

NATIONAL BUREAU OF STANDARDS  
MICROCOPY RESOLUTION TEST CHART

2

NPS 68-3C-001

# NAVAL POSTGRADUATE SCHOOL

## Monterey, California



DTIC  
ELECTE  
JAN 28 1986  
S D

AD-A163 429

DTIC FILE COPY

HYDROGRAPHIC DATA FROM THE OPTOMA PROGRAM  
OPTOMA18  
31 October and 2 November 1985  
  
by  
  
Paul A. Wittmann  
Marie C. Colton  
John J. Rendine  
Christopher N.K. Mooers  
  
December 1985

Approved for public release; distribution unlimited.

Prepared for:  
Office of Naval Research  
Environmental Sciences Directorate (Code 1122)  
Arlington, VA 22217

86 1 27 149

NAVAL POSTGRADUATE SCHOOL

Monterey, California 93943

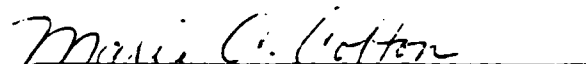
RADM R.H. Shumaker  
Superintendent

David A. Schrady  
Provost

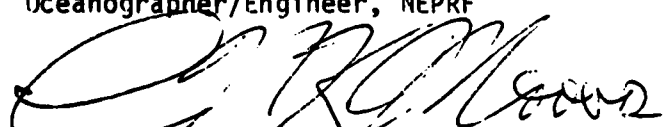
This report is for the research project "Ocean Prediction Through Observation, Modeling and Analysis" sponsored by the Physical Oceanography Program of the Office of Naval Research under Program Element 61153N. Reproduction of all or part of this report is authorized.

This report was prepared by:

  
PAUL A. WITTMANN  
Oceanographer


  
MARIE C. COLTON  
Oceanographer/Engineer, NEPRF


  
LT JOHN J. RENDINE, USN

  
CHRISTOPHER N.K. MOERS  
Professor and Chairman,  
Department of Oceanography

Reviewed by:

Released by:

  
CHRISTOPHER N.K. MOERS Chairman  
Department of Oceanography

  
JOHN N. DYER  
Dean of Science and Engineering

NPS 68-86-001

6a. NAME OF PERFORMING ORGANIZATION NAVPGSCOL Dept. of Oceanography		6b. OFFICE SYMBOL (if applicable) 68	7a. NAME OF MONITORING ORGANIZATION		
6c. ADDRESS (City, State, and ZIP Code) Monterey, California 93943-5008		7b. ADDRESS (City, State, and ZIP Code)			
8a. NAME OF FUNDING / SPONSORING ORGANIZATION Office of Naval Research	8b. OFFICE SYMBOL (if applicable) (1120 PO)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER N000146WR24027			
8c. ADDRESS (City, State, and ZIP Code) Arlington, VA 22217		10. SOURCE OF FUNDING NUMBERS			
		PROGRAM ELEMENT NO. 61153N	PROJECT NO. RR0310306	TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) Hydrographic Data from the OPTOMA Program, OPTOMA18, 31 October and 2 November 1985; Approved for public release; distribution unlimited.					
12. PERSONAL AUTHOR(S) Paul A. Wittmann, Marie C. Colton, LT John J. Rendine, USN, Christopher N.K. Mooers					
13a. TYPE OF REPORT Progress	13b. TIME COVERED FROM Oct 85 to Jan 86	14. DATE OF REPORT (Year, Month, Day) 85 December 17	15. PAGE COUNT 48		
16. SUPPLEMENTARY NOTATION					
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP	California Current System Physical Oceanography Dynamic Oceanography		
19. ABSTRACT (Continue on reverse if necessary and identify by block number)  Two P3 flights comprising OPTOMA18 were undertaken on 31 October and 2 November 1985 to sample a subdomain of the California Current System. This report presents the hydrographic data, acquired by AXBT deployments, from the flights.					
20. DISTRIBUTION / AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED		
22a. NAME OF RESPONSIBLE INDIVIDUAL Paul A. Wittmann		22b. TELEPHONE (Include Area Code) (408) 646-3350	22c. OFFICE SYMBOL 68		

# Hydrographic Data from the OPTOMA Program:

## OPTOMA18

31 October and 2 November, 1985

by

Paul A. Wittmann  
Marie C. Colton  
John J. Rendine  
Christopher N. K. Mooers

Accession For	
NTIS CRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification .....	
By .....	
Distribution / .....	
Availability Codes	
Dist	Avail and/or Special
A-1	



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

	<u>PAGE</u>
LIST OF TABLES	3
LIST OF FIGURES	4
INTRODUCTION	6
DATA ACQUISITION	6
DATA PROCESSING	7
DATA PRESENTATION	7
SECTION 1: FLIGHT I	8
SECTION 2: FLIGHT II	26
ACKNOWLEDGEMENTS	43
REFERENCES	43
INITIAL DISTRIBUTION LIST	44

LIST OF TABLES

<u>Table No.</u>	<u>Caption</u>	<u>Page</u>
1.	Flight I Station Listing	12
2.	Flight II Station Listing	30

## LIST OF FIGURES

<u>Figure No.</u>	<u>Caption</u>	<u>Page</u>
1.	The NOCAL and CENCAL subdomains of the OPTOMA Program. Isobaths are shown in meters.	5
2.	The flight track for OPTOMA18 Flight I.	9
3.	AXBT station locations for OPTOMA18 Flight I.	10
4.	Station numbers for OPTOMA18 Flight I.	11
5. (a)-(e).	Temperature profiles staggered by multiples of 5C (OPTOMA18 Flight I).	14
6. (a)-(f).	Along-track isotherms. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. Dashed lines are used if the cast was too shallow. (OPTOMA18 Flight I).	19
7.	Mean temperature profiles, with + and - the standard deviations, from OPTOMA18 Flight I.	25
8.	The flight track for OPTOMA18 Flight II.	27
9.	AXBT station locations for OPTOMA18 Flight II.	28
10.	Station numbers for OPTOMA18 Flight II.	29
11. (a)-(d).	Temperature profiles staggered by multiples of 5C (OPTOMA18 Flight II).	32
12. (a)-(f).	Along-track isotherms. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. Dashed lines are used if the cast was too shallow. (OPTOMA18 Flight II).	36
13.	Mean temperature profiles, with + and - the standard deviations, from OPTOMA18 Flight II.	42

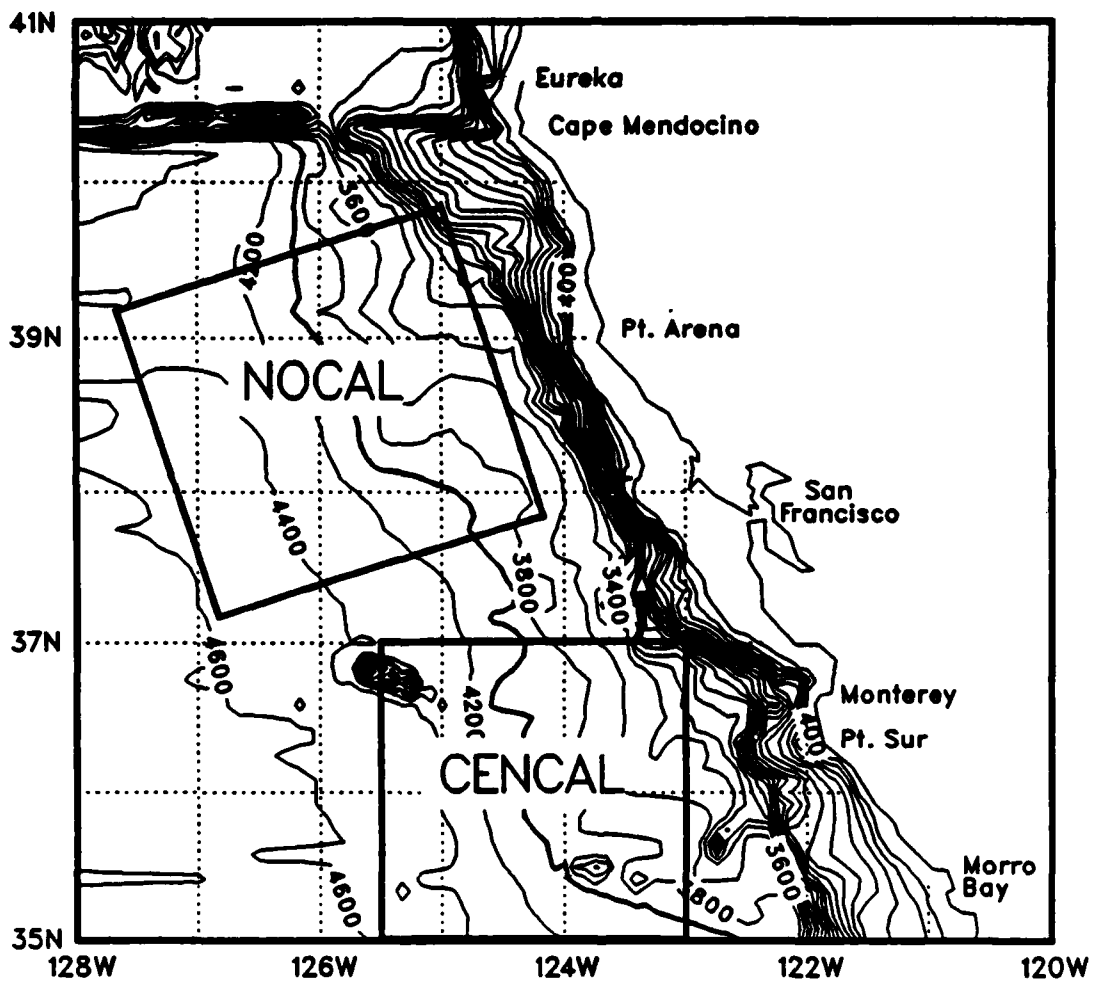


Figure 1: The NOCAL and CENCAL subdomains of the OPTOMA Program. Isobaths are shown in meters.

## INTRODUCTION

→ The OPTOMA (Ocean Prediction Through Observation, Modeling and Analysis) Program, a joint NPS/Harvard program sponsored by ONR, seeks to understand the mesoscale (fronts, 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 P3 flights has been planned in two subdomains, NOCAL and CENCAL, shown in Figure 1.

OPTOMA 18 Flight I was conducted by Patron Forty-six, COMPATWING TEN on 31 October 1985 in the CENCAL domain and Flight II was conducted by Patron Ninety-one, COMRESPATWINGSPAC on 2 November 1985 in the NOCAL domain.

Bathythermographic data were acquired along the tracks shown in figures 2 and 8. The total areal coverage was roughly 530 km alongshore by 260 km cross-shore. Nominal station spacing was about 30 km along-track.

## DATA ACQUISITION

Shallow (300m) and deep (700m) AXBT's were deployed from a Navy P3 aircraft during both flights. The aircraft maintained an altitude between 500 and 800 ft, depending on the low level visibility, and an airspeed of 200 knots. Close station spacing (30km) was achieved by alternately dropping Channel 14 and 16 AXBTs. The data were recorded onboard on audio tapes using a stereo tape recorder. Analog traces were also produced using two lofargram recorders which operated on UHF channels 14 and 16. The shallow AXBTs were digitized onboard the aircraft using a Sippican IK9 digitizer. The deep AXBTs were digitized after the flights, at NPS. A complete description of the data acquisition is given in Colton and Mooers (1985).

Station positions were obtained from the aircraft's Inertial Navigation System with hourly updates by TACAN (Tactical Air Navigation); accuracy of

position is within 2.0 km. The thermistor of the Sippican AXBT has an accuracy of  $\pm 0.18^{\circ}\text{C}$  in temperature and  $\pm 2\%$  or 5m (whichever is greater) in depth.

#### DATA PROCESSING

Temperatures were computed from the received frequencies according to Sippican (1983). Depths were computed empirically from the descent rate of the AXBT (Bane and Sessions, 1984). The temperature/depth profiles were then edited for erroneous data points, mainly due to RF noise. From the Flight I data set, approximately 86% of casts were retained; of these, 39 were from deep and 39 from shallow AXBT's. From the Flight II data set, approximately 87% of of casts were retained; of these, 40 were from deep and 39 from shallow AXBT's. The data have been transferred on digital tape to the National Oceanographic Data Center in Washington, D.C.

#### DATA PRESENTATION

The flight track, station locations and station numbers are shown in the first three figures of Sections I and II. These figures are followed by a listing of the stations, with their coordinates, and the date and time at which each station was occupied.

Vertical temperature profiles from the AXBT casts are shown in staggered fashion. The location of these profiles may be found by reference to the various maps of the flight track. Transect extremes are identified as nearly as possible. The first profile on each plot is shown with its temperature unchanged; an appropriate multiple of 5C has been added to each subsequent profile.

Isotherms along each transect are shown in the next pages. Transect extremes are identified. Based on instrument accuracy and the vertical temperature gradient, it is estimated that depths of isotherms in the main thermocline are uncertain to  $\pm 20\text{m}$ .

The data presentation concludes with plots of mean temperature profiles, with + and - the standard deviations.

SECTION I  
OPTOMA 18 FLIGHT I  
OCTOBER 31, 1985

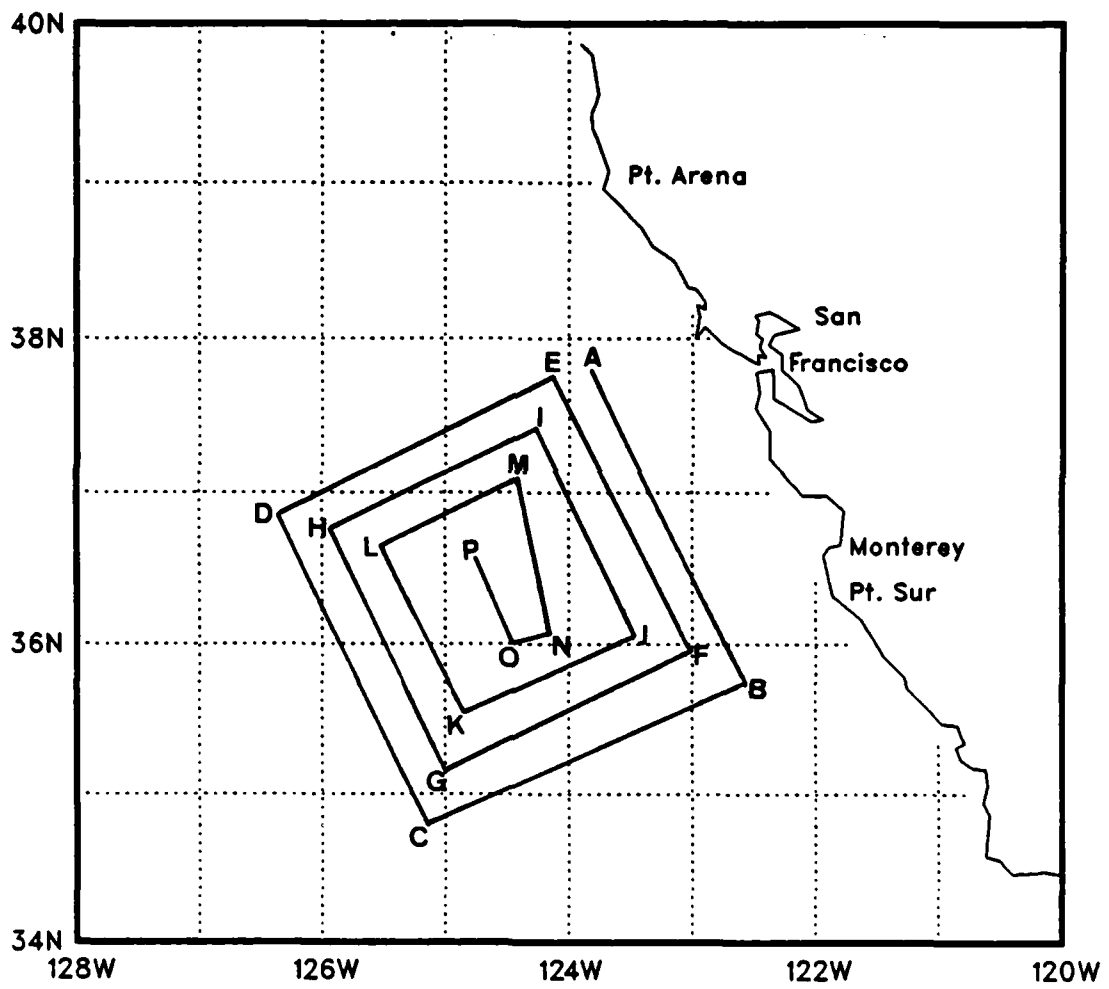


Figure 2. The flight track for OPTOMA18 Flight I.

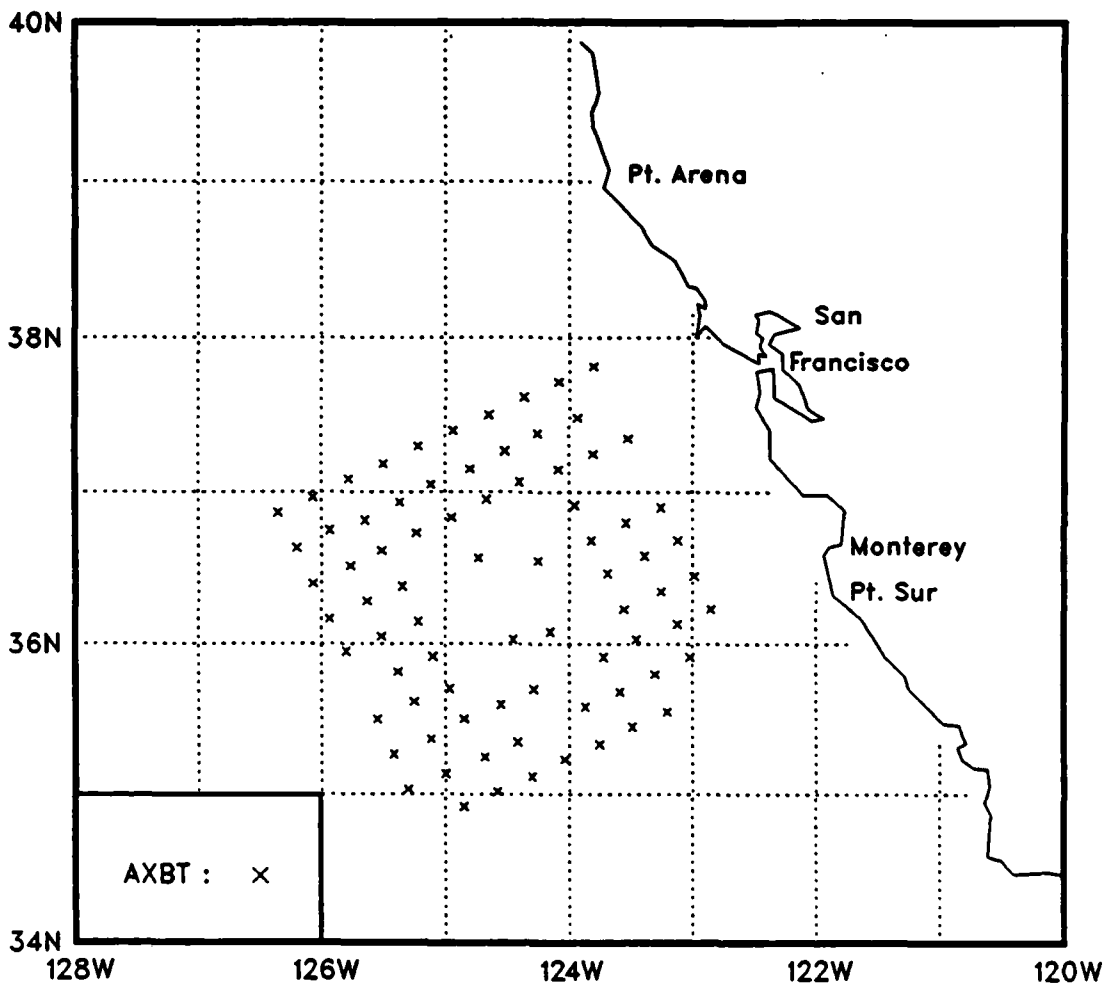


Figure 3. AXBT station locations for OPTOMA18 Flight I.

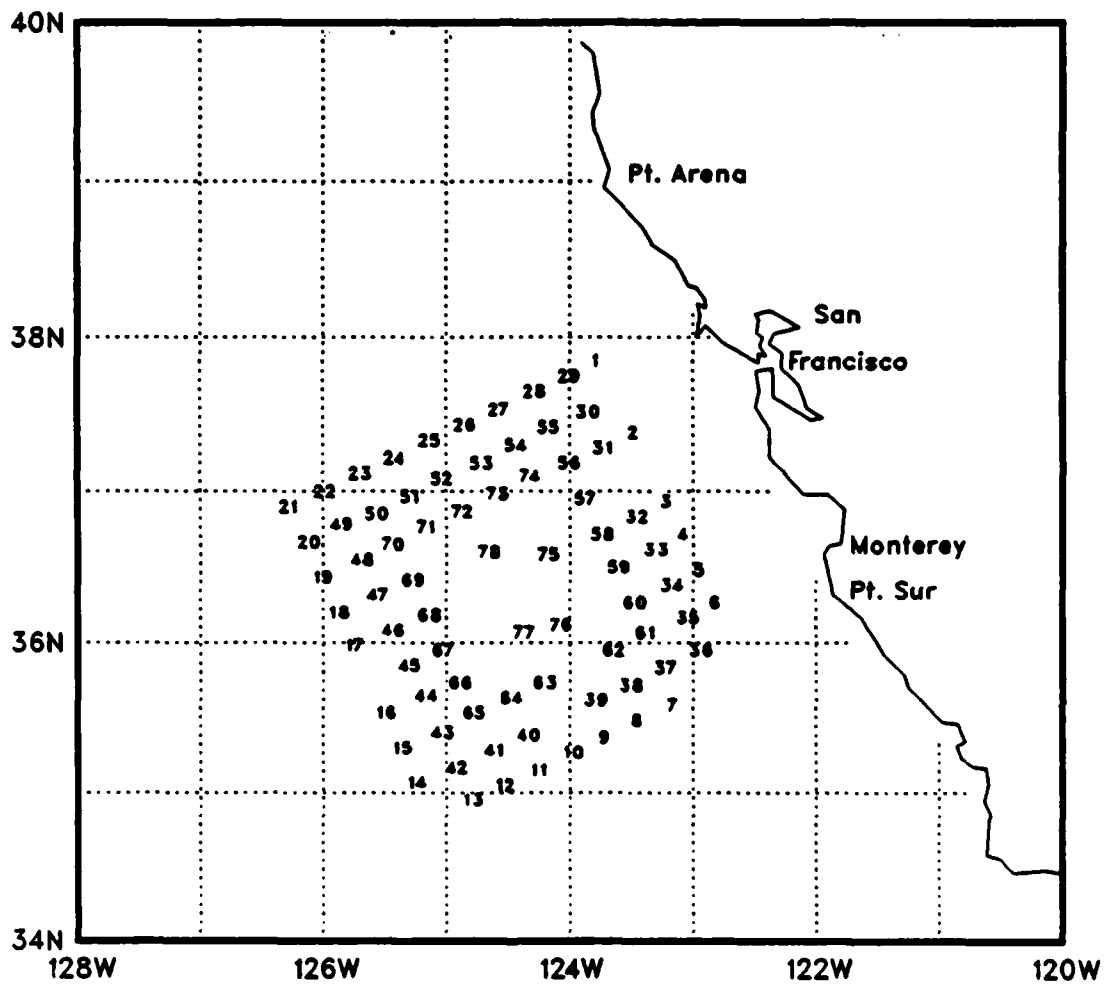


Figure 4. Station numbers for OPTOMA18 Flight I.

Table 1: Flight I Station Listing

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)
1	AXBT	85304	1622	37.49	123.48	12.3
2	AXBT	85304	1631	37.21	123.31	11.6
3	AXBT	85304	1638	36.54	123.15	12.9
4	AXBT	85304	1639	36.41	123.07	13.7
5	AXBT	85304	1620	36.27	122.59	13.7
6	AXBT	85304	1649	36.14	122.51	14.3
7	AXBT	85304	1704	35.33	123.12	14.8
8	AXBT	85304	1712	35.27	123.29	14.5
9	AXBT	85304	1717	35.20	123.45	14.6
10	AXBT	85304	1721	35.14	124.02	15.0
11	AXBT	85304	1725	35.07	124.18	15.8
12	AXBT	85304	1730	35.01	124.35	16.0
13	AXBT	85304	1734	34.55	124.51	16.0
14	AXBT	85304	1742	35.02	125.18	14.9
15	AXBT	85304	1743	35.16	125.25	15.4
16	AXBT	85304	1751	35.30	125.33	15.6
17	AXBT	85304	1800	35.57	125.48	16.2
18	AXBT	85304	1801	36.10	125.56	16.0
19	AXBT	85304	1809	36.24	126.04	16.5
20	AXBT	85304	1810	36.38	126.12	16.0
21	AXBT	85304	1818	36.52	126.21	15.4
22	AXBT	85304	1821	36.58	126.04	15.1
23	AXBT	85304	1827	37.05	125.47	14.8
24	AXBT	85304	1836	37.11	125.30	14.3
25	AXBT	85304	1843	37.18	125.13	13.9
26	AXBT	85304	1844	37.24	124.56	13.9
27	AXBT	85304	1852	37.30	124.39	13.6
28	AXBT	85304	1856	37.37	124.22	13.8
29	AXBT	85304	1900	37.43	124.05	11.6
30	AXBT	85304	1902	37.29	123.56	11.8
31	AXBT	85304	1909	37.15	123.48	12.5
32	AXBT	85304	1917	36.48	123.32	13.2
33	AXBT	85304	1918	36.35	123.23	14.7
34	AXBT	85304	1925	36.21	123.15	15.1
35	AXBT	85304	1928	36.08	123.07	14.9
36	AXBT	85304	1932	35.55	123.01	14.6
37	AXBT	85304	1934	35.48	123.18	15.5
38	AXBT	85304	1942	35.41	123.35	15.7
39	AXBT	85304	1943	35.35	123.52	15.2
40	AXBT	85304	1951	35.21	124.25	14.6
41	AXBT	85304	1953	35.15	124.41	15.3
42	AXBT	85304	2001	35.08	125.00	15.7
43	AXBT	85304	2010	35.22	125.07	15.3
44	AXBT	85304	2011	35.37	125.15	15.2
45	AXBT	85304	2019	35.49	125.23	15.5

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)
46	AXBT	85304	2023	36.03	125.31	16.1
47	AXBT	85304	2028	36.17	125.38	16.1
48	AXBT	85304	2029	36.31	125.46	16.3
49	AXBT	85304	2037	36.45	125.56	15.8
50	AXBT	85304	2038	36.49	125.39	15.8
51	AXBT	85304	2046	36.56	125.22	14.4
52	AXBT	85304	2047	37.03	125.07	13.5
53	AXBT	85304	2055	37.09	124.48	13.1
54	AXBT	85304	2057	37.16	124.31	12.8
55	AXBT	85304	2104	37.23	124.15	11.4
56	AXBT	85304	2105	37.09	124.05	13.7
57	AXBT	85304	2113	36.55	123.57	14.0
58	AXBT	85304	2117	36.41	123.49	14.9
59	AXBT	85304	2121	36.28	123.41	15.3
60	AXBT	85304	2125	36.14	123.33	15.7
61	AXBT	85304	2129	36.02	123.27	15.8
62	AXBT	85304	2130	35.55	123.43	16.0
63	AXBT	85304	2141	35.42	124.17	15.5
64	AXBT	85304	2147	35.36	124.33	15.3
65	AXBT	85304	2149	35.30	124.51	14.8
66	AXBT	85304	2156	35.42	124.58	15.7
67	AXBT	85304	2157	35.55	125.06	15.7
68	AXBT	85304	2205	36.09	125.13	16.4
69	AXBT	85304	2206	36.23	125.21	15.8
70	AXBT	85304	2215	36.37	125.31	16.7
71	AXBT	85304	2216	36.44	125.14	14.8
72	AXBT	85304	2225	36.50	124.57	13.3
73	AXBT	85304	2228	36.57	124.40	14.1
74	AXBT	85304	2233	37.04	124.24	14.9
75	AXBT	85304	2235	36.33	124.15	15.8
76	AXBT	85304	2250	36.05	124.09	15.4
77	AXBT	85304	2252	36.02	124.27	15.9
78	AXBT	85304	2310	36.34	124.44	15.8

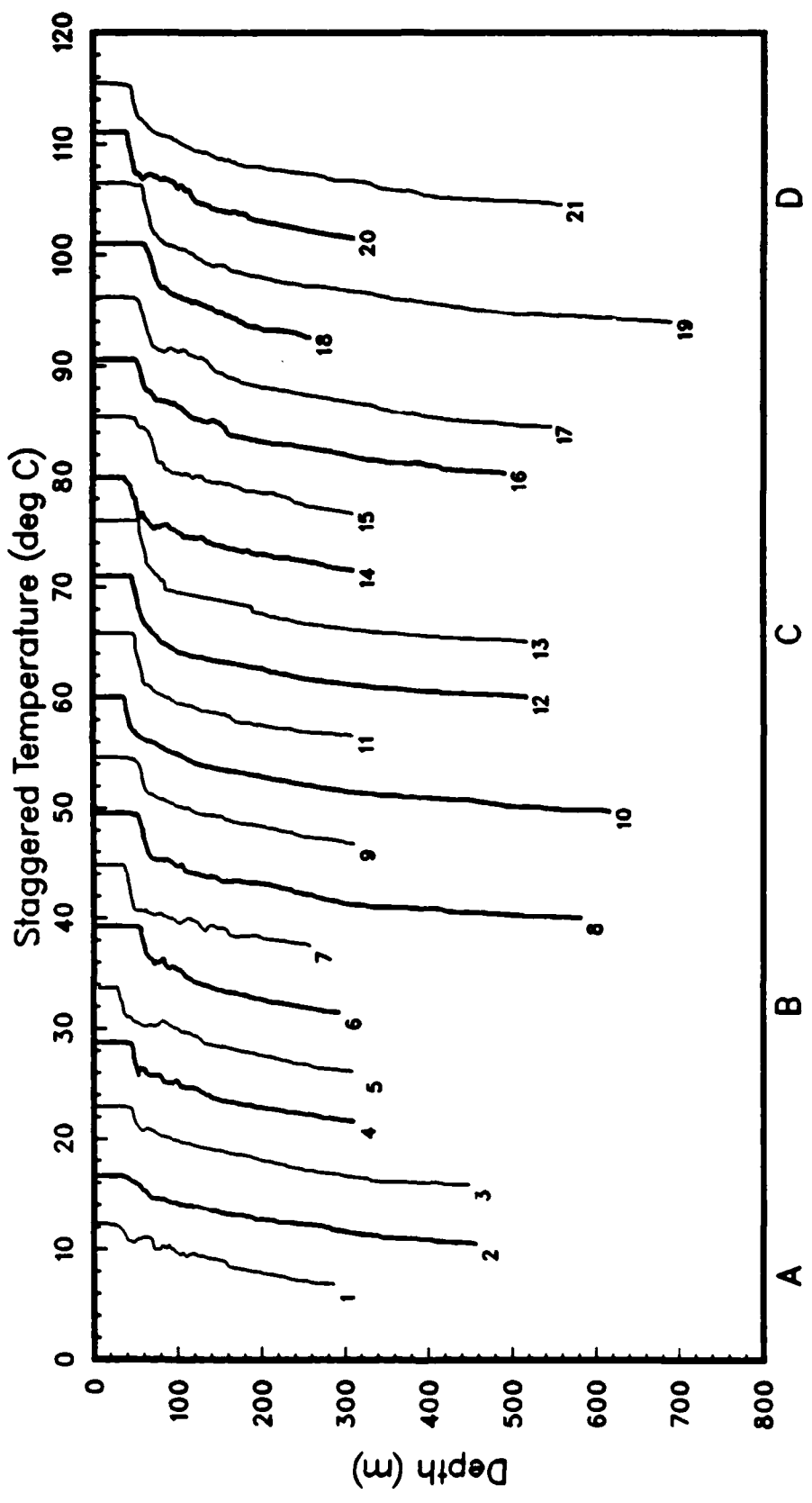


Figure 5 (a). Temperature profiles staggered by multiples of 5C (OPTOMA18 Flight 1).

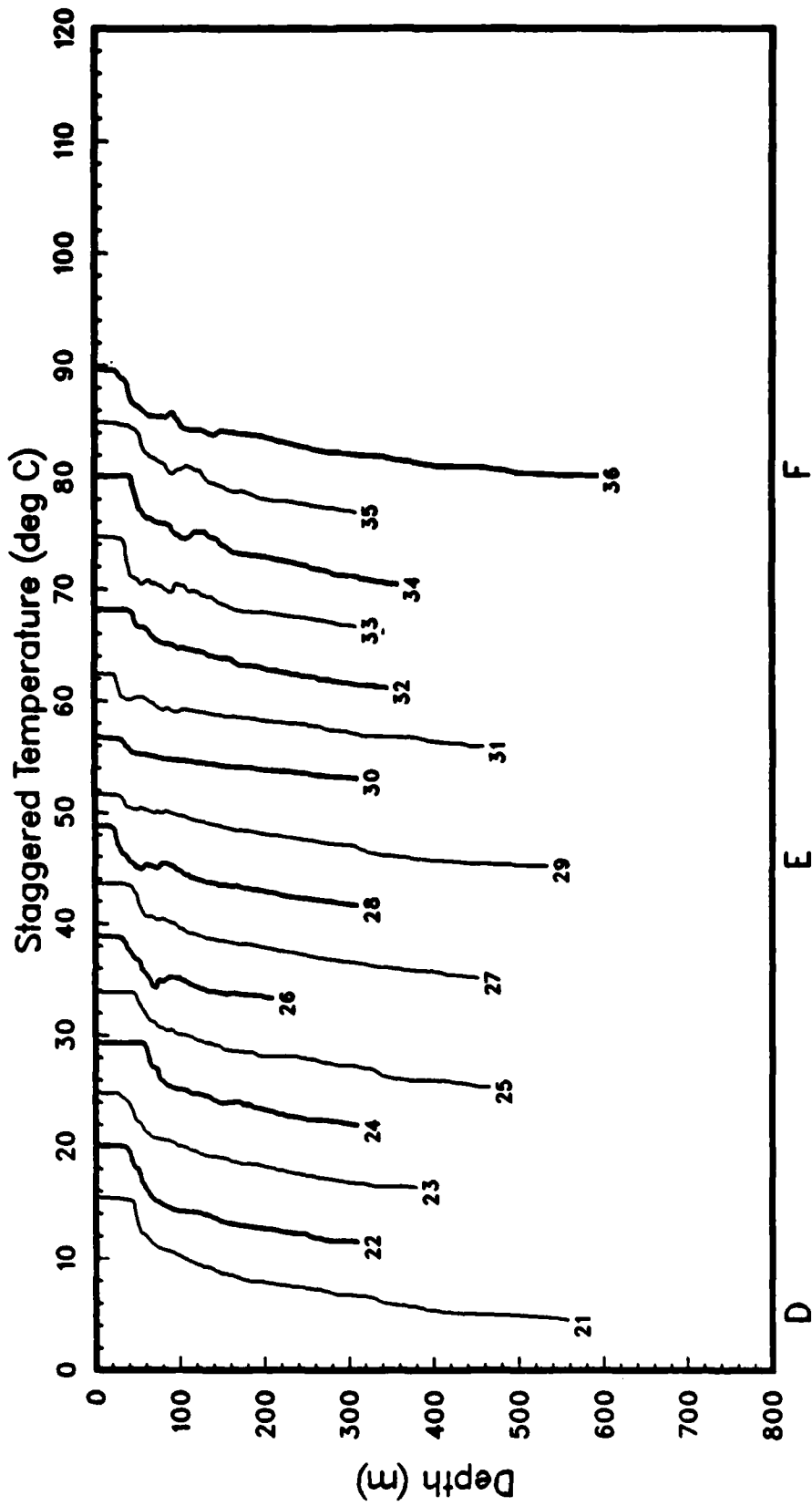


Figure 5 (b).

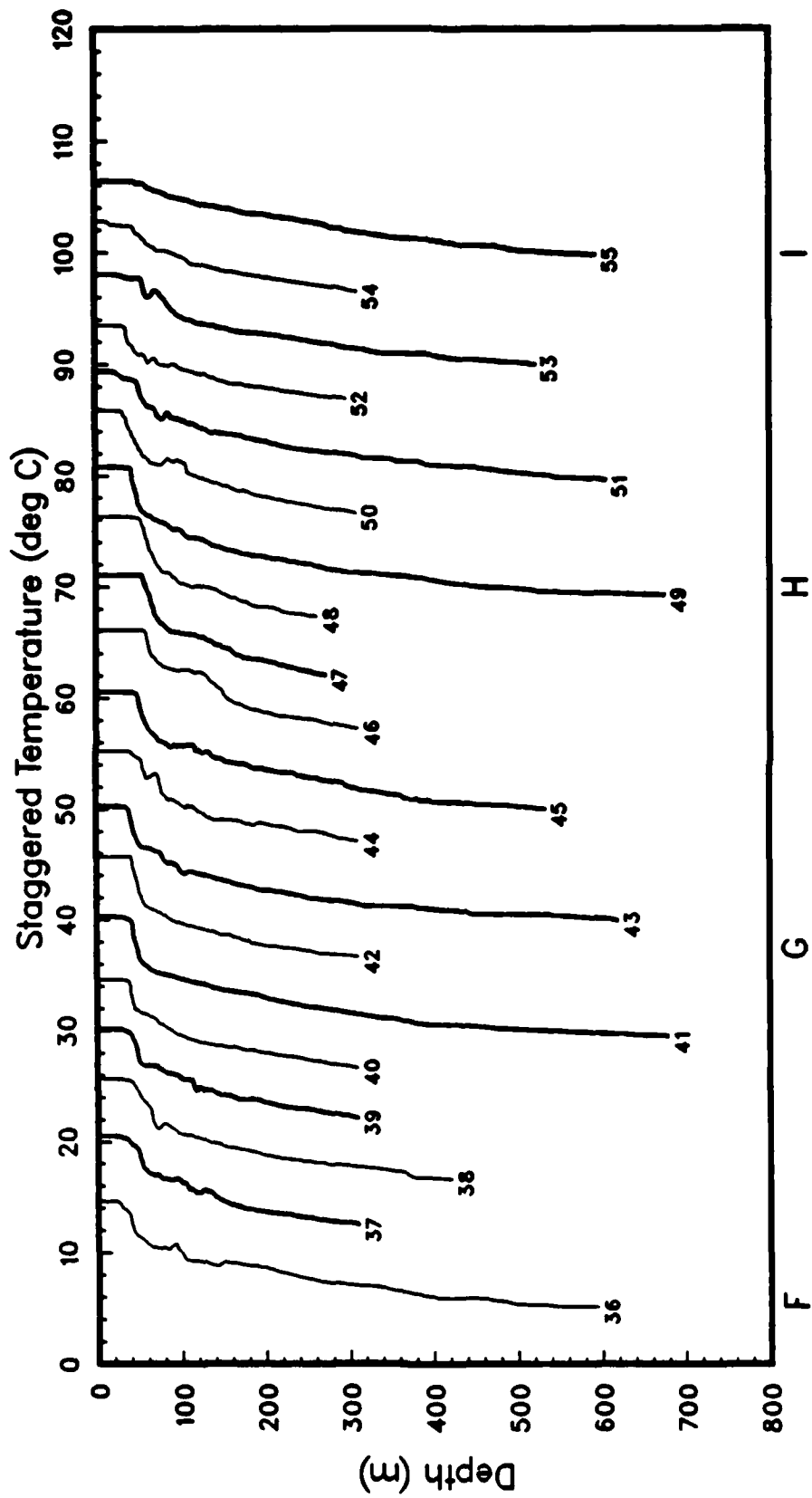


Figure 5 (c).

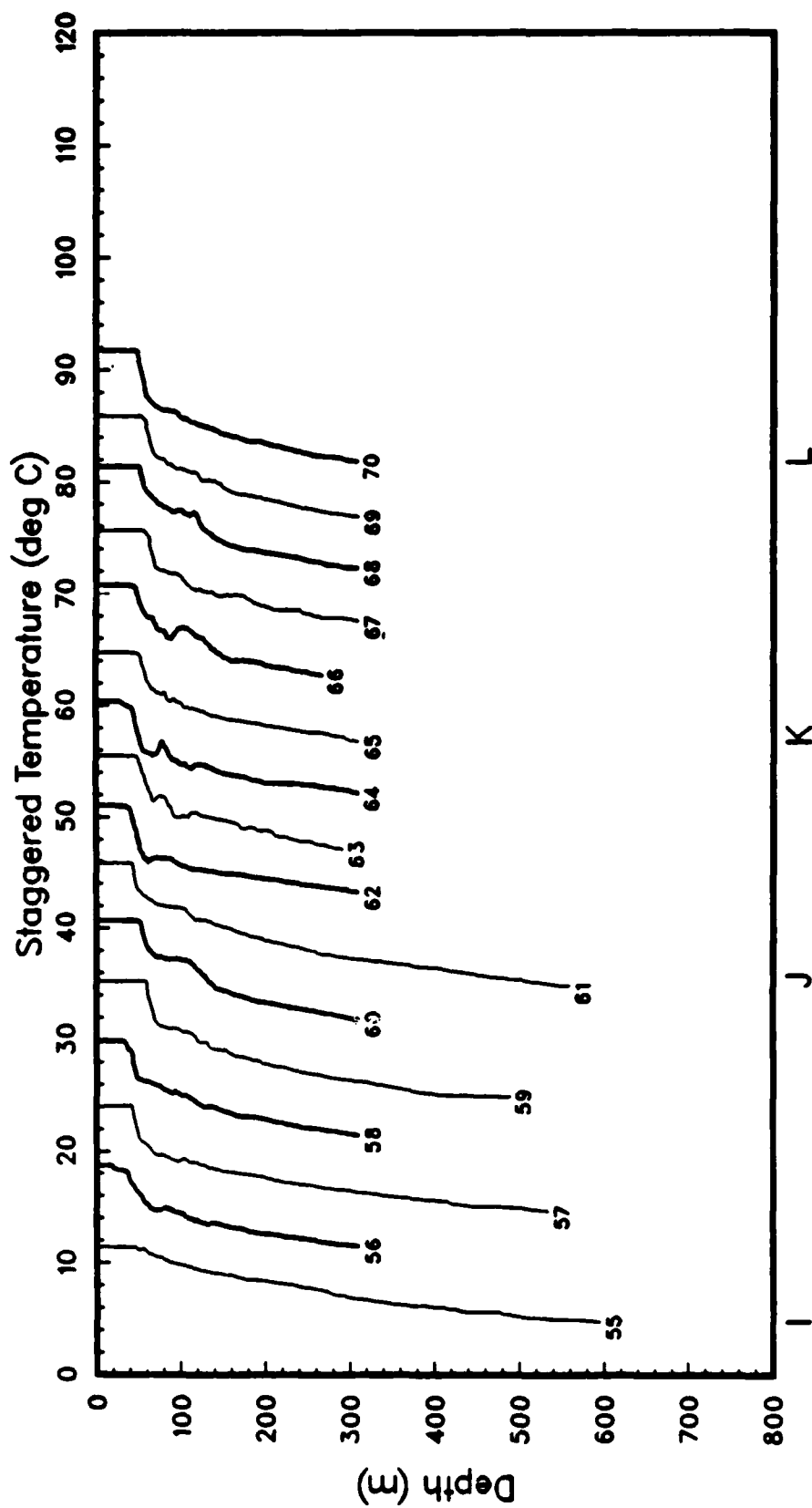


Figure 5 (d).

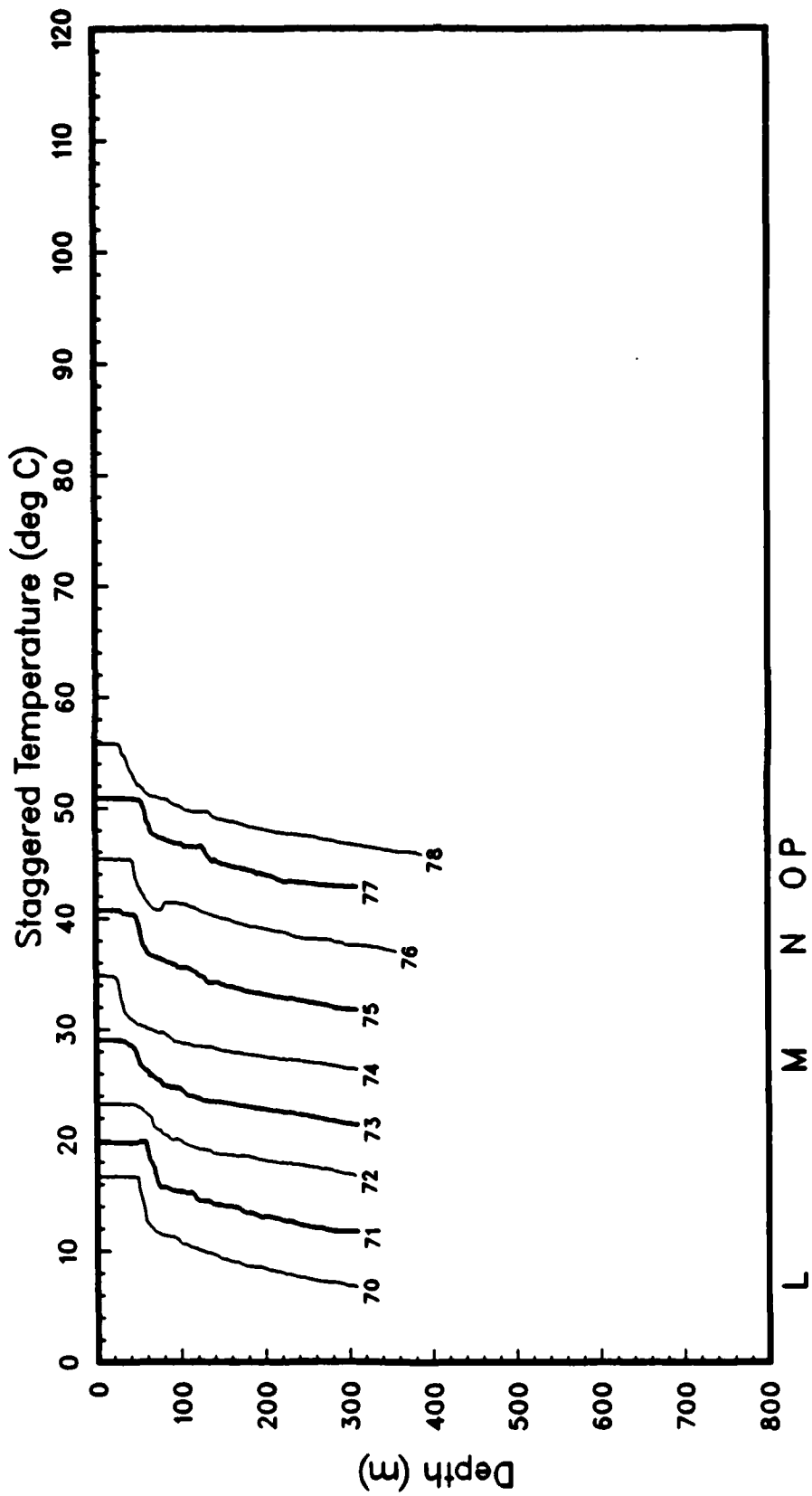


Figure 5 (e).

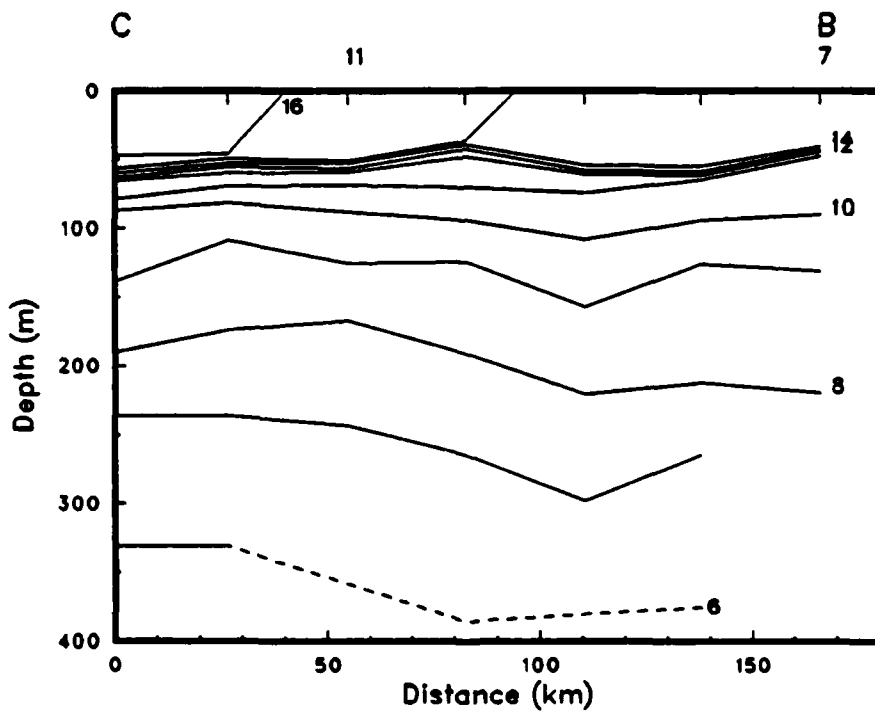
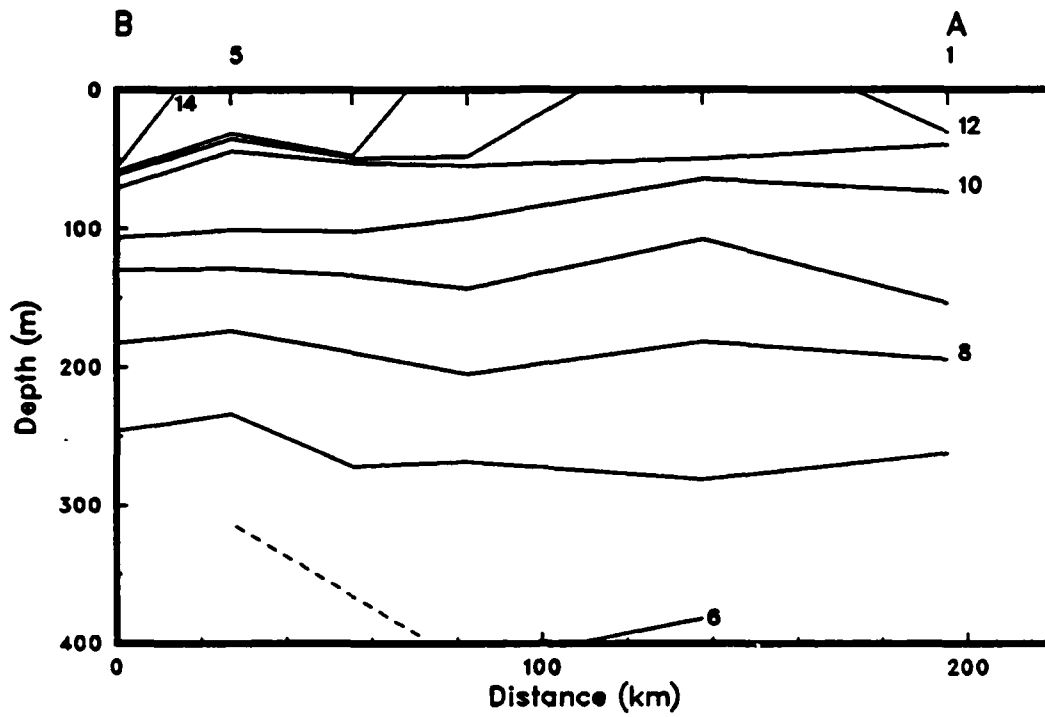


Figure 6 (a). Along-track isotherms. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. Dashed lines are used if the cast was too shallow (OPTOMA18 Flight I).

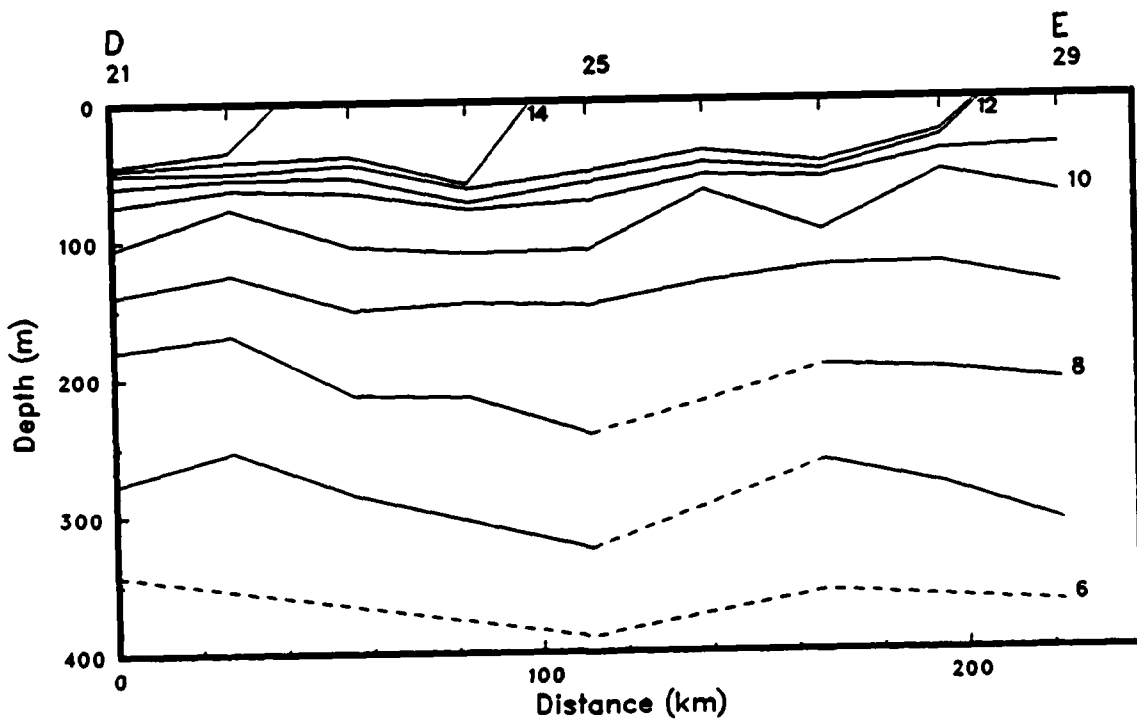
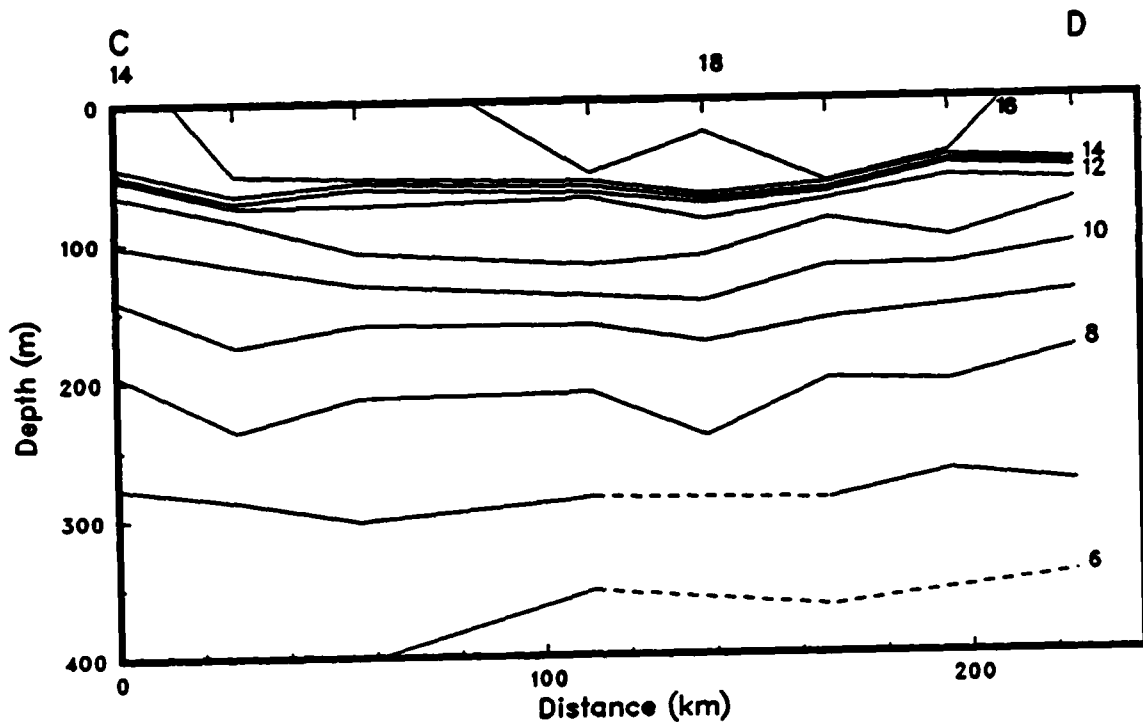


Figure 6 (b).

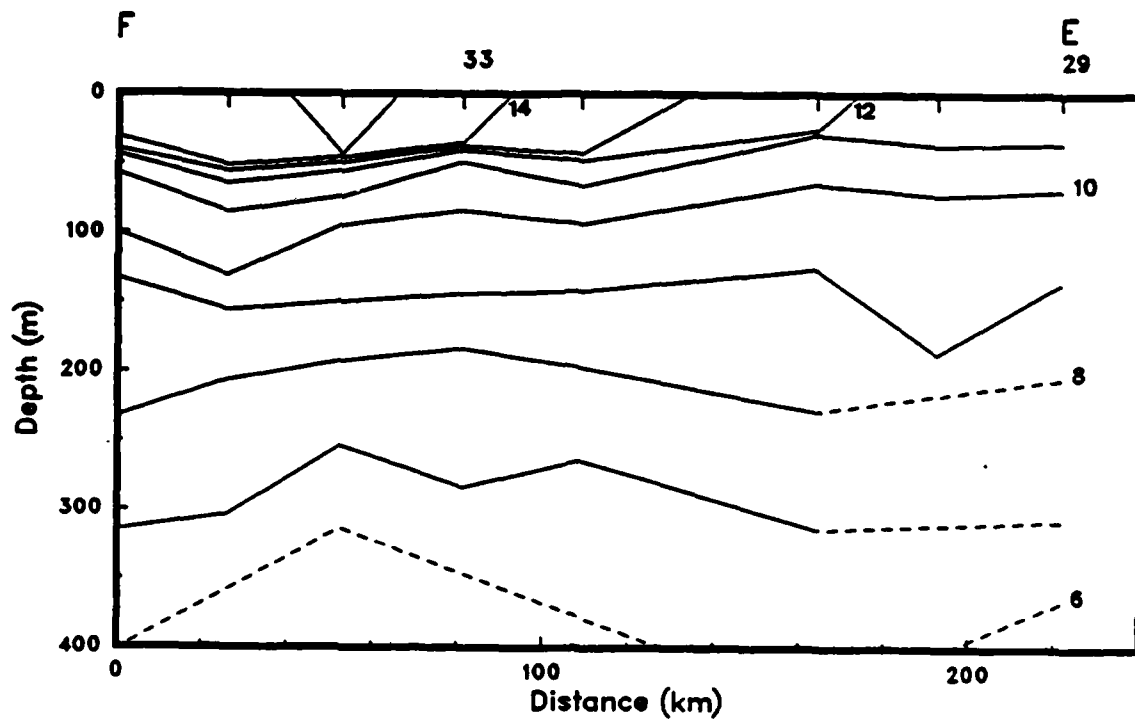


Figure 6 (c).

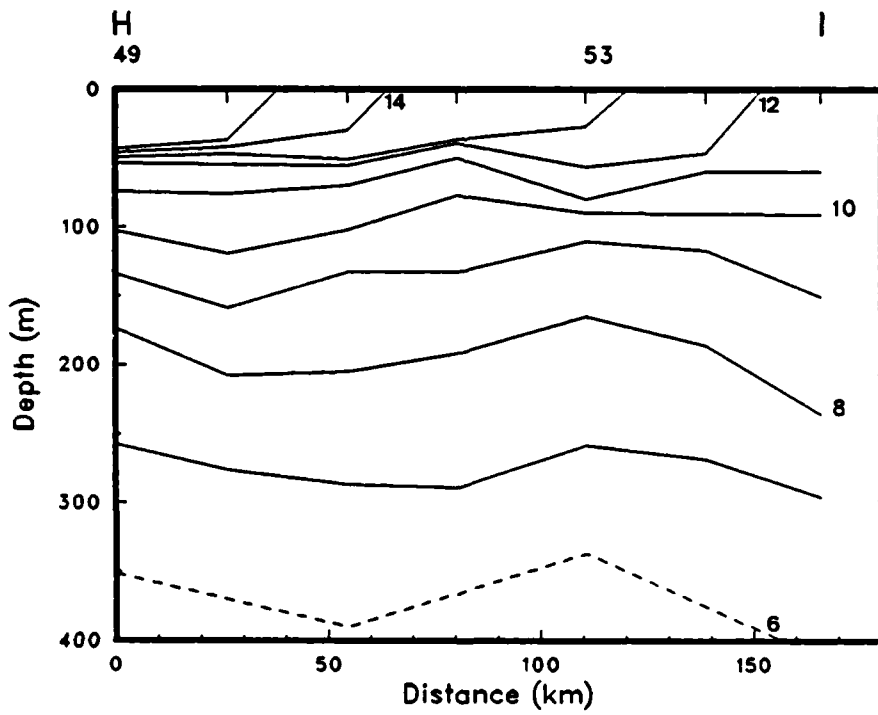
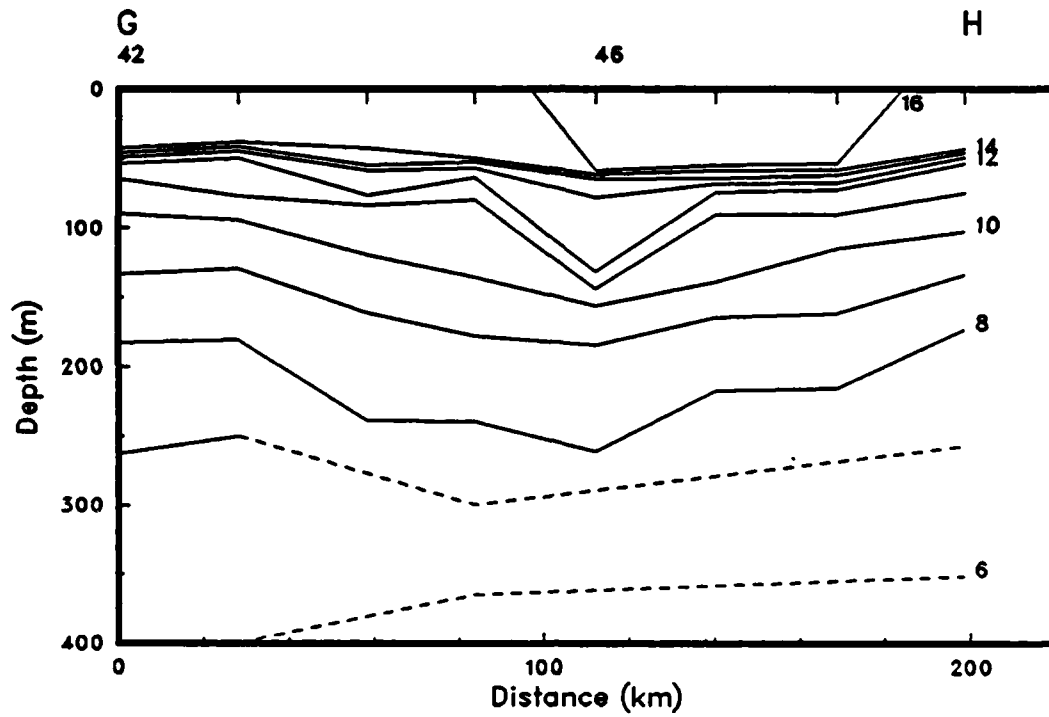


Figure 6 (d).

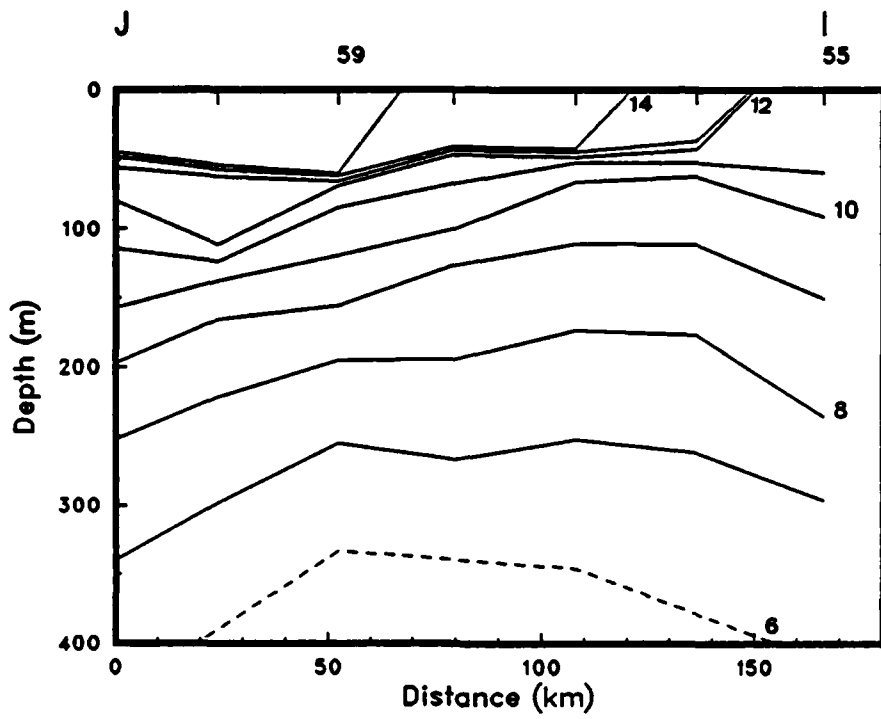


Figure 6 (e).

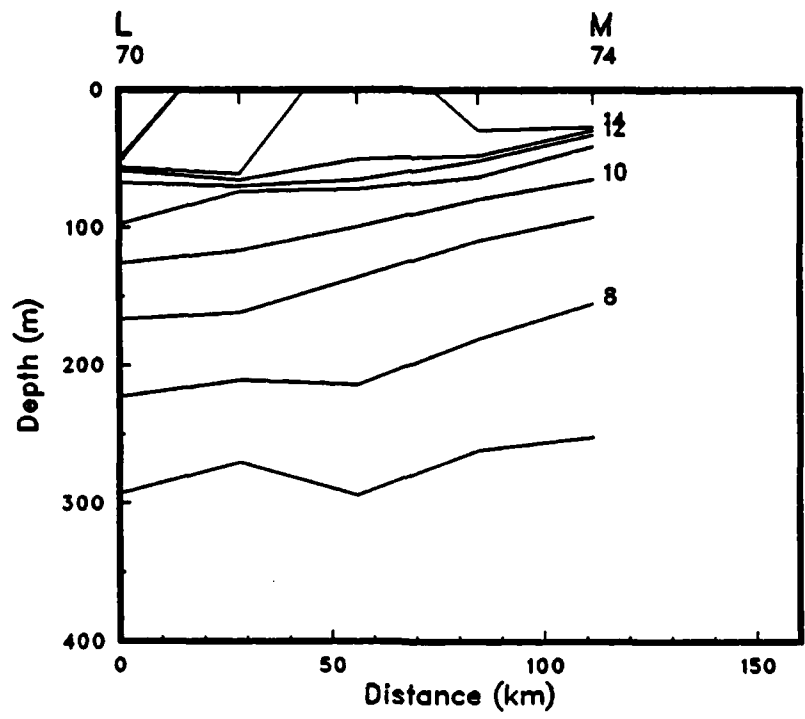
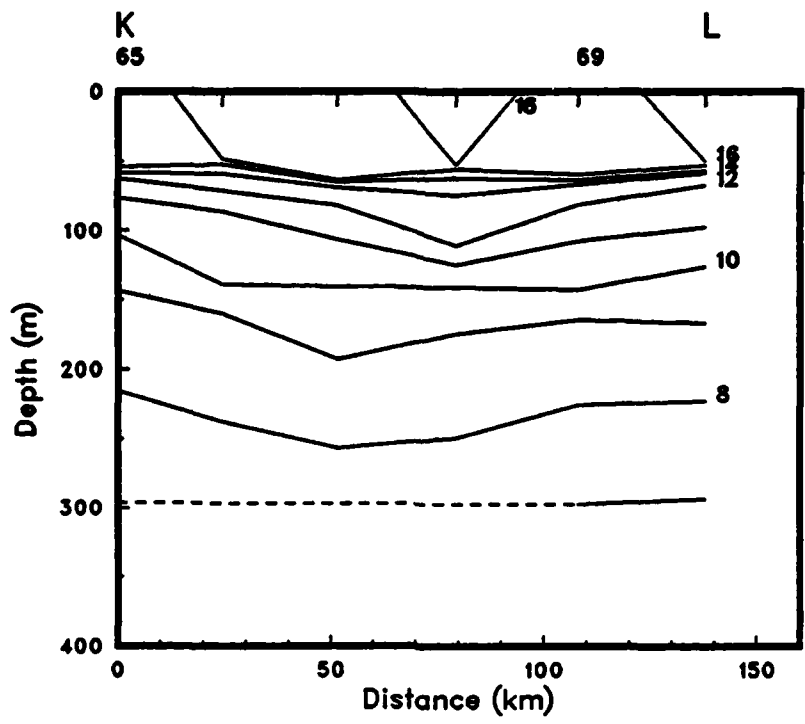


Figure 6 (f).

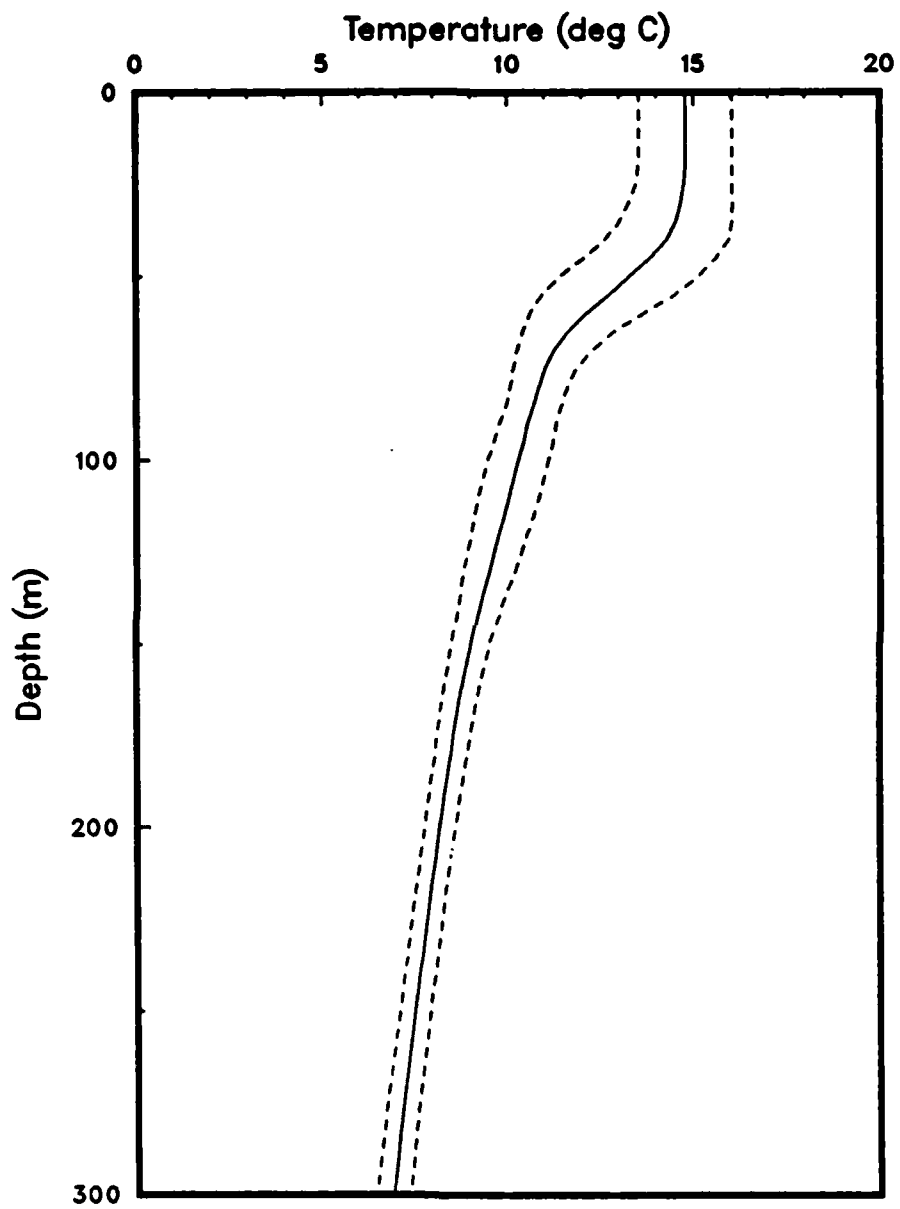


Figure 7. Mean temperature profile, with + and - the standard deviations, from OPTOMA18 Flight I.

SECTION 2  
OPTOMA 18 FLIGHT II  
NOVEMBER 2, 1985

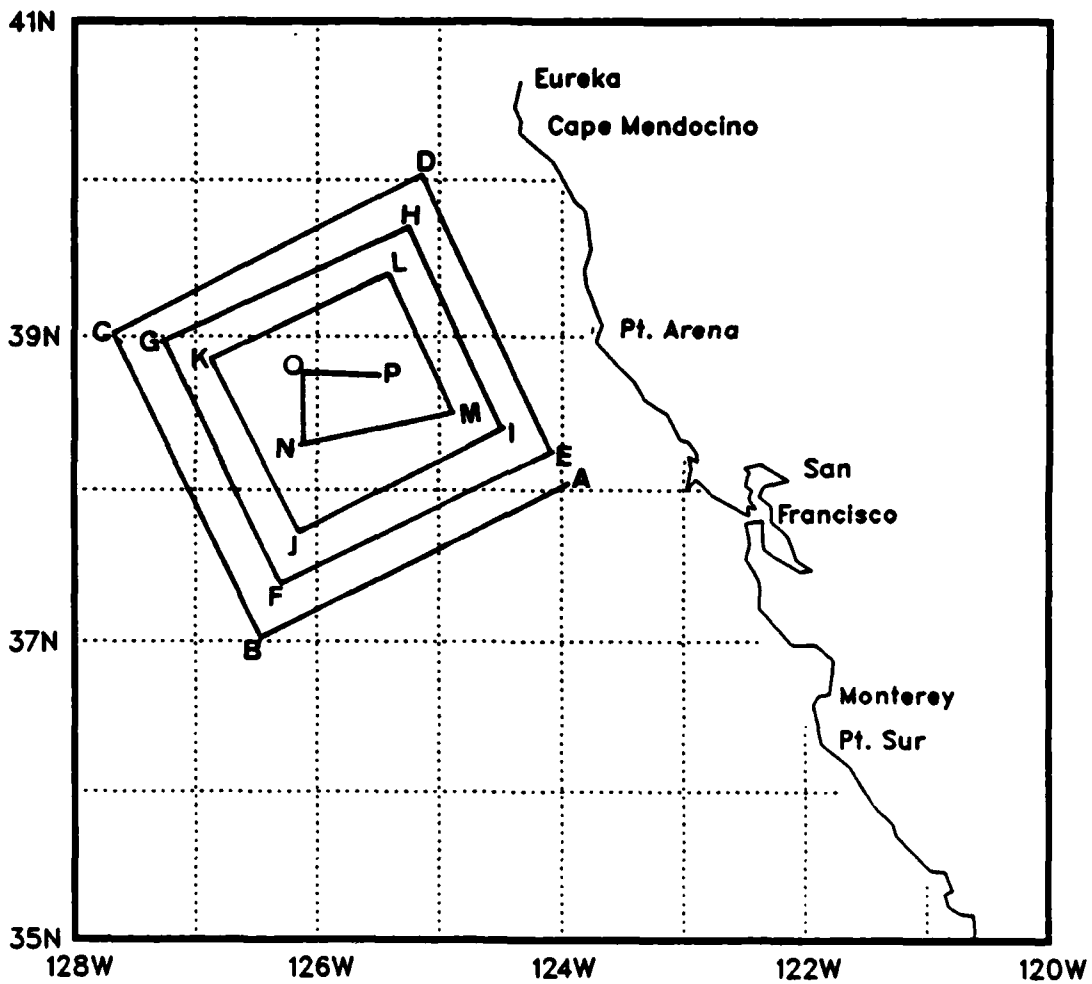


Figure 8. The flight track for OPTOMA18 Flight II.

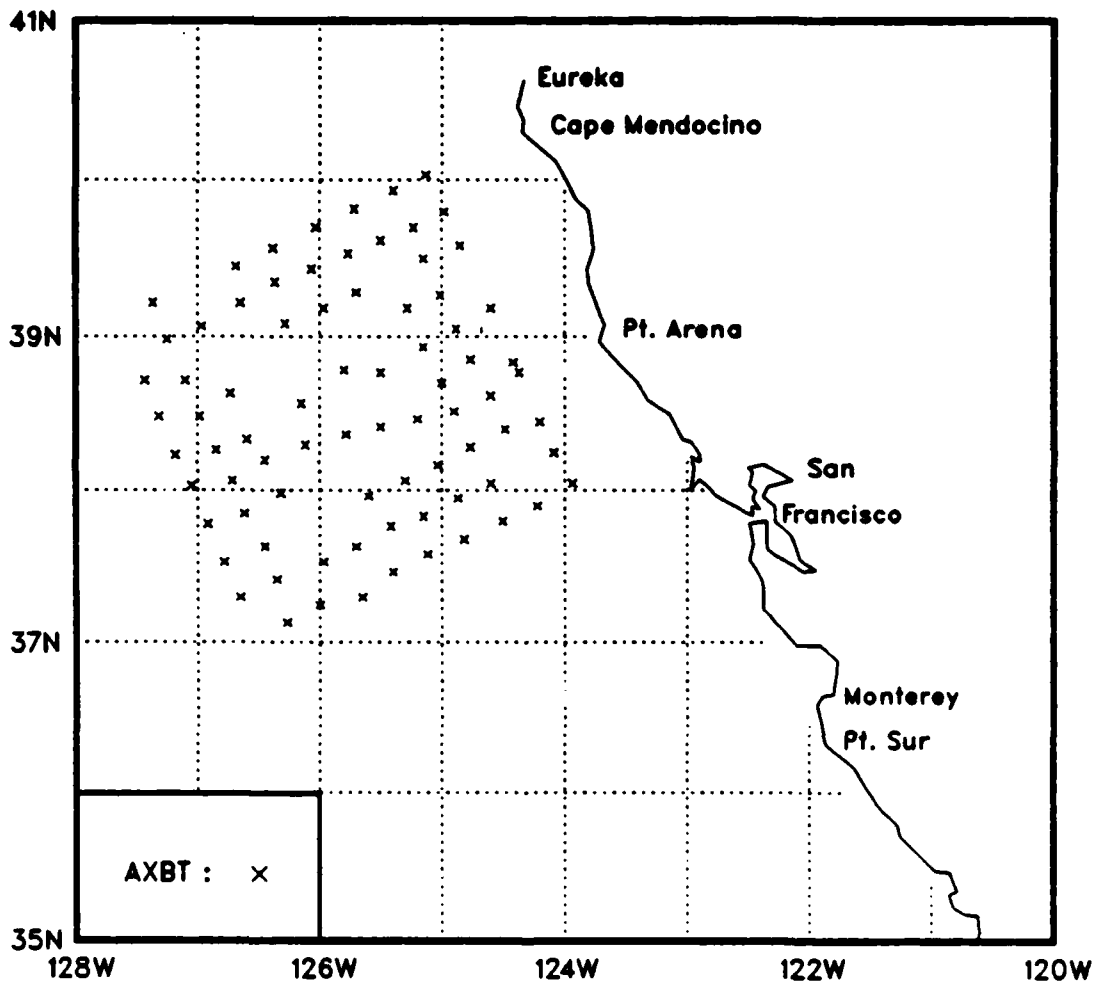


Figure 9. AXBT station locations for OPTOMA18 Flight II.

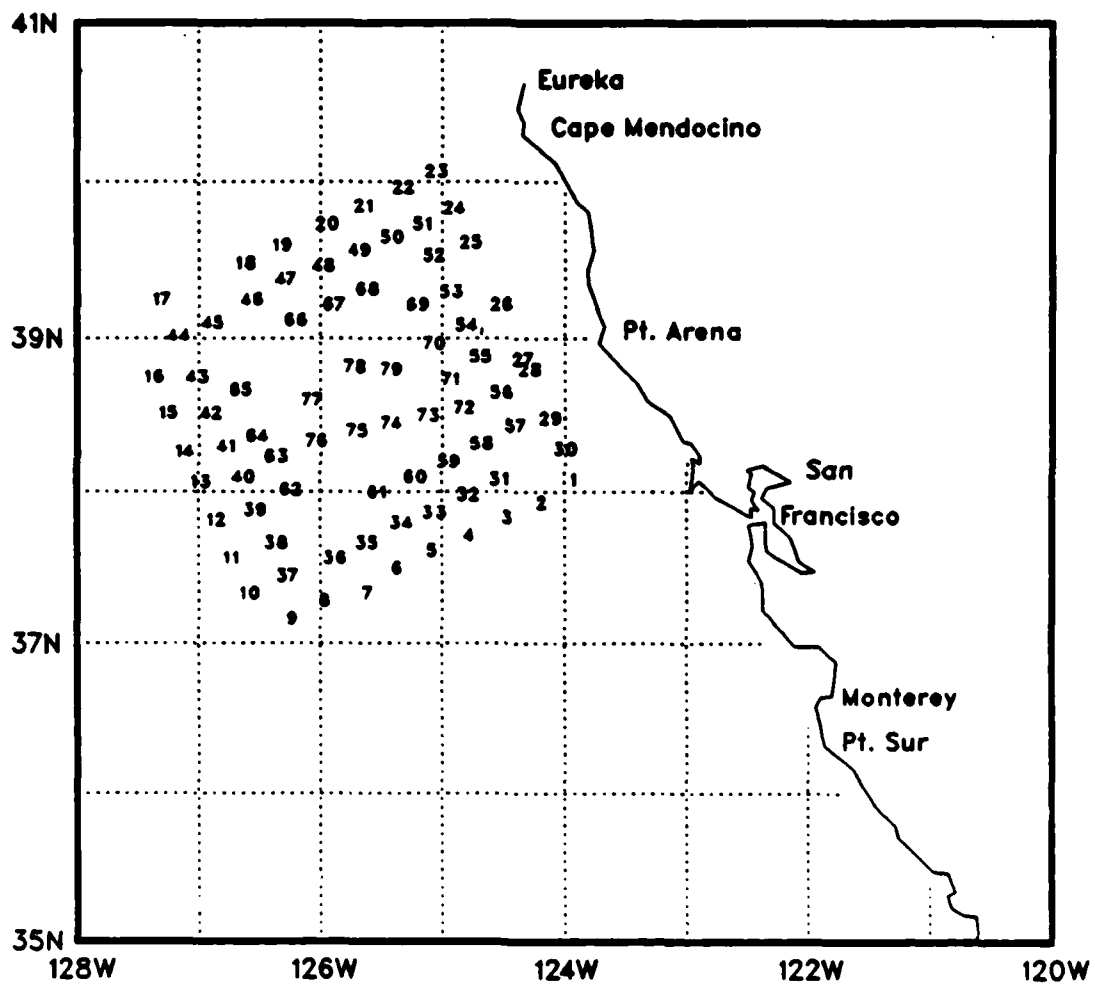


Figure 10. Station numbers for OPTOMA18 Flight II.

Table 2: Flight II Station Listing

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)
1	AXBT	85306	1812	38.03	123.56	12.8
2	AXBT	85306	1814	37.54	124.13	13.1
3	AXBT	85306	1821	37.48	124.30	13.0
4	AXBT	85306	1826	37.41	124.49	14.3
5	AXBT	85306	1830	37.35	125.07	13.8
6	AXBT	85306	1832	37.28	125.24	14.5
7	AXBT	85306	1839	37.18	125.39	14.3
8	AXBT	85306	1841	37.15	126.00	14.7
9	AXBT	85306	1848	37.08	126.16	15.3
10	AXBT	85306	1852	37.18	126.39	15.9
11	AXBT	85306	1901	37.32	126.47	15.8
12	AXBT	85306	1903	37.47	126.55	16.2
13	AXBT	85306	1912	38.02	127.03	15.9
14	AXBT	85306	1913	38.14	127.11	15.2
15	AXBT	85306	1922	38.29	127.19	14.8
16	AXBT	85306	1923	38.43	127.26	14.7
17	AXBT	85306	1939	39.13	127.22	16.2
18	AXBT	85306	1949	39.27	126.41	13.8
19	AXBT	85306	1956	39.34	126.23	13.4
20	AXBT	85306	1957	39.42	126.02	13.4
21	AXBT	85306	2005	39.49	125.43	13.6
22	AXBT	85306	2009	39.56	125.24	12.8
23	AXBT	85306	2014	40.02	125.08	11.8
24	AXBT	85306	2017	39.48	124.59	11.4
25	AXBT	85306	2021	39.35	124.51	12.9
26	AXBT	85306	2027	39.11	124.36	13.2
27	AXBT	85306	2033	38.50	124.25	13.4
28	AXBT	85306	2034	38.46	124.22	12.5
29	AXBT	85306	2041	38.27	124.12	13.3
30	AXBT	85306	2044	38.15	124.05	13.1
31	AXBT	85306	2050	38.03	124.36	13.9
32	AXBT	85306	2056	37.57	124.52	13.9
33	AXBT	85306	2057	37.50	125.09	14.2
34	AXBT	85306	2104	37.46	125.25	14.1
35	AXBT	85306	2106	37.38	125.42	14.5
36	AXBT	85306	2112	37.32	125.58	14.4
37	AXBT	85306	2118	37.25	126.21	15.0
38	AXBT	85306	2123	37.38	126.27	14.8
39	AXBT	85306	2127	37.51	126.37	14.9
40	AXBT	85306	2132	38.04	126.43	15.0
41	AXBT	85306	2134	38.16	126.51	15.2
42	AXBT	85306	2141	38.29	126.59	14.9
43	AXBT	85306	2145	38.43	127.06	15.0
44	AXBT	85306	2151	38.59	127.15	15.1
45	AXBT	85306	2154	39.04	126.58	15.9

STN	TYPE	YR/DAY	GMT	LAT (NORTH) (DD.MM)	LONG (WEST) (DDD.MM)	SURFACE TEMP (DEG C)
46	AXBT	85306	2201	39.13	126.39	14.8
47	AXBT	85306	2205	39.21	126.22	13.2
48	AXBT	85306	2210	39.26	126.04	12.6
49	AXBT	85306	2211	39.32	125.46	13.5
50	AXBT	85306	2219	39.37	125.30	13.3
51	AXBT	85306	2223	39.42	125.14	11.7
52	AXBT	85306	2227	39.30	125.09	12.9
53	AXBT	85306	2229	39.16	125.01	13.2
54	AXBT	85306	2235	39.03	124.53	13.2
55	AXBT	85306	2237	38.51	124.46	13.7
56	AXBT	85306	2243	38.37	124.36	12.6
57	AXBT	85306	2245	38.24	124.29	13.4
58	AXBT	85306	2252	38.17	124.46	14.2
59	AXBT	85306	2256	38.10	125.02	14.9
60	AXBT	85306	2301	38.04	125.18	14.5
61	AXBT	85306	2303	37.58	125.36	14.7
62	AXBT	85306	2319	37.59	126.19	15.1
63	AXBT	85306	2324	38.12	126.27	15.3
64	AXBT	85306	2329	38.20	126.36	14.4
65	AXBT	85306	2334	38.38	126.44	14.7
66	AXBT	85306	2336	39.05	126.17	13.9
67	AXBT	85306	2349	39.11	125.58	12.9
68	AXBT	85306	2356	39.17	125.42	13.9
69	AXBT	85307	5	39.11	125.17	13.3
70	AXBT	85307	6	38.56	125.09	13.5
71	AXBT	85307	14	38.42	125.00	14.2
72	AXBT	85307	14	38.31	124.54	14.6
73	AXBT	85307	22	38.28	125.12	14.0
74	AXBT	85307	24	38.25	125.30	14.7
75	AXBT	85307	31	38.22	125.47	14.8
76	AXBT	85307	32	38.18	126.07	15.0
77	AXBT	85307	41	38.34	126.09	14.9
78	AXBT	85307	50	38.47	125.48	14.6
79	AXBT	85307	52	38.46	125.30	14.2

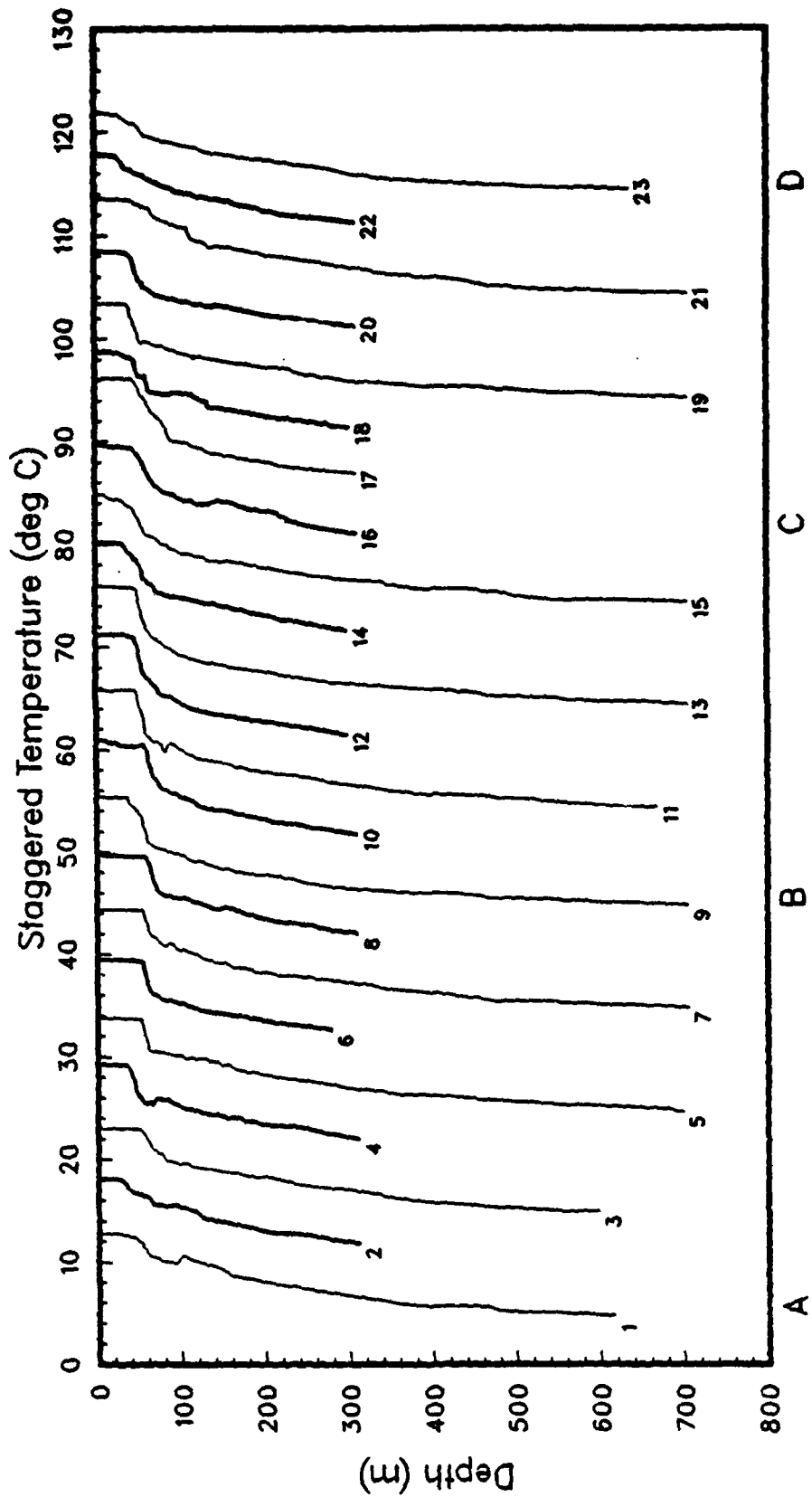


Figure 11 (a). Temperature profiles staggered by multiples of 5C (OPTOMA18 Flight II).

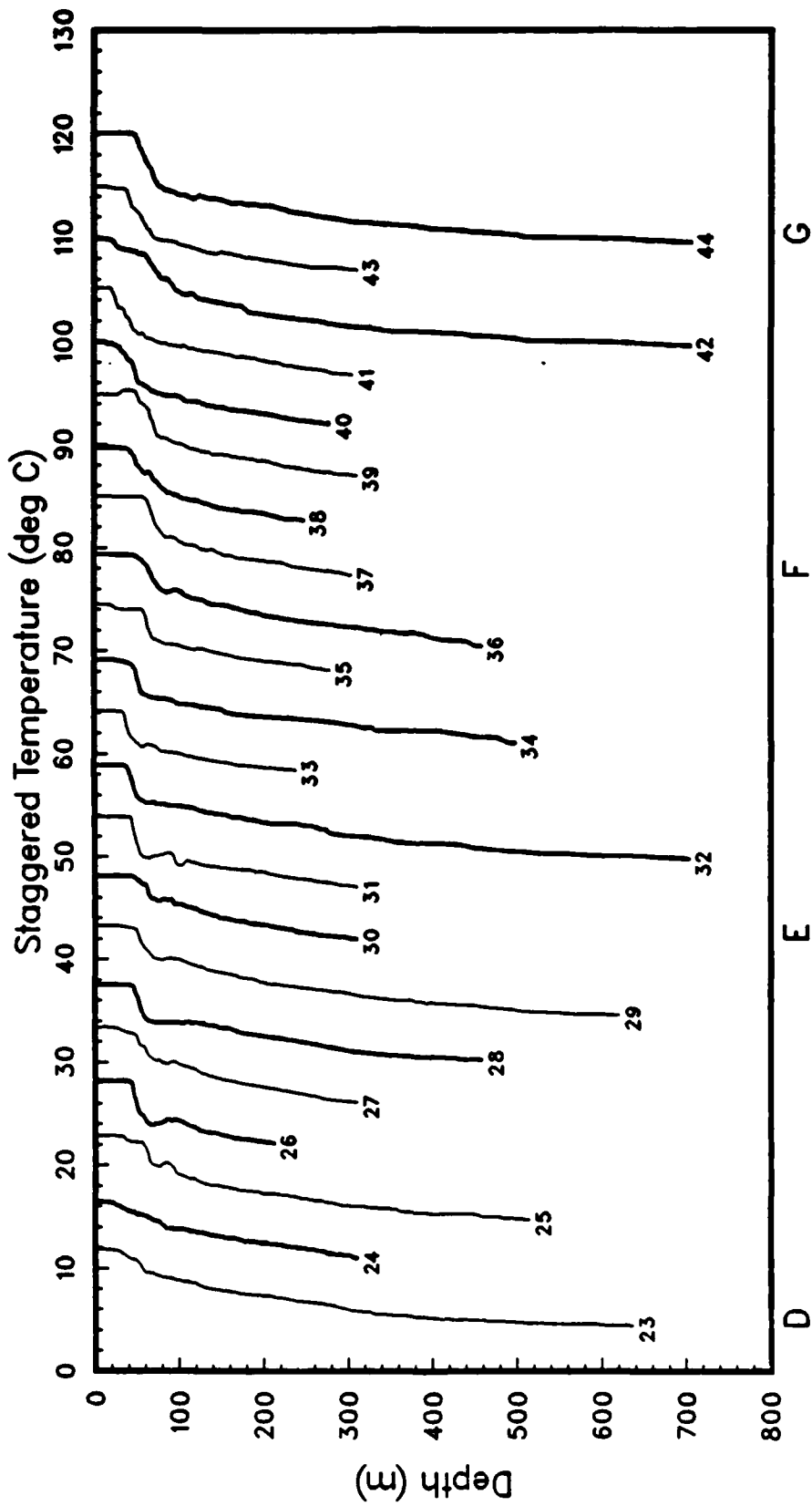


Figure 11 (b).

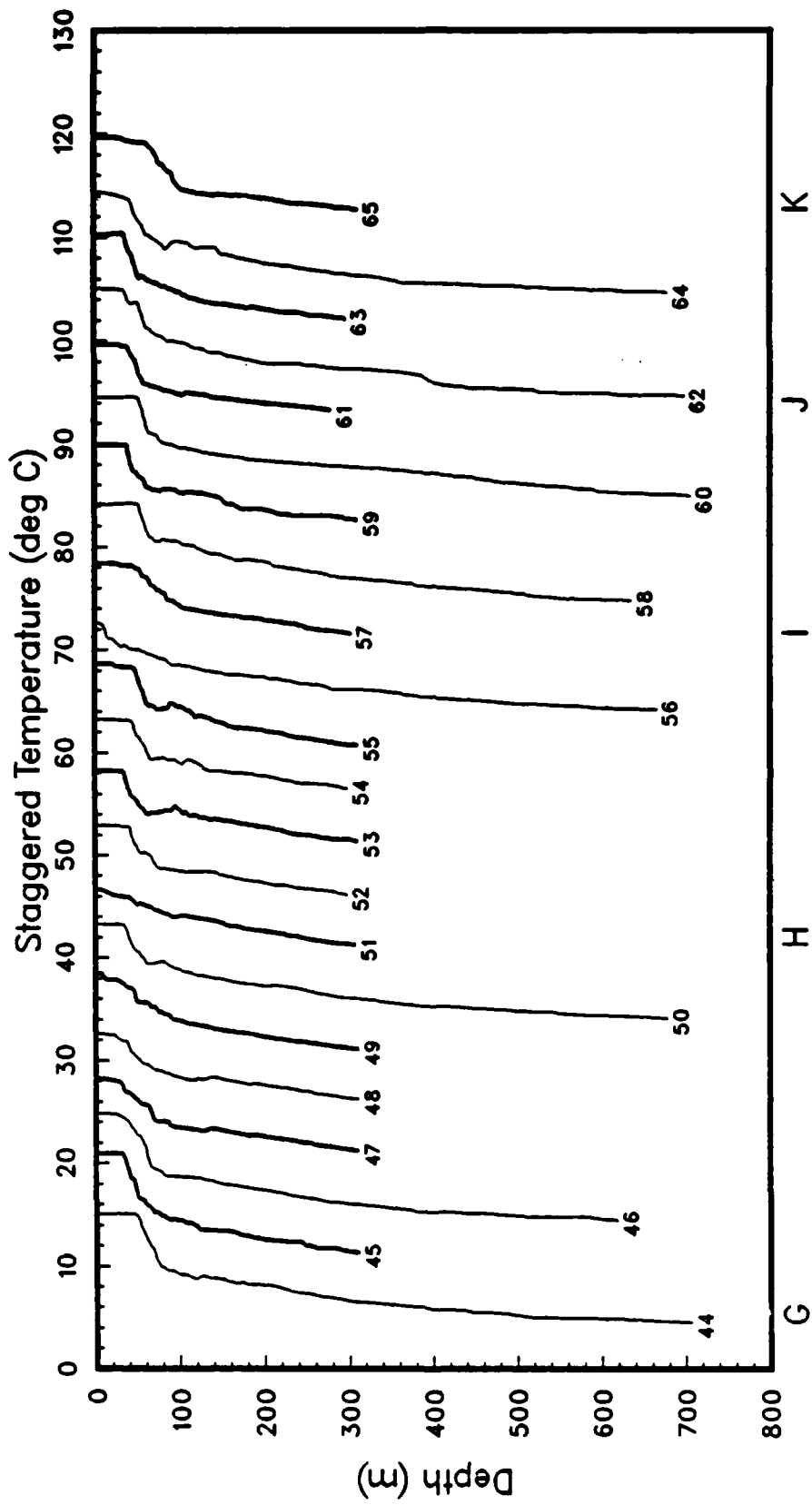


Figure 11 (c).

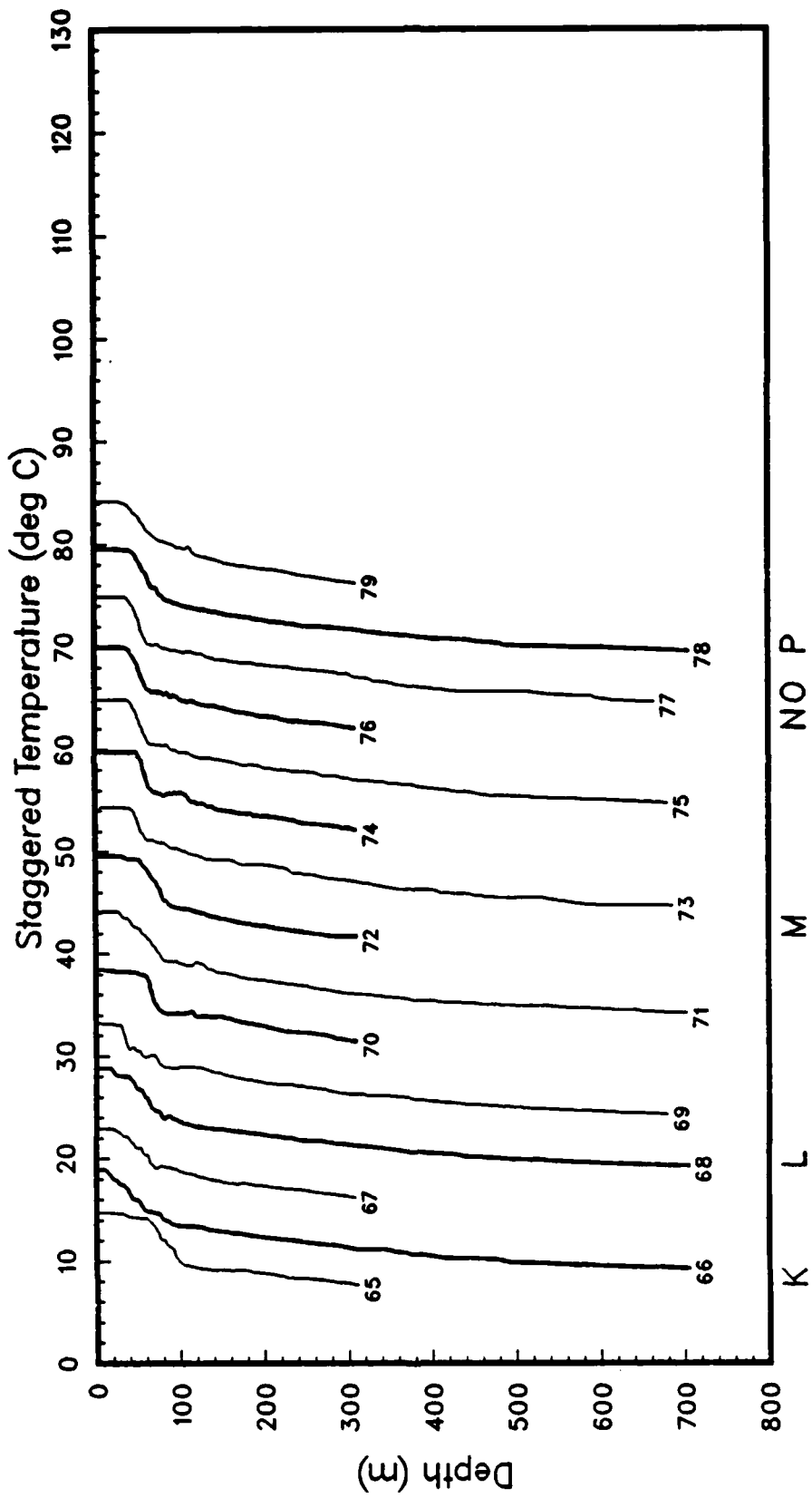


Figure 11 (d).

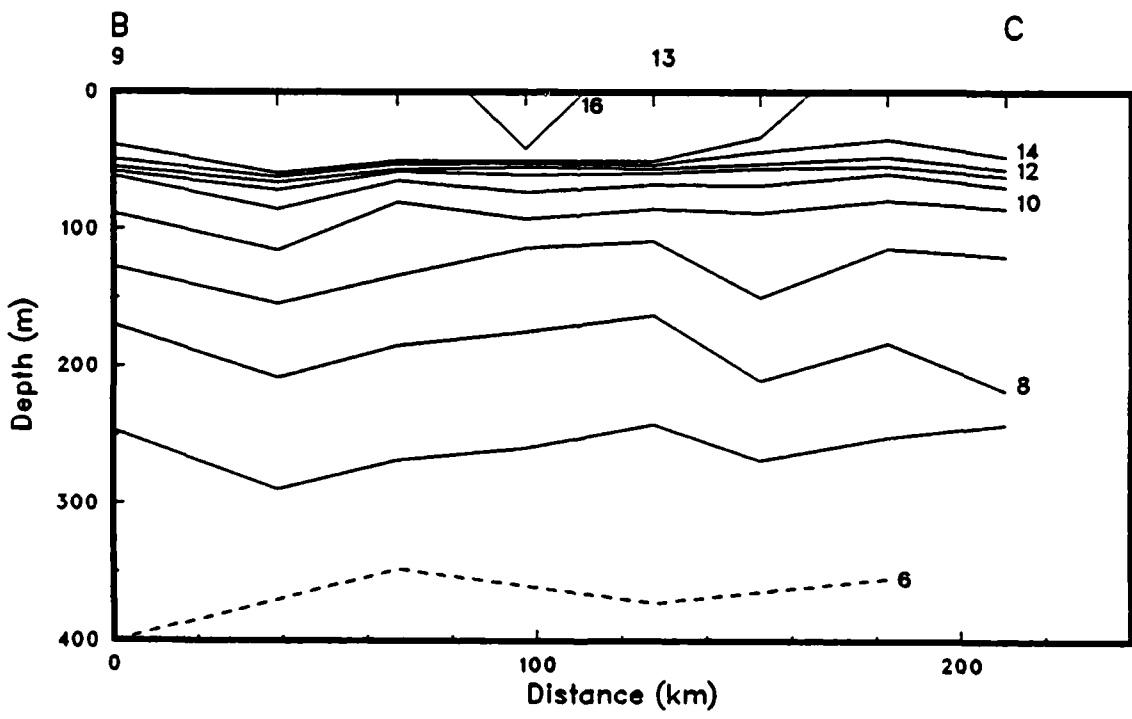
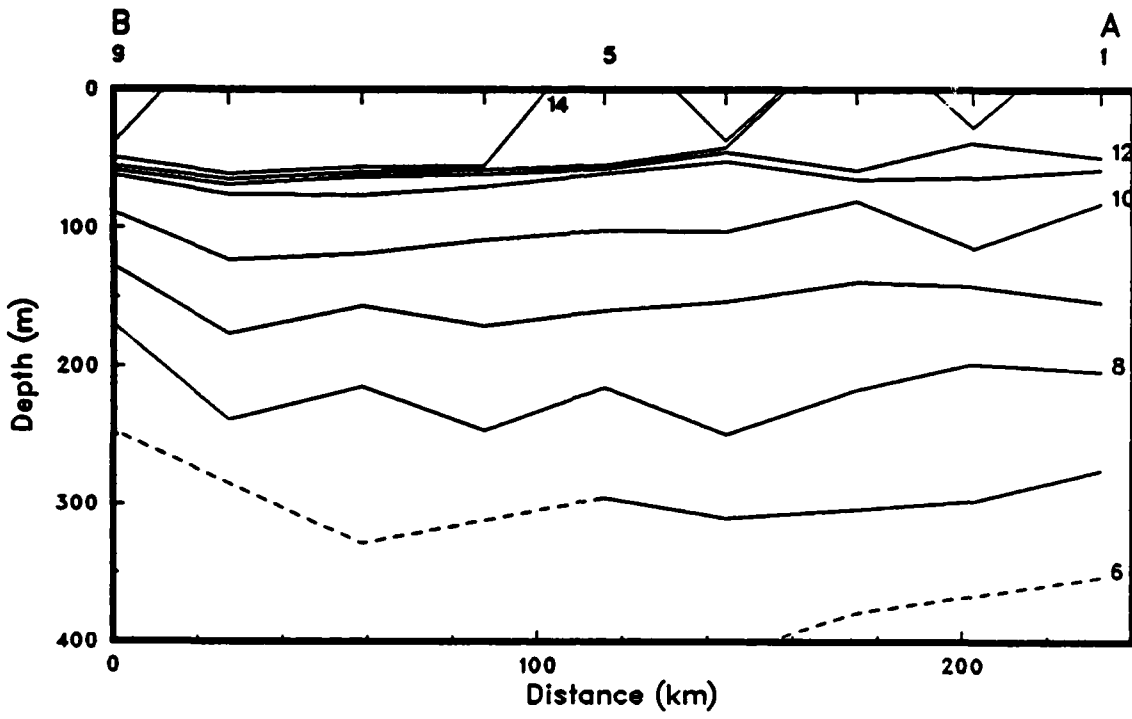


Figure 12 (a). Along-track isotherms. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. Dashed lines are used if the cast was too shallow. (OPTOMA18 Flight II).

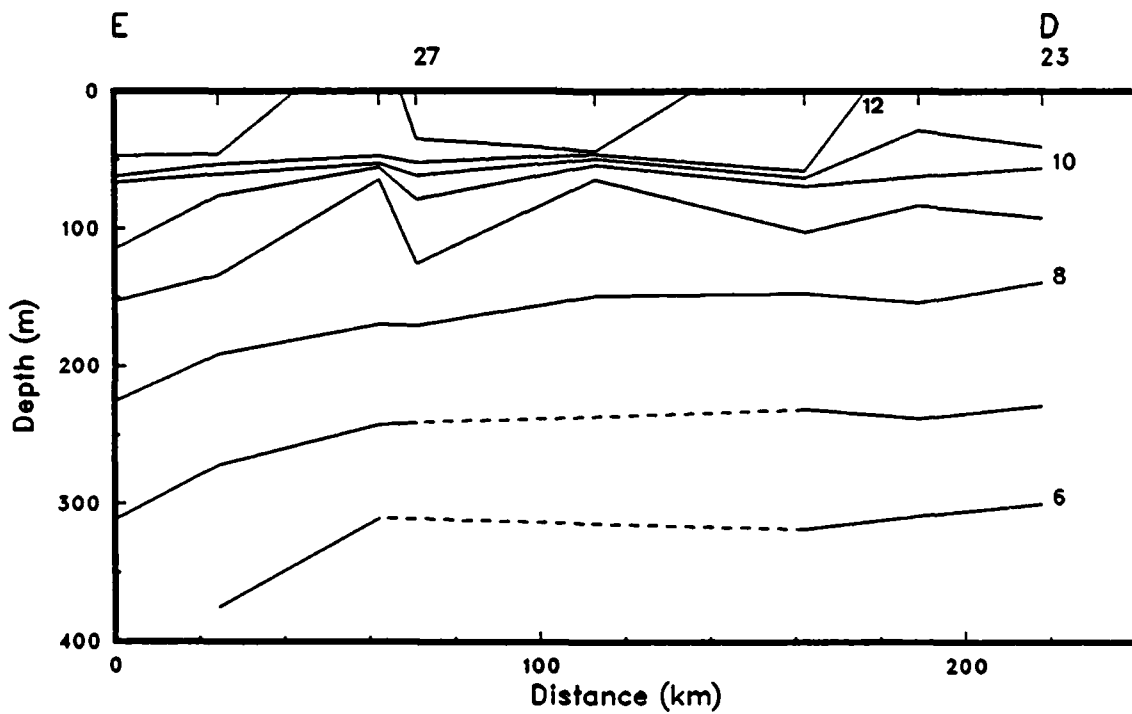
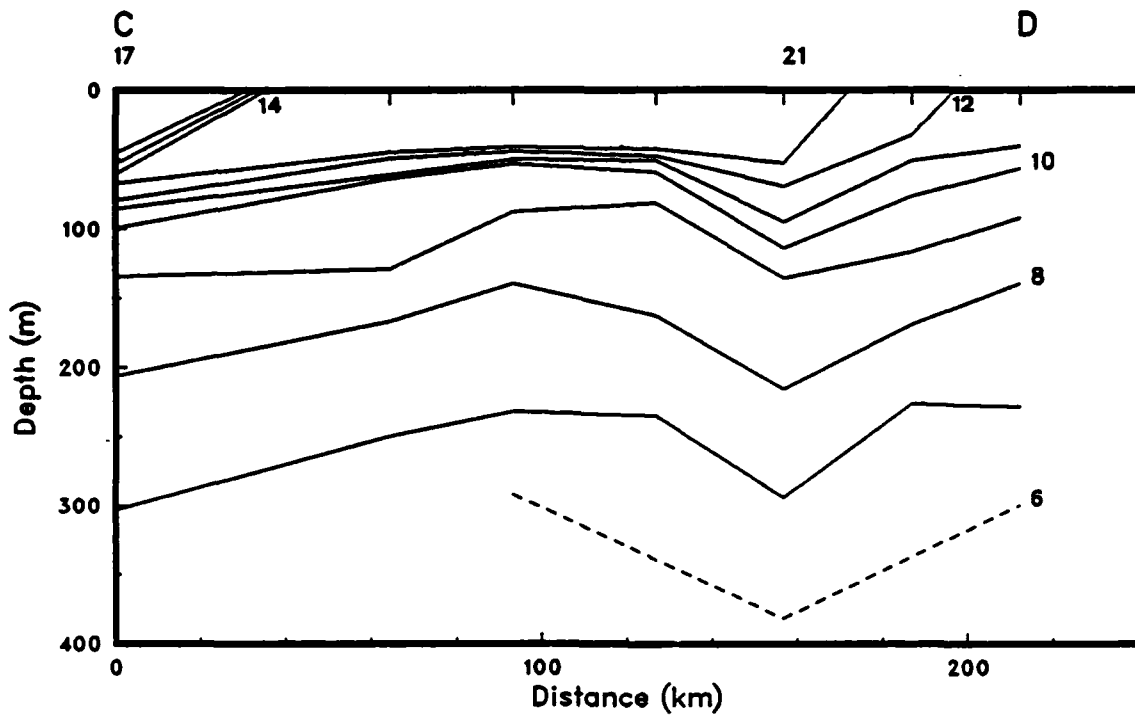


Figure 12 (b).

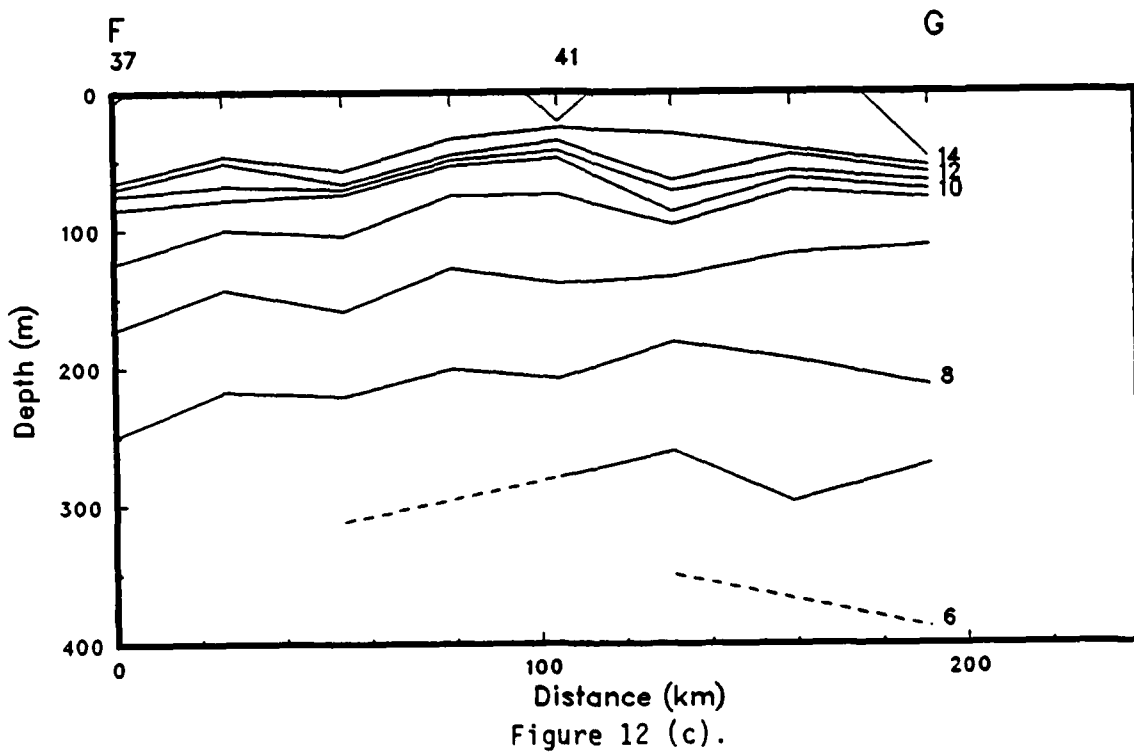
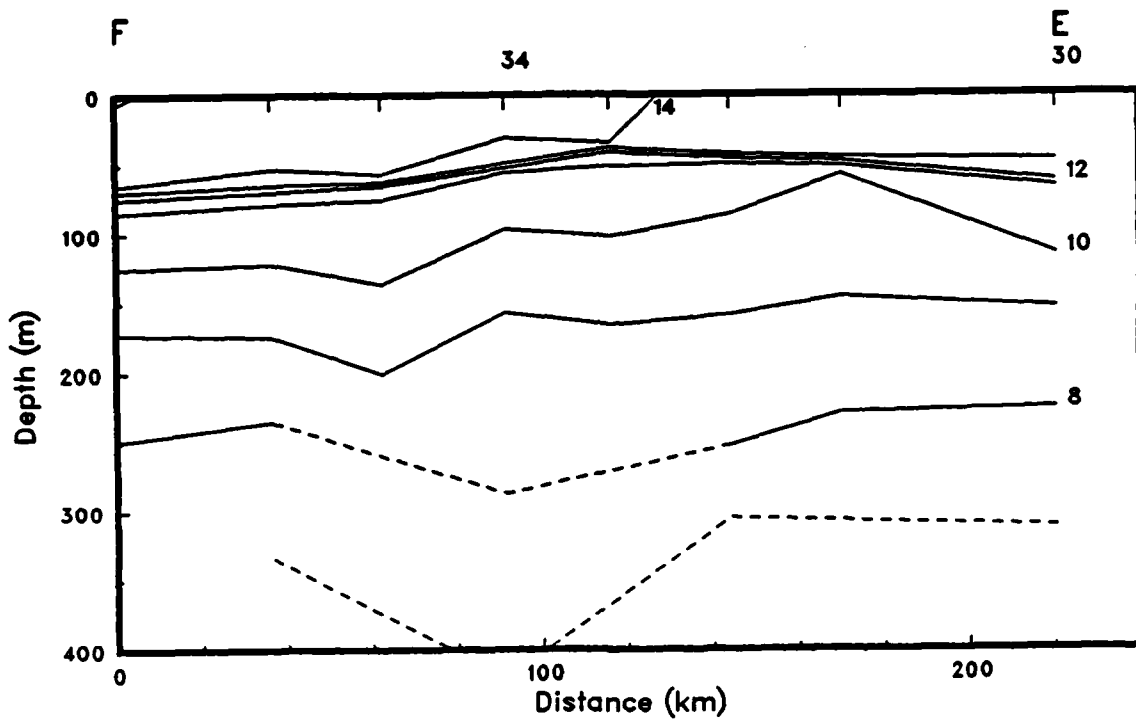


Figure 12 (c).

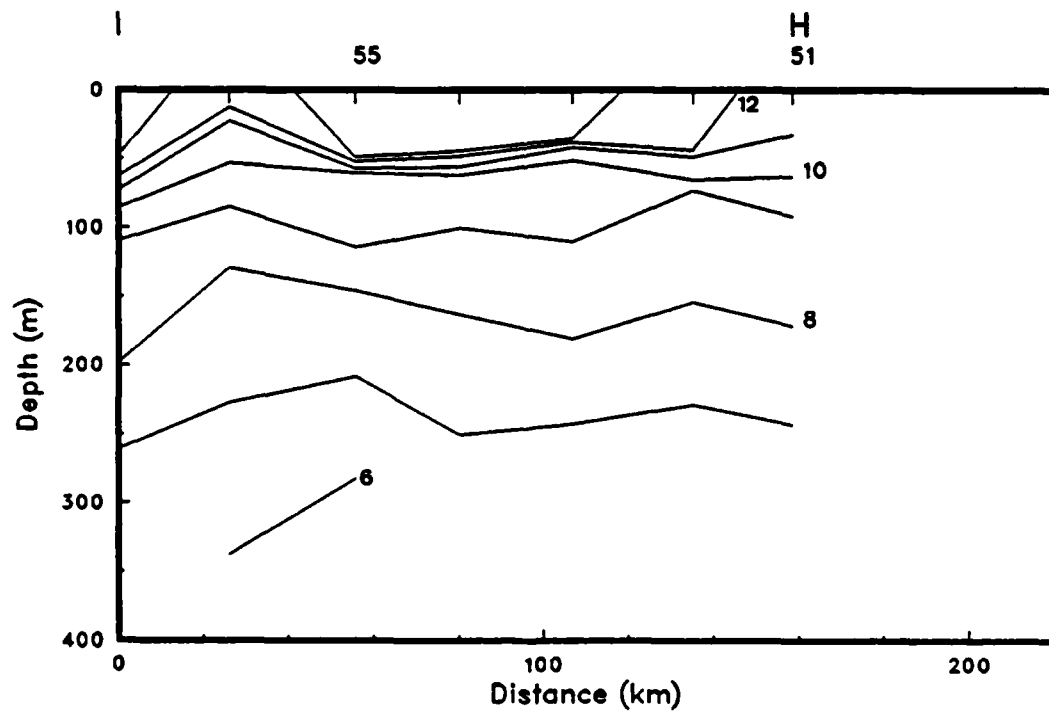
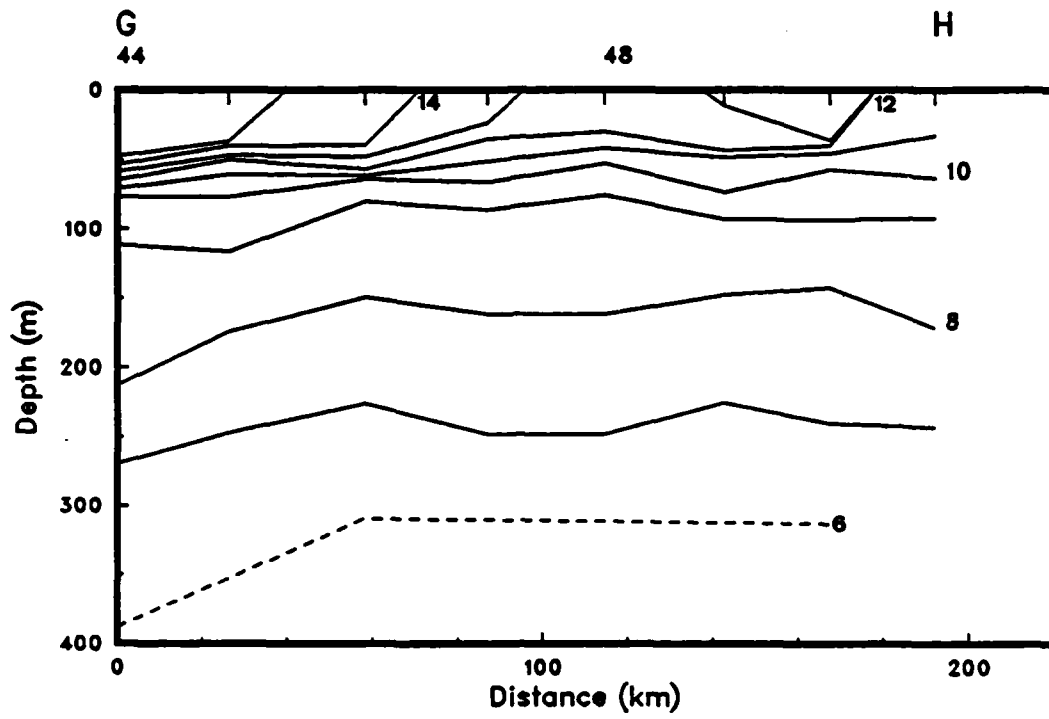


Figure 12 (d).

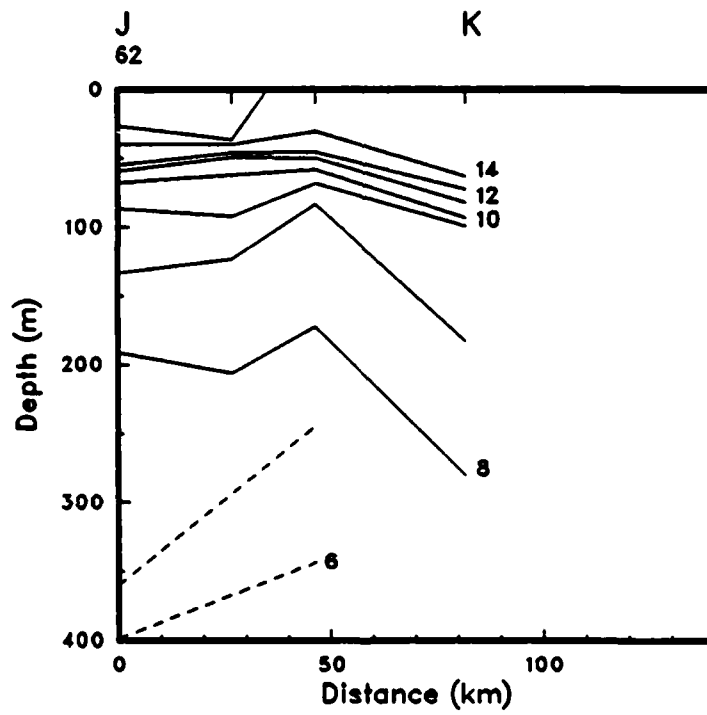
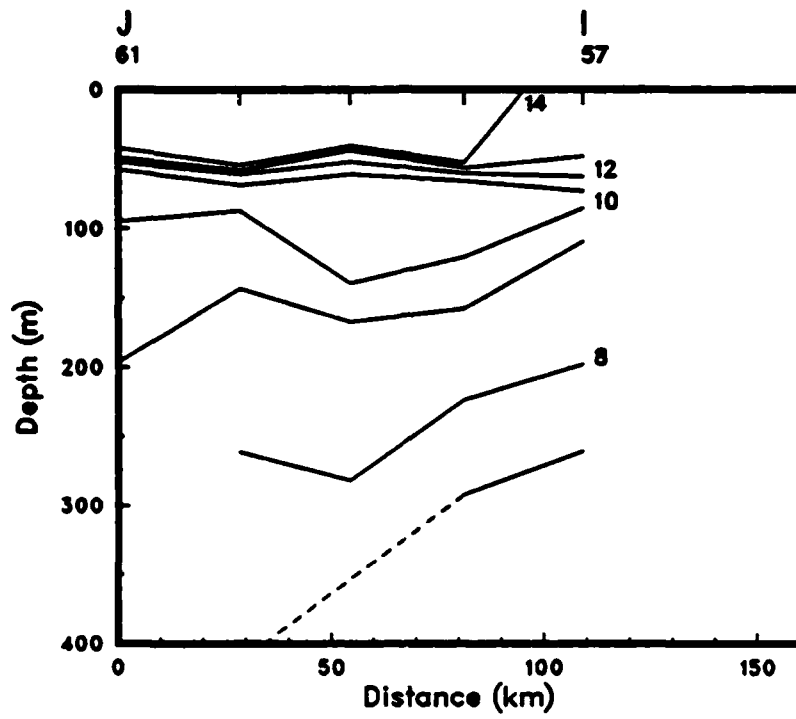


Figure 12 (e).

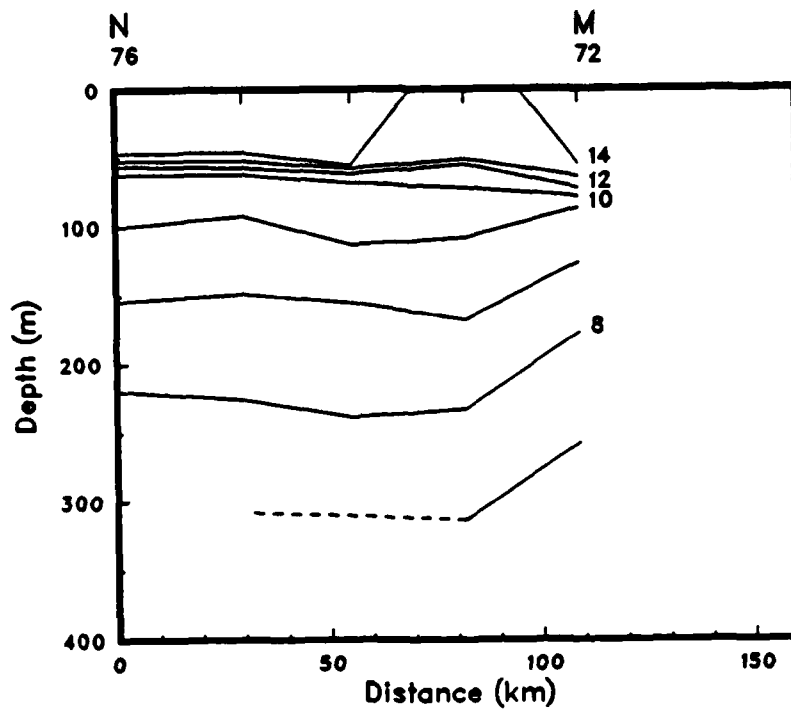
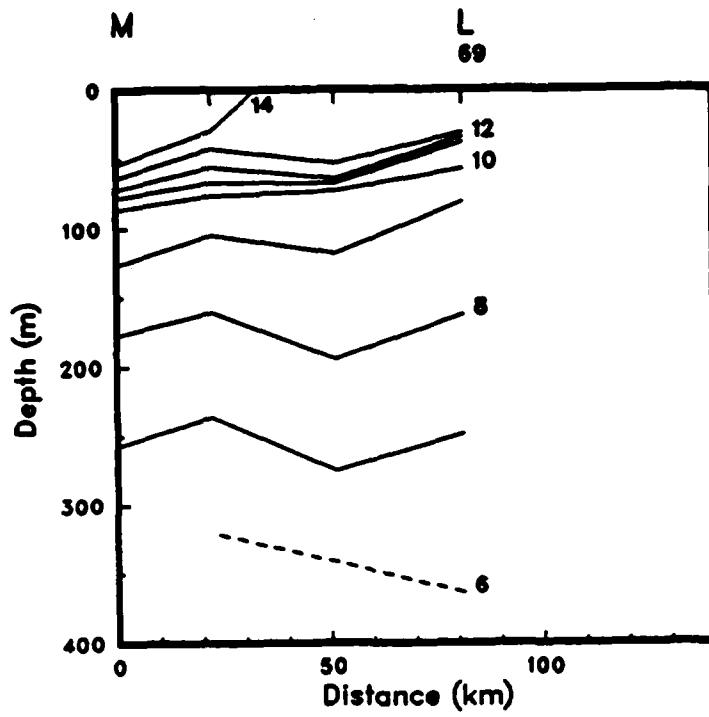


Figure 12 (f).

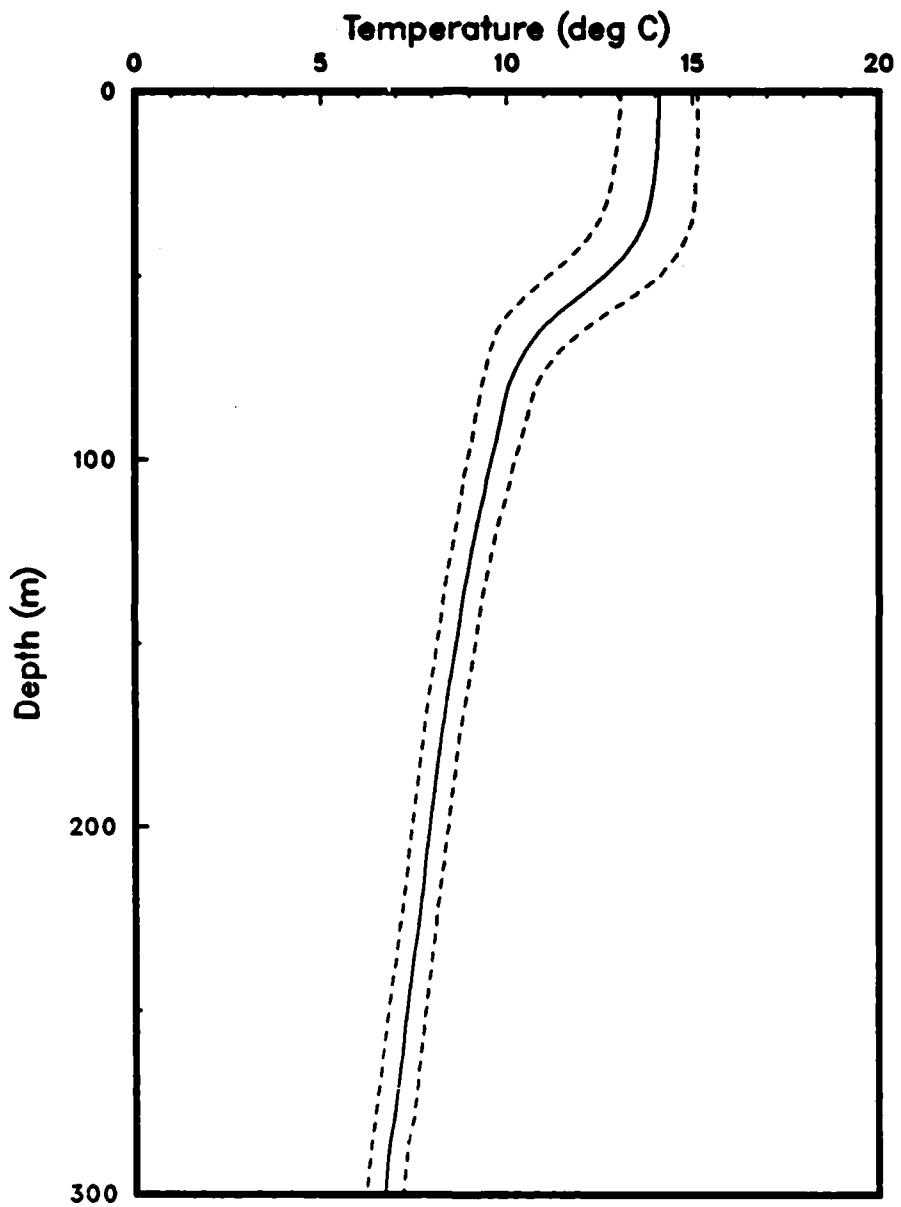


Figure 13. Mean temperature profile, with + and - the standard deviations, from OPTOMA18 Flight II.

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 Patrol Wing and Navy Reserve Patrol Wing. Members of the scientific crew were Ms. Marie Colton, NEPRF, and LT John J. Rendine, USN, NPS.

REFERENCES

- Bane, J.M., and Sessions, M.H., A Field Performance Test of the Sippican Deep Aircraft-Deployed Expendable Bathythermograph, J. Geophys. Res., Vol 89, pp. 3615-3621, 1984.
- Colton, M.C., and Mooers, C.N.K., OPTOMA Program Interim Report: The Airborne Ocean Thermal Structure Mapping Project. February, 1983 through February 1985, NPS Technical Report No. NPS-68-85-008, August 1985.
- Sippican Operation and Maintenance Manual: MK9 Digital XBT/XSV System, R-1197/B, September 1983.

INITIAL DISTRIBUTION LIST

1. Naval Postgraduate School  
Department of Oceanography  
Monterey, CA 93943  
  
Prof. Christopher N.K. Mooers 33  
Dr. Michele M. Rienecker 1  
Mr. Paul A. Wittmann 1  
Dr. Mary L. Ratteen 1  
Dr. Laurence C. Breaker 1  
LCDR J. Edward Johnson, USN 1  
Dr. James L. Mueller 1  
Prof. Kenneth L. Davidson 1  
Dr. Roland W. Garwood 1  
Prof. Robert L. Haney 1  
Prof. Dale F. Leipper 1  
Prof. Robert D. Renard 1  
Dr. Glenn H. Jung 1  
Dr. Gordon Groves 1  
LT John J. Rendine, USN 1
  
2. Harvard University  
Division of Applied Sciences  
Pierce Hall, Room 100D  
Cambridge, MA 02138  
  
Prof. Allan R. Robinson 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
  
4. College of Oceanography  
Oregon State University  
Corvallis, OR 97331  
  
Prof. Robert L. Smith 1  
Dr. Adriana 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 (FNOC)  
Monterey, CA 93943
- CDR John F. Pfeiffer, USN 1  
Mr. R. Michael Clancy 1  
Mr. Ken Pollak 1  
Ms. Evelyn Hesse 1  
LTJG Diane Durban 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. Ocean Circulation Division  
 Atlantic Oceanography Laboratory  
 Bedford Institute of Oceanography  
 Dartmouth, N.S. Box 1006  
 CANADA B2Y 4A2
- Dr. Motoyoshi Ikeda 1
18. Precision Marine  
 Meteorologic Nationale  
 2 Ave. RAPP  
 75340 Paris CEDEX 07  
 France
- Dr. Jacques Saurel 1

19. Div. of Oceanography  
RSMAS  
University of Miami  
4600 Rickenbacker Causeway  
Miami, FL 33149
- Dr. Otis Brown 1
20. Applied Physics Laboratory  
University of Washington  
1013 NE 40th Str.  
Seattle, WA 98105
- Dr. Thomas B. Sanford 1
21. School of Oceanography  
University of Washington  
Seattle, WA 98195
- Dr. Steven C. Riser 1
22. California Space Institute  
MS-A021  
Scripps Institution of Oceanography  
La Jolla, CA 92093
- Dr. Robert L. Bernstein 1
23. Marine Sciences Research Center  
State University of New York  
Stony Brook, NY 11794
- Dr. Dong-Ping Wang 1
24. Applied Physics Laboratory  
Johns Hopkins University  
Laurel, MD 20707
- Dr. Jack Calman 1
25. Pacific Marine Environmental Lab  
NOAA  
Bldg. 3  
7600 Sand Point Way, NE  
Seattle, WA 98115
- Mr. James R. Holbrook 1
26. Naval Environmental Prediction  
Research Facility (NEPRF)
- Ms. Marie Colton 1  
Mr. Robert Fett 1

- |     |  |   |
|-----|--|---|
| 27. | Graduate School of Oceanography<br>University of Rhode Island<br>Kingston, RI 02881      | 1 |
|     | Dr. Everett F. Carter  | 1 |
| 28. | Dept. of Meteorology<br>University of Maryland<br>College Park, MD 20792                 | 1 |
|     | Dr. James A. Carton  |   |
| 29. | Coastal Studies Institute<br>Louisiana State University<br>Baton Rouge, LA<br>70803-7527 |   |
|     | Prof. S. A. Hsu  | 1 |
|     | Mr. Robert Sylvia  | 1 |
| 30. | Defense Technical Information Center<br>Cameron Station<br>Alexandria, VA 22314          | 2 |
| 31. | Dudley Knox Library<br>Code 0142<br>Naval Postgraduate School<br>Monterey, CA 93943      | 2 |
| 32. | Research Administration (Code 012)<br>Naval Postgraduate School<br>Monterey, CA 93943    | 1 |

**END**

**FILMED**

**2-86**

**DTIC**