research was sponsored by the ONR Physical Oceanography Program. The success of the fieldwork was strongly dependent on the competent, willing support of the crew of the USNS DE STEIGUER and Mr. Robert Sylvia, LSU, who independently maintained the radiosonde launch operations.

Members of the scientific cruise party were:

Prof. C.N.K. Mooers, Chief Scientist, NPS
Ms. Marie C. Colton, Party Chief, NPS
Mr. Luke Chung, Harvard
AG3 Mary Robinette, FNOC
AG3 Lisa Campbell, FNOC
DP2 Marianne Drewett, FNOC
Mr. Robert Sylvia, LSU

REFERENCES

Wittmann, P.A.; Rienecker, M.M.; Kelley, Jr., E.A.; Mooers, C.N.K,
Hydrographic Data from the OPTOMA Program, OPTOMA11, 5 June to 5 August, 1984, NPS Technical Report No. NPS-68-85-011, March, 1985.

APPENDIX A

The following charts are from the National Weather Service northern hemisphere surface pressure analyses at synoptic times 0000Z and 1200Z for the period 1 to 10 July, 1984 (synoptic times 0600Z and 1200Z for 6 July 84), as noted in the bottom left-hand corner of each map.

REPRODUCED AT GOVERNMENT EXPENSE

12Z SUN 1 JUL 1984 1618Z RW3

120 HAIN "E" L 120 15
157N/112.0W
122 58 25N

140
H2T N Douglas
14.7N/130.9W
140 25N

00Z MON 2 JUL 1984 422Z RW3

ELIDA

160N 113.7W

105 181005

105 181005

105 181005

105 181005

105 181005

105 181005

105 181005

105 181005

105 181005

105 181005

105 181005

105 181005

105 181005

105 181005

REPRODUCED AT GOVERNMENT EXPENSE

TUE 3 JUL 1984 422Z RW3

REPRODUCED AT GOVERNMENT EXPENSE

REPRODUCED AT GOVERNMENT EXPENSE

HURCN "EKIDA"

SFO
ASW. 17.1N
18.8W

RW3

1615Z

JUL 1984

12Z TUE 13

T.D. DOUGLAS
18.0N 138.8W
SFO PSN

Q503

PRODUCED AT GOVERNMENT EXPENSE

PRODUCED AT GOVERNMENT EXPENSE

REPRODUCED AT GOVERNMENT EXPENSE

12Z THU 5 JUL 1984 1E29Z RW3

REPRODUCED AT GOVERNMENT EXPENSE

REPRODUCED AT GOVERNMENT EXPENSE

06Z FRI 16 JUL 1984 1028Z RW3

12th FRI 6 JUL 1984 16⁰⁰ Z. RW3

PRODUCED AT GOVERNMENT EXPENSE

REPRODUCED AT GOVERNMENT EXPENSE

12Z SAT 7 JUL 1984 1620Z #03

T.D. FLIDA

00Z SUN 8 JUL 1984 428Z RW3

PRODUCED AT GOVERNMENT EXPENSE

122 SUN 8 JUL 1984 1619Z RW3

00Z MON 9 JUL 1984 419Z RW3

12Z MON 9 JUL 1984 1616Z RW3

12Z TUE 10 JUL 1984 1552Z RW3

INITIAL DISTRIBUTION LIST

1. Naval Postgraduate School
Department of Oceanography
Monterey, CA 93943

Prof. Christopher N.K. Mooers	30
Dr. Michele M. Rienecker	1
Dr. Edward A. Kelley	1
Ms. Marie C. Colton	1
Mr. Paul A. Wittmann	1
Dr. Mary L. Batteen	1
Dr. Laurence C. Breaker	1
LCDR J. Edward Johnson, USN	1
Prof. James L. Mueller	1
Prof. Kenneth L. Davidson	1
Dr. Gary Geernaert	1
Prof. Roland W. Garwood	1
Prof. Robert L. Haney	1
Prof. Dale F. Leipper	1
Prof. Robert D. Renard	1
Prof. Glenn H. Jung	1

2. Harvard University
Division of Applied Sciences
Pierce Hall, Room 100D
Cambridge, MA 02138

Prof. Allan R. Robinson	1
Dr. James A. Carton	1
Dr. Everett F. Carter	1
Mr. Leonard J. Walstad	1
Mr. Wayne G. Leslie	1
Ms. Nadia Pinardi	1
Prof. Myron B. Fiering	1

3. Office of Naval Research (ONR)
800 N. Quincy St.
Arlington, VA 22217

Dr. Thomas W. Spence	1
Dr. Thomas B. Curtin	1
Dr. Robert Abbey	1
Dr. Kenneth H. Brink	1

4. College of Oceanography
Oregon State University
Corvallis, OR 97331

Prof. Robert L. Smith	1
Dr. Adrian Huyer	1

5. Jet Propulsion Laboratory (JPL)
California Institute of Tech.
4800 Oak Grove Road
Pasadena, CA 91109

Dr. Denise E. Hagan (Code 183-501) 1
Dr. Mark Abbott (also at Scripps) 1
6. Commanding Officer
Fleet Numerical Oceanography Center (FNOG)
Monterey, CA 93943

CDR John F. Pfeiffer, USN 1
Mr. R. Michael Clancy 1
Mr. Ken Pollak 1
Ms. Evelyn Hesse 1
LCDR Michael R. Frost, RN 1
7. Sandia National Laboratories
Div. 6334
Albuquerque, NM 97185

Dr. Mel Marietta 1
Dr. Eugene S. Hertel 1
Dr. Stuart L. Kupferman 1
8. Marine Products Branch, W/NMC21
National Meteorological Center
National Weather Service, NOAA
Washington, D.C. 20233

LCDR Craig S. Nelson, NOAA Corps 1
9. National Center for Atmospheric Research (NCAR)
P.O. Box 3000
Boulder, CO 80307

Dr. Dale B. Haidvogel 1
10. Scripps Institution of Oceanography
University of California, San Diego
La Jolla, CA 92093

Prof. Russ E. Davis 1
Dr. Jerome A. Smith 1
Mr. Phillip Bogden 1
11. Princeton University
Geophysical Fluid Dynamics Program
P.O. Box 308
Princeton, NJ 08540

Prof. George L. Mellor 1

12. Tulane University
 Department of Mathematics
 6823 St. Charles
 New Orleans, LA 70118

 Dr. Robert N. Miller 1

13. Woods Hole Oceanographic Institution
 Department of Physical Oceanography
 Woods Hole, MA 02543

 Dr. Kenneth H. Brink 1
 Dr. Robert C. Beardsley 1

14. Naval Ocean Research and
 Development Activity (NORDA)
 NSTL Station
 Bay St. Louis, MS 39525

 Dr. Steve A. Piacsek 1
 Dr. Dana A. Thompson 1
 Dr. Harley C. Hurlburt 1
 Dr. Alexander Warn-Varnas 1

15. Mathematics Department
 121-1984 Mathematics Road
 University of British Columbia
 Vancouver, British Columbia
 CANADA V6T 1Y4

 Prof. Lawrence A. Mysak 1

16. Department of Oceanography
 University of Hawaii
 2525 Correa Road
 Honolulu, HI 96822

 Prof. Lorenz Magaard 1

17. NAVOCEANCOMFAC Keflavik Iceland
 FPO NY 09571

 LTJG Diane C. Durban, USN 1

18. Ocean Circulation Division
 Atlantic Oceanography Laboratory
 Bedford Institute of Oceanography
 Dartmouth, N.S. Box 1006
 CANADA B2Y 4A2

 Dr. Motoyoshi Ikeda 1

19. Precision Marine
Meteorologic Nationale
2 Ave. RAPP
75340 Paris CEDEX 07
France

Dr. Jacques Saurel 1
20. Div. of Oceanography
RSMAS
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149

Dr. Otis Brown 1
21. Applied Physics Laboratory
University of Washington
1013 NE 40th Str.
Seattle, WA 98105

Dr. Thomas B. Sanford 1
22. School of Oceanography
University of Washington
Seattle, WA 98195

Dr. Steven C. Riser 1
23. California Space Institute
MS-A021
Scripps Institution of Oceanography
La Jolla, CA 92093

Dr. Robert L. Bernstein 1
24. Marine Sciences Research Center
State University of New York
Stony Brook, NY 11794

Dr. Dong-Ping Wang 1
25. Applied Physics Laboratory
Johns Hopkins University
Laurel, MD 20707

Dr. Jack Calman 1

26. Pacific Marine Environmental Lab
 NOAA
 Bldg. 3
 7600 Sand Point Way, NE
 Seattle, WA 98115

 Mr. James R. Holbrook 1
27. Defense Technical Information Center 2
 Cameron Station
 Alexandria, VA 22314
28. Dudley Knox Library 2
 Code 0142
 Naval Postgraduate School
 Monterey, CA 93943
29. Coastal Studies Institute
 Louisiana State University
 Baton Rouge, LA
 70803-7527

 Prof. S. A. Hsu 1
 Mr. Robert Sylvia 1
30. Naval Environmental Prediction
 Research Facility (NEPRF)

 Mr. Robert Fett 1

DUDLEY KNOX LIBRARY

3 2768 00396470 1