NPS68-85-005

NAVAL POSTGRADUATE SCHOOL

Monterey, California

HYDROGRAPHIC DATA FROM THE OPTOMA PROGRAM
OPTOMA7
17-20 November 1983

by

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January 1985

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

NAVAL POSTGRADUATE SCHOOL

Monterey, California 93943

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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.

This report was Prepared by:

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: NPS 68-85-005	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): HYDROGRAPHIC DATA FROM THE OPTOMA PROGRAM OPTOMA7, 17-20 November 1983	5. TYPE OF REPORT & PERIOD COVERED: Report for October 1982 to January 1985
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Paul A. Wittmann, Michele M. Rienecker, Edward A. Kelley, Jr., Christopher N. K. Mooers	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Naval Postgraduate School, Monterey, CA 93943	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 61153N, N000148WR24051
11. CONTROLLING OFFICE NAME AND ADDRESS: Office of Naval Research (Code 420), Arlington, VA 22217	12. REPORT DATE: January 1985
	13. NUMBER OF PAGES: 26
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	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)

California Current System
Physical Oceanography
Dynamic Oceanography

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The cruise OPTOMA7 was undertaken in November 1983 to sample a subdomain of the California Current System. This report presents the hydrographic data, acquired by XBT and CTD casts, from the cruise.

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S/N 0102-LF-014-6601

Hydrographic Data from the **OPTOMA** *Program: OPTOMA7*

17 - 20 November, 1983

by

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Michele M. Rienecker
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The **OPTOMA** Program is a joint program of

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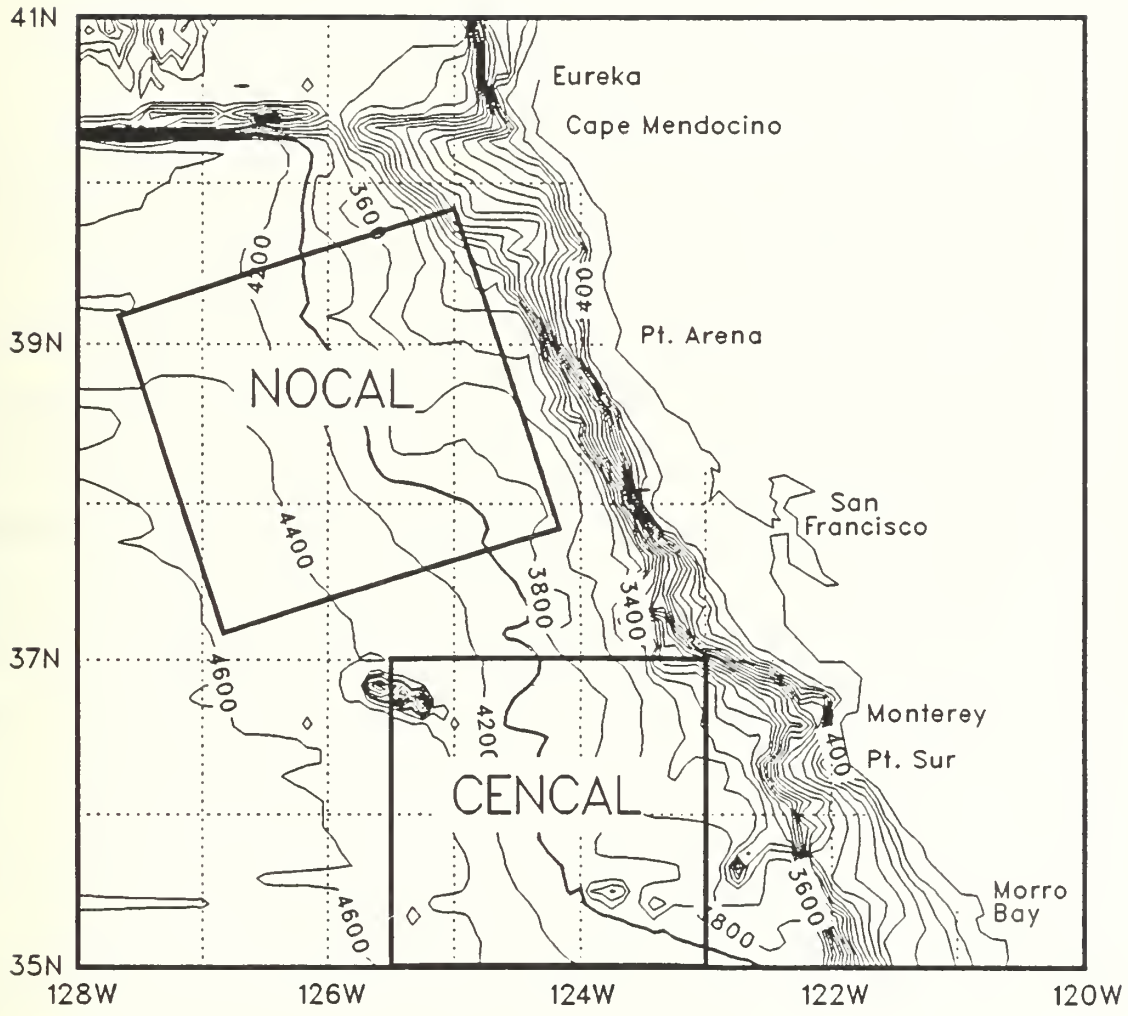


Figure 1: The NOCAL and CENCAL subdomains of the OPTOMA Program. Isobaths are shown in meters.

INTRODUCTION

The OPTOMA (Ocean Prediction Through Observations, 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 has been planned in two subdomains, NOCAL and CENCAL, shown in Figure 1.

The cruise OPTOMA7 was undertaken, in the R/V ACANIA, in November, 1983 and covered part of the CENCAL domain, roughly 200 km square centered about 200 km off the California coast from Pt. Sur.

Hydrographic data were acquired during the period 17 to 20 November in an area 120 km cross-shore by 170 km alongshore with an additional transect to the domain as shown in Figure 2. The transect extremes are identified by letter to aid in the cross-referencing of data presented in subsequent figures. The track pattern consisted of two diamonds with parallel tracks separated by roughly 60 km and along which hydrographic stations were occupied every 11 km.

DATA ACQUISITION

Data acquired during OPTOMA7 include XBT and CTD profiles and continuous 2 m thermalsalinograph measurements. A bucket surface temperature and a water sample for salinity were taken at every CTD station. These surface values and those at 2 m were used for calibration purposes as well as contributions to the data base. Continuous meteorological data such as atmospheric pressure at a height of 2 m and wind speed and direction at a height of 20 m were also recorded. The XBT, CTD and continuous "underway" data were digitized using a

HP 5328 frequency counter and a 40 channel digital voltmeter. The continuous data were averaged over two-minute intervals. All data were recorded, using an HP 9835 computer, on data cassettes and transferred ashore to the IBM 3033 mainframe computer for editing and processing.

Station positions were determined by Loran C fixes and are claimed to be accurate to within about 0.1 km. Table 1 on page 5 summarizes the various sensors available on the R/V ACANIA and their accuracy. The bottle surface salinity samples were determined ashore by a Guildline Model 8400 "Autosal" salinometer with an accuracy of $\pm$0.003 ppt.

DATA PROCESSING

Data processing, such as estimating depth profiles for the XBT temperature profiles based on the XBT's descent speed, and conversion of CTD conductivity to salinity using the algorithm given in Lewis and Perkin (1981), was carried out on the IBM 3033 at the Naval Postgraduate School. The data were then edited by removing obvious temperature and salinity spikes. All casts were retained in the data set. The CTD salinity profiles were corrected by reference to the 2m salinity and surface salinity measurements. The surface salinities from the CTD casts were too low on the average by 0.013 ppt; hence they were adjusted accordingly. The CTD data were interpolated to 5 m intervals and then up and down casts were averaged.

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

DATA PRESENTATION

The cruise track, station locations (with XBT's and CTD's identified) and station numbers are shown in Figures 2, 3, and 4, respectively. These figures are followed by a listing of the stations, with their coordinates, the date and time at which the station was occupied, and the surface information obtained at the station.

Vertical profiles of temperature from the XBT casts are shown in staggered fashion in Figure 5. The location of these profiles may be found by reference to the various maps of the cruise track. Transect extremes are identified as nearly as possible. The first profile on each plot is shown with its temperature unchanged; to each subsequent profile an appropriate multiple of 5C has been added. Vertical profiles from the CTD's follow. Profiles of temperature are staggered by 5C and those of salinity by 4 ppt.

Isotherms for each transect are shown in the next pages, followed by isopleths of temperature, salinity and sigma-t from the CTD's. Based on instrument accuracy and the vertical temperature gradient, it is estimated that depths of isotherms in the main thermocline are uncertain to $\pm$20m. The tick marks identify station positions and, again, the transect extremes are shown on these plots.

Mean profiles of temperature from the XBT's and temperature, salinity and sigma-t from the CTD's are given in Figures 9 and 10, followed by a scatter diagram of the T-S pairs and the mean S(T) curve with the $\pm$ standard deviation envelope. The data presentation concludes with a plot of the mean N^2 (Brunt-Vaisala frequency squared) profile with $\pm$ the standard deviation. On the sigma-t and N^2 plots, the appropriate profiles derived from the mean temperature and mean salinity profiles are also shown.

Table 1: Scientific instruments aboard the R/V ACANIA

	Instrument	Variable	Sensor	Accuracy	Resolution
	Neil Brown CTD Mark IIIb	pressure	strain gage	1.6 db	0.025 db
		temperature	thermistor	0.005 C	0.0005 C
		conductivity	electrode cell	0.005 mmho	0.001 mmho
	Sippican BT	temperature	thermistor	0.2 C	
		depth	descent speed	greater of 4.6 m and 2% of depth	
*	Guildline Autosal	conductivity	electrode cell	0.003 ppt	0.0002 ppt
*	Amatek straza ADVP	velocity profiles to 100m	4 beam sonar	3 cm/sec relative to ship speed	3 cm/sec
*	Rosemount Sensor	sea surface temperature	platinum thermometer	0.05 C	0.005 C
	Sea-Bird Sensors	temperature	thermistor	0.003 C	0.0005 C
		conductivity at 2 meters	electrode cell	0.003 mmho	0.0005 mmho
	Rosemount Sensor	air temperature	thermometer	0.01 C	
	Kavolico Barometer	atmospheric pressure	pressure transducer	1.5 mb	0.1 mb
*	1200 EPS Hygrometer	dew point	condensation temp. sensor	0.2 C	0.02 C
	Meteorology Res. Inc.	wind speed	anemometer	0.15 mph or 1%	
	Meteorology Res. Inc.	wind direction	vane	2.5 degrees	
	Internav LC408 LORAN C	position	two chain LORAN receiver	100 meters	10 meters
	Motorola Miniranger	position	microwave transponders	4 meters	2 meters

* Not operating on the OPTOMA7 cruise.

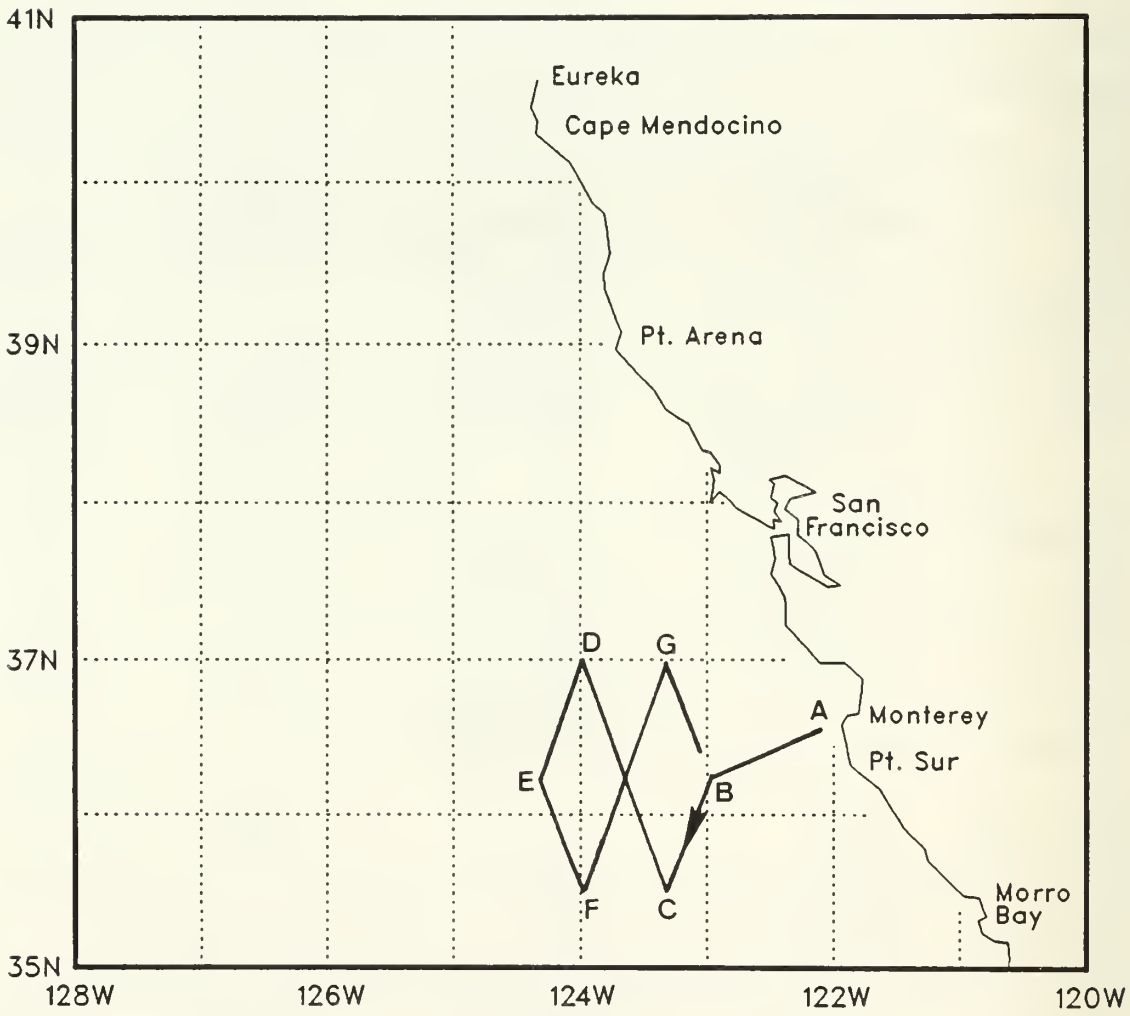


Figure 2: Cruise track for OPTOMA7 with transect extremes identified by letter.

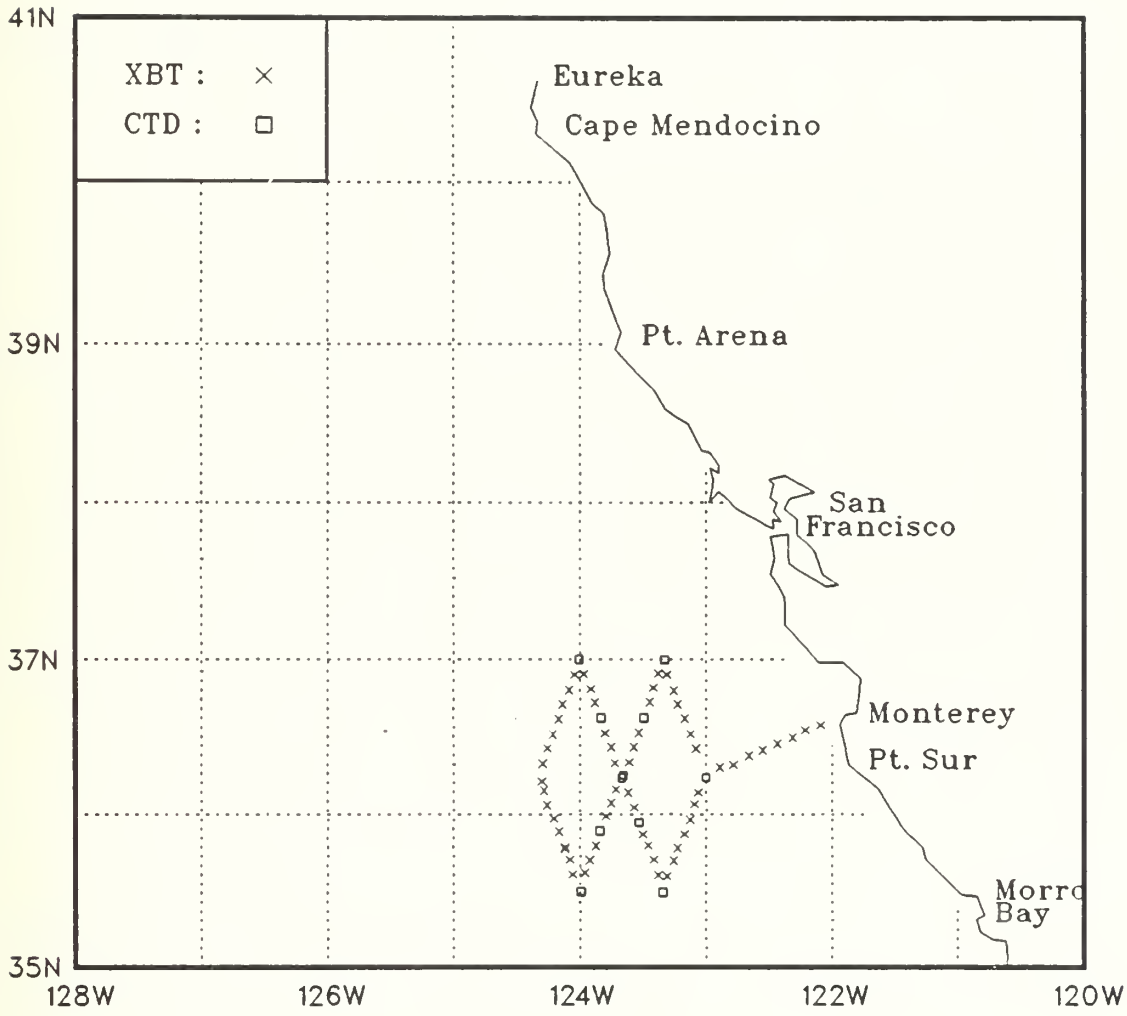


Figure 3: XBT and CTD locations for OPTOMA7.

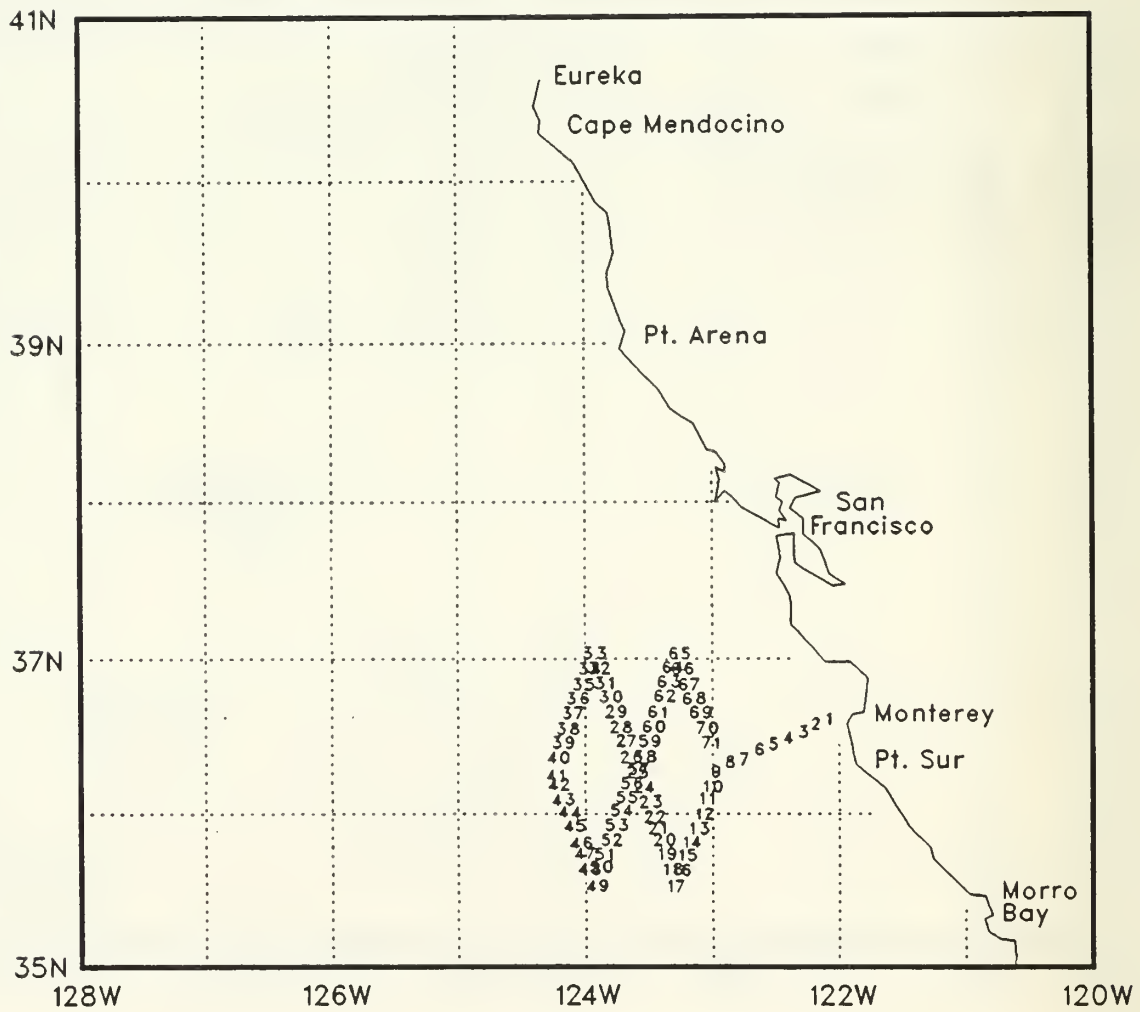


Figure 4: Station numbers for OPTOMA7.

Table 2: 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	83322	151	36.35	122.05	15.9			
2	XBT	83322	237	36.33	122.13	16.2			
3	XBT	83322	315	36.30	122.19	16.2			
4	XBT	83322	359	36.28	122.26	16.8			
5	XBT	83322	441	36.25	122.33	16.4			
6	XBT	83322	520	36.23	122.39	16.3			
7	XBT	83322	609	36.19	122.47	16.2			
8	XBT	83322	649	36.18	122.53	16.3			
9	CTD	83322	841	36.14	123.00	16.4	33.16	16.4	33.10
10	XBT	83322	948	36.09	123.04	16.3			
11	XBT	83322	1022	36.04	123.05	16.5			
12	XBT	83322	1104	35.58	123.07	16.5			
13	XBT	83322	1146	35.52	123.10	16.8			
14	XBT	83322	1226	35.47	123.13	16.7			
15	XBT	83322	1302	35.42	123.15	16.6			
16	XBT	83322	1346	35.36	123.18	16.8			
17	CTD	83322	1506	35.29	123.20	16.6	33.02	15.6	33.04
18	XBT	83322	1638	35.36	123.23	16.6			
19	XBT	83322	1725	35.42	123.25	16.6			
20	XBT	83322	1811	35.48	123.27	16.4			
21	XBT	83322	1848	35.52	123.30	16.8			
22	CTD	83322	1949	35.57	123.32	16.3	33.15		33.10
23	XBT	83322	2050	36.03	123.34	16.7			
24	XBT	83322	2136	36.08	123.37	16.2			
25	CTD	83322	2306	36.14	123.40	15.9	32.96	15.7	32.98
26	XBT	83323	34	36.20	123.43	16.2			
27	XBT	83323	120	36.26	123.45	16.3			
28	XBT	83323	201	36.32	123.48	16.0			
29	CTD	83323	258	36.38	123.50	16.0	33.08	16.0	33.10
30	XBT	83323	355	36.43	123.53	16.5			
31	XBT	83323	433	36.49	123.55	16.7			
32	XBT	83323	517	36.55	123.58	16.1			
33	CTD	83323	628	37.00	124.00	16.1	33.25	15.8	33.25
34	XBT	83323	748	36.54	124.02	16.0			
35	XBT	83323	833	36.48	124.05	16.4			
36	XBT	83323	915	36.43	124.08	16.2			
37	XBT	83323	957	36.37	124.10	16.1			
38	XBT	83323	1041	36.31	124.13	16.0			
39	XBT	83323	1120	36.26	124.15	16.3			
40	XBT	83323	1204	36.20	124.18	16.2			
41	XBT	83323	1420	36.13	124.18	16.2			
42	XBT	83323	1443	36.09	124.17	16.5			
43	XBT	83323	1523	36.03	124.16	16.1			
44	XBT	83323	1559	35.58	124.12	16.6			
45	XBT	83323	1636	35.53	124.10	17.4			

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	83323	1723	35.46	124.07	17.6			
47	XBT	83323	1752	35.42	124.05	17.7			
48	XBT	83323	1831	35.36	124.03	17.6			
49	CTD	83323	1953	35.30	123.59	17.6	33.17	17.8	33.21
50	XBT	83323	2125	35.37	123.57	17.2			
51	XBT	83323	2202	35.42	123.55	17.5			
52	XBT	83323	2244	35.48	123.52	17.0			
53	CTD	83323	2338	35.54	123.50	16.4	33.05	*	*
54	XBT	83324	30	35.59	123.48	16.1			
55	XBT	83324	107	36.04	123.45	16.2			
56	XBT	83324	145	36.10	123.43	16.8			
57	CTD	83324	258	36.15	123.39	15.9	32.95	16.0	32.94
58	XBT	83324	411	36.20	123.37	16.0			
59	XBT	83324	453	36.26	123.34	16.1			
60	XBT	83324	531	36.32	123.32	16.0			
61	CTD	83324	629	36.38	123.30	15.8	32.94	16.0	32.95
62	XBT	83324	727	36.44	123.27	15.9			
63	XBT	83324	807	36.49	123.25	15.9			
64	XBT	83324	848	36.55	123.23	16.5			
65	CTD	83324	943	37.00	123.20	16.3	33.13	15.8	33.10
66	XBT	83324	1039	36.54	123.18	16.7			
67	XBT	83324	1122	36.48	123.15	16.3			
68	XBT	83324	1200	36.43	123.13	15.9			
69	XBT	83324	1239	36.37	123.10	16.1			
70	XBT	83324	1322	36.31	123.07	16.4			
71	XBT	83324	1403	36.26	123.05	16.3			

* Data not available.

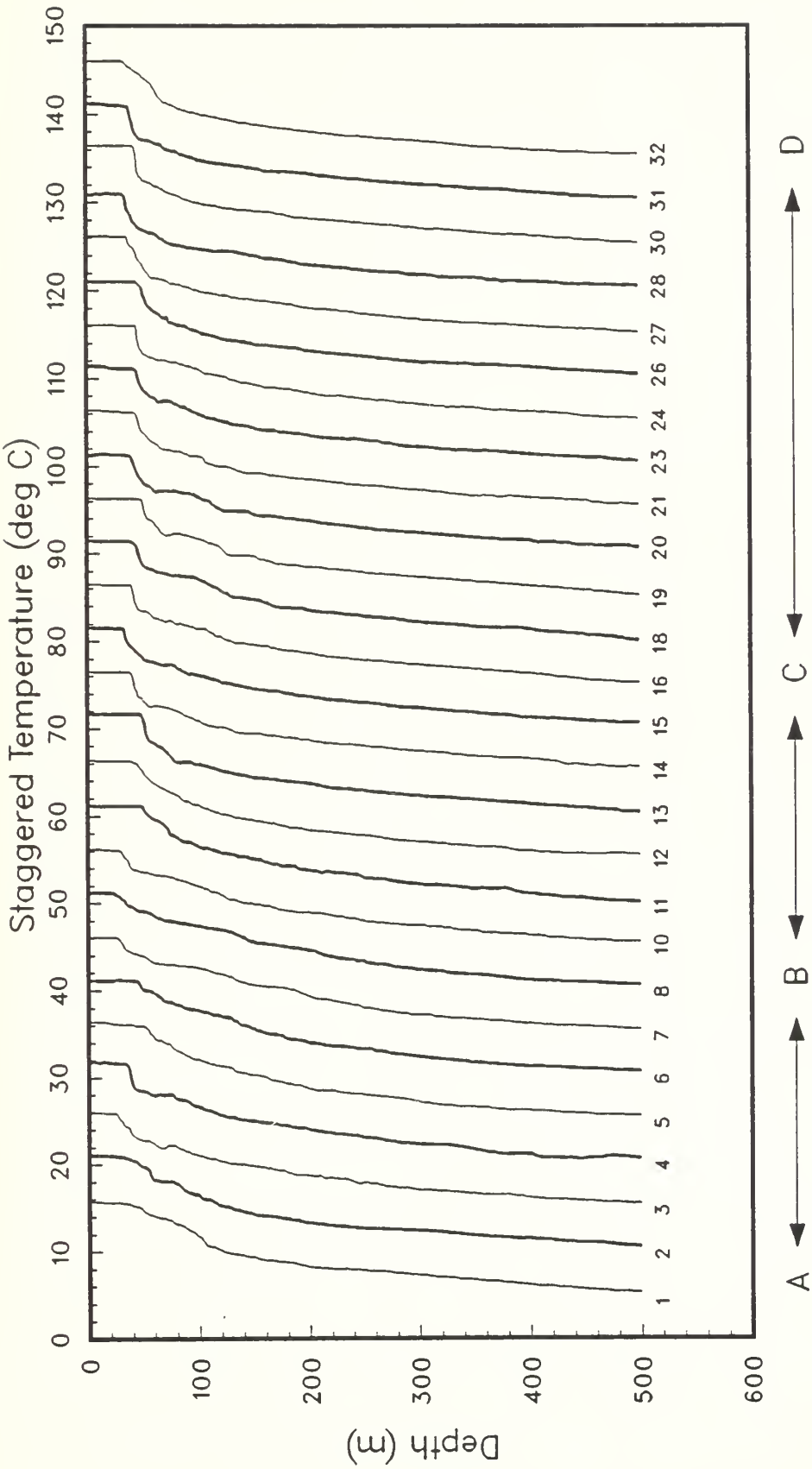


Figure 5(a): Staggered temperature profiles from the XBT's. Profiles are staggered by a multiple of 5C. (OPTOMA7).

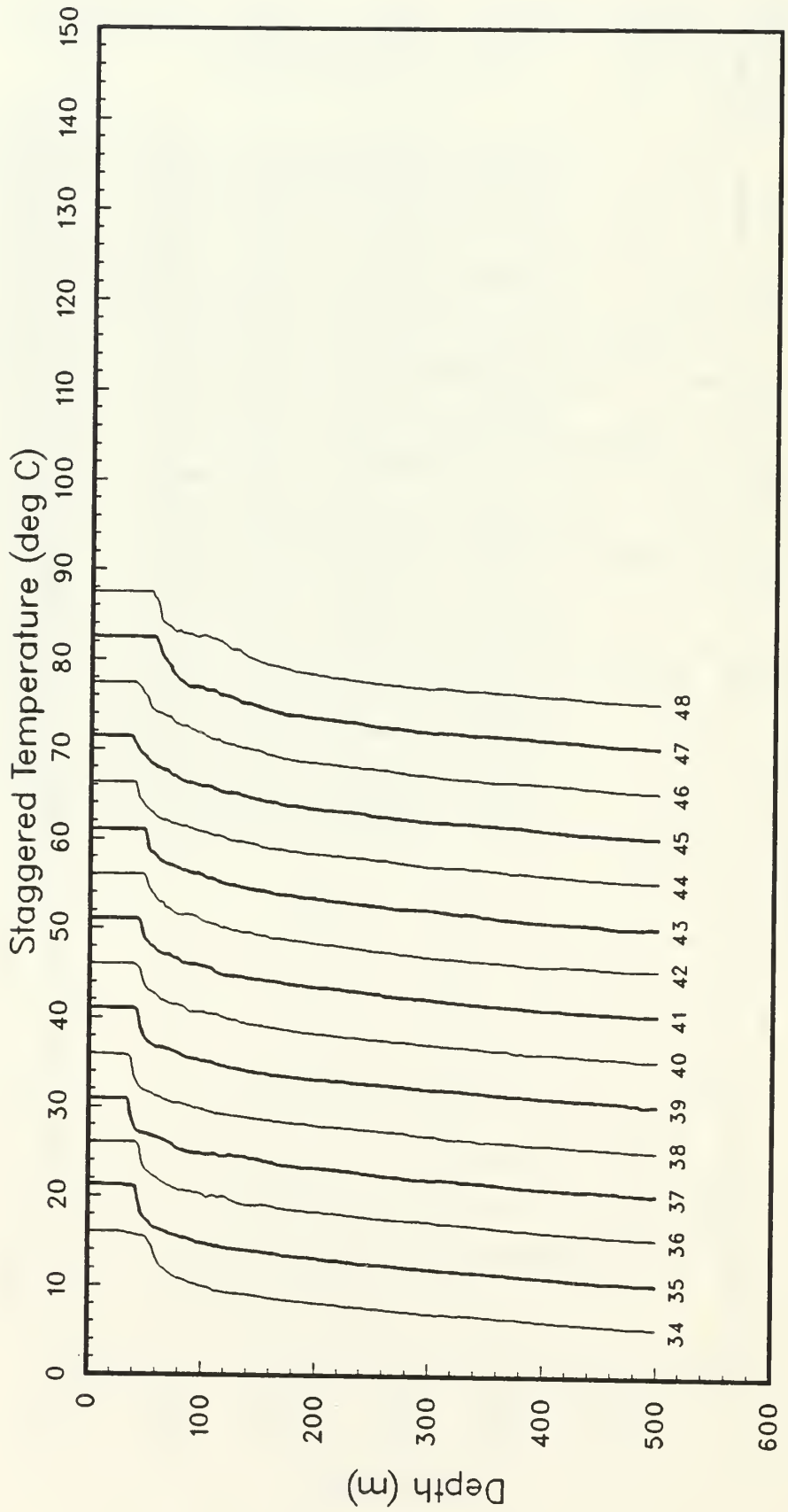

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Depth (m)
0
100
200
300
400
500
600
34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
D
E
F

Figure 5(b).

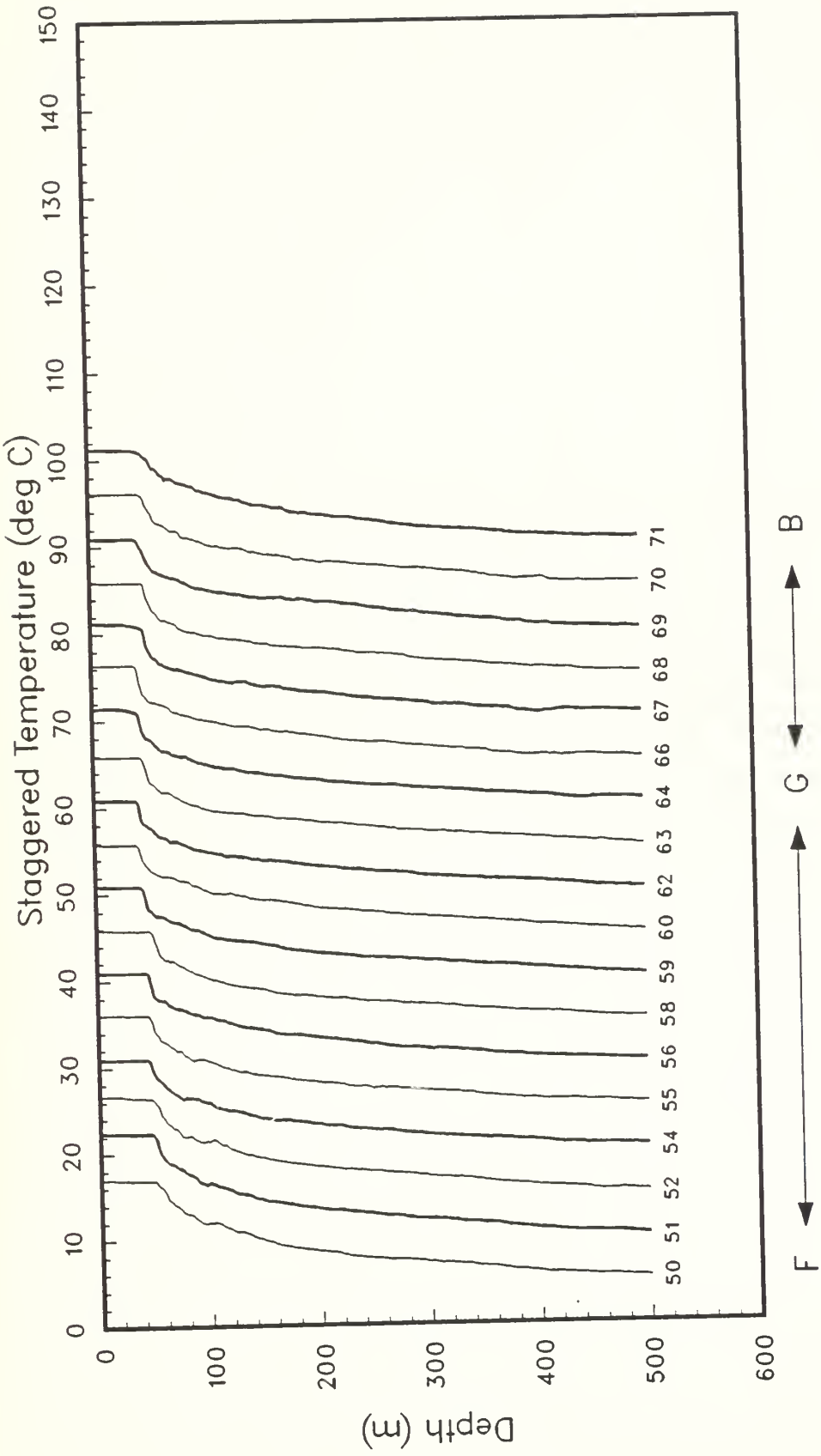

Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Depth (m)
0
100
200
300
400
500
600
50 51 52 54 55 56 58 59 60 62 63 64 66 67 68 69 70 71
F
G
B

Figure 5(c).

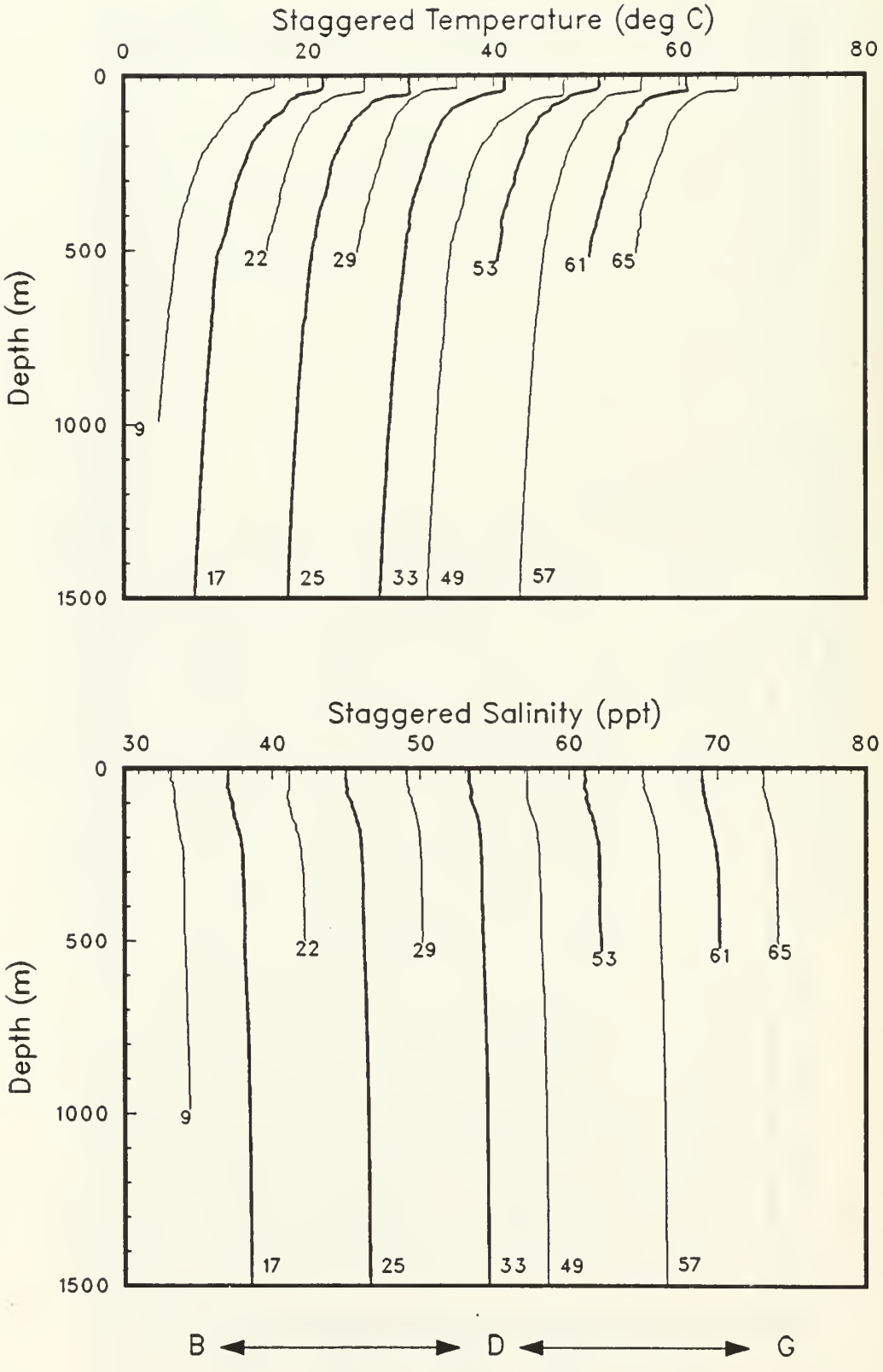
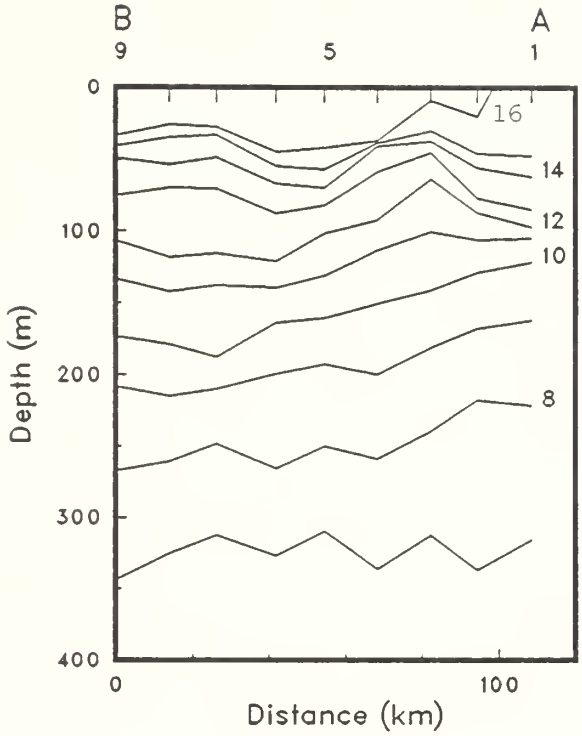
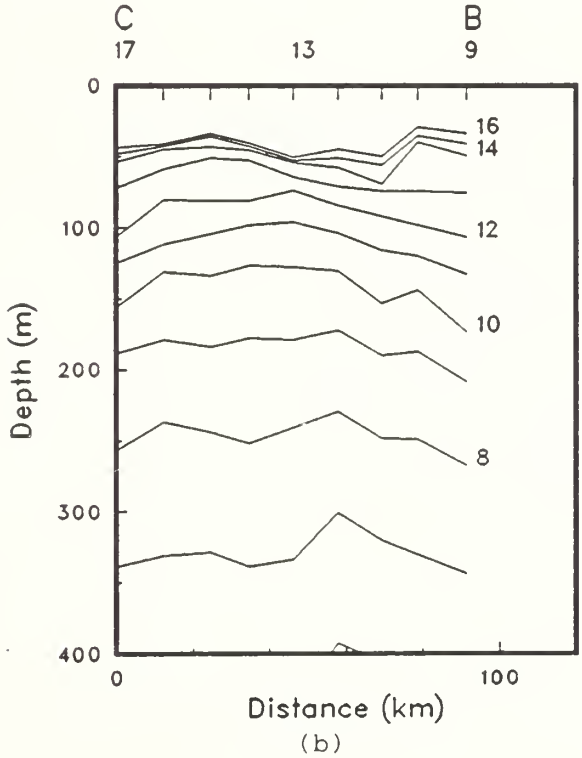


Figure 6: CTD temperature profiles, staggered by multiples of 5C, and salinity profiles, staggered by multiples of 4 ppt. (OPTOMA7).



(a)



(b)

Figure 7(a), (b): Isotherms from XBT's and CTD's. Tick marks along the upper horizontal axis show station positions. Some station numbers are given. (OPTOMA7).

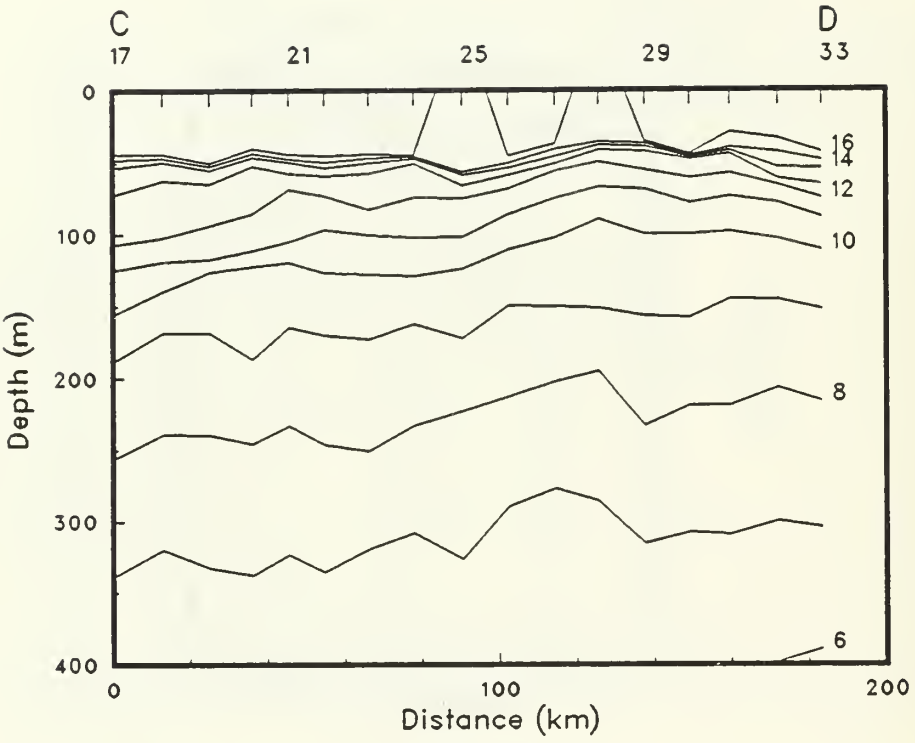


Figure 7(c).

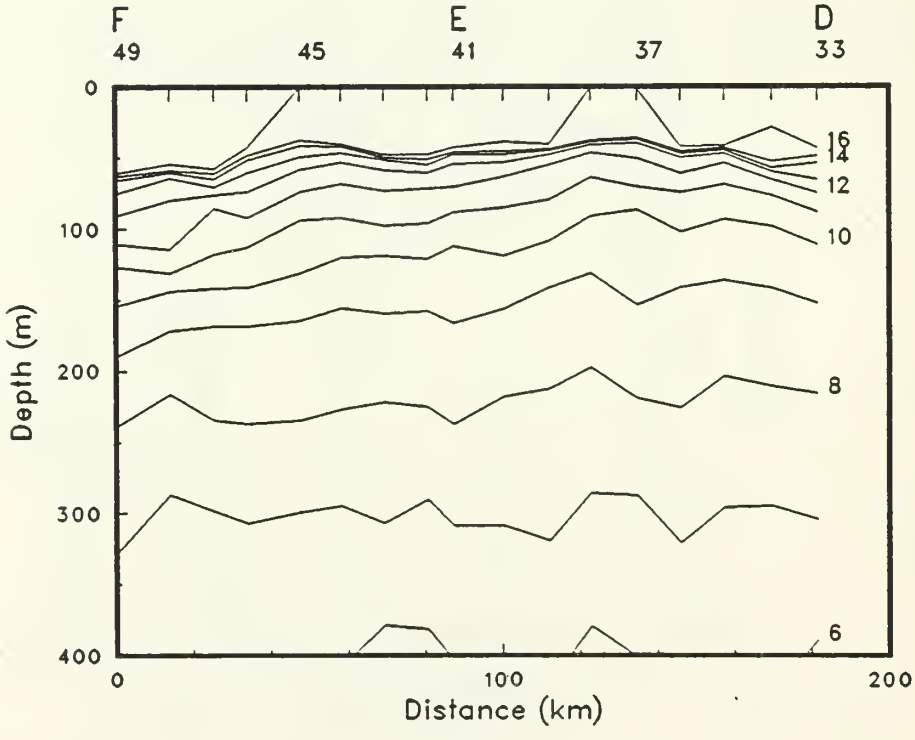


Figure 7(d).

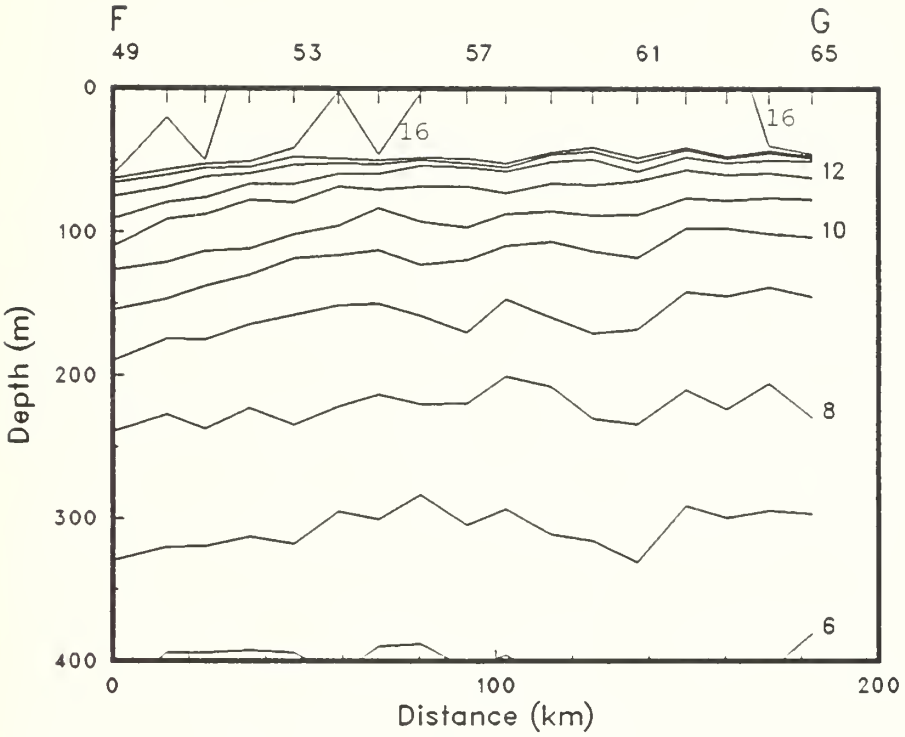


Figure 7(e).

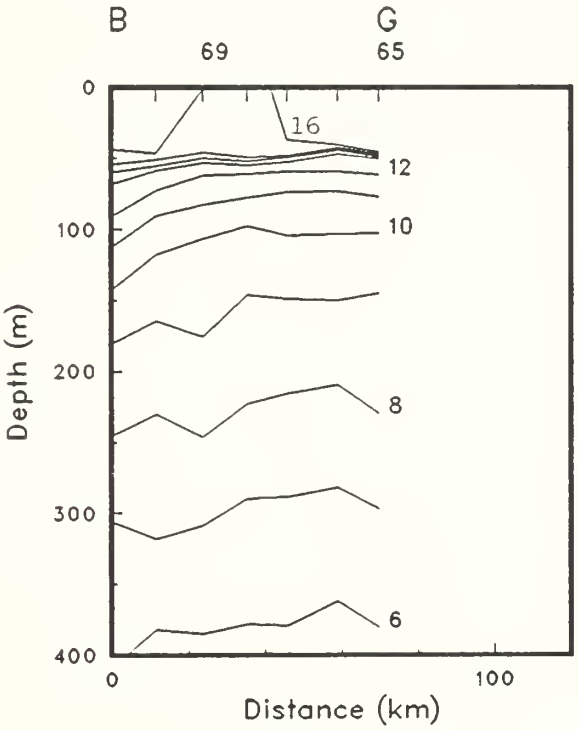


Figure 7(f).

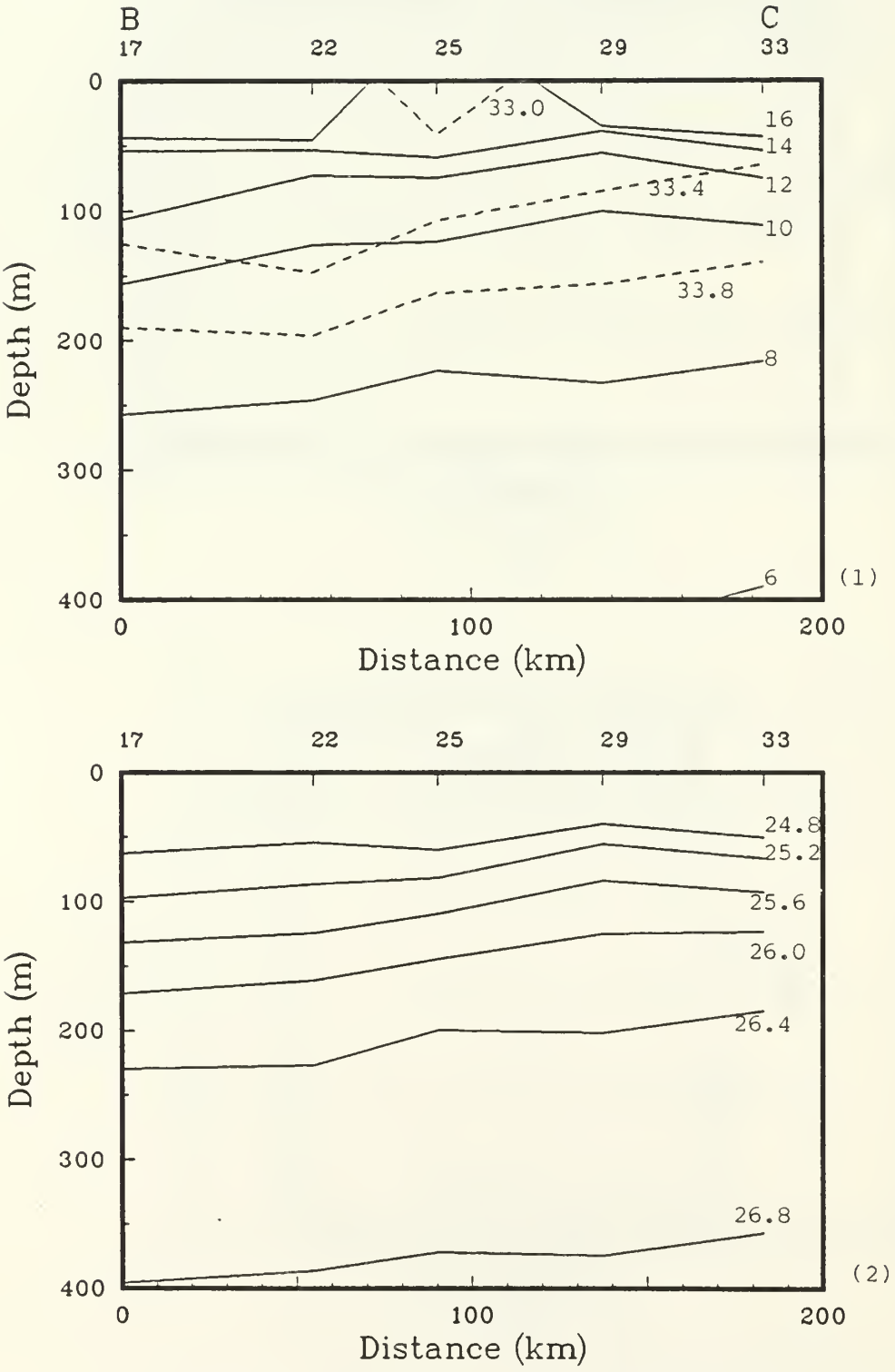


Figure 8(a): Isopleths of (1) temperature and salinity and (2) sigma-t from the CTD's. (OPTOMA7).

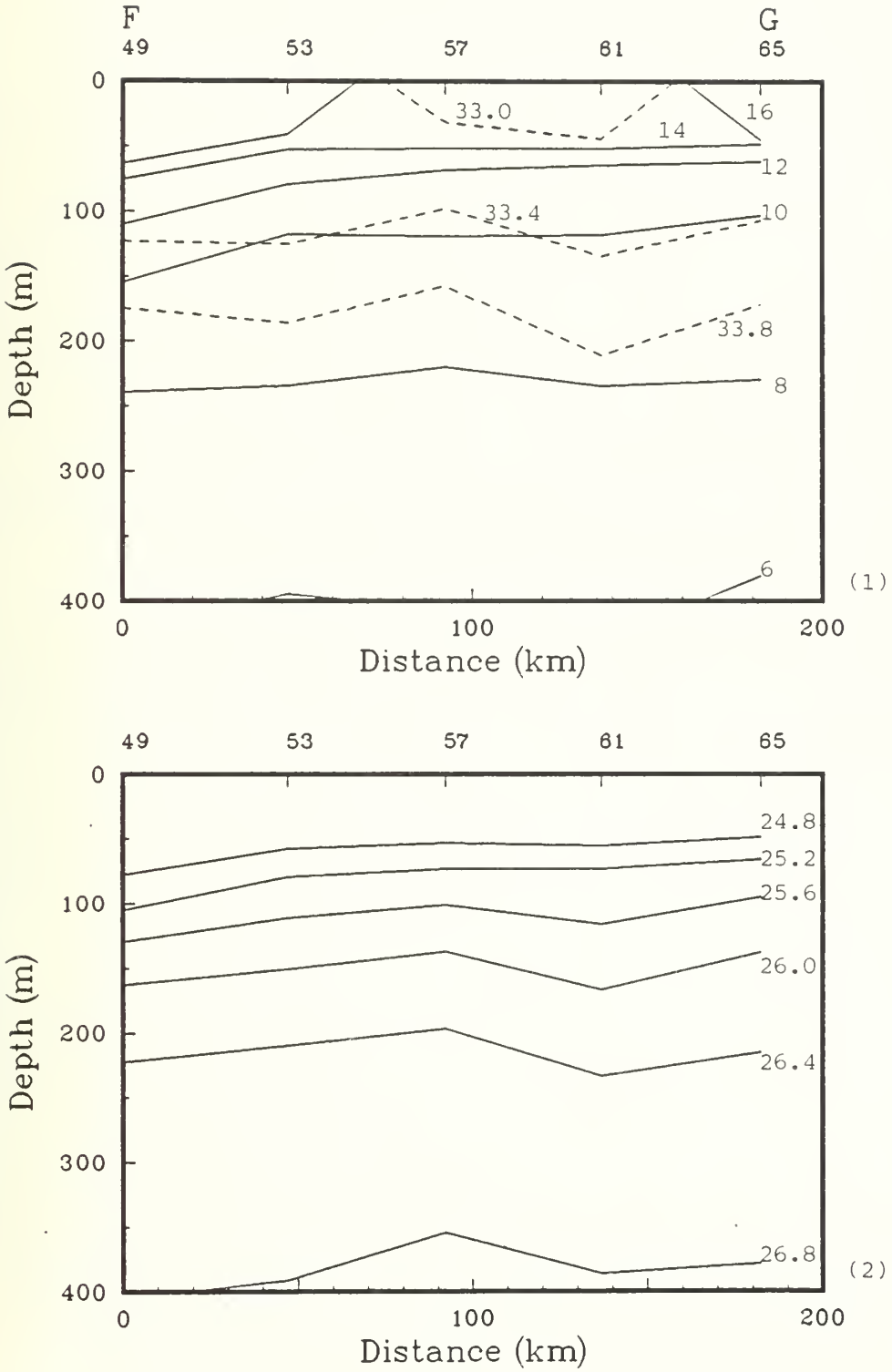

F
G
49
53
57
61
65
0
100
200
300
400
Depth (m)
33.0
16
14
12
33.4
10
33.8
8
6
(1)
0
100
200
Distance (km)
49
53
57
61
65
0
100
200
300
400
Depth (m)
24.8
25.2
25.6
26.0
26.4
26.8
(2)
0
100
200
Distance (km)

Figure 8(b).

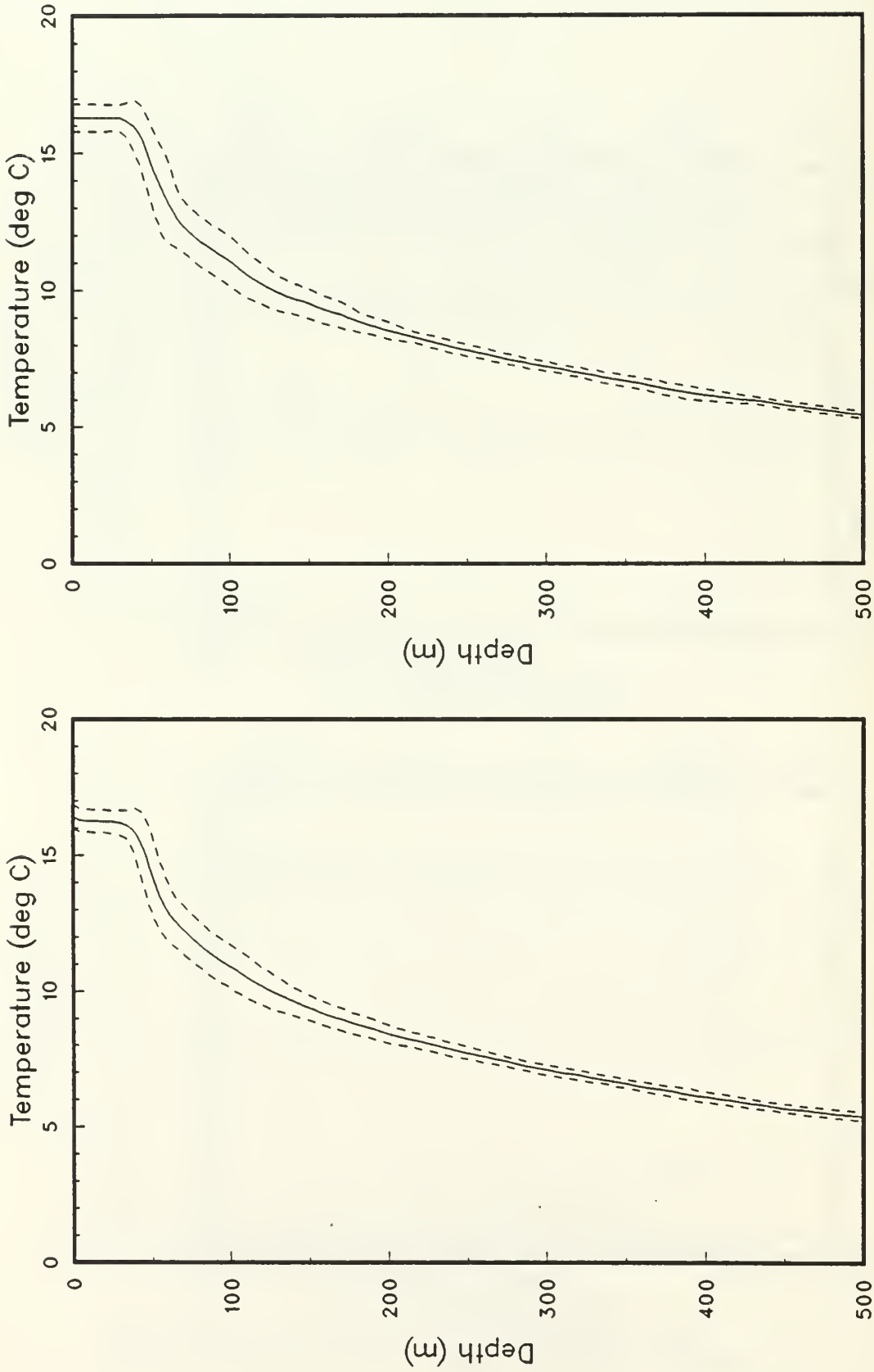


Figure 9: Profiles of $\overline{T(z)}$ with + and - the standard deviation from (a) XBT's and (b) CTD's. (OPTOMA7).

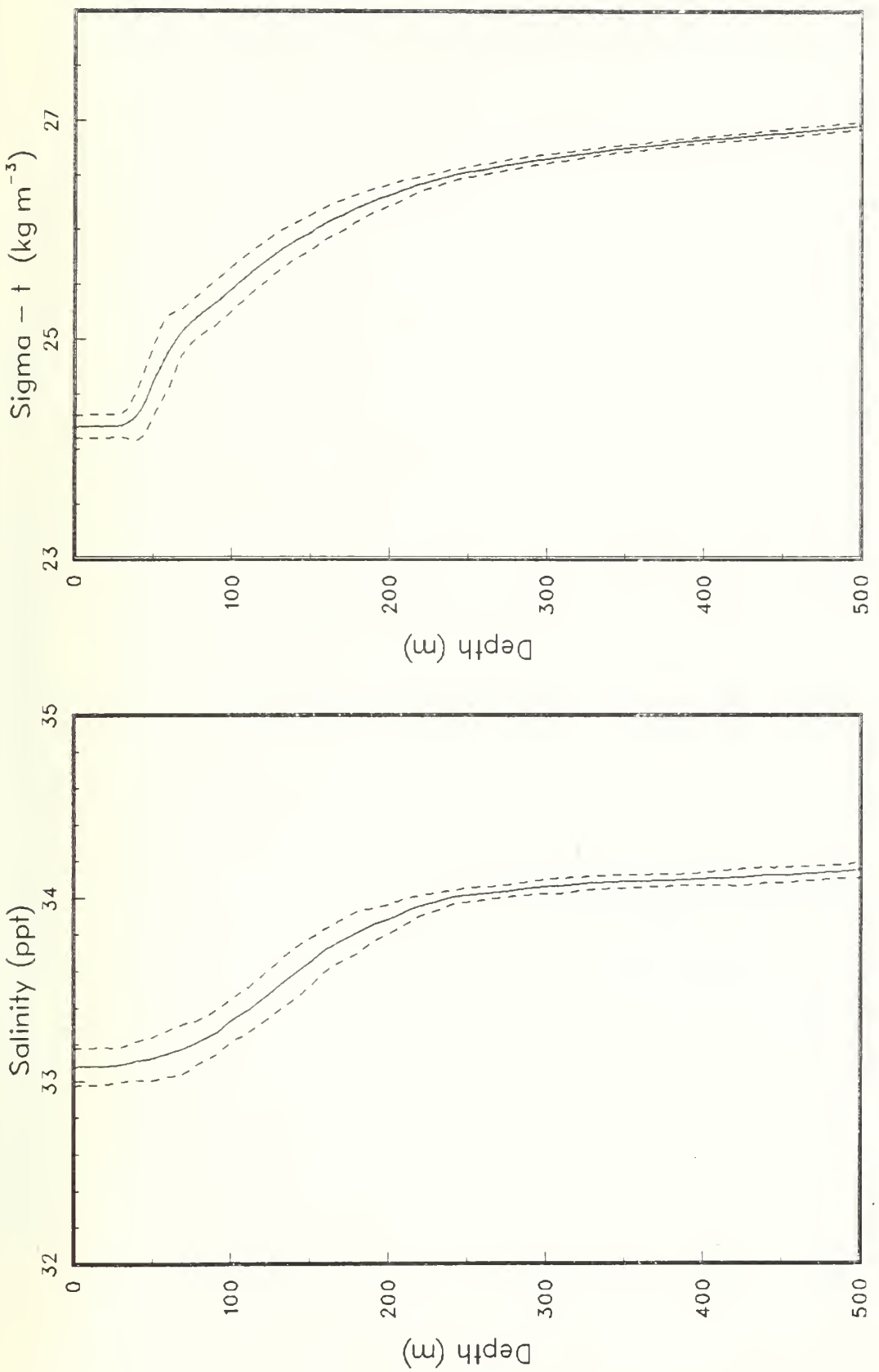


Figure 10: Profiles of (a) mean salinity and (b) mean sigma-t, with + and - the standard deviations, from the CTD's. (OPTOMA7).

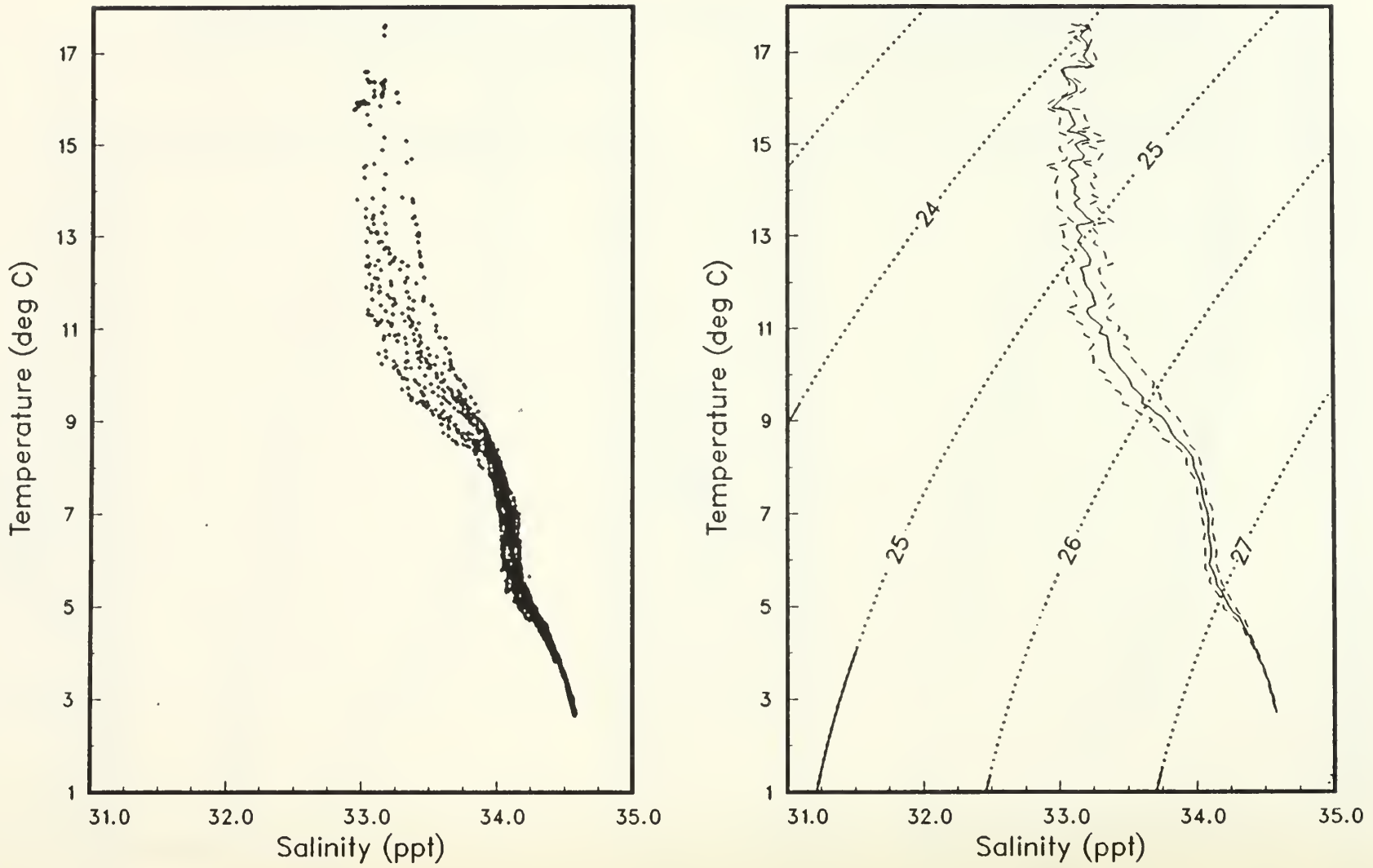


Figure 11: (a) T-S pairs and (b) mean T-S relationship, with + and - the standard deviation and selected sigma-t contours, from the CTD casts. (OPTOMA7).

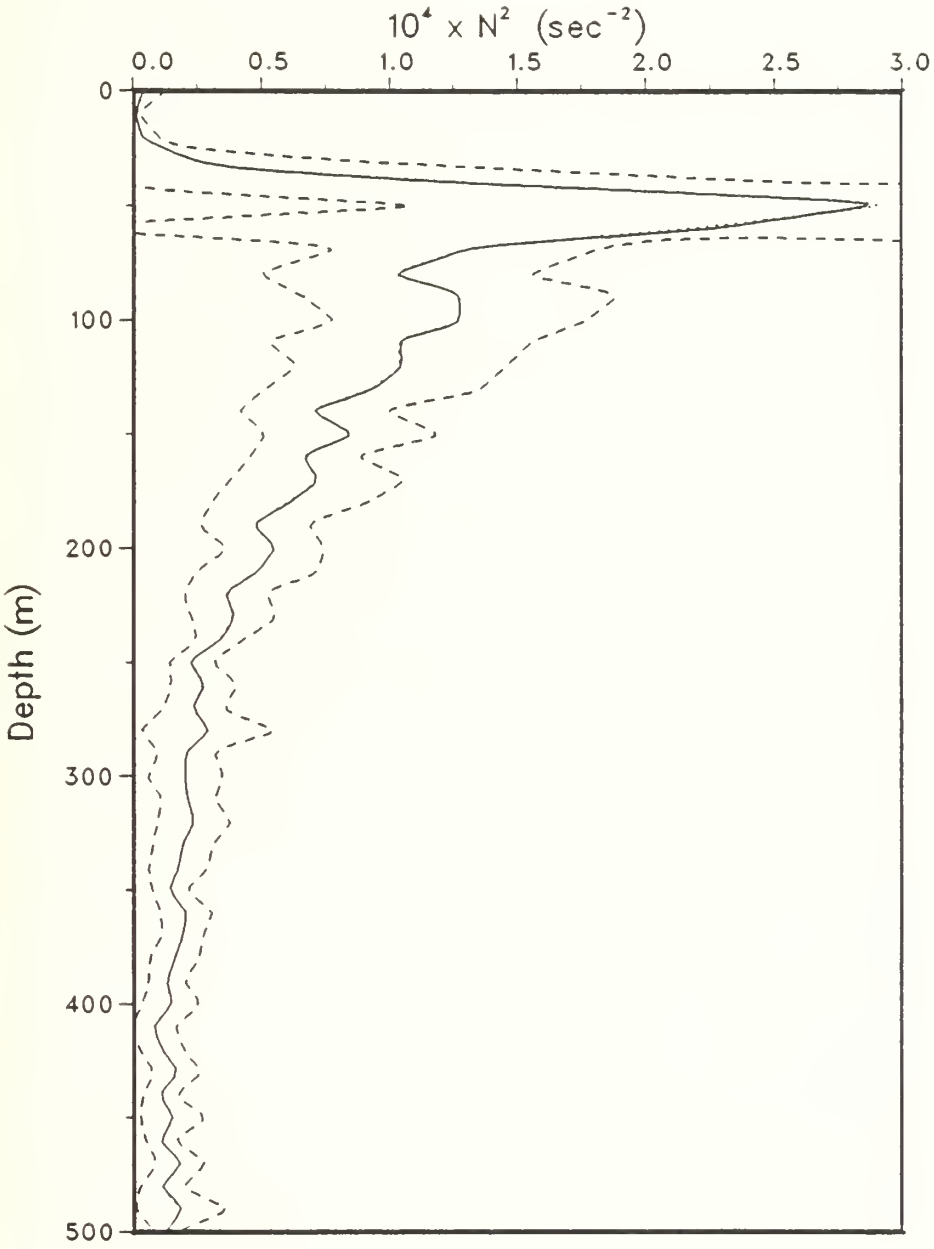


Figure 12: Profile of $\overline{N^2(z)}$ (——), with + and - the standard deviation (----), and the profile of N^2 from $\overline{T(z)}$ and $\overline{S(z)}$ (••••).(OPTOMA7).

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 Captain Steve Bliss and other crew members of the R/V ACANIA. Members of the scientific cruise party were:

Personnel: Ms. Marie Colton, Co-Party Chief, NPS
Mr. Paul Wittmann, Co-Party Chief, NPS
Mr. Harrison Faulkner, NPS
LCDR Rodney Bartsch, USN, NPS
AG3 Lisa Campbell, USN, FNOC
DP2 Lawrence McLaughlin, USN, FNOC

REFERENCE

Lewis, E.L. and R.G. Perkin, 1981: The Practical Salinity Scale 1978: conversion of existing data. Deep Sea Res. 28A, 307-328.

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