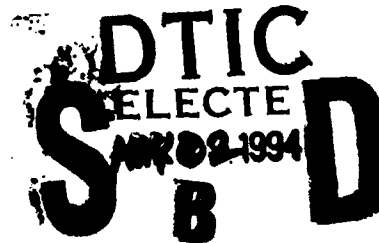


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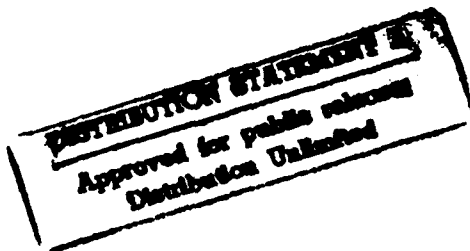


Environmental Measurements in the Beaufort Sea, Spring 1993

by T. Wen and F. Karig



Technical Memorandum
APL-UW TM4-93
December 1993



This Technical Memorandum
has received limited review.



Applied Physics Laboratory University of Washington
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Acknowledgments

The research presented in this report was sponsored by the organizations participating in the ICEX 1-93 Applied Physics Laboratory Ice Station (APLIS). Funding was provided by the Naval Sea Systems Command, Code 06UR43. Participating laboratories were the Naval Undersea Warfare Center, New London Laboratory; the Naval Undersea Warfare Center, Arctic Submarine Laboratory; and the Naval Surface Warfare Center, Carderock Division.

The purpose of this report is simply to present the environmental data obtained during the camp. The data analysis is very limited. All the data presented here are stored in digital format and are available for further analysis. Requests for data should be forwarded to

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ABSTRACT

This report presents environmental data obtained by the Applied Physics Laboratory of the University of Washington (APL-UW) at APLIS 93, an ice camp established in the Beaufort Sea in Spring 1993 to support Navy-sponsored tests and research during ICEX 1-93. Data analysis is limited because the purpose of this report is to provide field data to ice camp participants. The data were collected to document the meteorological and oceanographic conditions that existed during camp activities. The main data sets are weather, floe drift, STD profiles, currents, and ice properties.

I. INTRODUCTION

This report presents environmental data taken in the spring of 1993 at APLIS (Applied Physics Laboratory Ice Station) in the Beaufort Sea. The ice camp was established and maintained by personnel from the Applied Physics Laboratory, University of Washington, to support Navy-sponsored research and test activities conducted by the organizations participating in ICEX 1-93. The environmental data — weather, floe drift, STD profiles, currents, and ice properties — were gathered by APL-UW personnel and are intended to support the analysis of experimental data obtained by ICEX 1-93 participants. APL-UW has been conducting acoustic and oceanographic research in the Arctic since the 1970s. The ICEX 1-93 data are therefore part of a growing database for the Beaufort Sea.

APLIS 93 was established on a multiyear floe approximately 275 km north of Prudhoe Bay, Alaska (see Figure 1). The floe was selected on 22 March after a one-day search. Camp setup took place the following week. During this build-up phase, five people erected a mess hall, sleeping quarters, generators, and control building. Collection of environmental data started on 29 March and lasted until 16 April, when the objectives of ICEX 1-93 were met. During the test period, personnel at the camp numbered as many as 35 and dwindled to only a few near the end. Evacuation of the camp was completed on 17 April.

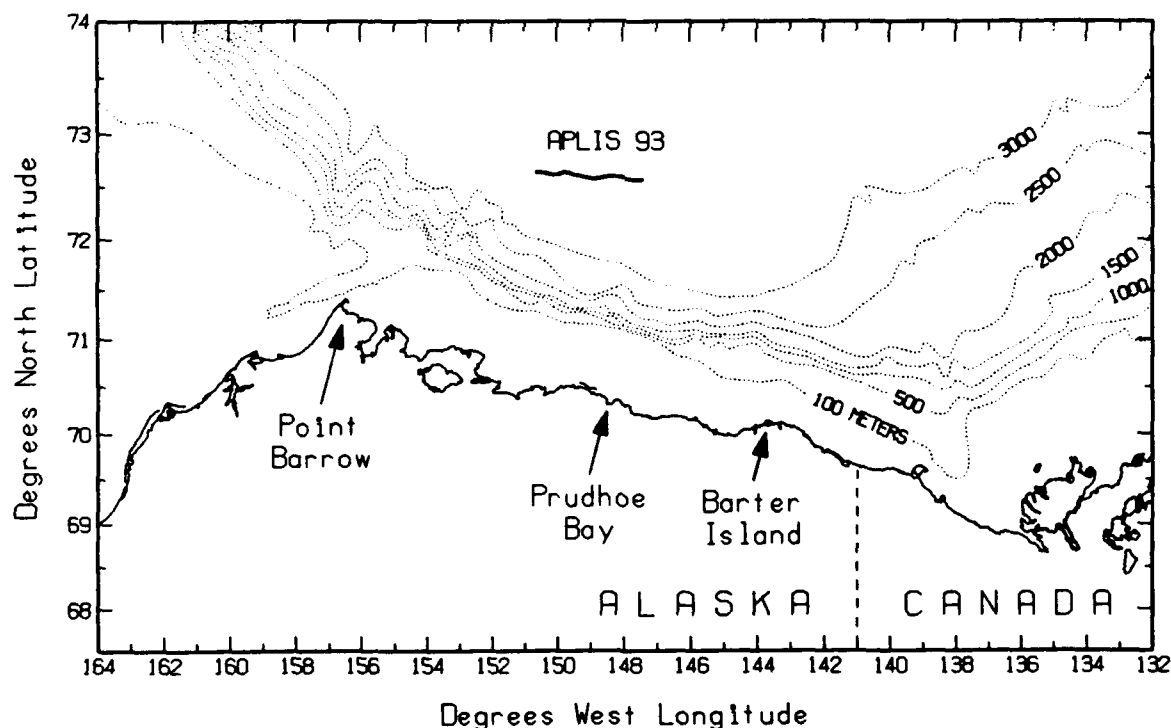


Figure 1. Position of APLIS 93.

For quick access to a runway, a site at the edge of the floe next to a flat refrozen lead was chosen for the camp. The thickness of the ice at the camp and at other level locations of the floe was 2–3 m. The runway lead was about 1 m thick and over 500 m long. An underwater acoustic tracking range consisting of four hydrophones was deployed to track underwater vehicles participating in the ICEX tests.

Air temperature and pressure and wind speed and direction were recorded automatically at 5-minute intervals. The weather was generally calm, except for a 24-hour period during which high winds built up snow drifts in and around the camp.

Because the floe drifted in response to wind stress, its position needed to be tracked for the analysis of some data such as satellite imagery. Latitude and longitude of the floe supplied by a GPS receiver were logged at 30-minute intervals and also used to determine drift speed and direction.

CTD casts were made often to determine the properties of the water column down to 350 m. Sound speed profiles were then derived from the measured temperature and salinity and were used to predict the real-time performance of acoustic equipment and the underwater tracking range.

The time of acquisition for some data is tagged ‘L’ for local time, while others are tagged ‘UTC’ for Universal Coordinated Time. Local time is UTC – 9 hours.

Because the purpose of this report is simply to present environmental data from the camp, analysis is very limited. All data presented here are stored in digital format and are available upon request. The Spring 1993 CTD data, as well as those from previous years, are also available from the National Oceanographic Data Center in Washington, D.C.

II. THE FLOE

Selection of an ice floe suitable for a camp was based on several requirements. First, we needed a refrozen lead long enough and thick enough (at least 1 m) to serve as a runway, since transportation to and from the camp depended entirely on aircraft (only one Twin Otter this year). Second, the floe had to be over deep water for the long-range underwater tracking operation. This required that the camp be located north of 72° latitude, where the water is at least 3000 m deep. Third, the initial site had to be far enough east to allow for the westerly drift that would (historically) occur during the period of camp occupancy. As in previous years, the first criterion narrowed down the usable floes to those north of 72°N so the second criterion was fulfilled automatically. This year, a suitable floe was found at 72.5°N and 147.1°W after one day of air search.

The camp was established at the edge of the floe, next to a refrozen lead (see Figure 2). Ice in the floe, excluding hummocks, varied from 2 to 3 m thick, with a snow cover of 5–10 cm. Ice in the refrozen lead was 1 m thick with the same amount of snow cover. A 550-m runway was constructed on the lead by leveling off the uneven snow cover with a snowmobile-towed grader. Figure 3 shows an ERS-1 C-band microwave SAR image of the ice pack. The X marks the location of the camp. In this image, made on 15 April, light areas represent multiyear ice and dark areas represent first-year or young ice. The darkest area, such as the one found in the upper right-hand corner, was most likely open water.



Figure 2. Aerial photo of ice camp.

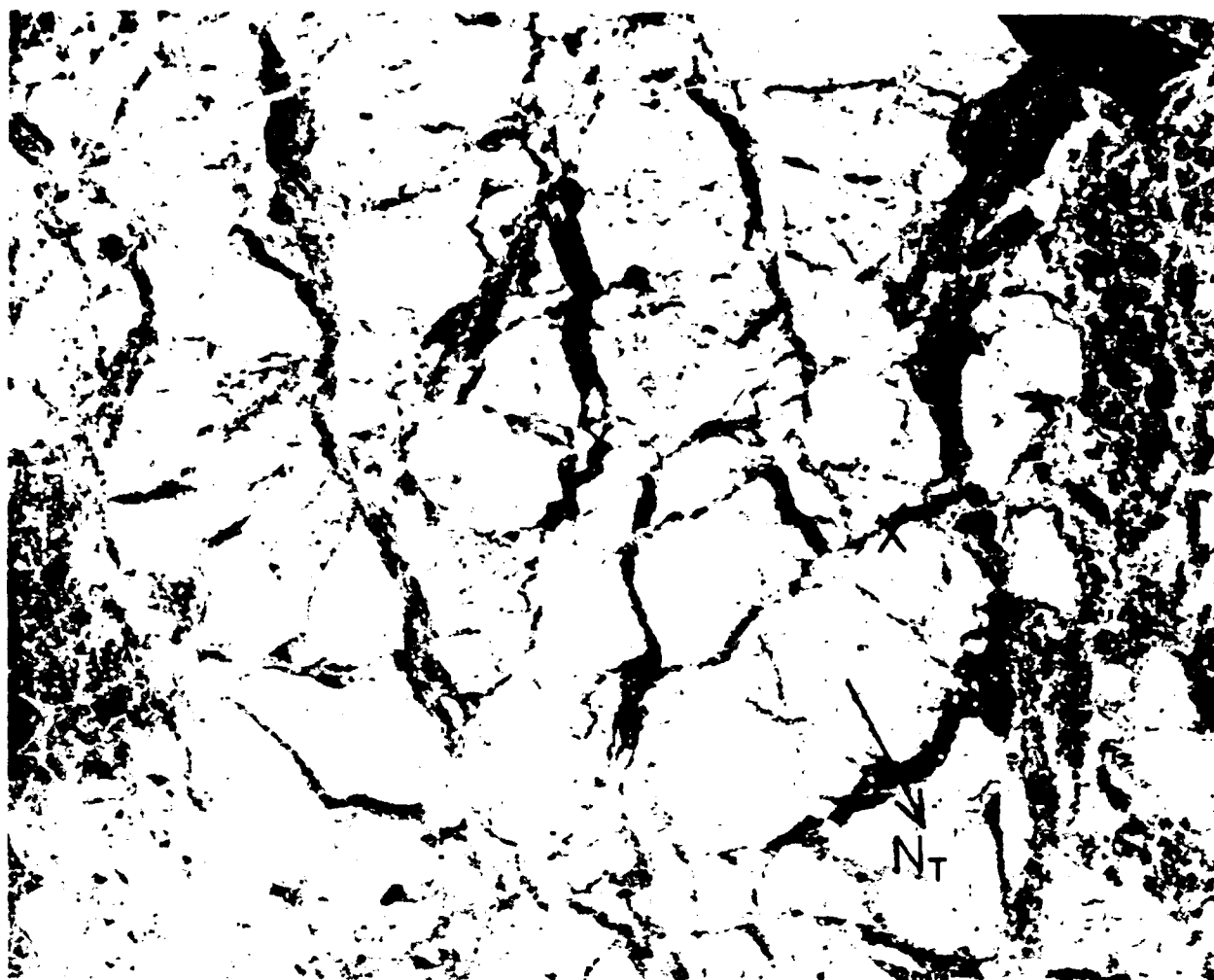


Figure 3. C-band microwave SAR image of 25 km $\times$ 25 km area containing the ice floe. ERS-1, Beaufort Sea, 15 April 1993. Dark areas represent mostly first-year ice and some open water. (Copyright European Space Agency; provided by Alaska SAR facility)

The ICEX 1-93 tests involved submarines. To track the submarines, we set up an underwater tracking range with an imaginary X-Y coordinate system shown in Figure 4. The origin of the coordinate system was a 1-m-diameter hydrohole (marked "O" on the figure) beneath the control building. Four hydrophones, each approximately 500 m from the camp, were suspended at 30.5-m depth for receiving cw pulses transmitted by the submarines. The signals were cabled back to the control building, filtered, amplified, validated, and time stamped. An x,y fix can then be made based on the time-of-flights and an average sound speed. The operational distance of the range is 15,000 m, sometimes as far as 20,000 m, but with large scatter in the x,y fixes. To transform an x,y fix in

the arbitrary X-Y system to earth coordinates, the latitude and the longitude of the origin and the true bearing of the +Y axis must be known. The true bearing of the +Y axis was determined by celestial sightings and was found to vary from 84.8° to 82.3° due to floe rotation.

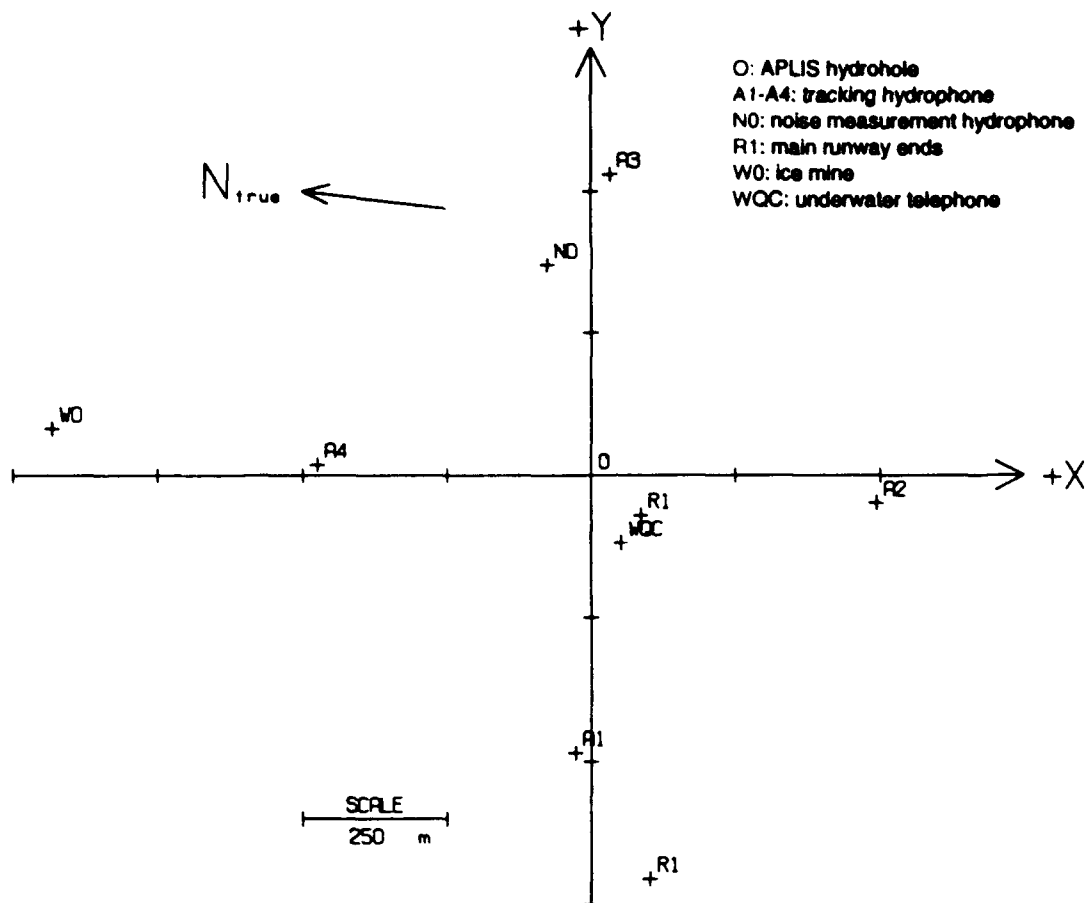


Figure 4. Underwater tracking range X-Y coordinate system.

The magnetic variation at the general locale was 31°, calculated using GEOMAG, a PC program published by the Naval Oceanographic Office and based on the World Magnetic Model for Epoch 1990 (WMM-90).

III. FLOE MOVEMENT

The camp's position was determined using a Global Positioning System (GPS) receiver (Kinematics/Truetime GPS-DC) and displayed and logged on a PC computer via RS-232 bus. GPS fixes were read from the receiver every 30 minutes and stored on a floppy disk. At least four GPS satellites were in view 99% of the time. Consequently, the geometric dilution of precision, an indicator of tracking precision, was usually 3 or less. But because of the uncertainty of up to 100 m in the fixes, the data had to be smoothed using an 11-point binomial filter during postprocessing. The smoothing operation is essential when floe drift speed and direction are to be determined. Figure 5 shows the drift track of the floe. During the camp period, the floe drifted a net distance of 118 km toward the west. Drift speed and direction are plotted in Figure 6 along with wind speed and direction (sense reversed); the plots show good correlation between the wind and drift. As a rule of thumb, the floe drift speed is about 1/60–1/50 of the wind speed, sometimes even less, and its direction is about 45° to the right of the wind direction¹⁻³ due to the Coriolis force. The floe's position, as well as its drift speed and direction, is listed in Appendix A.

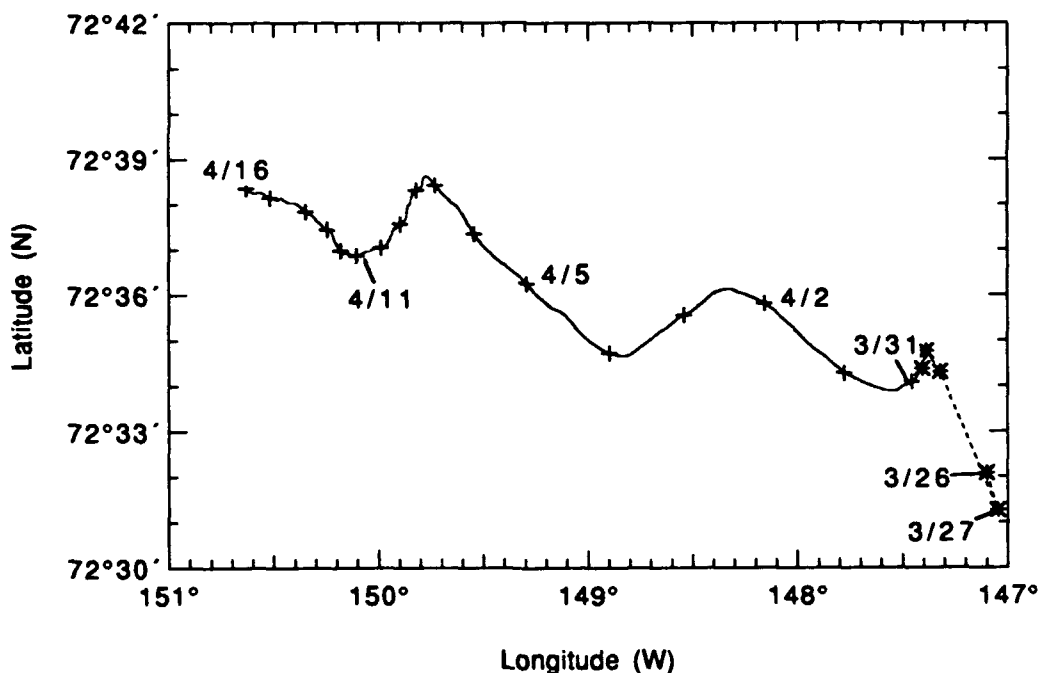


Figure 5. Drift track of APLIS 93. Asterisks denote positions obtained with a portable GPS receiver.

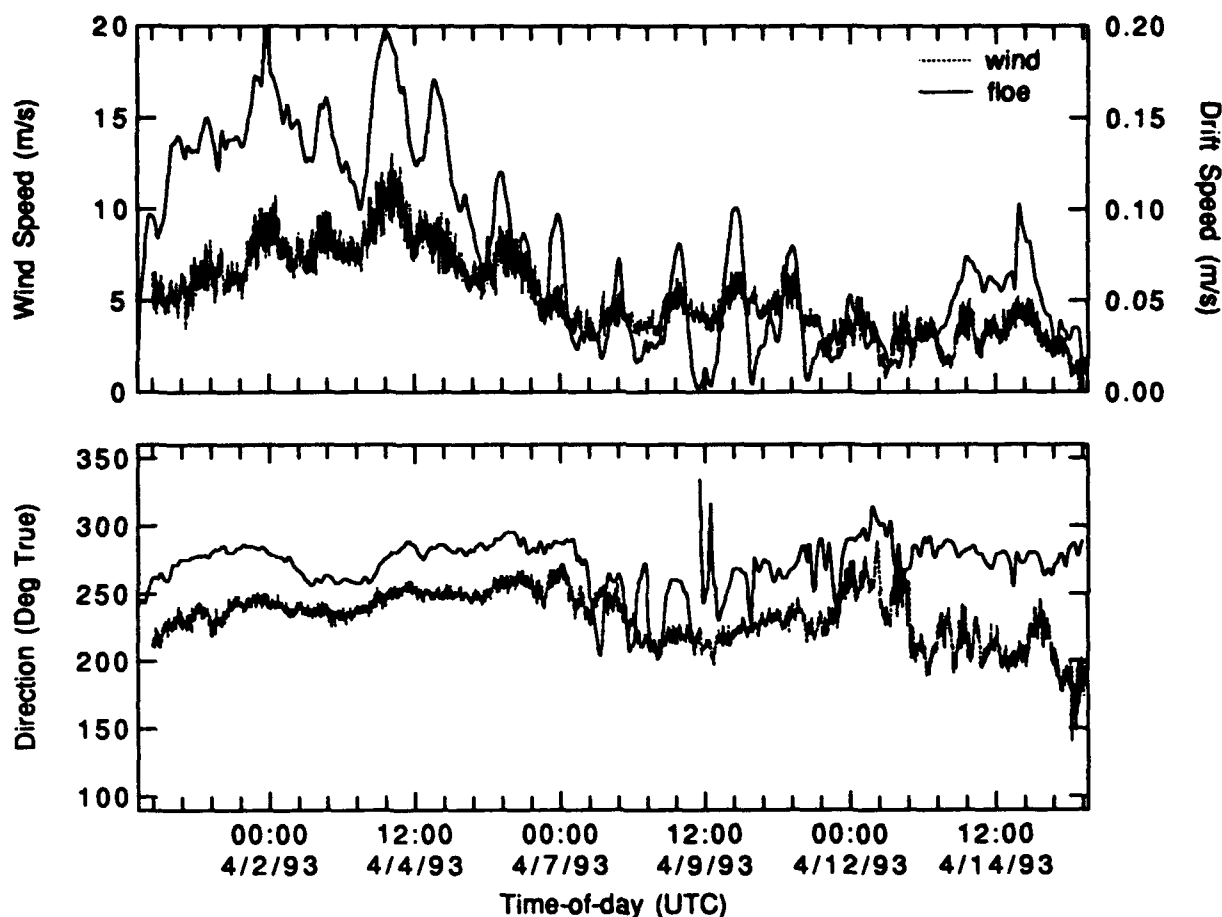


Figure 6. Floe drift speed and direction, with wind data superposed for comparison.

Our GPS receiver also provided 1-Hz timing pulses accurate to within microseconds of UTC. These were used to check the drift of the tracking range master clock and were therefore crucial to the precision of our underwater tracking range.

The rotation of the floe was determined by measuring the change in the true bearing of the +Y axis of the X-Y coordinate system. To obtain the true bearing of the +Y axis, the grid bearing of the Sun was first read with a transit set up on top of the control building over the hydrohole at (0,0). The time at which the bearing was read was noted to the nearest second. Using the time and current location, the true bearing of the Sun was calculated using the PC program MICA (Multiyear Interactive Computer Almanac; U. S. Naval Observatory, Washington, D.C.). The difference between the grid and true bearings of the Sun was the true bearing of the +Y axis. Celestial sightings were made frequently until the last few days when overcast conditions precluded sightings. The +Y axis of the coordinate system varied from 84.8° to 82.3° during the observation period (see Table 1), indicating a CCW floe rotation of 2.5° .

*Table 1. Bearing of the +Y axis of underwater tracking range. All sightings were made on the Sun with the exception of one on Venus, flagged with *.*

Time (UTC)		Lat.	Long.	Azimuth	Grid	True Bearing
mmdd	hhmmss	dd mm ss	ddd mm ss	of Sun	Bearing	of +Y Axis
0401	002926	72 34 19	147 47 07	220.71	135.87	84.84
	005330	72 34 21	147 47 34	226.93	142.02	84.91
0403	194645	72 34 39	148 48 48	144.85	60.73	84.12
	195017			145.77	61.67	84.10
0404	231933	72 36 13	149 17 12	201.45	116.62	84.83
	232205			202.12	117.31	84.81
0406	000120	72 37 21	149 32 42	212.39	127.52	84.87
	000707			213.91	129.02	84.89
0407	021226	72 38 32	149 45 02	245.74	160.92	84.82
	021448			246.32	161.52	84.80
0408	175538	72 37 45	149 52 02	115.46	30.83	84.63
	175915			116.36	31.71	84.65
0409	201601	72 37 11	149 57 25	151.44	67.79	83.65
	201925			152.34	68.70	83.64
	235259	72 37 04	149 59 22	210.26	126.84	83.42
	235643			211.25	127.83	83.42
0410	074946	72 36 57	150 02 27	156.86	73.64	83.22*
	173715	72 36 58	150 04 15	110.65	27.75	82.90
	174016			111.39	28.53	82.86
	214558	72 36 54	150 05 26	175.75	93.07	82.68
	214910			176.63	93.97	82.66
0411	235358	72 36 59	150 10 59	210.58	128.22	82.36
	235711			211.44	129.08	82.36

IV. WEATHER

Weather information was important for research as well as for logistics. There was also general interest in the wind speed and air temperature. Weather parameters therefore became one of the routine environmental measurements made at APLIS 93. Data were collected by a weather station (Weatherpak 100/Coastal Climate Co.) mounted on a telescoping mast at a height of 10 m. The mast was guy-wired so that it would not sway in high winds and cause erroneous wind speed readings. Air temperature, atmospheric pressure, and wind speed and direction were measured and recorded at regular intervals. The accuracy of the meteorological measurements is 0.5 m/s for wind speed, 2° for wind direction, 0.5 mbar for atmospheric pressure, and 0.2°C for temperature.

A laptop PC in the control building was used to control the weather station and to display meteorological data. Commands and data were sent over an RS-232C link. The Weatherpak was programmed to average the weather parameters for 5 s at 5-minute intervals. Sampled data were stored in the Weatherpak's internal memory and also downloaded to the PC for display and storage on floppy disk. Weather parameters could also be read at any time by pressing a programmed menu key on the PC.

The data are plotted and presented in Figure 7. Wind direction was originally logged as magnetic but has been converted to true using an average variation of 31° . The temperature and the wind speed showed diurnal variations until the overcast condition set in. With the overcast, the temperature hovered about -10°C . During this period of high temperatures and low winds, the weather seemed very warm, compared to earlier times.

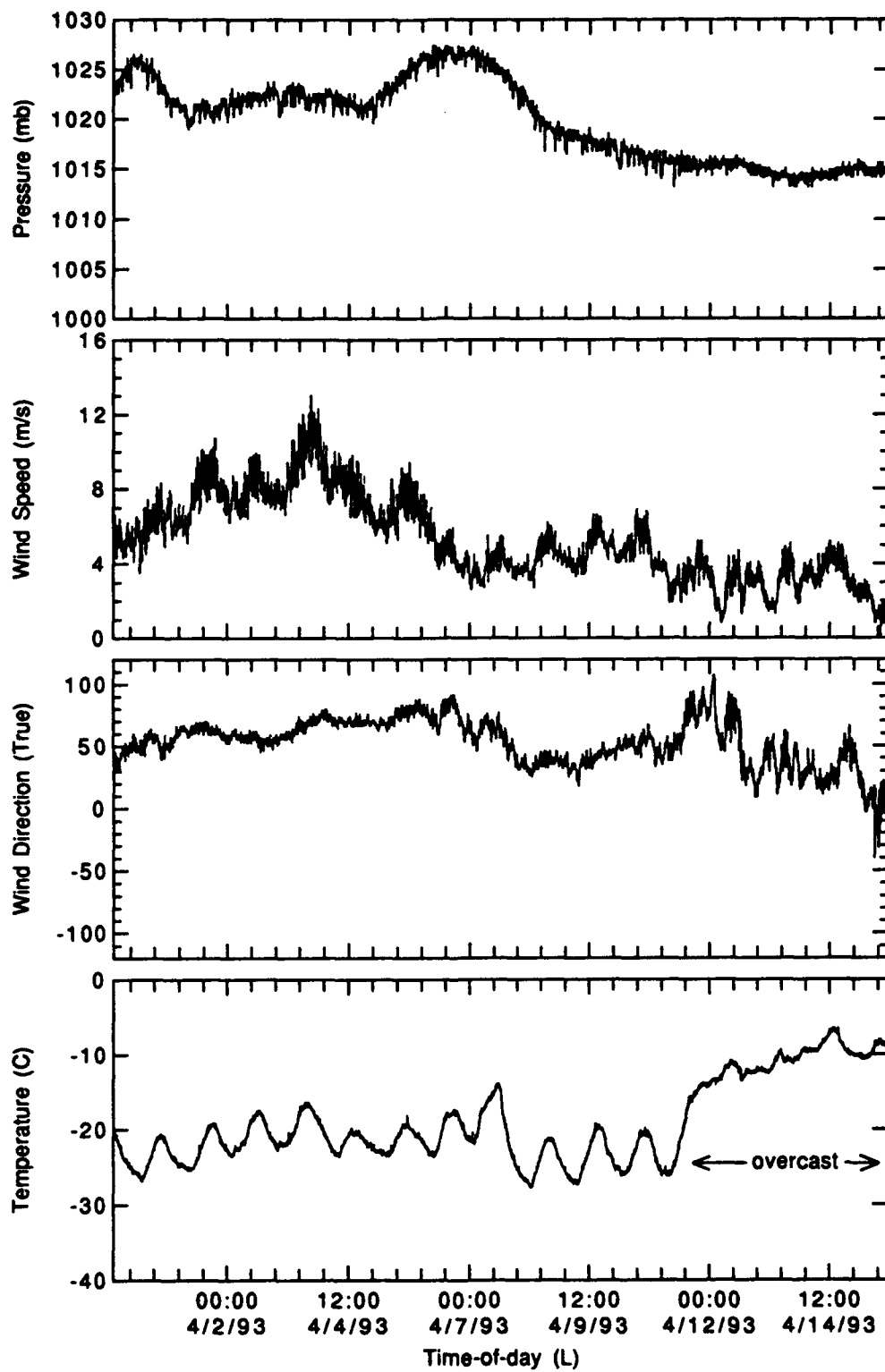


Figure 7. Weather parameters.

V. CTD MEASUREMENTS

CTD casts were made daily to obtain the temperature and salinity properties of the water column. The components of the CTD profiler were a solid-state data logger (Sea-Bird), a thermistor (Sea-Bird), a conductivity cell (Sea-Bird), and a pressure sensor (Paroscientific Digiquartz). The profiler was attached to the end of a 6.4-mm-diameter nylon line and deployed with an ac-powered winch. To ensure adequate flushing of seawater through the conductivity cell, the profiler was allowed to free-fall (attached to the line), reaching a speed of ~ 1.3 m/s. With the sampling rate of the logger at 8 Hz, the water column was consequently sampled at ~ 16 cm intervals, resulting in high-resolution temperature and salinity profiles. The casts were generally to only ~ 350 m or less because water properties at greater depths do not vary significantly from day to day. After each cast, the raw data were read out of the logger via an RS-232C link to a laptop PC for processing and plotting. The raw data were first converted to temperature, conductivity, and depth using sensor calibration constants. UNESCO '83 algorithms⁴ were then used to compute salinity, sound speed, and σ_t (the density of the *in situ* water with the pressure reduced to atmospheric). The conductivity cells and depth sensors were last calibrated 24 months before the field trip, and the thermistors 16 months before. Since these sensors are very stable, according to the historical calibration data, we felt the last set of calibration constants was still fairly good. For the measured properties, we suggest an accuracy of 0.005°C for temperature, 0.008 mS/cm for conductivity, and 0.05 m for depth; the computed properties should have an accuracy of 0.01 ppt for salinity, 0.02 m/s for sound speed, and 0.01 kg/m³ for σ_t .

Table 2 lists the casts made at APLIS 93. The STD plots from all casts are given in Appendix B. Figure 8 shows the STD profiles from a typical cast. The well-mixed upper layer in this case was 40 m deep, although it has extended as deep as 60 m in other years. An intrusion of warmer water from the Bering Sea lies under the mixed layer, creating a thermocline and a halocline (and therefore a pycnocline). This intrusion typically extends to a depth of 100 m. Below this is the colder Chukchi Sea water. From ~ 200 m down is Atlantic Water with a temperature maximum of 0.5°C . A temperature staircase is observed below 250 m with an average step change of $1\text{--}2$ m and $0.01\text{--}0.02^\circ\text{C}$. The temperature and salinity profiles are presented in Figures 9a and 9b, respectively, in waterfall format to show the temporal as well as spatial variations as the floe drifted about.

The thermocline/halocline at 30–40 m depth could have had a large effect on the underwater tracking. Figure 10 shows a ray trace based on the sound speed profile of cast #22. It can be seen that there is a dearth of rays in the weak zone bounded by 2000–4500 m in range and 0–100 m in depth. A source in this zone would have been more difficult to hear through the hydrophones compared with a source outside the zone. We experienced this phenomenon when we tried and had great difficulty in obtaining the x,y fix of some hydroholes at these ranges using a pinger at various depths to 30.5 m. Tracking of submarines was generally trouble-free, as they usually stayed below 100 m depth and out of the weak zone.

Table 2. CTD casts made at APLIS 93.

Date	Time (Local)	Cast No.	Latitude	Longitude
03-29-93	1851	CAST 001	72°34.8'N	147°23.3'W
03-30-93	0649	CAST 002	72°34.5'N	147°24.2'W
03-30-93	1738	CAST 003	72°34.0'N	147°29.5'W
03-31-93	0632	CAST 004	72°34.0'N	147°39.1'W
03-31-93	2016	CAST 005	72°34.6'N	147°51.3'W
04-01-93	1613	CAST 006	72°35.9'N	148°11.2'W
04-02-93	0630	CAST 007	73°36.0'N	148°24.8'W
04-02-93	1520	CAST 008	72°35.6'N	148°32.5'W
04-02-93	1847	CAST 009	72°35.4'N	148°36.1'W
04-02-93	2229	CAST 010	72°35.2'N	148°38.9'W
04-03-93	0630	CAST 011	72°34.9'N	148°44.6'W
04-03-93	1406	CAST 012	72°34.7'N	148°52.5'W
04-03-93	2128	CAST 013	72°35.1'N	149°01.3'W
04-04-93	0610	CAST 014	72°35.6'N	149°08.5'W
04-04-93	1416	CAST 015	72°36.1'N	149°16.2'W
04-05-93	0848	CAST 016	72°36.7'N	149°28.5'W
04-05-93	1654	CAST 017	72°37.3'N	149°32.7'W
04-06-93	0934	CAST 018	72°38.1'N	149°40.7'W
04-06-93	1147	CAST 019	72°38.2'N	149°41.5'W
04-06-93	1617	CAST 020	72°38.5'N	149°44.2'W
04-06-93	2140	CAST 021	72°38.6'N	149°45.8'W
04-07-93	0751	CAST 022	72°38.5'N	149°47.5'W
04-07-93	2014	CAST 023	72°38.1'N	149°50.7'W
04-08-93	0914	CAST 024	72°37.8'N	149°51.9'W
04-08-93	1844	CAST 025	72°37.5'N	149°55.4'W
04-09-93	0831	CAST 026	72°37.3'N	149°56.5'W
04-09-93	1427	CAST 027	72°37.3'N	149°58.3'W
04-09-93	2239	CAST 028	72°36.9'N	150°02.5'W
04-10-93	1232	CAST 029	72°36.9'N	150°04.9'W
04-10-93	1750	CAST 030	72°36.9'N	150°07.3'W
04-11-93	0656	CAST 031	72°36.9'N	150°09.5'W
04-11-93	1424	CAST 032	72°36.9'N	150°10.5'W
04-11-93	2340	CAST 033	72°37.2'N	150°12.8'W
04-12-93	0746	CAST 034	72°37.4'N	150°13.8'W
04-12-93	1450	CAST 035	72°37.4'N	150°14.6'W
04-12-93	2248	CAST 036	72°37.5'N	150°16.1'W
04-13-93	0754	CAST 037	72°37.7'N	150°18.0'W
04-13-93	2320	CAST 038	72°38.0'N	150°24.0'W
04-14-93	0635	CAST 039	72°38.1'N	150°26.7'W
04-14-93	1418	CAST 040	72°38.1'N	150°30.2'W
04-14-93	2134	CAST 041	72°38.3'N	150°33.7'W
04-15-93	0621	CAST 042	72°38.8'N	150°36.1'W
04-15-93	1407	CAST 043	72°38.3'N	150°37.7'W

04-12-93 2248 CAST 036 72-37.5 N / 150-16.1 W

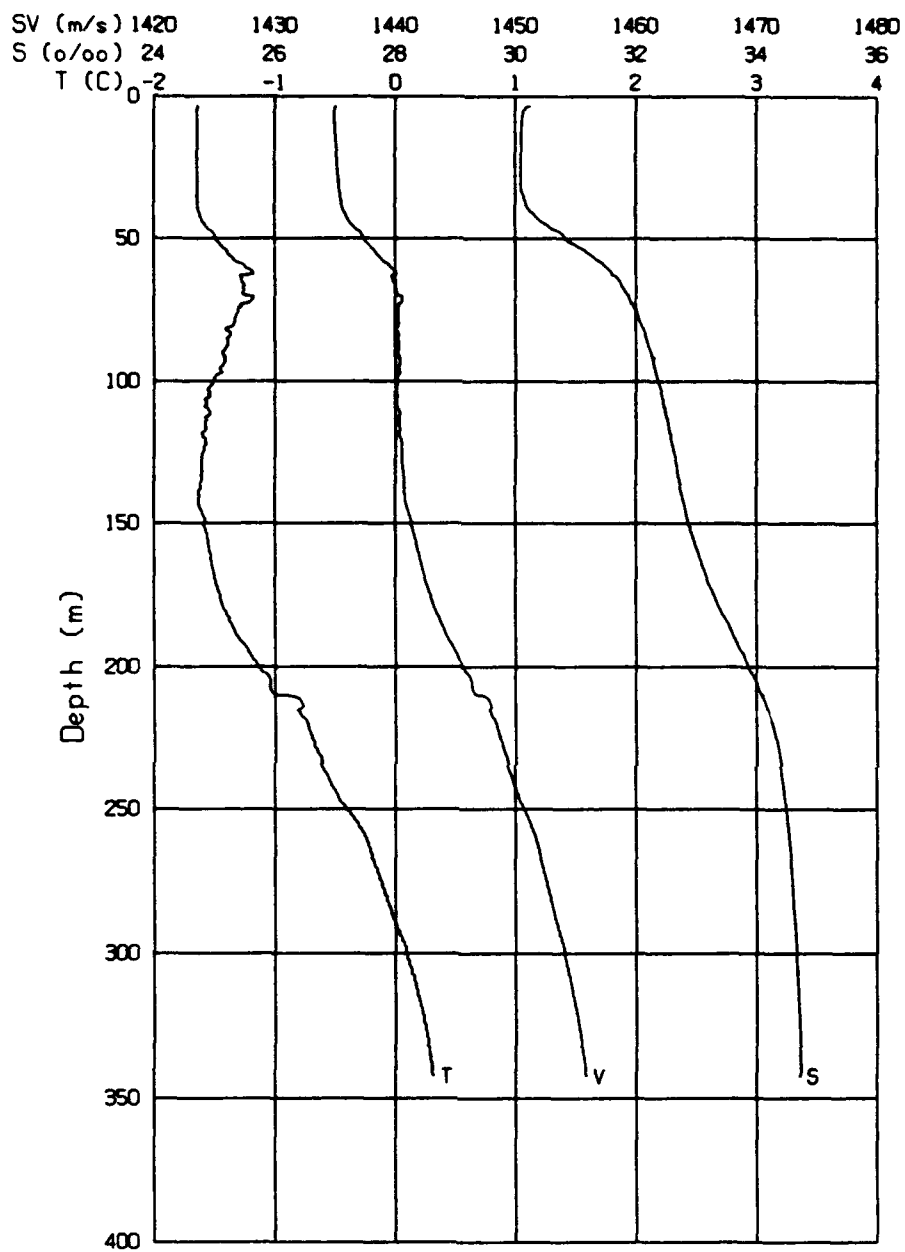


Figure 8. Sample STD profiles from cast 36 showing intrusions at 70 m and 220 m depth and temperature staircase below 250 m.

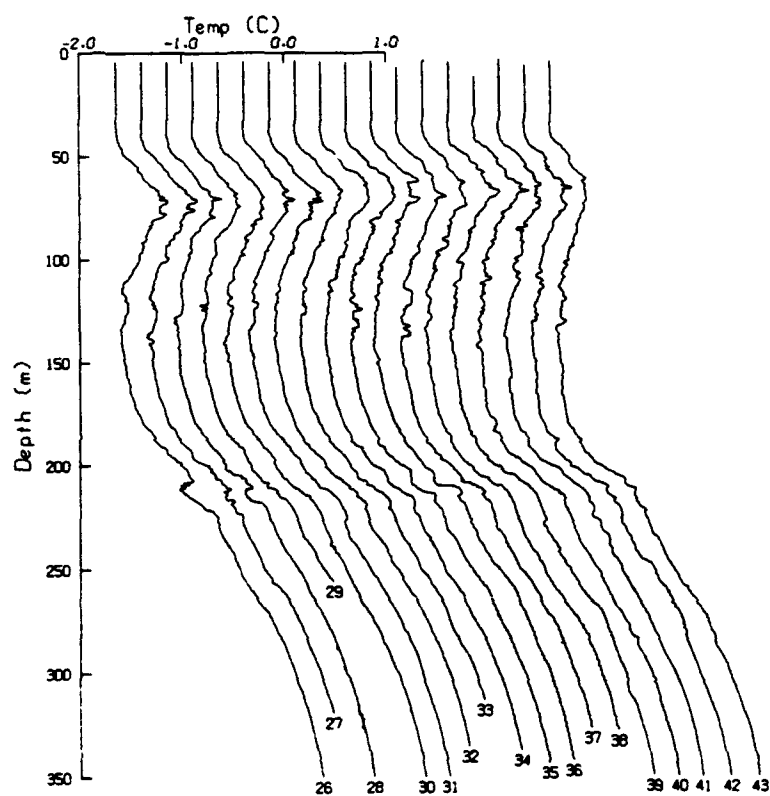
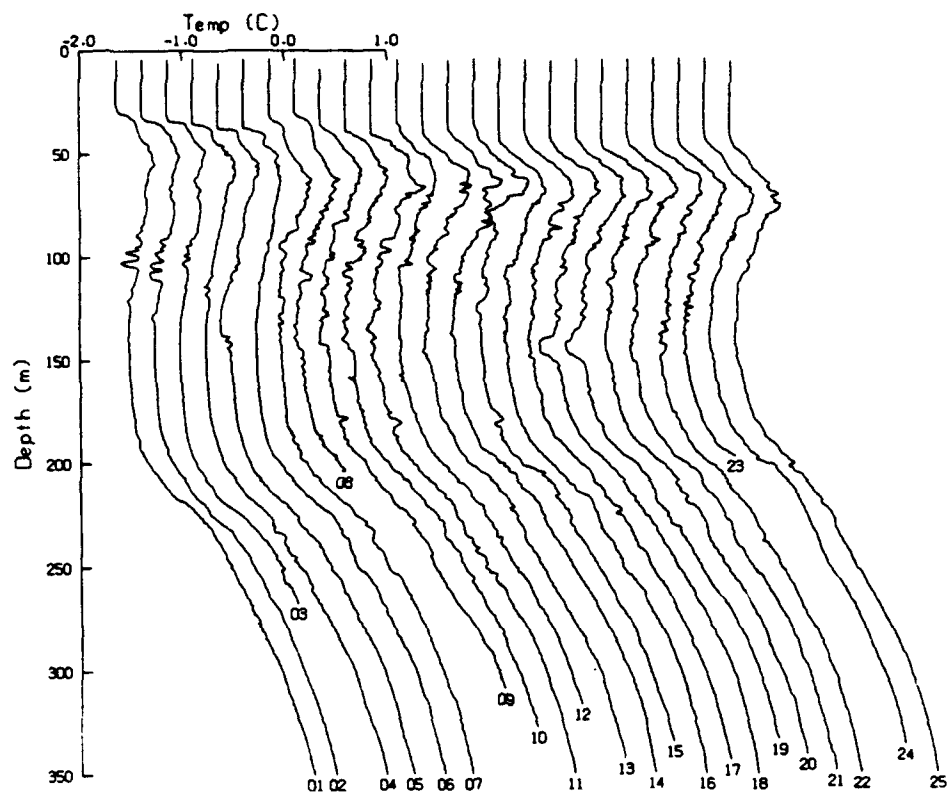


Figure 9a. Waterfall presentation of temperature profiles.

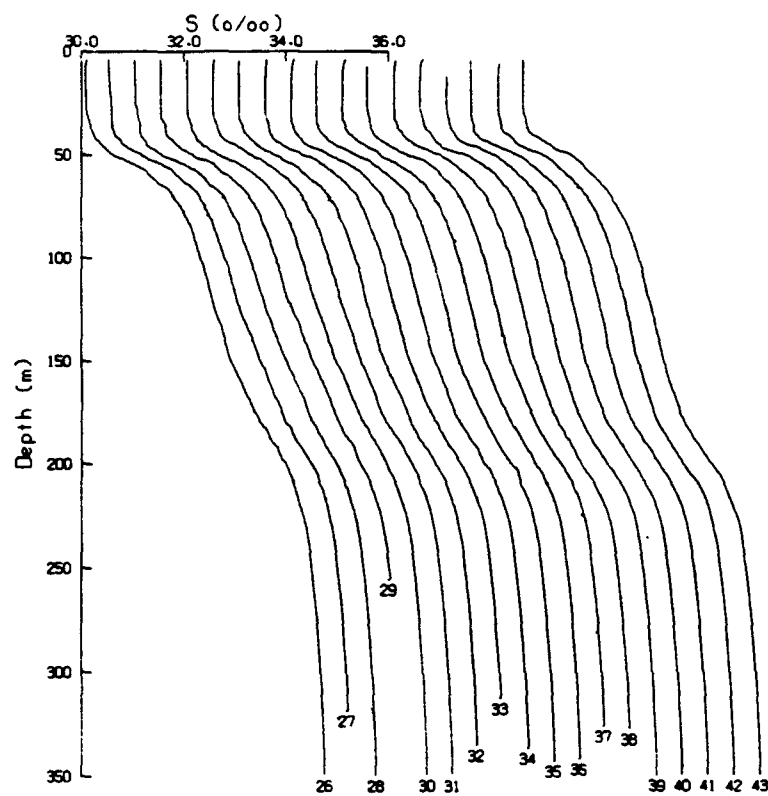
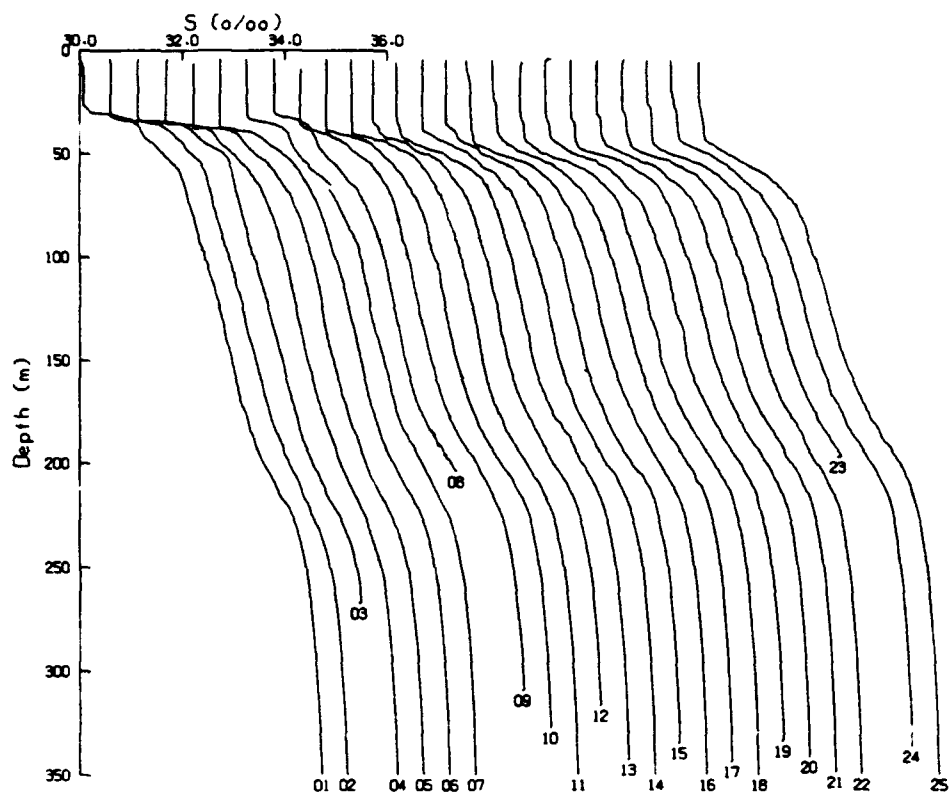


Figure 9b. Waterfall presentation of salinity profiles.

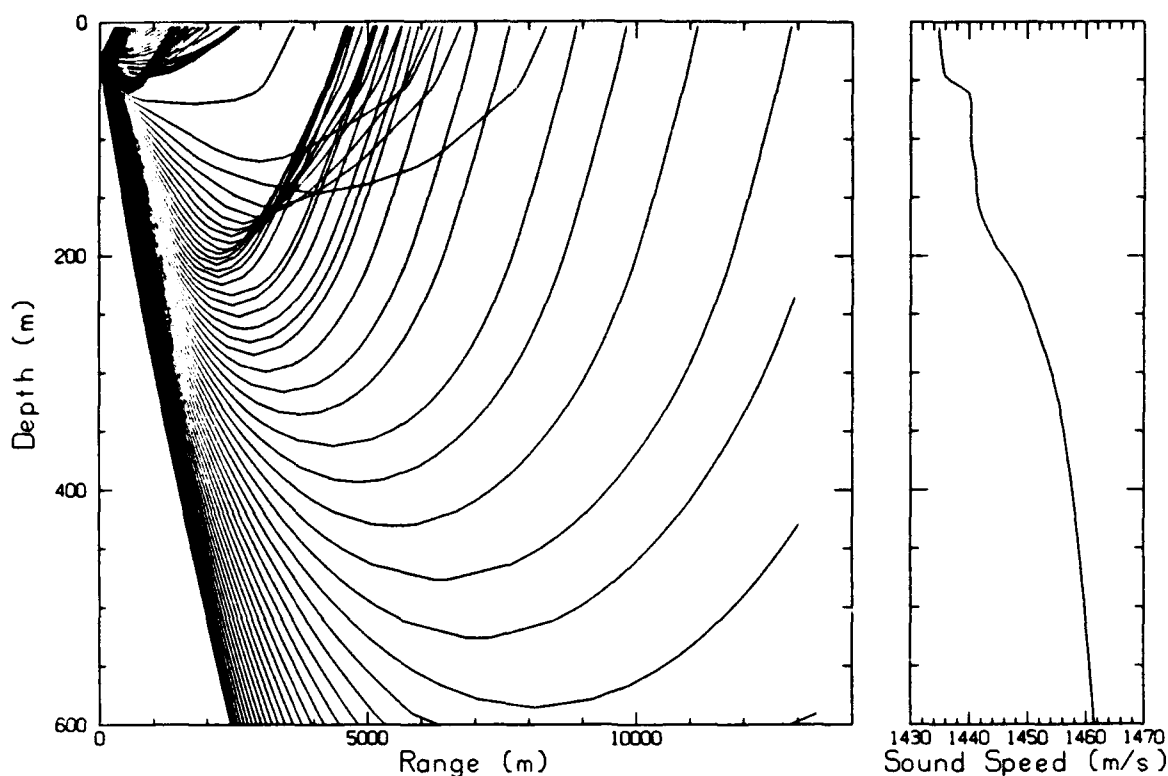


Figure 10. Ray trace showing weak zone, cast #22. Source depth at 30.5 m, rays from -15° to 5° at 0.2° increment.

VI. CURRENTS

To measure current, the CTD profiler was replaced with an InterOcean S4 current meter. A 4.5-kg lead weight was hung 1 m below the instrument to reduce streaming. The default sampling rate of the current meter was 2 Hz, but generally we recorded 5-s (10 samples) or 60-s (120 samples) averages. In addition to recording the magnetic north and east components of the current, the S4 also recorded depth. To obtain stable current measurements, we lowered the meter at depth increments of about 5–10 m, stopping for approximately 1 minute or longer at each depth. When the current meter was brought back to the surface, the data were downloaded to a computer for processing. The mean and standard deviations were computed for the data at each depth. Time series at selected depths, based on CTD information, were also made to assess the temporal variation. Table 3 lists the current meter casts. Vertical current profiles and time series data are shown in Appendix C. Both relative and absolute currents are shown for the vertical profiles, with the former plotted as a solid line and the latter dashed. Bars plotted at each depth represent plus or minus one standard deviation about the averages. In general, the currents were weak. A shear layer is observed at about 205 m in casts 3 and 4.

Table 3. *Current meter casts made at APLIS 93.*

mmdd	hhmm (Local)	Cast	Floe Drift Ave (s)	cm/s	Dir	Comments
0401	1635	1	60	17.3	278	
0404	1810	2	60	12.0	281	Time series at 70 m
0405	1745	3	5	10.0	295	
0408	1145	4	5	4.8	254	
0409	1645	5	5	9.9	268	
0410	1815	6	5	4.9	280	
0411	1456	7	5	5.3	289	Time series at 225 m
0413	0915	8	5	5.0	286	Time series at 220 m

VII. ICE CORE SAMPLES

Some tests were conducted in first-year ice several kilometers from the camp. The ice ranged from 0.6–1 m in thickness. Cores were taken from this ice to determine the salinity and ultimately its physical properties. Some samples were also removed for analysis from refrozen melt ponds and an ice mine.

A 7.6-cm (inside diameter) SIPRE corer was used to remove short segments about 0.5 m in length. Each segment was placed in a miter box and cut into sections 7.5 cm long. Each section was then sealed in a Ziploc bag and tagged. This procedure was repeated until the whole segment, and ultimately the whole ice column, was sampled. The temperature of each section was not measured due to difficulties in handling and the unavoidable cooling of the ice when exposed to the air during handling. Instead, a linear temperature profile in the ice was assumed by using a line defined by the surface and water temperatures. This assumption results in errors of up to 1°C and seemed reasonable based on past measurements of first-year ice. We emphasize that the temperature profile in the ice is not linear throughout the year but is close to being so at this time of year.

The samples were transported back to camp and allowed to melt at room temperature. We set up a "salinometer" with the thermistor and conductivity cell of the CTD profiler; this configuration allowed us to use the standard data-acquisition and reduction system. The sensors were mounted on a frame. The cell was tilted to avoid trapping air bubbles. A length of Tygon tubing was attached to each end of the glass tubing, which was 1 cm in diameter and 18 cm in length. The thermistor was inserted in the Tygon tubing near the conductivity cell. When the melted sample was shaken and poured into the two types of tubing and the cell, conductivity and temperature were measured simultaneously, and salinity was computed. Prior to analysis, the samples and the sensors were

placed on a bench top for several hours to bring them to the same temperature. This was necessary because any large temperature differential would have affected the conductivity results. To reduce the temperature differential further, the water sample was mixed within the cell by raising and lowering the pinched-off Tygon tubing at one end to pass the water sample back and forth.

Once the salinity of the ice was known, its other physical properties were derived using empirical models. Density, as well as brine volume, was calculated from measured salinity and assumed temperature using relationships derived by Cox and Weeks⁵. We chose not to obtain the density by weight and volume because of the problems of irregular core diameters and brine drainage. This choice also simplified the whole operation considerably by eliminating the need for weighing and measuring the core sections. Young's modulus was computed using the empirical formula of Langleben and Pounder⁶.

A. First-Year Ice

Cores were taken from four test sites in the first-year ice and designated by the date of test as shown in Table 4. Plots for the properties of the cores from the first-year ice are given in Appendix D. Salinity profiles from days 4–11 are superposed and shown in Figure 11a. The profiles are typical for first-year ice: the salinity is high near the surface, owing to a faster freezing rate, and decreases as the ice grows thicker and more slowly, allowing a longer time for brine expulsion. The salinity should increase again near the bottom because the brine has not had enough time to drain out, and brine has a higher salinity (for example, 37.6 ppt at -2°C and 70.6 ppt at -4°C) than that of seawater (~ 30 ppt). However, the measurements show relatively low salinities near the bottom. This could be explained by brine drainage occurring during core retrieval due to seawater dilution or displacement of brine.

Table 4. Summary of ice cores.

Core No.	Thickness (cm)	Surface Temp. ($^{\circ}\text{C}$)	Comments
4-2 #1, #2	102	-13.0	1.6 m apart
4-5 #1, #2	74	-12.7	> 2 m apart
4-6 #1, #2	76	-12.7	> 5 m apart
4-11 #1	84	-13.1	
#2, #3	85	-13.6	0.5 m apart, >10 m from #1
4-12 #1, #2	---	----	Refrozen melt ponds

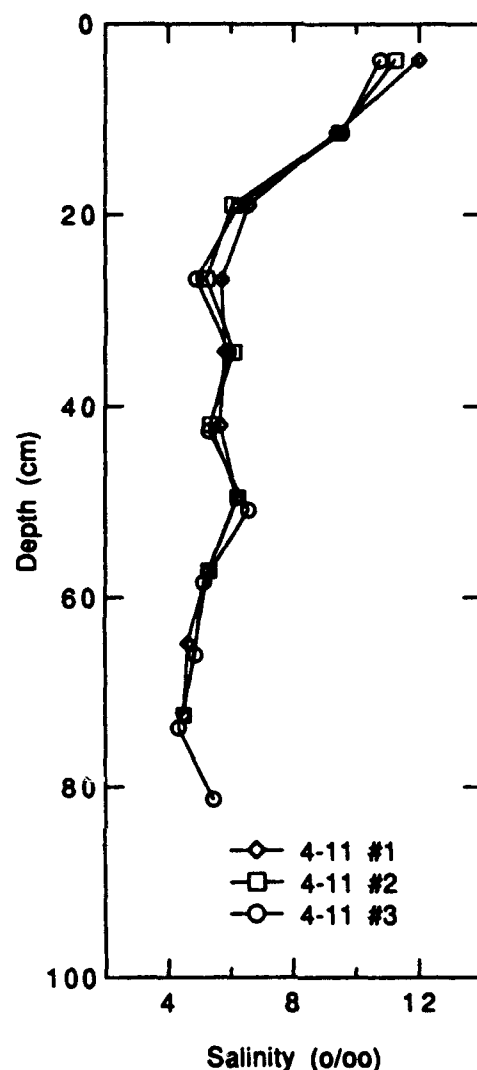


Figure 11a. Salinity profiles in first-year ice, 4-11 #1, #2, and #3 showing interprofile consistency.

Note that in the mid-ice the profile is not smooth, with the salinity varying by as much as 1 ppt from that of the ice above or below. This variation is real and not due to measurement errors, as shown by the consistency of the two cores, #2 and #3, which were taken from ice 0.5 m apart. The vertical variation can be attributed to the different freezing rates that resulted in different lengths of time available for brine drainage.

Figure 11b shows two profiles for cores 4-6 #1 and #2 from the same first-year ice with inter-profile difference of ~1 ppt. The cores were taken from locations over 5 m apart. Again, we believe the difference is real and not due to measurement errors, because all sampling procedures were identical and we were able to obtain nearly identical results with cores 4-11 #2 and #3. The horizontal variation in salinity is therefore most likely due to the presence of brine channels and pockets in the ice.

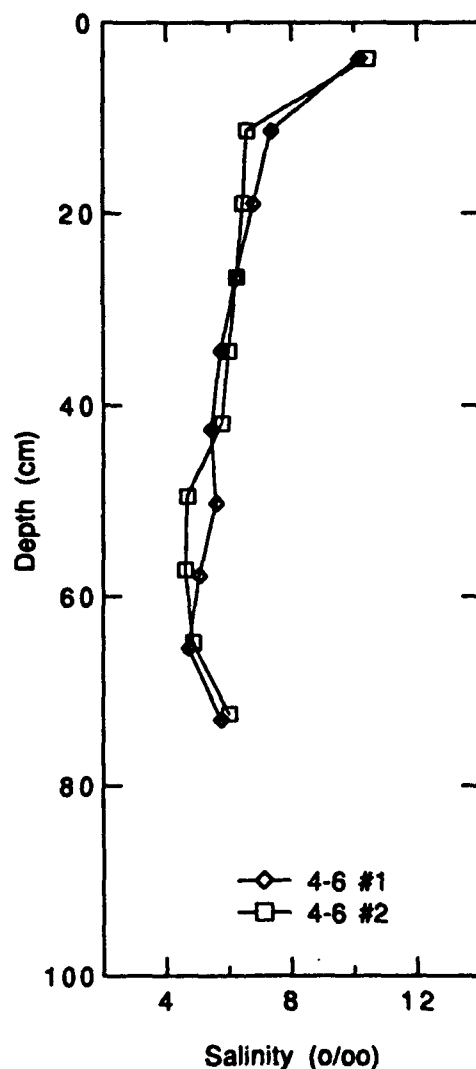


Figure 11b. Salinity profiles in first-year ice, 4-6 #1 and #2, showing interprofile variation.

B. Melt Ponds and Ice Mine

Figure 12 shows the salinity profiles from two different refrozen meltponds. The salinity is very low in the upper layer. This is expected because when meltwater from ice of 4–8 ppt freezes, an even smaller amount of salt will be trapped in the new ice. Somewhere below 20 cm the salinity jumps up to 4 ppt, comparable to that in typical ice. This tends to suggest that the depths of the melt ponds were at one time on the order of 30 cm.

We also measured the salinity of ice taken from the ice mine that was our source for drinking water. The mine was a 6-m high, well-weathered ridge at least a year old. Two samples were taken from the top of the ridge. The salinity was 0.015 ppt, almost at the noise level of our salinometer. This measurement verifies our judgement that meltwater from multiyear ridge ice tastes as good as fresh water.

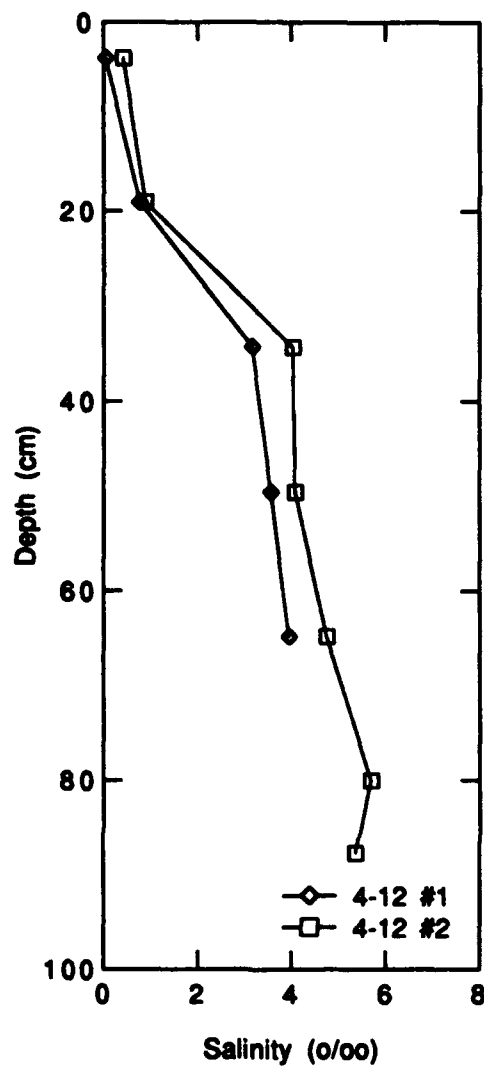


Figure 12. Salinity profiles in two different refrozen melt ponds, 4-12 #1 and #2.

VIII. REFERENCES

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APPENDIX A
Floe Position and Drift Data
(time is UTC)

Time (UTC)	N. Latitude	W. Longitude	ddd mm. mm	spd km/hr	dir deg	Time (UTC)	N. Latitude	W. Longitude	ddd mm. mm	spd km/hr	dir deg	Time (UTC)	N. Latitude	W. Longitude	ddd mm. mm	spd km/hr	dir deg
89180000	72 34.39	147 24.66	72 34.39	.040	239	91010000	72 34.36	147 47.99	72 34.36	.493	281	92100000	72 36.14	148 19.75	72 36.14	.522	270
89183000	72 34.38	147 24.74	72 34.38	.112	241	91013000	72 34.39	147 48.42	72 34.39	.486	282	92103000	72 36.13	148 20.22	72 36.13	.526	269
89190000	72 34.36	147 24.88	72 34.36	.166	243	91020000	72 34.42	147 49.61	72 34.42	.436	282	92110000	72 36.12	148 21.18	72 36.12	.529	268
89193000	72 34.34	147 25.04	72 34.34	.198	245	91023000	72 34.47	147 50.01	72 34.47	.454	283	92113000	72 36.11	148 22.14	72 36.11	.536	267
89200000	72 34.31	147 25.22	72 34.31	.223	245	91030000	72 34.50	147 50.44	72 34.50	.490	284	92120000	72 36.09	148 22.61	72 36.09	.539	266
89203000	72 34.28	147 25.42	72 34.28	.245	244	91033000	72 34.53	147 50.88	72 34.53	.508	285	92123000	72 36.08	148 23.06	72 36.08	.546	265
89210000	72 34.25	147 25.63	72 34.25	.266	243	91040000	72 34.56	147 51.33	72 34.56	.508	285	92130000	72 36.06	148 23.50	72 36.06	.549	263
89213000	72 34.21	147 25.87	72 34.21	.295	243	91043000	72 34.63	147 51.76	72 34.63	.490	284	92133000	72 36.04	148 23.93	72 36.04	.549	263
89220000	72 34.18	147 26.14	72 34.18	.324	247	91050000	72 34.66	147 52.18	72 34.66	.479	281	92140000	72 36.02	148 24.34	72 36.02	.546	261
89223000	72 34.15	147 26.43	72 34.15	.342	251	91053000	72 34.68	147 52.61	72 34.68	.486	280	92143000	72 36.00	148 24.74	72 36.00	.545	259
89230000	72 34.12	147 26.74	72 34.12	.349	255	91060000	72 34.73	147 53.06	72 34.73	.497	280	92150000	72 35.97	148 25.14	72 35.97	.545	258
89233000	72 34.11	147 27.05	72 34.11	.349	259	91063000	72 34.75	147 53.50	72 34.75	.497	280	92160000	72 35.94	148 25.55	72 35.94	.541	257
89236000	72 34.09	147 27.36	72 34.09	.346	261	91070000	72 34.85	147 53.94	72 34.85	.497	280	92163000	72 35.92	148 25.95	72 35.92	.541	256
89240000	72 34.08	147 27.66	72 34.08	.346	262	91073000	72 34.88	147 54.38	72 34.88	.497	280	92170000	72 35.89	148 26.35	72 35.89	.547	256
89243000	72 34.06	147 27.97	72 34.06	.338	262	91080000	72 34.92	147 54.82	72 34.92	.497	280	92173000	72 35.86	148 26.75	72 35.86	.545	256
89246000	72 34.05	147 28.26	72 34.05	.328	261	91083000	72 34.95	147 55.26	72 34.95	.497	281	92180000	72 35.81	148 27.15	72 35.81	.547	257
89250000	72 34.04	147 28.53	72 34.04	.310	261	91090000	72 34.98	147 55.70	72 34.98	.500	282	92183000	72 35.78	148 27.56	72 35.78	.548	260
89253000	72 34.03	147 28.80	72 34.03	.302	262	91093000	72 35.01	147 56.15	72 35.01	.504	283	92190000	72 35.76	148 28.00	72 35.76	.545	260
89256000	72 34.02	147 29.08	72 34.02	.306	264	91100000	72 35.05	147 56.59	72 35.05	.504	283	92193000	72 35.73	148 28.45	72 35.73	.545	259
89260000	72 34.01	147 29.36	72 34.01	.317	265	91103000	72 35.08	147 57.03	72 35.08	.490	284	92200000	72 35.70	148 28.94	72 35.70	.544	259
89263000	72 34.00	147 29.66	72 34.00	.328	264	91110000	72 35.12	147 57.48	72 35.12	.486	286	92203000	72 35.67	148 29.33	72 35.67	.545	258
89266000	72 33.99	147 29.96	72 33.99	.331	262	91113000	72 35.15	147 57.92	72 35.15	.483	285	92210000	72 35.62	148 29.74	72 35.62	.548	260
89270000	72 33.98	147 30.26	72 33.98	.342	260	91116000	72 35.18	147 58.30	72 35.18	.482	286	92213000	72 35.60	148 30.14	72 35.60	.545	262
89273000	72 33.97	147 30.57	72 33.97	.356	259	91120000	72 35.22	147 58.74	72 35.22	.486	284	92220000	72 35.58	148 30.54	72 35.58	.545	263
89276000	72 33.96	147 30.87	72 33.96	.378	259	91123000	72 35.26	147 59.15	72 35.26	.486	284	92223000	72 35.56	148 30.94	72 35.56	.545	263
89280000	72 33.95	147 31.17	72 33.95	.403	260	91126000	72 35.30	147 59.59	72 35.30	.486	284	92230000	72 35.54	148 31.34	72 35.54	.545	262
89283000	72 33.94	147 31.47	72 33.94	.428	262	91130000	72 35.34	147 60.03	72 35.34	.486	284	92233000	72 35.52	148 31.74	72 35.52	.545	262
89286000	72 33.93	147 31.77	72 33.93	.457	266	91133000	72 35.38	147 60.47	72 35.38	.486	284	92240000	72 35.50	148 32.14	72 35.50	.545	262
89290000	72 33.92	147 32.06	72 33.92	.475	266	91136000	72 35.42	147 60.91	72 35.42	.486	284	92243000	72 35.48	148 32.54	72 35.48	.545	262
89293000	72 33.91	147 32.36	72 33.91	.486	275	91140000	72 35.46	147 61.35	72 35.46	.486	284	92250000	72 35.46	148 32.94	72 35.46	.545	262
89296000	72 33.90	147 32.66	72 33.90	.497	275	91143000	72 35.50	147 61.79	72 35.50	.486	284	92253000	72 35.44	148 33.34	72 35.44	.545	262
89300000	72 33.89	147 32.96	72 33.89	.486	271	91146000	72 35.54	147 62.23	72 35.54	.486	284	92260000	72 35.42	148 33.74	72 35.42	.545	262
89303000	72 33.88	147 33.26	72 33.88	.490	271	91150000	72 35.58	147 62.67	72 35.58	.486	284	92263000	72 35.40	148 34.14	72 35.40	.545	262
89306000	72 33.87	147 33.56	72 33.87	.490	271	91153000	72 35.62	147 63.11	72 35.62	.486	284	92270000	72 35.38	148 34.54	72 35.38	.545	262
89309000	72 33.86	147 33.86	72 33.86	.490	271	91156000	72 35.66	147 63.55	72 35.66	.486	284	92273000	72 35.36	148 34.94	72 35.36	.545	262
89312000	72 33.85	147 34.16	72 33.85	.490	271	91160000	72 35.70	147 63.99	72 35.70	.486	284	92280000	72 35.34	148 35.34	72 35.34	.545	262
89315000	72 33.84	147 34.46	72 33.84	.490	271	91163000	72 35.74	147 64.43	72 35.74	.486	284	92283000	72 35.32	148 35.74	72 35.32	.545	262
89318000	72 33.83	147 34.76	72 33.83	.490	271	91166000	72 35.78	147 64.87	72 35.78	.486	284	92290000	72 35.30	148 36.14	72 35.30	.545	262
89321000	72 33.82	147 35.06	72 33.82	.490	271	91170000	72 35.82	147 65.31	72 35.82	.486	284	92293000	72 35.28	148 36.54	72 35.28	.545	262
89324000	72 33.81	147 35.36	72 33.81	.490	271	91173000	72 35.86	147 65.75	72 35.86	.486	284	92300000	72 35.26	148 36.94	72 35.26	.545	262
89327000	72 33.80	147 35.66	72 33.80	.490	271	91176000	72 35.90	147 66.19	72 35.90	.486	284	92303000	72 35.24	148 37.34	72 35.24	.545	262
89330000	72 33.79	147 35.96	72 33.79	.490	271	91180000	72 35.94	147 66.63	72 35.94	.486	284	92306000	72 35.22	148 37.74	72 35.22	.545	262
89333000	72 33.78	147 36.26	72 33.78	.490	271	91183000	72 35.98	147 67.07	72 35.98	.486	284	92310000	72 35.20	148 38.14	72 35.20	.545	262
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89339000	72 33.76	147 36.86	72 33.76	.490	271	91190000	72 36.06	147 67.95	72 36.06	.486	284	92316000	72 35.16	148 38.94	72 35.16	.545	262
89342000	72 33.75	147 37.16	72 33.75	.490	271	91193000	72 36.10	147 68.39	72 36.10	.486	284	92320000	72 35.14	148 39.34	72 35.14	.545	262
89345000	72 33.74	147 37.46	72 33.74	.490	271	91196000	72 36.14	147 68.83	72 36.14	.486	284	92323000	72 35.12	148 39.74	72 35.12	.545	262
89348000	72 33.73	147 37.76	72 33.73	.490	271	91200000	72 36.18	147 69.27	72 36.18	.486	284	92330000	72 35.10	148 40.14	72 35.10	.545	262
89351000	72 33.72	147 38.06	72 33.72	.490	271	91203000	72 36.22	147 69.71	72 36.22	.486	284	92333000	72 35.08	148 40.54	72 35.08	.545	262
89354000	72 33.71	147 38.36	72 33.71	.490	271	91206000	72 36.26	147 70.15	72 36.26	.486	284	92336000	72 35.06	148 40.94	72 35.06	.545	262
89357000	72 33.70	147 38.66	72 33.70	.490	271	91210000	72 36.30	147 70.59	72 36.30	.486	284	92340000	72 35.04	148 41.34	72 35.04	.545	262
89360000	72 33.69	147 38.96	72 33.69	.490	271	91213000	72 36.34	147 71.03	72 36.34	.486	284	92343000	72 35.02	148 41.74	72 35.02	.545	262
89363000	72 33.68	147 39.26	72 33.68	.490	271	91216000	72 36.38	147 71.47	72 36.38	.486	284	92346000	72 35.00	148 42.14	72 35.00	.545	262
89366000	72 33.67	147 39.56	72 33.67	.490	271	91220000	72 36.42	147 71.91	72 36.42	.486	284	92350000	72 34.98	148 42.54	72 34.98	.545	262
89369000	72 33.66	147 39.86	72 33.66	.490	271	91223000	72 36.46	147 72.35	72 36.46	.486	284	92353000	72 34.96	148 42.94	72 34.96	.545	262
89372000	72 33.65	147 40.16	72 33.65	.490	271	91226000	72 36.50	147 72.79	72 36.50	.486	284	92356000	72 34.94	148 43.34	72 34.94	.545	262
89375000	72 33.64	147 40.46	72 33.64	.490	271	91230000	72 36.54	147 73.23	72 36.54	.486	284	92360000	72 34.92	148 43.74	72 34.92	.545	262
89378000	72 33.63	147 40.76	72 33.63	.490	271	91233000	72 36.58	147 73.67	72 36.58</								

Time (UTC)	N.Latitude	W.Longitude	spd	dir	Time (UTC)	N.Latitude	W.Longitude	spd	dir	Time (UTC)	N.Latitude	W.Longitude	spd	dir
93183000	72 34.73	148 47.21	.558	260	95030000	72 36.45	149 20.25	.432	281	96113000	72 38.04	149 38.80	.277	280
93190000	72 34.70	148 47.74	.587	262	95033000	72 36.47	149 20.61	.418	281	96120000	72 38.05	149 39.03	.256	281
93193000	72 34.68	148 48.28	.608	263	95040000	72 36.49	149 20.97	.407	281	96123000	72 38.06	149 39.23	.227	282
93200000	72 34.67	148 48.85	.626	265	95043000	72 36.51	149 21.33	.400	280	96130000	72 38.07	149 39.41	.202	283
93203000	72 34.66	148 49.43	.641	267	95050000	72 36.53	149 21.68	.392	280	96133000	72 38.09	149 39.57	.184	282
93210000	72 34.66	148 50.02	.659	269	95053000	72 36.55	149 22.02	.382	281	96140000	72 38.09	149 39.73	.173	281
93213000	72 34.66	148 50.63	.670	271	95060000	72 36.57	149 22.35	.371	283	96143000	72 38.10	149 39.88	.173	280
93220000	72 34.67	148 51.24	.680	272	95063000	72 36.59	149 22.69	.360	283	96150000	72 38.11	149 40.04	.176	282
93223000	72 34.68	148 51.86	.688	273	95070000	72 36.61	149 22.98	.356	283	96153000	72 38.12	149 40.19	.169	286
93230000	72 34.69	148 52.49	.698	274	95073000	72 36.64	149 23.30	.360	282	96160000	72 38.14	149 40.32	.151	288
93233000	72 34.71	148 53.12	.706	275	95080000	72 36.65	149 23.63	.371	281	96163000	72 38.15	149 40.44	.140	286
94000000	72 34.72	148 53.76	.709	275	95083000	72 36.67	149 23.97	.385	278	96170000	72 38.16	149 40.56	.140	282
94003000	72 34.74	148 54.40	.709	276	95090000	72 36.69	149 24.32	.389	278	96173000	72 38.16	149 40.70	.151	279
94010000	72 34.76	148 55.03	.706	276	95093000	72 36.70	149 24.66	.382	278	96180000	72 38.17	149 40.85	.162	280
94013000	72 34.79	148 55.66	.702	277	95100000	72 36.74	149 25.30	.356	281	96183000	72 38.18	149 41.00	.176	284
94020000	72 34.82	148 56.28	.695	278	95103000	72 36.77	149 25.99	.334	281	96190000	72 38.20	149 41.17	.194	286
94023000	72 34.85	148 56.89	.684	280	95110000	72 36.75	149 25.61	.342	282	96193000	72 38.21	149 41.37	.227	285
94030000	72 34.88	148 57.49	.677	280	95113000	72 36.79	149 26.19	.324	281	96200000	72 38.23	149 41.60	.293	283
94033000	72 34.91	148 58.09	.670	280	95120000	72 36.79	149 26.19	.331	281	96203000	72 38.25	149 41.86	.295	283
94040000	72 34.94	148 58.68	.666	280	95123000	72 36.80	149 26.47	.313	281	96210000	72 38.27	149 42.14	.313	285
94043000	72 34.98	148 59.26	.655	280	95130000	72 36.82	149 26.74	.299	283	96213000	72 38.29	149 42.42	.328	287
94050000	72 35.01	148 59.82	.637	281	95133000	72 36.84	149 26.99	.288	284	96220000	72 38.32	149 42.70	.328	288
94053000	72 35.04	149 .37	.612	281	95140000	72 36.86	149 27.23	.277	285	96223000	72 38.35	149 42.99	.338	288
94060000	72 35.07	149 .89	.594	282	95143000	72 36.88	149 27.46	.270	286	96230000	72 38.38	149 43.29	.349	287
94063000	72 35.11	149 1.41	.590	283	95150000	72 36.90	149 27.69	.263	287	96233000	72 38.40	149 43.59	.349	287
94070000	72 35.15	149 1.94	.598	284	95153000	72 36.92	149 27.91	.248	287	97000000	72 38.43	149 43.89	.342	287
94073000	72 35.19	149 2.47	.601	284	95160000	72 36.94	149 28.11	.234	286	97003000	72 38.45	149 44.18	.328	287
94080000	72 35.23	149 2.98	.587	286	95163000	72 36.95	149 28.30	.223	285	97010000	72 38.48	149 44.44	.310	286
94083000	72 35.27	149 3.46	.562	287	95170000	72 36.97	149 28.50	.227	283	97013000	72 38.50	149 44.69	.281	286
94090000	72 35.32	149 3.92	.536	288	95173000	72 36.98	149 28.72	.245	282	97020000	72 38.52	149 44.90	.245	287
94093000	72 35.36	149 4.37	.518	288	95180000	72 37.00	149 28.96	.266	282	97023000	72 38.53	149 45.08	.209	288
94100000	72 35.40	149 4.80	.500	288	95183000	72 37.02	149 29.21	.281	284	97030000	72 38.55	149 45.23	.180	289
94103000	72 35.44	149 5.22	.490	287	95190000	72 37.04	149 29.46	.288	285	97033000	72 38.56	149 45.37	.155	288
94110000	72 35.48	149 5.64	.479	286	95193000	72 37.06	149 29.71	.292	285	97040000	72 38.57	149 45.48	.137	288
94113000	72 35.51	149 6.05	.468	286	95200000	72 37.08	149 29.98	.306	285	97050000	72 38.58	149 45.67	.104	290
94120000	72 35.55	149 6.45	.457	285	95203000	72 37.10	149 30.26	.328	286	97053000	72 38.60	149 45.76	.097	290
94123000	72 35.58	149 6.84	.450	284	95210000	72 37.13	149 30.57	.353	288	97060000	72 38.61	149 45.91	.086	280
94130000	72 35.60	149 7.24	.446	282	95213000	72 37.17	149 30.89	.382	290	97070000	72 38.62	149 46.07	.086	275
94133000	72 35.62	149 7.64	.450	280	95220000	72 37.20	149 31.24	.403	290	97080000	72 38.62	149 46.16	.097	277
94140000	72 35.64	149 8.05	.457	278	95223000	72 37.24	149 31.59	.418	289	97090000	72 38.62	149 46.25	.108	275
94143000	72 35.66	149 8.46	.461	277	95230000	72 37.28	149 31.96	.428	289	97093000	72 38.62	149 46.35	.112	271
94150000	72 35.67	149 8.87	.461	276	95233000	72 37.32	149 32.33	.432	289	97100000	72 38.63	149 46.55	.108	274
94153000	72 35.68	149 9.29	.457	275	96000000	72 37.36	149 32.70	.432	291	97103000	72 38.63	149 46.65	.115	275
94160000	72 35.69	149 9.70	.464	276	96003000	72 37.40	149 33.05	.428	292	97110000	72 38.63	149 46.76	.119	271
94163000	72 35.71	149 10.13	.475	277	96010000	72 37.45	149 33.40	.414	293	97113000	72 38.63	149 46.86	.112	262
94170000	72 35.73	149 10.57	.493	279	96013000	72 37.49	149 33.72	.396	294	97120000	72 38.62	149 46.95	.108	253
94173000	72 35.76	149 11.02	.515	281	96020000	72 37.53	149 34.04	.382	294	97123000	72 38.61	149 47.04	.101	247
94180000	72 35.79	149 11.50	.540	282	96023000	72 37.57	149 34.35	.371	294	97130000	72 38.58	149 47.21	.104	243
94183000	72 35.82	149 12.00	.569	283	96030000	72 37.61	149 34.64	.360	295	97140000	72 38.55	149 47.37	.112	230
94190000	72 35.86	149 12.52	.590	284	96033000	72 37.65	149 34.92	.342	295	97150000	72 38.52	149 47.44	.108	222
94193000	72 35.90	149 13.05	.605	283	96040000	72 37.69	149 35.18	.317	295	97153000	72 38.50	149 47.49	.101	215
94200000	72 35.94	149 13.59	.616	283	96043000	72 37.72	149 35.42	.292	295	97160000	72 38.46	149 47.53	.094	209
94203000	72 35.97	149 14.14	.616	283	96050000	72 37.75	149 35.64	.274	295	97163000	72 38.46	149 47.56	.079	205
94210000	72 36.01	149 14.67	.605	284	96053000	72 37.78	149 35.86	.266	294	97170000	72 38.44	149 47.58	.068	204
94213000	72 36.05	149 15.19	.594	285	96060000	72 37.81	149 36.29	.252	291	97173000	72 38.42	149 47.62	.065	214
94220000	72 36.10	149 15.69	.587	286	96063000	72 37.83	149 36.29	.252	291	97180000	72 38.42	149 47.67	.072	230
94223000	72 36.14	149 16.20	.583	286	96070000	72 37.85	149 36.51	.248	287	97183000	72 38.41	149 47.74	.086	243
94230000	72 36.18	149 16.70	.576	286	96073000	72 37.87	149 36.73	.257	286	97190000	72 38.40	149 47.82	.094	251
94233000	72 36.23	149 17.19	.565	286	96080000	72 37.89	149 36.97	.277	286	97193000	72 38.39	149 47.91	.101	258
95000000	72 36.27	149 17.67	.551	286	96083000	72 37.92	149 37.23	.302	289					
95003000	72 36.31	149 18.14	.536	285	96090000	72 37.95	149 37.50	.313	291					
95010000	72 36.34	149 18.60	.522	284	96093000	72 37.98	149 37.76	.310	289					
95013000	72 36.37	149 19.04	.500	283	96100000	72 38.00	149 38.03	.302	285					
95020000	72 36.40	149 19.46	.475	282	96103000	72 38.01	149 38.29	.299	281					
95023000	72 36.42	149 19.86	.454	282	96110000	72 38.02	149 38.55	.292	279					

Time (UTC)	N. Latitude	W. Longitude	spd	dir	Time (UTC)	N. Latitude	W. Longitude	spd	dir	Time (UTC)	N. Latitude	W. Longitude	spd	dir
dddhhmmss	dd mm. mm	ddd mm. mm	km/hr	deg	dddhhmmss	dd mm. mm	ddd mm. mm	km/hr	deg	dddhhmmss	dd mm. mm	ddd mm. mm	km/hr	deg
97200000	72 38.39	149 48.01	.112	264	99043000	72 37.43	149 55.89	.169	250	100130000	72 36.97	150 3.12	.097	274
97200000	72 38.38	149 48.13	.130	264	99050000	72 37.42	149 56.01	.140	247	100130000	72 36.97	150 3.23	.113	273
97200000	72 38.38	149 48.26	.148	261	99050000	72 37.40	149 56.09	.115	240	100140000	72 36.98	150 3.35	.133	273
97210000	72 38.37	149 48.40	.162	259	99060000	72 37.39	149 56.16	.090	231	100143000	72 36.98	150 3.48	.144	272
97220000	72 38.36	149 48.55	.173	258	99060000	72 37.37	149 56.20	.068	222	100150000	72 36.98	150 3.61	.148	268
97223000	72 38.35	149 48.72	.191	258	99070000	72 37.36	149 56.22	.050	216	100153000	72 36.97	150 3.74	.140	263
97230000	72 38.34	149 48.91	.209	259	99070000	72 37.35	149 56.24	.036	211	100160000	72 36.96	150 3.86	.133	259
97233000	72 38.33	149 49.12	.230	262	99080000	72 37.35	149 56.25	.025	205	100163000	72 36.96	150 3.97	.126	258
98000000	72 38.32	149 49.35	.252	264	99083000	72 37.34	149 56.25	.014	-99	100170000	72 36.95	150 4.07	.115	259
98003000	72 38.32	149 49.58	.263	263	99090000	72 37.34	149 56.25	.007	-99	100170000	72 36.95	150 4.16	.101	261
98010000	72 38.30	149 49.80	.252	260	99093000	72 37.35	149 56.24	.011	-99	100180000	72 36.94	150 4.25	.097	265
98013000	72 38.29	149 50.00	.227	257	99100000	72 37.35	149 56.24	.007	-99	100183000	72 36.94	150 4.34	.101	268
98020000	72 38.27	149 50.17	.198	254	99103000	72 37.35	149 56.26	.011	277	100190000	72 36.94	150 4.44	.115	267
98023000	72 38.26	149 50.32	.173	250	99110000	72 37.35	149 56.27	.018	252	100193000	72 36.94	150 4.56	.133	263
98030000	72 38.24	149 50.44	.155	241	99113000	72 37.34	149 56.29	.025	243	100200000	72 36.93	150 4.70	.158	261
98033000	72 38.21	149 50.55	.151	230	99120000	72 37.34	149 56.32	.040	243	100203000	72 36.92	150 4.87	.184	261
98040000	72 38.18	149 50.63	.144	219	99123000	72 37.33	149 56.36	.047	247	100210000	72 36.91	150 5.05	.205	261
98043000	72 38.15	149 50.69	.137	211	99130000	72 37.33	149 56.39	.043	253	100213000	72 36.90	150 5.26	.230	261
98050000	72 38.12	149 50.74	.122	207	99133000	72 37.33	149 56.42	.029	266	100220000	72 36.90	150 5.48	.252	263
98053000	72 38.09	149 50.79	.112	209	99140000	72 37.33	149 56.43	.014	256	100223000	72 36.89	150 5.72	.266	264
98060000	72 38.07	149 50.84	.101	212	99143000	72 37.33	149 56.44	.011	316	100230000	72 36.88	150 5.97	.270	266
98063000	72 38.05	149 50.88	.086	213	99150000	72 37.33	149 56.45	.011	276	100233000	72 36.88	150 6.22	.274	267
98070000	72 38.03	149 50.92	.072	215	99153000	72 37.33	149 56.47	.025	257	101000000	72 36.88	150 6.47	.281	268
98073000	72 38.02	149 50.96	.061	227	99160000	72 37.33	149 56.50	.040	255	101003000	72 36.88	150 6.73	.288	268
98080000	72 38.02	149 51.01	.058	246	99163000	72 37.33	149 56.54	.047	252	101010000	72 36.87	150 6.99	.284	269
98083000	72 38.01	149 51.07	.061	258	99170000	72 37.32	149 56.59	.058	243	101013000	72 36.87	150 7.23	.274	270
98090000	72 38.01	149 51.12	.065	261	99173000	72 37.31	149 56.65	.079	230	101020000	72 36.88	150 7.46	.256	272
98093000	72 38.01	149 51.18	.061	262	99180000	72 37.29	149 56.72	.104	230	101023000	72 36.88	150 7.67	.230	274
98100000	72 38.01	149 51.24	.065	266	99183000	72 37.27	149 56.81	.133	232	101030000	72 36.89	150 7.86	.205	277
98103000	72 38.01	149 51.31	.079	270	99190000	72 37.22	149 56.93	.155	236	101033000	72 36.90	150 8.01	.176	280
98110000	72 38.01	149 51.39	.094	272	99193000	72 37.22	149 57.07	.184	239	101040000	72 36.90	150 8.14	.148	282
98113000	72 38.01	149 51.48	.101	271	99200000	72 37.19	149 57.24	.212	241	101043000	72 36.91	150 8.25	.122	284
98120000	72 38.01	149 51.56	.090	262	99203000	72 37.16	149 57.43	.234	244	101050000	72 36.92	150 8.33	.090	285
98123000	72 38.00	149 51.63	.079	241	99210000	72 37.14	149 57.65	.252	248	101053000	72 36.92	150 8.38	.058	284
98130000	72 37.98	149 51.67	.086	217	99213000	72 37.11	149 57.88	.270	253	101060000	72 36.92	150 8.41	.032	276
98133000	72 37.95	149 51.71	.097	207	99220000	72 37.08	149 58.14	.292	256	101063000	72 36.92	150 8.43	.022	273
98140000	72 37.93	149 51.75	.097	207	99223000	72 37.07	149 58.42	.313	259	101070000	72 36.92	150 8.45	.022	286
98143000	72 37.91	149 51.80	.090	212	99230000	72 37.04	149 58.42	.313	259	101073000	72 36.93	150 8.48	.029	286
98150000	72 37.89	149 51.84	.086	216	99233000	72 37.06	149 59.03	.349	266	101080000	72 36.93	150 8.51	.040	271
98153000	72 37.87	149 51.88	.086	213	100000000	72 37.06	149 59.35	.356	268	101083000	72 36.92	150 8.56	.054	256
98160000	72 37.85	149 51.92	.090	206	100003000	72 37.05	149 59.68	.360	268	101090000	72 36.92	150 8.62	.065	251
98163000	72 37.83	149 51.95	.094	201	100010000	72 37.05	150 .01	.364	268	101093000	72 36.91	150 8.67	.065	254
98170000	72 37.80	149 51.98	.097	202	100013000	72 37.05	150 .34	.364	268	101100000	72 36.91	150 8.73	.065	265
98173000	72 37.78	149 52.02	.097	204	100020000	72 37.04	150 .66	.356	268	101103000	72 36.91	150 8.80	.076	277
98180000	72 37.75	149 52.06	.097	206	100023000	72 37.04	150 .97	.346	268	101110000	72 36.92	150 8.87	.086	284
98183000	72 37.73	149 52.10	.094	212	100030000	72 37.03	150 1.27	.324	266	101113000	72 36.93	150 8.96	.097	288
98190000	72 37.71	149 52.16	.097	223	100033000	72 37.03	150 1.53	.288	265	101120000	72 36.94	150 9.04	.097	290
98193000	72 37.70	149 52.24	.112	236	100040000	72 37.02	150 1.75	.252	265	101123000	72 36.94	150 9.11	.086	289
98200000	72 37.68	149 52.36	.137	244	100043000	72 37.02	150 1.95	.212	265	101130000	72 36.95	150 9.18	.076	281
98203000	72 37.67	149 52.49	.155	250	100050000	72 37.01	150 2.11	.180	263	101133000	72 36.95	150 9.25	.072	270
98210000	72 37.65	149 52.64	.173	254	100053000	72 37.00	150 2.24	.148	257	101140000	72 36.95	150 9.32	.076	267
98213000	72 37.64	149 52.81	.194	258	100060000	72 36.99	150 2.34	.112	250	101143000	72 36.95	150 9.39	.083	274
98220000	72 37.63	149 53.00	.212	260	100063000	72 36.98	150 2.40	.076	242	101150000	72 36.95	150 9.47	.086	283
98223000	72 37.62	149 53.21	.230	260	100070000	72 36.97	150 2.42	.040	231	101153000	72 36.96	150 9.53	.076	287
98230000	72 37.61	149 53.42	.241	260	100073000	72 36.97	150 2.44	.018	226	101160000	72 36.96	150 9.59	.061	281
98233000	72 37.60	149 53.65	.256	260	100080000	72 36.97	150 2.45	.014	258	101163000	72 36.96	150 9.64	.058	266
99000000	72 37.59	149 53.89	.266	260	100083000	72 36.97	150 2.47	.029	276	101170000	72 36.96	150 9.69	.061	255
99003000	72 37.58	149 54.13	.277	259	100090000	72 36.97	150 2.52	.047	273	101173000	72 36.95	150 9.75	.065	250
99010000	72 37.56	149 54.39	.284	259	100093000	72 36.97	150 2.57	.065	269	101180000	72 36.95	150 9.81	.068	245
99013000	72 37.54	149 54.65	.292	259	100100000	72 36.97	150 2.64	.072	267	101183000	72 36.94	150 9.86	.068	240
99020000	72 37.52	149 54.90	.292	258	100103000	72 36.97	150 2.71	.083	266	101190000	72 36.93	150 9.91	.065	241
99023000	72 37.51	149 55.15	.281	256	100110000	72 36.97	150 2.79	.086	268	101193000	72 36.92	150 9.96	.065	250
99030000	72 37.49	149 55.38	.259	253	100113000	72 36.97	150 2.87	.090	270	101200000	72 36.92	150 10.03	.072	263
99033000	72 37.47	149 55.57	.230	251	100120000	72 36.97	150 2.95	.090	273	101203000	72 36.92	150 10.10	.079	271
99040000	72 37.45	149 55.74	.198	250	100123000	72 36.97	150 3.04	.090	275	101210000	72 36.92	150 10.18	.090	276

Time (UTC)	N.Latitude	W.Longitude	spd	dir	Time (UTC)	N.Latitude	W.Longitude	spd	dir	Time (UTC)	N.Latitude	W.Longitude	spd	dir	Time (UTC)	N.Latitude	W.Longitude	spd	dir
ddhhmmss	dd mm.mm	ddd mm.mm	km/hr	deg	ddhhmmss	dd mm.mm	ddd mm.mm	km/hr	deg	ddhhmmss	dd mm.mm	ddd mm.mm	km/hr	deg	ddhhmmss	dd mm.mm	ddd mm.mm	km/hr	deg
101213000	72 36.93	150 10.27	.101	280	103063000	72 37.51	150 15.99	.112	290	104153000	72 38.12	150 27.10	.215	280	104153000	72 38.12	150 27.10	.215	280
101220000	72 36.93	150 10.27	.115	284	103070000	72 37.53	150 16.09	.126	291	104160000	72 38.13	150 27.29	.216	281	104160000	72 38.13	150 27.29	.216	281
101230000	72 36.94	150 10.49	.137	287	103073000	72 37.54	150 16.21	.137	289	104163000	72 38.14	150 27.49	.223	279	104163000	72 38.14	150 27.49	.223	279
101233000	72 36.96	150 10.63	.158	289	103080000	72 37.55	150 16.33	.133	287	104170000	72 38.14	150 27.69	.227	277	104170000	72 38.14	150 27.69	.227	277
101233000	72 36.97	150 10.78	.180	289	103083000	72 37.56	150 16.43	.126	289	104173000	72 38.15	150 27.90	.230	275	104173000	72 38.15	150 27.90	.230	275
102000000	72 36.99	150 10.94	.191	289	103090000	72 37.57	150 16.53	.119	292	104180000	72 38.15	150 28.11	.230	271	104180000	72 38.15	150 28.11	.230	271
102003000	72 37.01	150 11.10	.187	290	103093000	72 37.58	150 16.63	.115	290	104183000	72 38.14	150 28.32	.234	264	104183000	72 38.14	150 28.32	.234	264
102010000	72 37.02	150 11.25	.176	290	103100000	72 37.59	150 16.74	.119	284	104190000	72 38.13	150 28.53	.238	257	104190000	72 38.13	150 28.53	.238	257
102013000	72 37.04	150 11.39	.162	289	103103000	72 37.59	150 16.85	.122	278	104193000	72 38.11	150 28.72	.220	255	104193000	72 38.11	150 28.72	.220	255
102020000	72 37.05	150 11.53	.158	288	103110000	72 37.60	150 16.96	.119	276	104200000	72 38.11	150 28.90	.202	264	104200000	72 38.11	150 28.90	.202	264
102023000	72 37.07	150 11.66	.151	289	103113000	72 37.60	150 17.06	.115	277	104203000	72 38.11	150 29.11	.223	277	104203000	72 38.11	150 29.11	.223	277
102030000	72 37.08	150 11.78	.148	291	103120000	72 37.61	150 17.16	.112	281	104210000	72 38.13	150 29.36	.349	280	104210000	72 38.13	150 29.36	.349	280
102033000	72 37.09	150 11.90	.140	292	103123000	72 37.61	150 17.26	.112	281	104213000	72 38.14	150 29.68	.392	277	104213000	72 38.14	150 29.68	.392	277
102040000	72 37.11	150 12.01	.133	293	103130000	72 37.62	150 17.36	.119	284	104220000	72 38.15	150 30.01	.371	274	104220000	72 38.15	150 30.01	.371	274
102043000	72 37.12	150 12.12	.130	293	103133000	72 37.63	150 17.47	.126	283	104223000	72 38.15	150 30.33	.353	272	104223000	72 38.15	150 30.33	.353	272
102050000	72 37.14	150 12.22	.130	296	103140000	72 37.64	150 17.58	.126	284	104230000	72 38.15	150 30.63	.331	272	104230000	72 38.15	150 30.63	.331	272
102053000	72 37.15	150 12.32	.119	298	103143000	72 37.65	150 17.69	.126	285	104233000	72 38.16	150 30.92	.320	272	104233000	72 38.16	150 30.92	.320	272
102060000	72 37.17	150 12.40	.104	297	103150000	72 37.66	150 17.80	.130	287	104233000	72 38.16	150 31.20	.310	273	104233000	72 38.16	150 31.20	.310	273
102063000	72 37.17	150 12.48	.090	292	103153000	72 37.67	150 17.92	.130	288	105000000	72 38.17	150 31.47	.302	274	105000000	72 38.17	150 31.47	.302	274
102070000	72 37.18	150 12.55	.086	289	103160000	72 37.68	150 18.03	.137	289	105010000	72 38.17	150 31.74	.295	276	105010000	72 38.17	150 31.74	.295	276
102073000	72 37.19	150 12.63	.090	289	103163000	72 37.69	150 18.16	.144	289	105013000	72 38.19	150 32.01	.295	278	105013000	72 38.19	150 32.01	.295	278
102080000	72 37.20	150 12.71	.094	294	103170000	72 37.71	150 18.29	.151	288	105020000	72 38.20	150 32.27	.295	280	105020000	72 38.20	150 32.27	.295	280
102083000	72 37.21	150 12.78	.097	302	103173000	72 37.72	150 18.43	.162	288	105030000	72 38.21	150 32.53	.295	280	105030000	72 38.21	150 32.53	.295	280
102090000	72 37.23	150 12.85	.101	311	103180000	72 37.73	150 18.58	.173	288	105033000	72 38.23	150 32.78	.281	279	105033000	72 38.23	150 32.78	.281	279
102093000	72 37.25	150 12.92	.108	314	103183000	72 37.75	150 18.73	.180	286	105033000	72 38.24	150 33.01	.259	279	105033000	72 38.24	150 33.01	.259	279
102100000	72 37.27	150 13.00	.119	312	103190000	72 37.76	150 18.90	.187	285	105040000	72 38.25	150 33.22	.238	280	105040000	72 38.25	150 33.22	.238	280
102103000	72 37.29	150 13.09	.122	308	103193000	72 37.77	150 19.06	.191	283	105043000	72 38.26	150 33.42	.220	280	105043000	72 38.26	150 33.42	.220	280
102110000	72 37.31	150 13.18	.122	305	103200000	72 37.78	150 19.24	.194	280	105050000	72 38.27	150 33.61	.212	279	105050000	72 38.27	150 33.61	.212	279
102113000	72 37.33	150 13.26	.115	303	103203000	72 37.79	150 19.42	.202	277	105053000	72 38.27	150 33.79	.205	278	105053000	72 38.27	150 33.79	.205	278
102120000	72 37.34	150 13.35	.104	301	103210000	72 37.79	150 19.61	.212	276	105060000	72 38.28	150 33.97	.202	277	105060000	72 38.28	150 33.97	.202	277
102123000	72 37.36	150 13.42	.097	300	103213000	72 37.80	150 19.80	.216	277	105063000	72 38.29	150 34.15	.194	274	105063000	72 38.29	150 34.15	.194	274
102130000	72 37.37	150 13.50	.094	301	103220000	72 37.81	150 20.00	.216	279	105070000	72 38.29	150 34.31	.184	271	105070000	72 38.29	150 34.31	.184	271
102133000	72 37.38	150 13.57	.090	301	103223000	72 37.82	150 20.20	.223	280	105073000	72 38.28	150 34.47	.176	266	105073000	72 38.28	150 34.47	.176	266
102140000	72 37.40	150 13.63	.086	300	103230000	72 37.83	150 20.41	.238	281	105080000	72 38.28	150 34.62	.166	263	105080000	72 38.28	150 34.62	.166	263
102143000	72 37.41	150 13.70	.083	297	103233000	72 37.85	150 20.64	.256	281	105083000	72 38.27	150 34.77	.158	263	105083000	72 38.27	150 34.77	.158	263
102150000	72 37.41	150 13.76	.076	293	104000000	72 37.86	150 20.87	.266	282	105090000	72 38.27	150 34.91	.155	265	105090000	72 38.27	150 34.91	.155	265
102153000	72 37.42	150 13.86	.065	292	104003000	72 37.88	150 21.11	.266	282	105093000	72 38.27	150 35.05	.151	268	105093000	72 38.27	150 35.05	.151	268
102160000	72 37.43	150 13.95	.058	297	104010000	72 37.89	150 21.34	.263	282	105100000	72 38.26	150 35.44	.137	263	105100000	72 38.26	150 35.44	.137	263
102163000	72 37.44	150 13.91	.058	303	104013000	72 37.90	150 21.57	.259	282	105110000	72 38.25	150 35.54	.119	264	105110000	72 38.25	150 35.54	.119	264
102170000	72 37.45	150 14.00	.054	290	104020000	72 37.92	150 21.80	.256	284	105113000	72 38.25	150 35.63	.097	268	105113000	72 38.25	150 35.63	.097	268
102180000	72 37.45	150 14.05	.058	276	104030000	72 37.96	150 22.24	.252	285	105120000	72 38.25	150 35.70	.083	271	105120000	72 38.25	150 35.70	.083	271
102183000	72 37.45	150 14.11	.061	270	104033000	72 37.97	150 22.46	.245	284	105123000	72 38.25	150 35.78	.079	271	105123000	72 38.25	150 35.78	.079	271
102190000	72 37.45	150 14.16	.061	271	104040000	72 37.98	150 22.67	.238	281	105130000	72 38.25	150 35.78	.079	271	105130000	72 38.25	150 35.78	.079	271
102193000	72 37.45	150 14.21	.058	278	104043000	72 37.99	150 22.88	.238	279	105133000	72 38.26	150 35.86	.090	272	105133000	72 38.26	150 35.86	.090	272
102200000	72 37.46	150 14.26	.050	286	104050000	72 38.00	150 23.09	.238	279	105140000	72 38.26	150 35.96	.112	275	105140000	72 38.26	150 35.96	.112	275
102203000	72 37.46	150 14.30	.047	284	104053000	72 38.01	150 23.30	.230	279	105143000	72 38.26	150 36.08	.133	278	105143000	72 38.26	150 36.08	.133	278
102210000	72 37.46	150 14.35	.050	271	104060000	72 38.02	150 23.49	.220	279	105150000	72 38.27	150 36.21	.140	279	105150000	72 38.27	150 36.21	.140	279
102213000	72 37.46	150 14.41	.065	262	104063000	72 38.03	150 23.68	.205	279	105153000	72 38.27	150 36.32	.130	279	105153000	72 38.27	150 36.32	.130	279
102220000	72 37.45	150 14.48	.086	262	104070000	72 38.04	150 23.85	.198	277	105160000	72 38.28	150 36.43	.122	275	105160000	72 38.28	150 36.43	.122	275
102223000	72 37.45	150 14.57	.101	264	104073000	72 38.04	150 24.03	.198	275	105163000	72 38.28	150 36.54	.119	270	105163000	72 38.28	150 36.54	.119	270
102230000	72 37.45	150 14.67	.104	267	104080000	72 38.05	150 24.22	.202	273	105170000	72 38.28	150 36.65	.119	269	105170000	72 38.28	150 36.65	.119	269
102233000	72 37.45	150 14.75	.097	268	104083000	72 38.05	150 24.41	.212	271	105173000	72 38.28	150 36.73	.104	28					

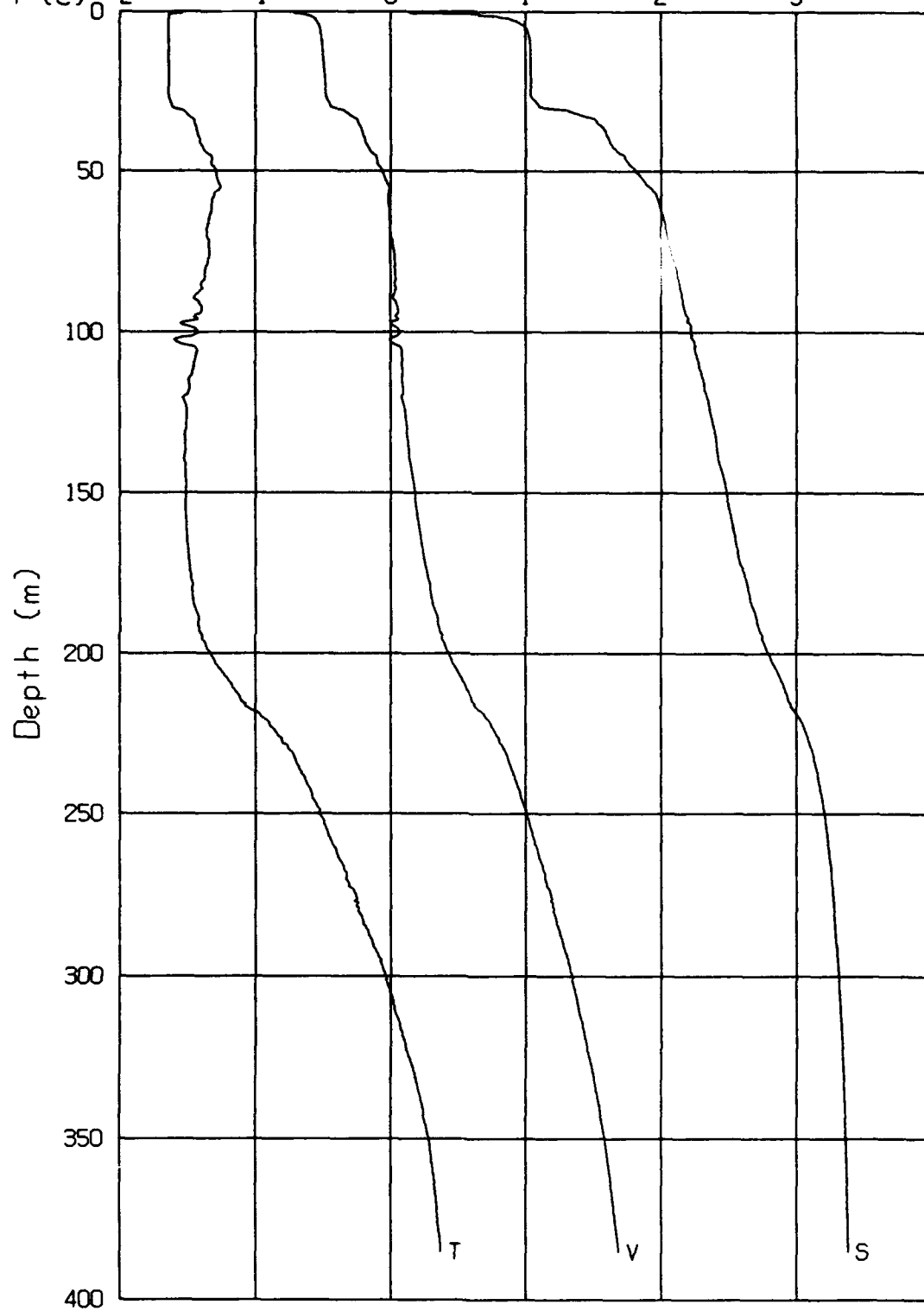
APPENDIX B

STD Plots

Date	Time (Local)	Cast No.	Latitude	Longitude
03-29-93	1851	CAST 001	72°34.8' N	147°23.3' W
03-30-93	0649	CAST 002	72°34.5' N	147°24.2' W
03-30-93	1738	CAST 003	72°34.0' N	147°29.5' W
03-31-93	0632	CAST 004	72°34.0' N	147°39.1' W
03-31-93	2016	CAST 005	72°34.6' N	147°51.3' W
04-01-93	1613	CAST 006	72°35.9' N	148°11.2' W
04-02-93	0630	CAST 007	73°36.0' N	148°24.8' W
04-02-93	1520	CAST 008	72°35.6' N	148°32.5' W
04-02-93	1847	CAST 009	72°35.4' N	148°36.1' W
04-02-93	2229	CAST 010	72°35.2' N	148°38.9' W
04-03-93	0630	CAST 011	72°34.9' N	148°44.6' W
04-03-93	1406	CAST 012	72°34.7' N	148°52.5' W
04-03-93	2128	CAST 013	72°35.1' N	149°01.3' W
04-04-93	0610	CAST 014	72°35.6' N	149°08.5' W
04-04-93	1416	CAST 015	72°36.1' N	149°16.2' W
04-05-93	0848	CAST 016	72°36.7' N	149°28.5' W
04-05-93	1654	CAST 017	72°37.3' N	149°32.7' W
04-06-93	0934	CAST 018	72°38.1' N	149°40.7' W
04-06-93	1147	CAST 019	72°38.2' N	149°41.5' W
04-06-93	1617	CAST 020	72°38.5' N	149°44.2' W
04-06-93	2140	CAST 021	72°38.6' N	149°45.8' W
04-07-93	0751	CAST 022	72°38.5' N	149°47.5' W
04-07-93	2014	CAST 023	72°38.1' N	149°50.7' W
04-08-93	0914	CAST 024	72°37.8' N	149°51.9' W
04-08-93	1844	CAST 025	72°37.5' N	149°55.4' W
04-09-93	0831	CAST 026	72°37.3' N	149°56.5' W
04-09-93	1427	CAST 027	72°37.3' N	149°58.3' W
04-09-93	2239	CAST 028	72°36.9' N	150°02.5' W
04-10-93	1232	CAST 029	72°36.9' N	150°04.9' W
04-10-93	1750	CAST 030	72°36.9' N	150°07.3' W
04-11-93	0656	CAST 031	72°36.9' N	150°09.5' W
04-11-93	1424	CAST 032	72°36.9' N	150°10.5' W
04-11-93	2340	CAST 033	72°37.2' N	150°12.8' W
04-12-93	0746	CAST 034	72°37.4' N	150°13.8' W
04-12-93	1450	CAST 035	72°37.4' N	150°14.6' W
04-12-93	2248	CAST 036	72°37.5' N	150°16.1' W
04-13-93	0754	CAST 037	72°37.7' N	150°18.0' W
04-13-93	2320	CAST 038	72°38.0' N	150°24.0' W
04-14-93	0635	CAST 039	72°38.1' N	150°26.7' W
04-14-93	1418	CAST 040	72°38.1' N	150°30.2' W
04-14-93	2134	CAST 041	72°38.3' N	150°33.7' W
04-15-93	0621	CAST 042	72°38.8' N	150°36.1' W
04-15-93	1407	CAST 043	72°38.3' N	150°37.7' W

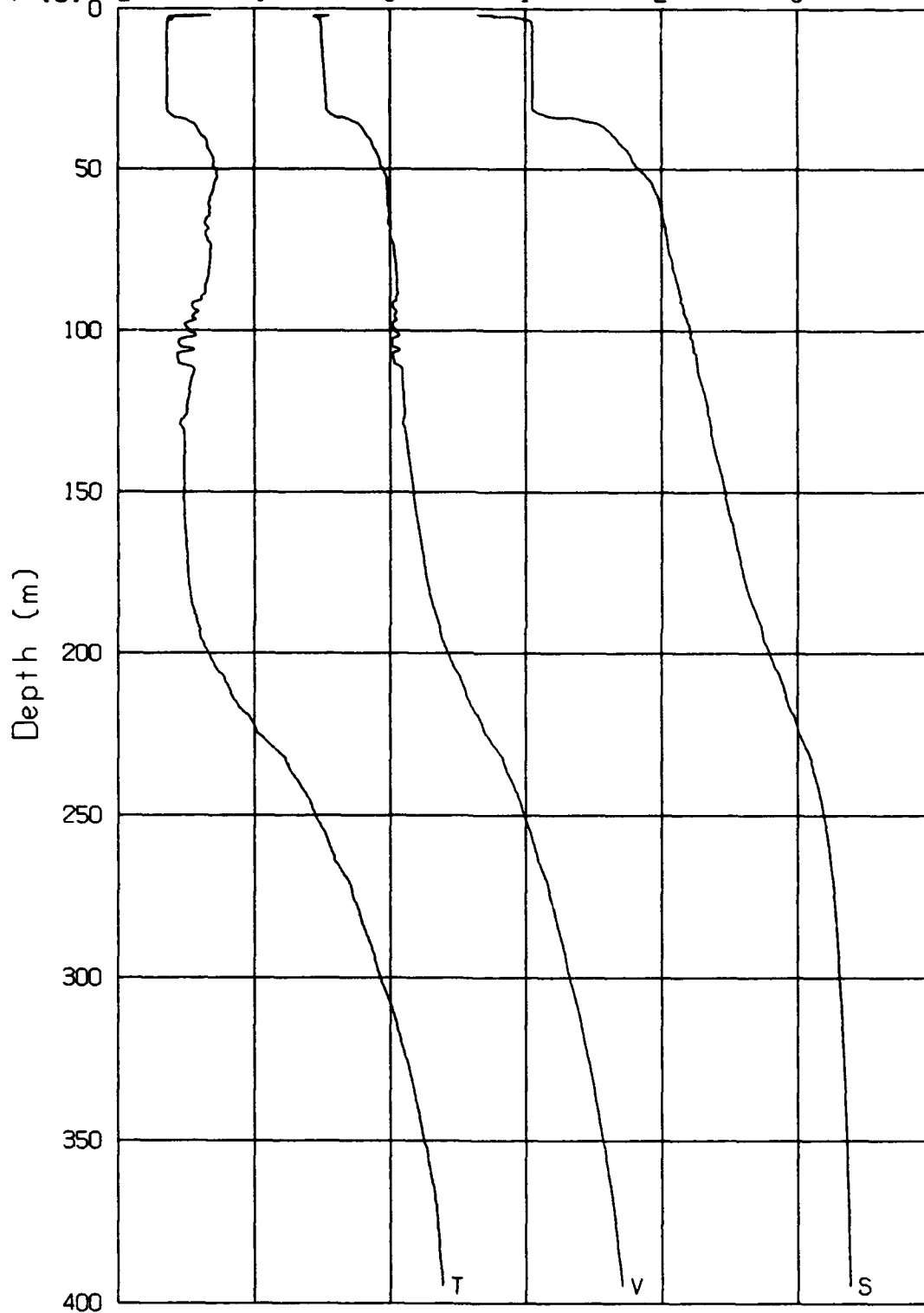
03-29-93 1851 CAST 001 72-34.76N/147-23.3W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



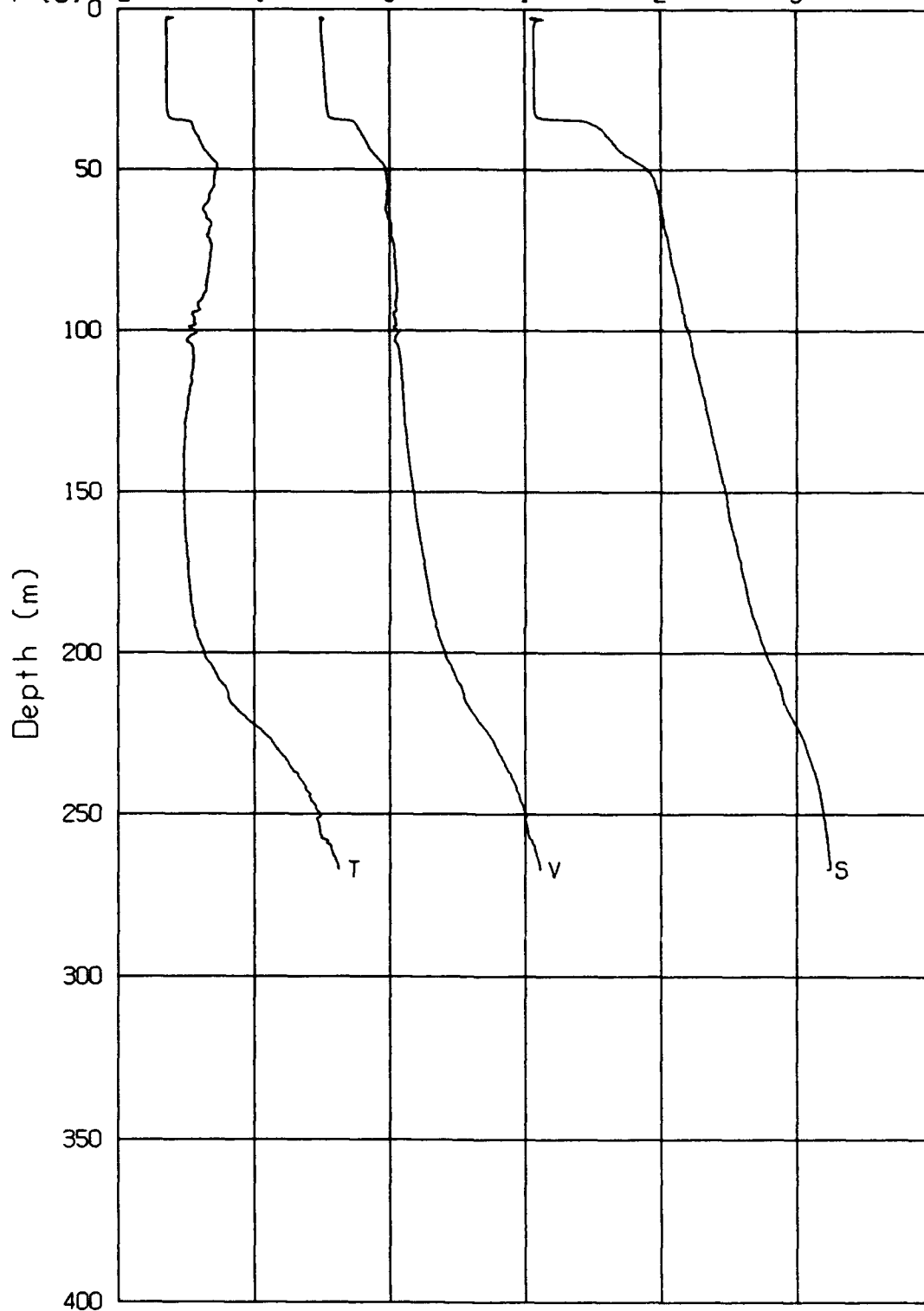
03-30-93 0649 CAST 002 72-34.5 N / 147-24.2 W

SV (m/s) 1420 1430 1440 1450 1460 1470 1480
S (o/oo) 24 26 28 30 32 34 36
T (C) -2 -1 0 1 2 3 4



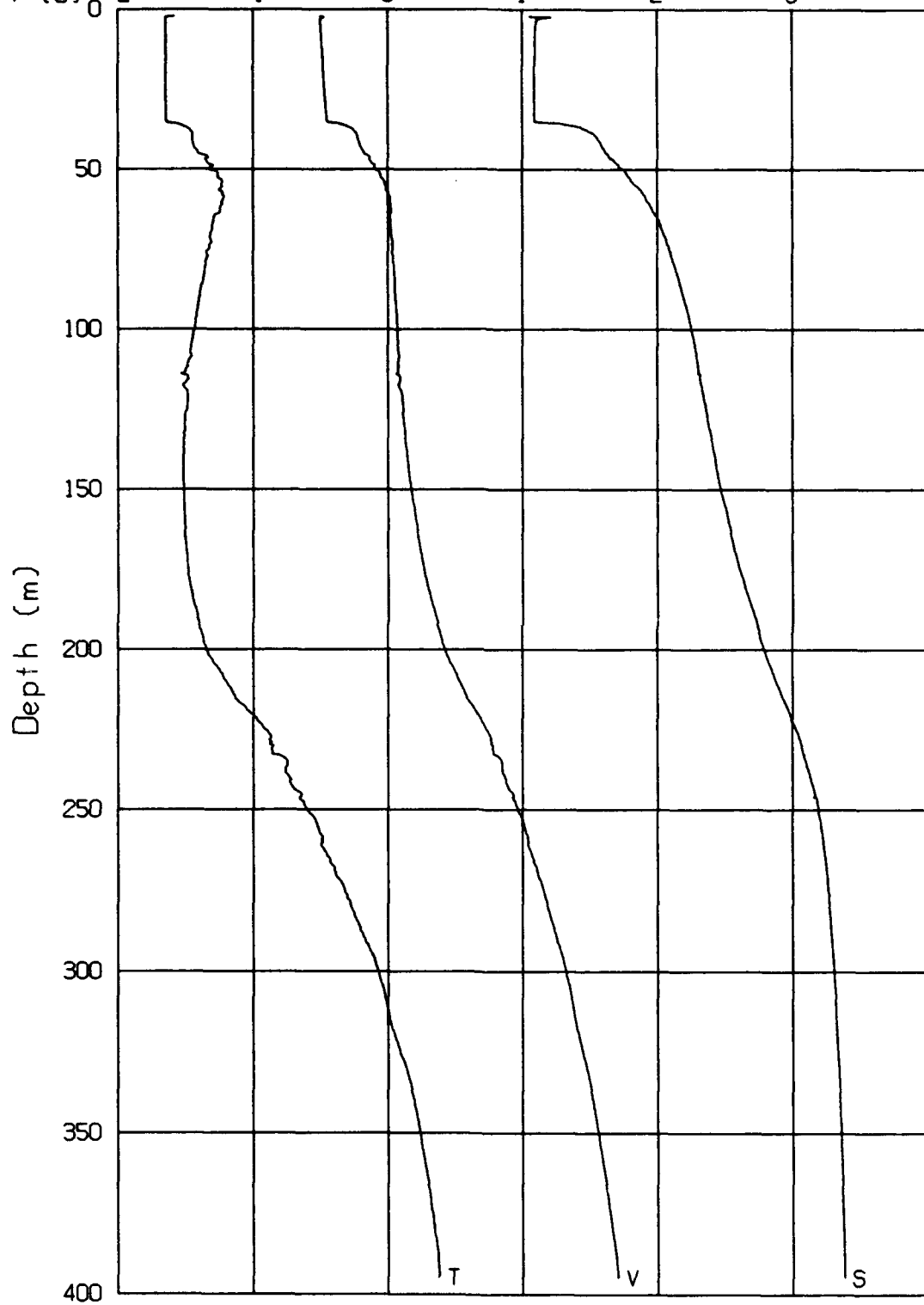
03-30-93 1738 CAST 003 72-34.0 N / 147-29.5 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



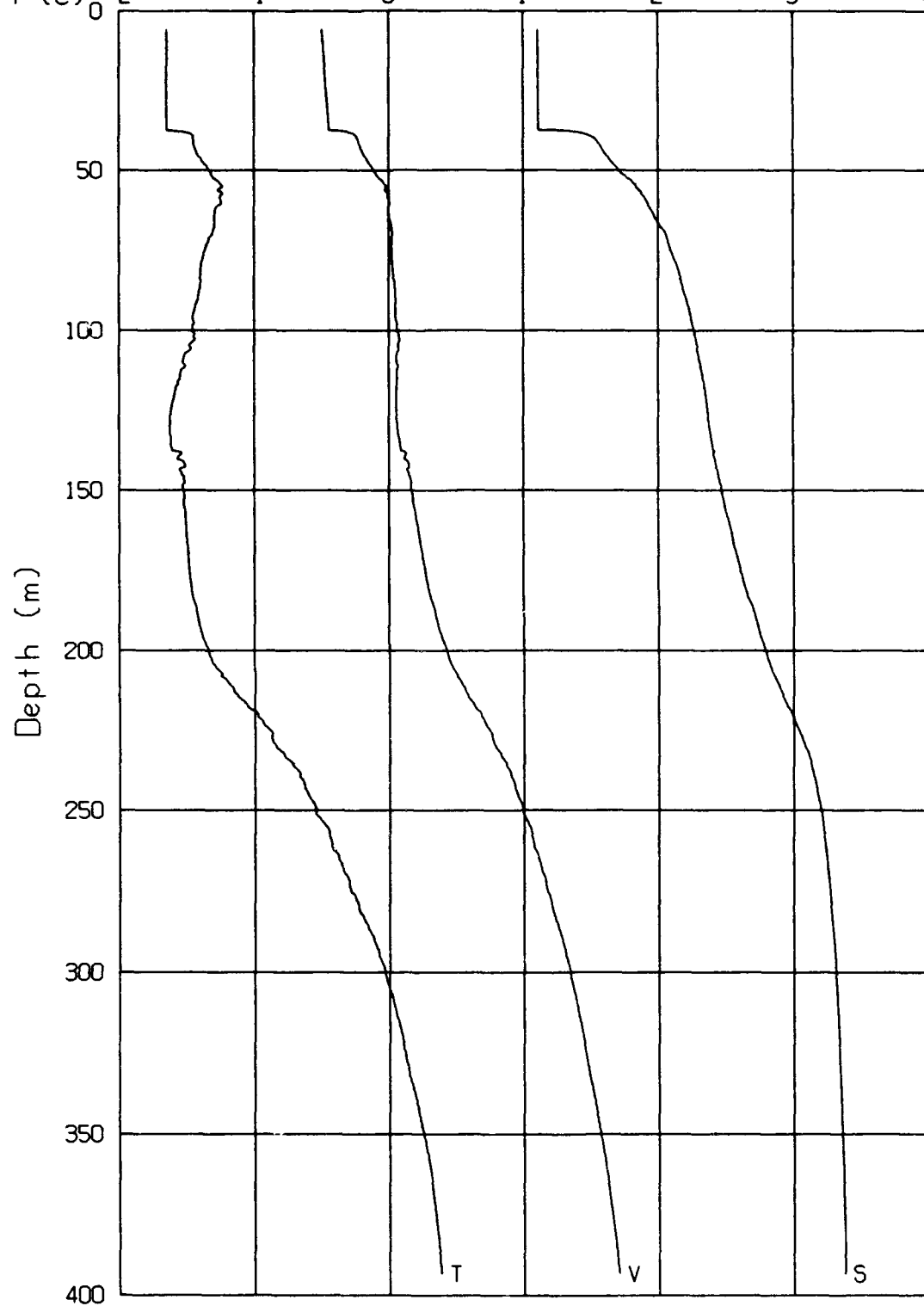
03-31-93 0632 CAST 004 72-34.0 N / 147-39.1 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



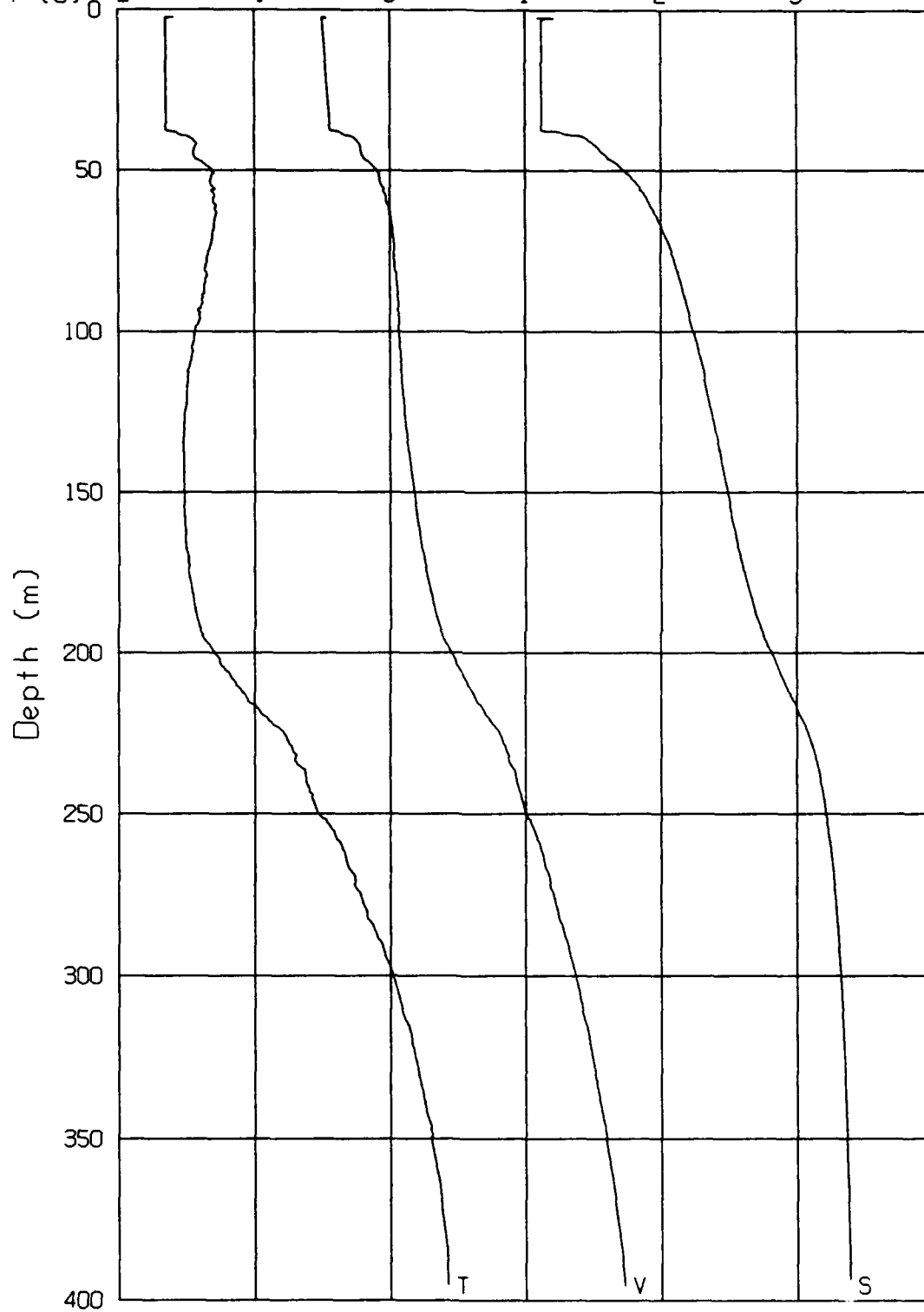
03-31-93 2016 CAST 005 72-34.6 N / 147-51.3 W

SV (m/s) 1420 1430 1440 1450 1460 1470 1480
S (o/oo) 24 26 28 30 32 34 36
T (C) -2 -1 0 1 2 3 4



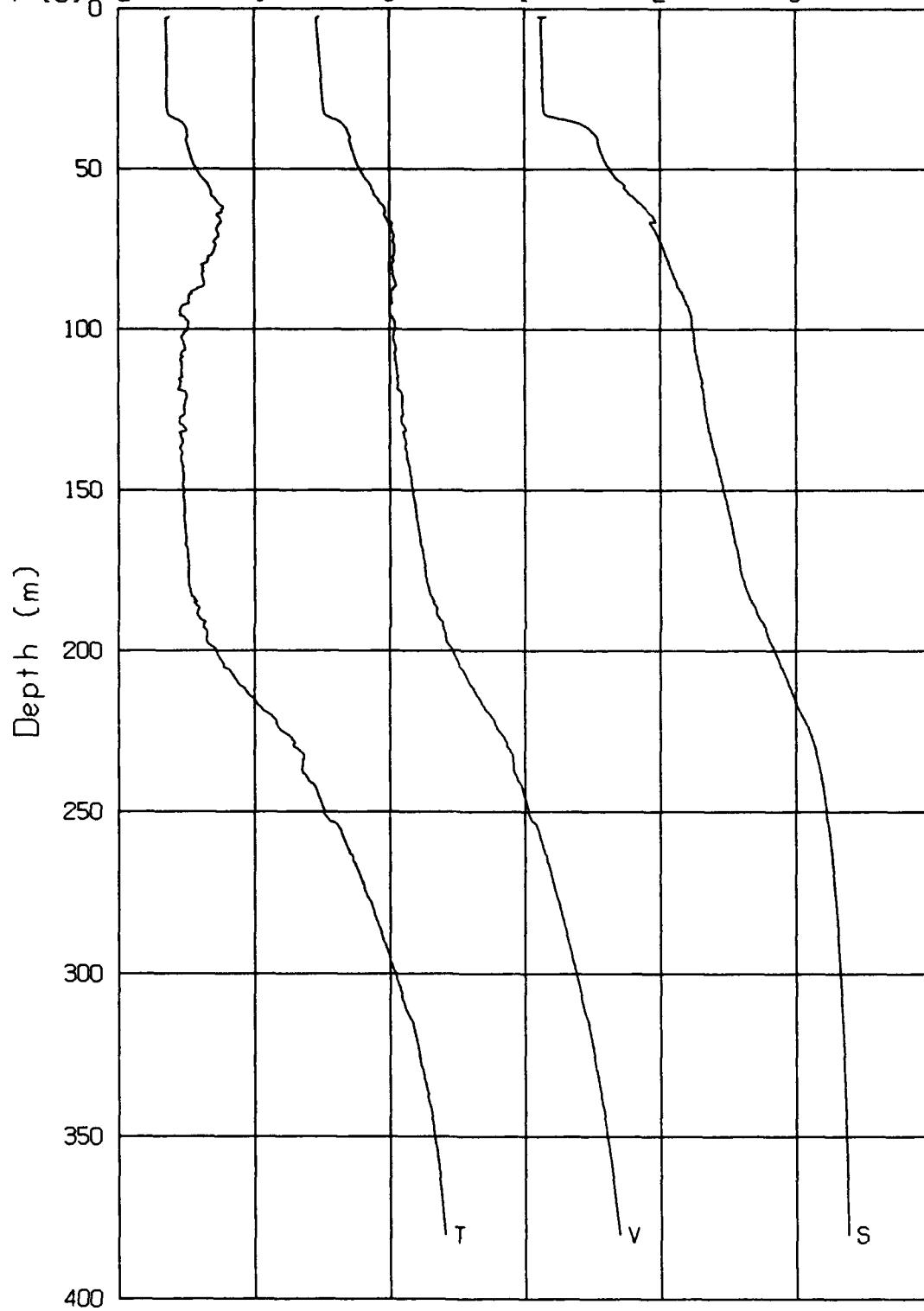
04-01-93 1613 CAST 006 72-35.9 N / 148-11.2 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



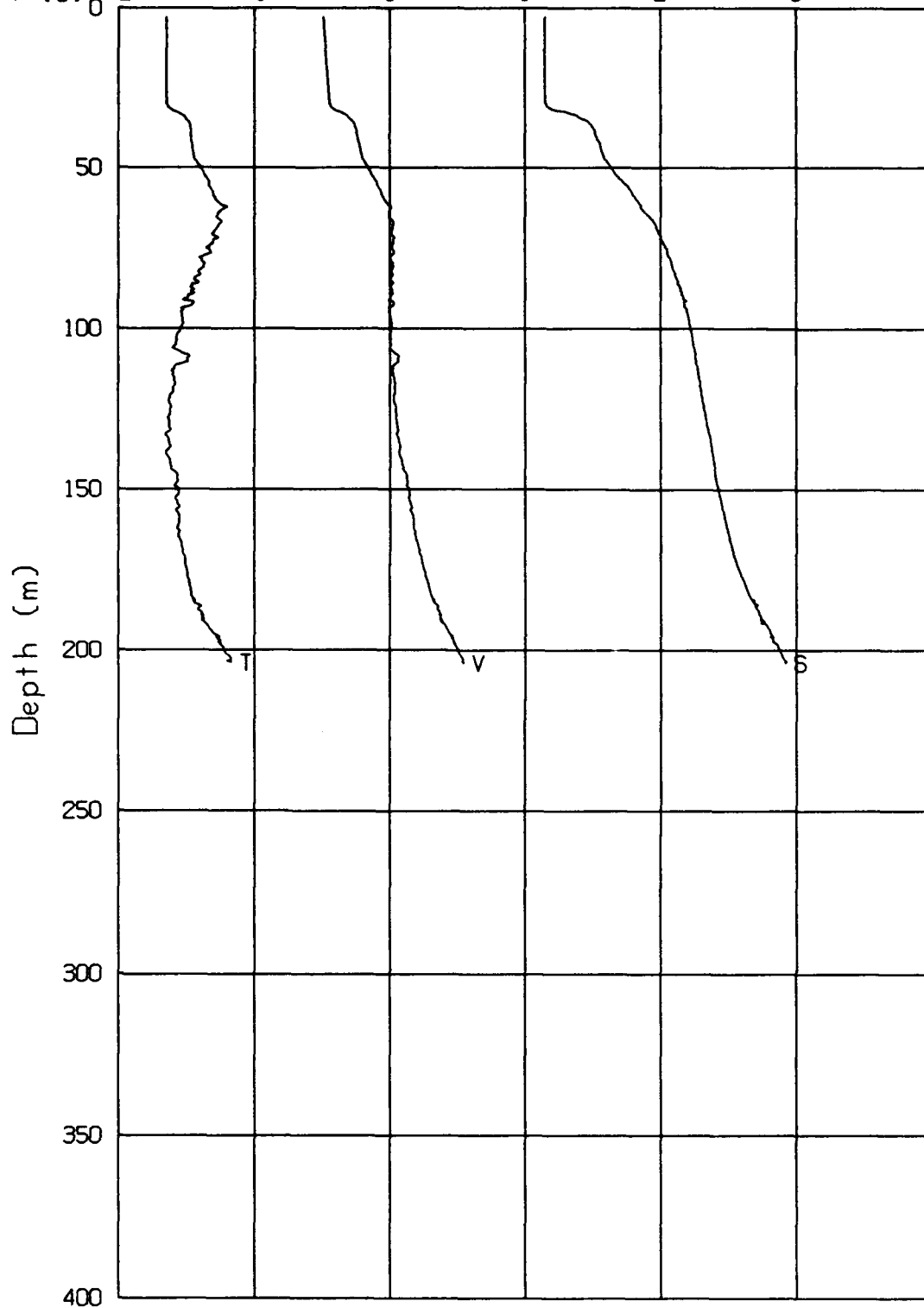
04-02-93 0630 CAST 007 73-36.0 N / 148-24.8 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



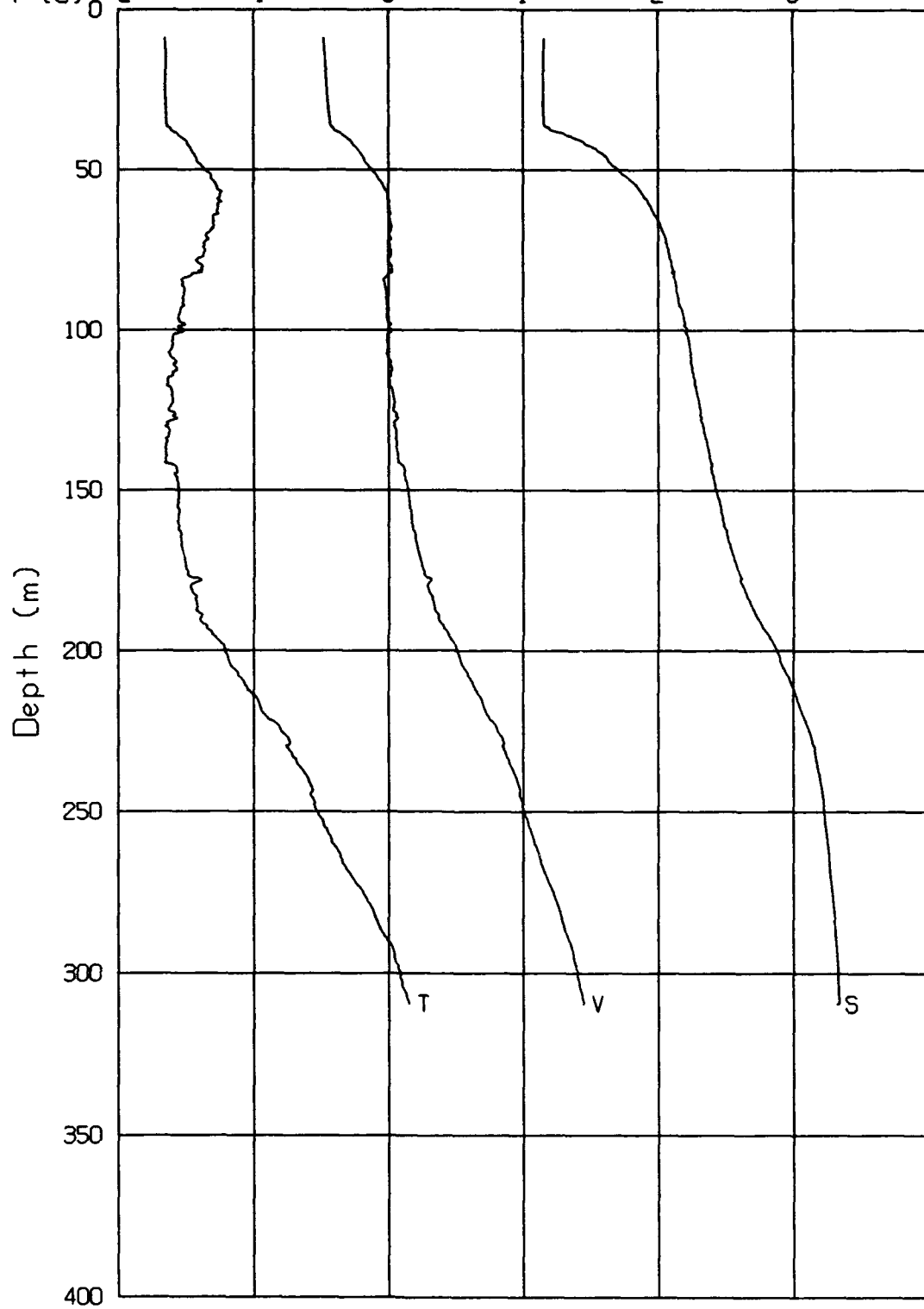
04-02-93 1520 CAST 008 72-35.6 N / 148-32.5 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (‰)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



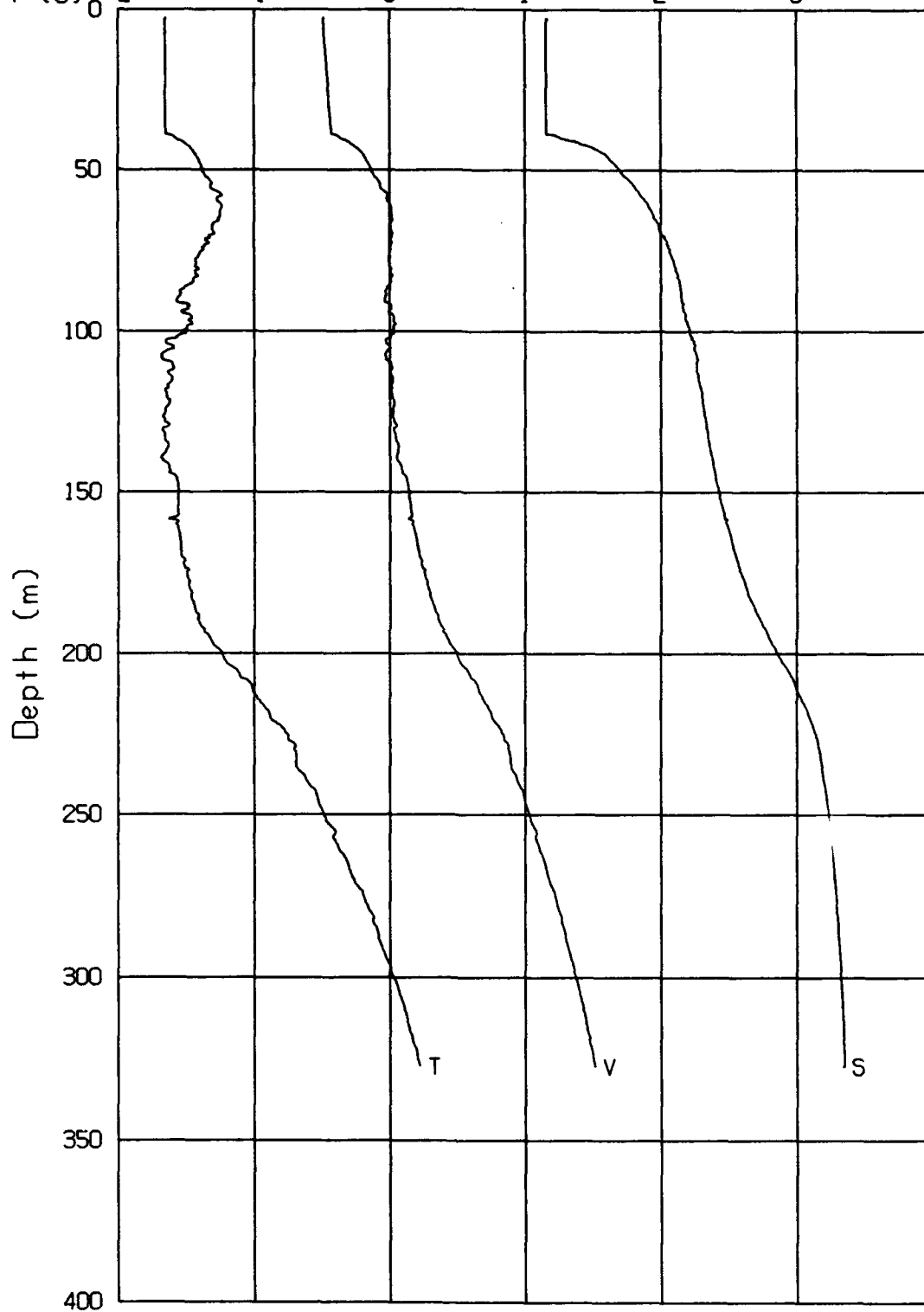
04-02-93 1847 CAST 009 72-35.4 N / 148-36.1 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



04-02-93 2229 CAST 010 72-35.2 N / 148-38.9 W

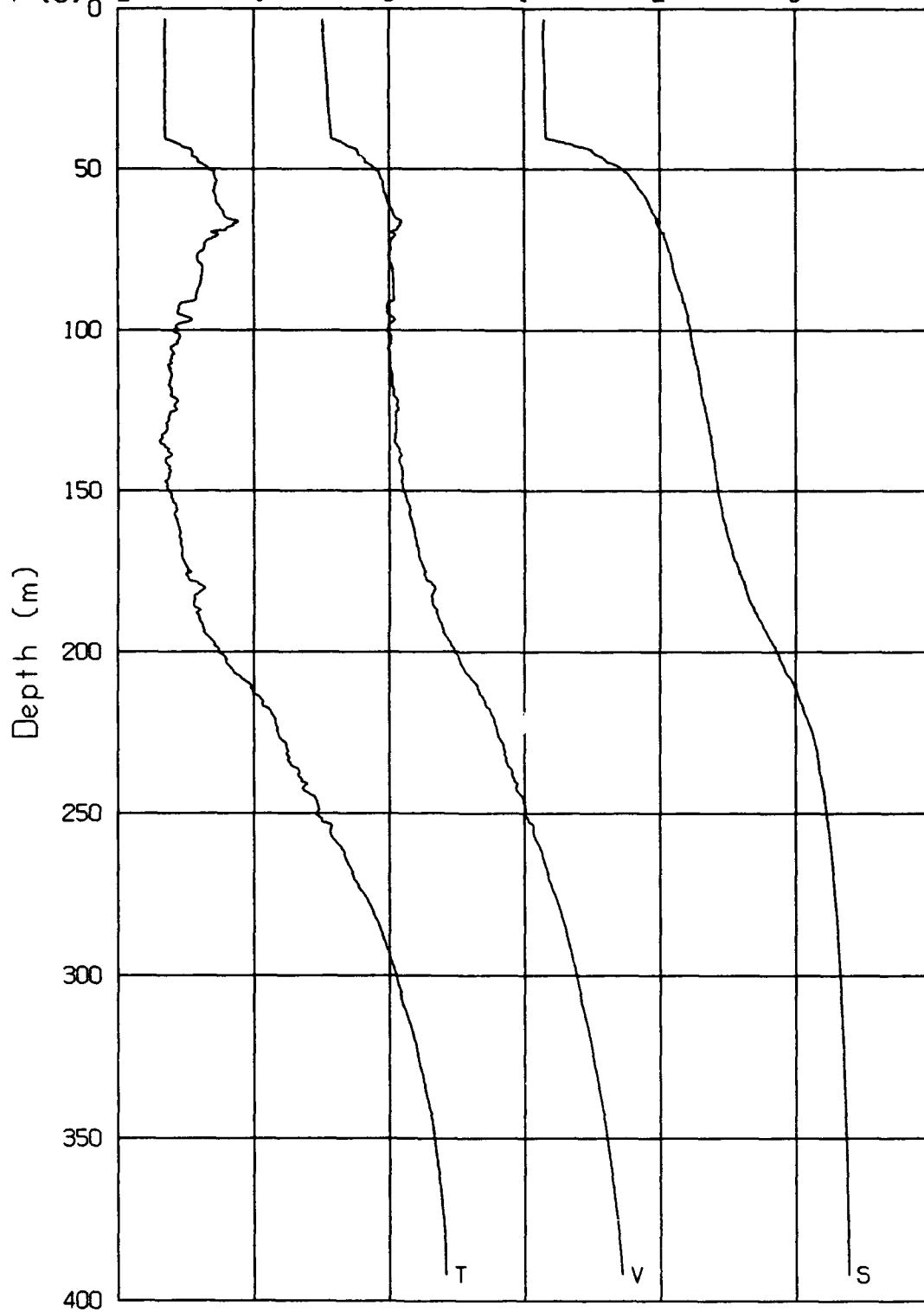
SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



04-03-93 0630

CAST 011 72-34.9 N / 148-44.6 W

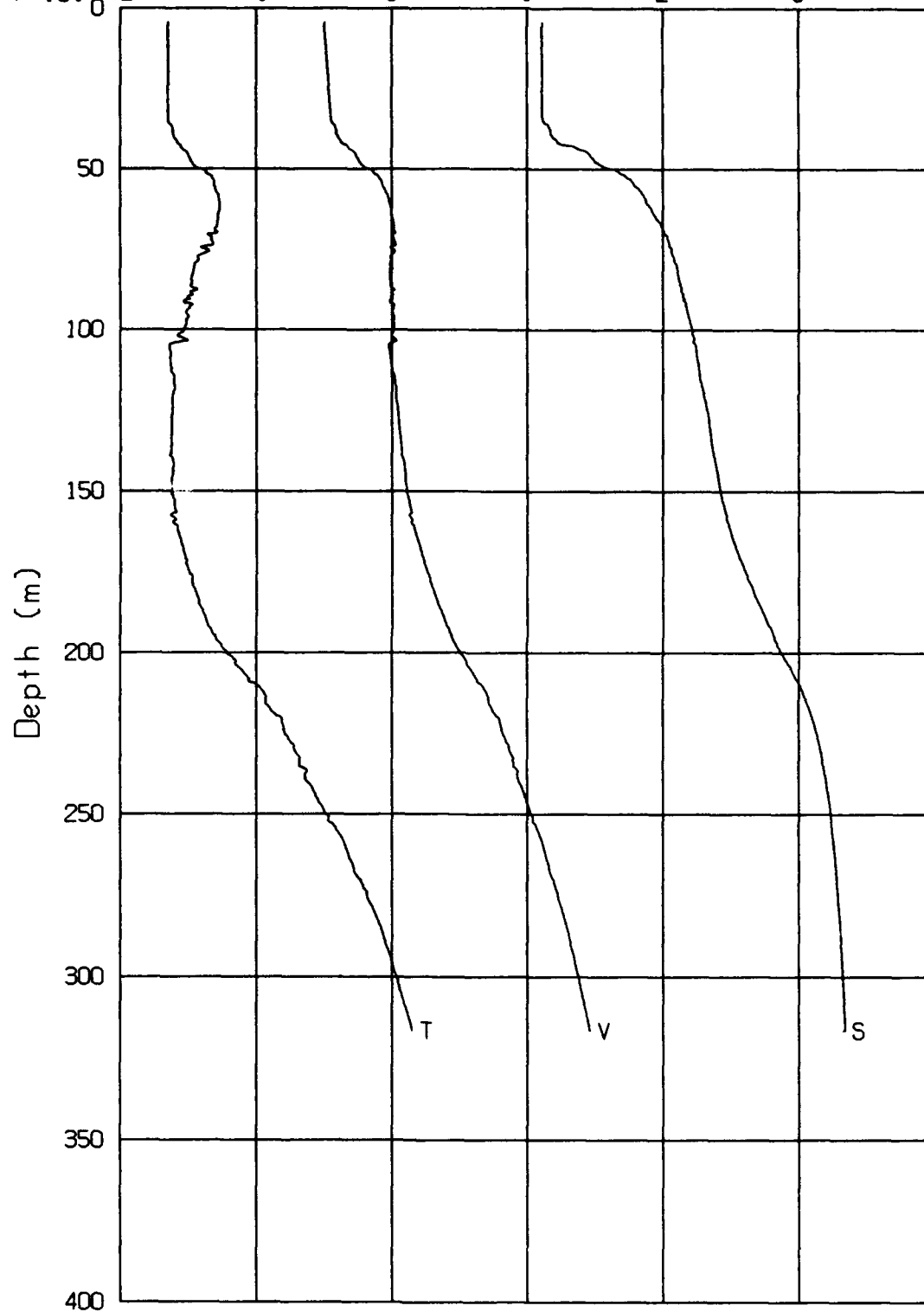
SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



B11

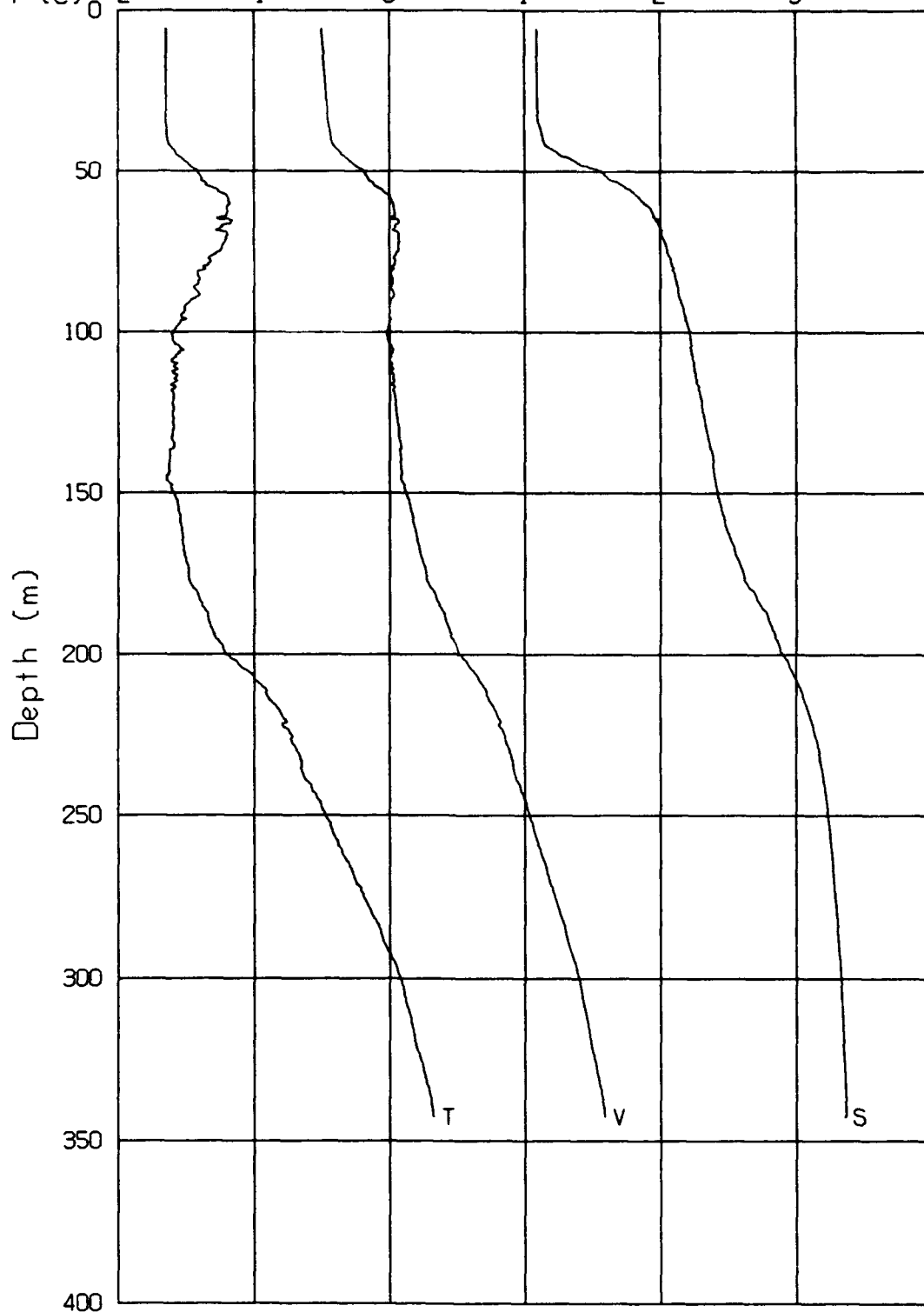
04-03-93 1406 CAST 012 72-34.7 N / 148-52.5 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (‰)	24	26	28	30	32	34	36
T (°C)	-2	-1	0	1	2	3	4



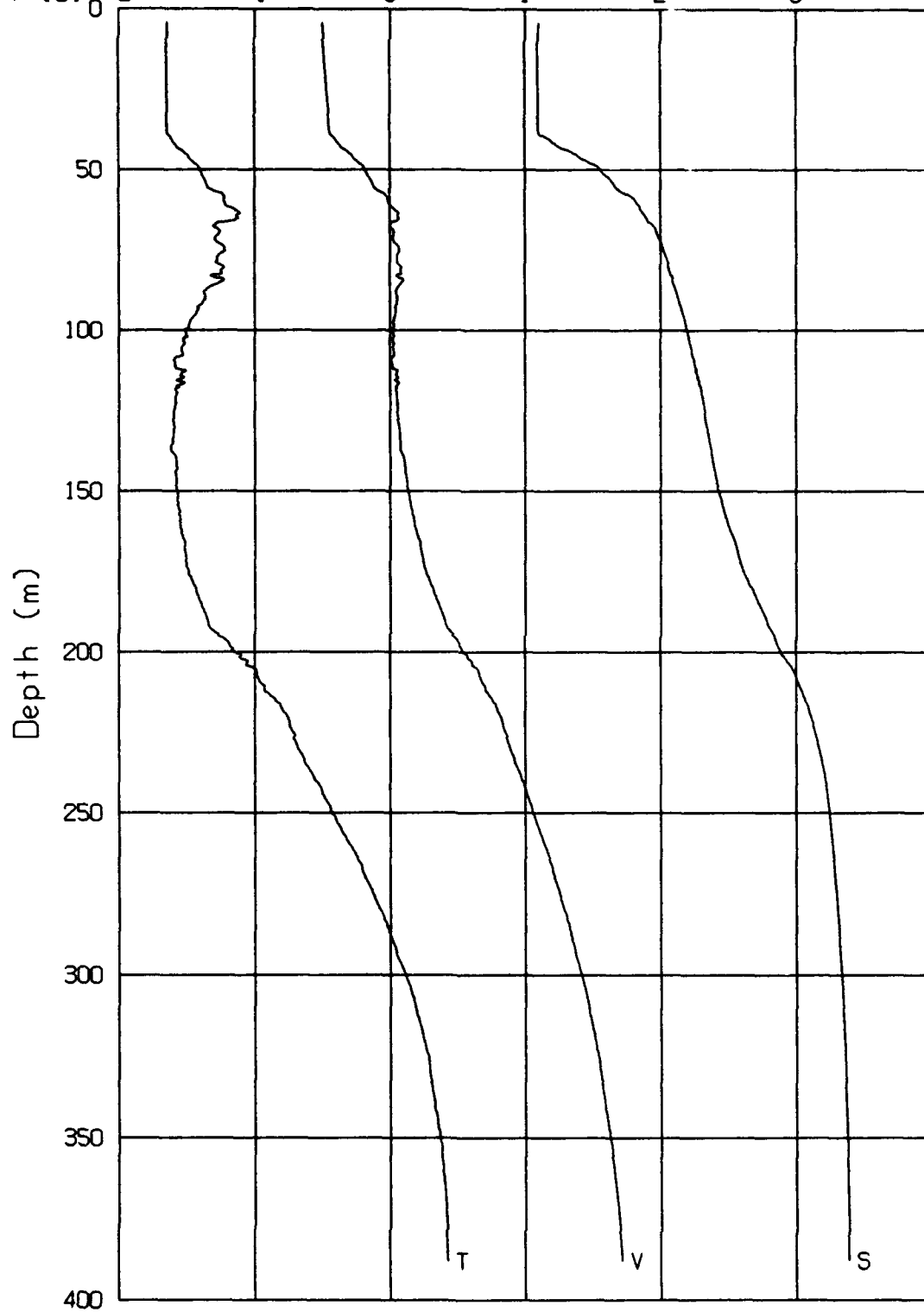
04-03-93 2128 CAST 013 72-35.1 N / 149-01.3 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



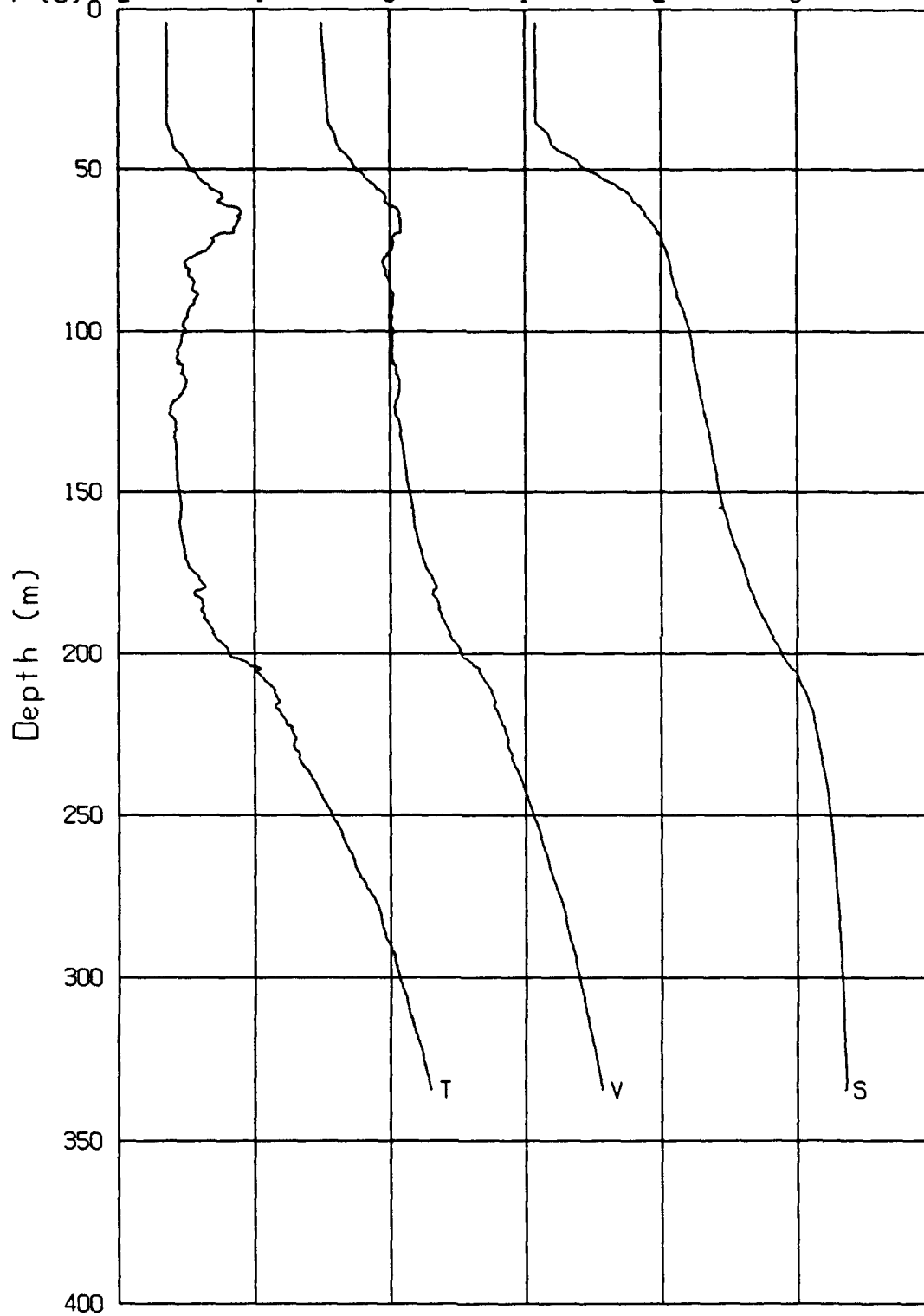
04-04-93 0610 CAST 014 72-35.6 N / 149-08.5 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



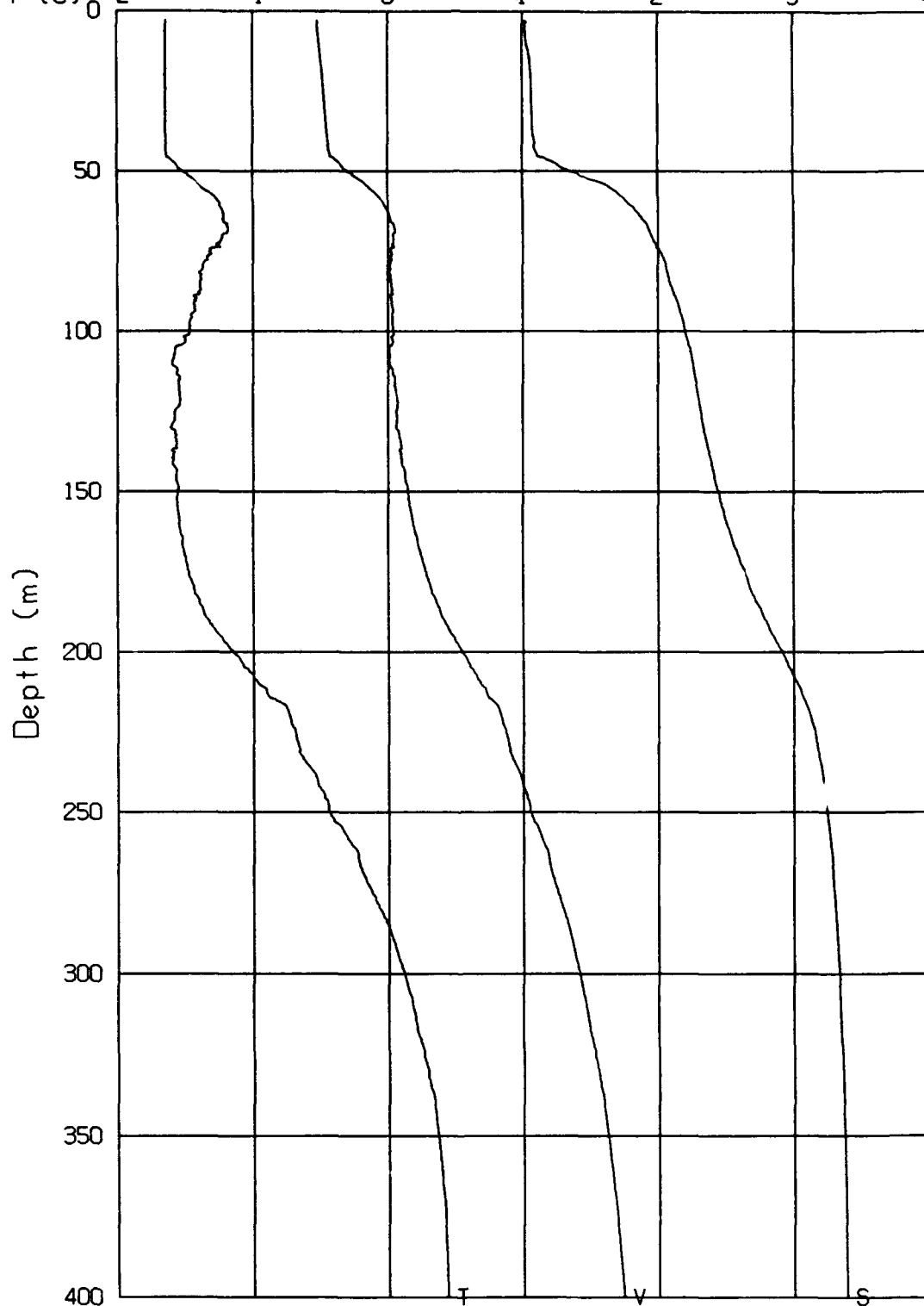
04-04-93 1416 CAST 015 72-36.1 N / 149-16.2 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (‰)	24	26	28	30	32	34	36
T (°C)	-2	-1	0	1	2	3	4



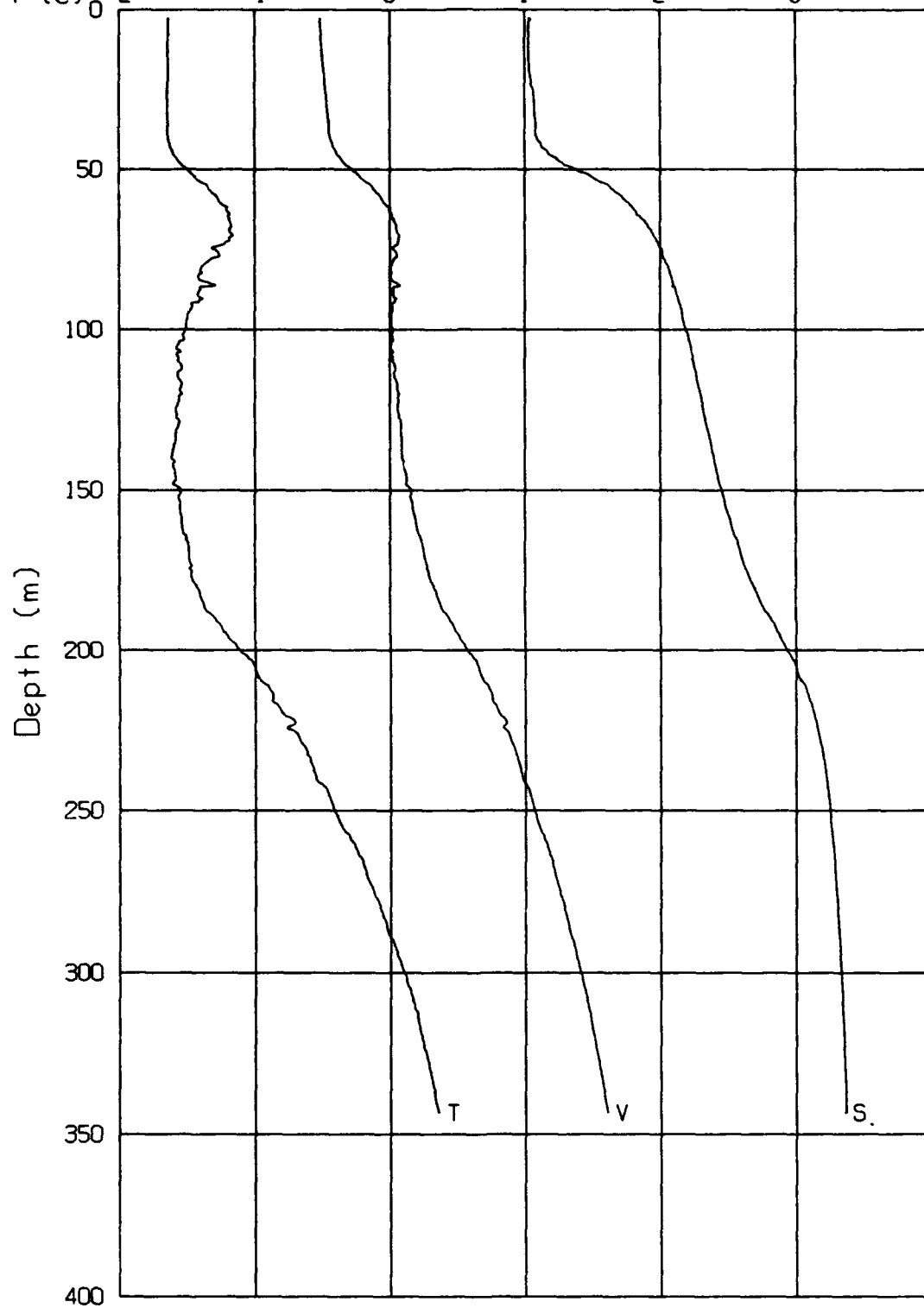
04-05-93 0848 CAST 016 72-36.7 N / 149-28.5 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



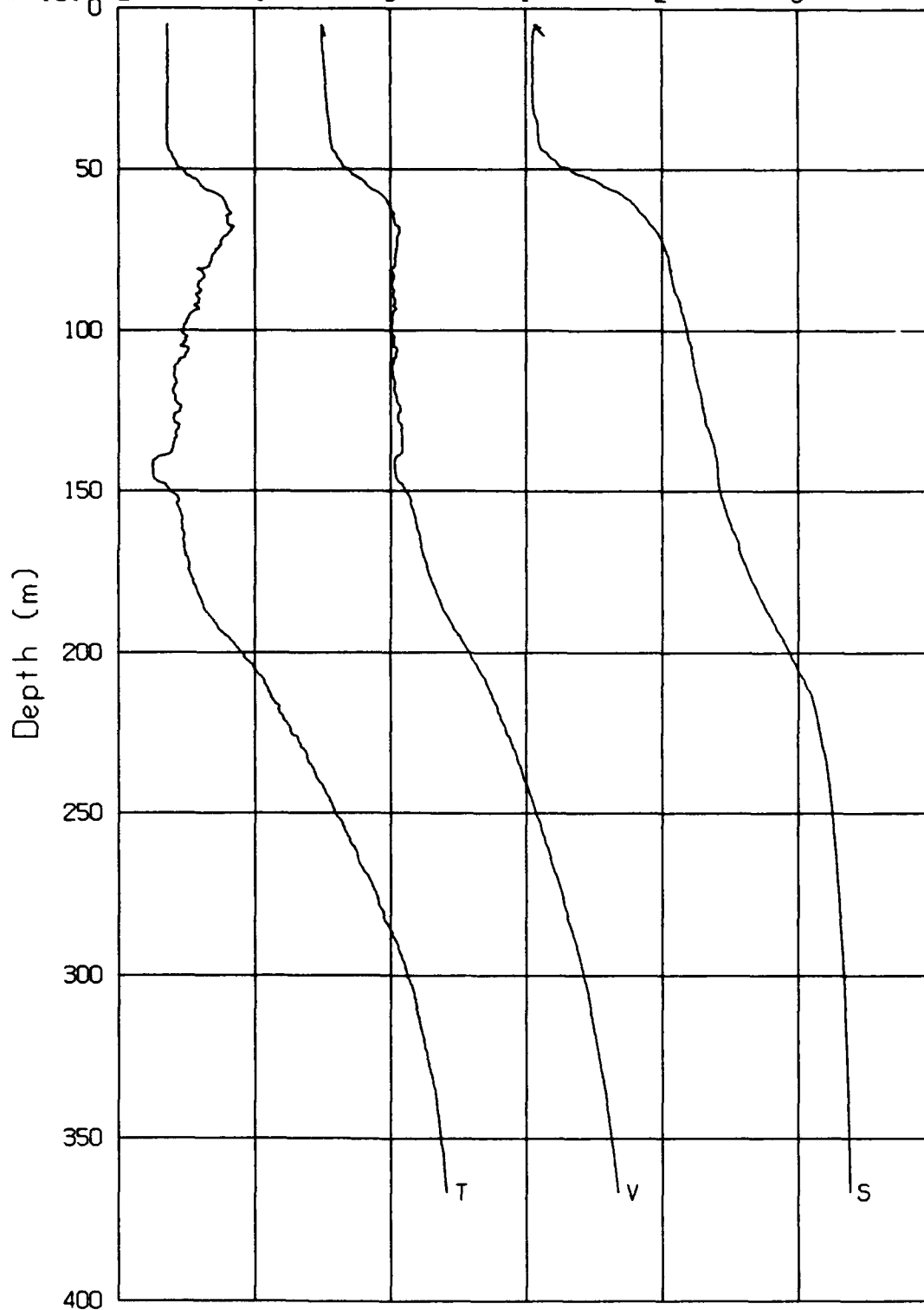
04-05-93 1654 CAST 017 72-37.3 N / 149-32.7 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



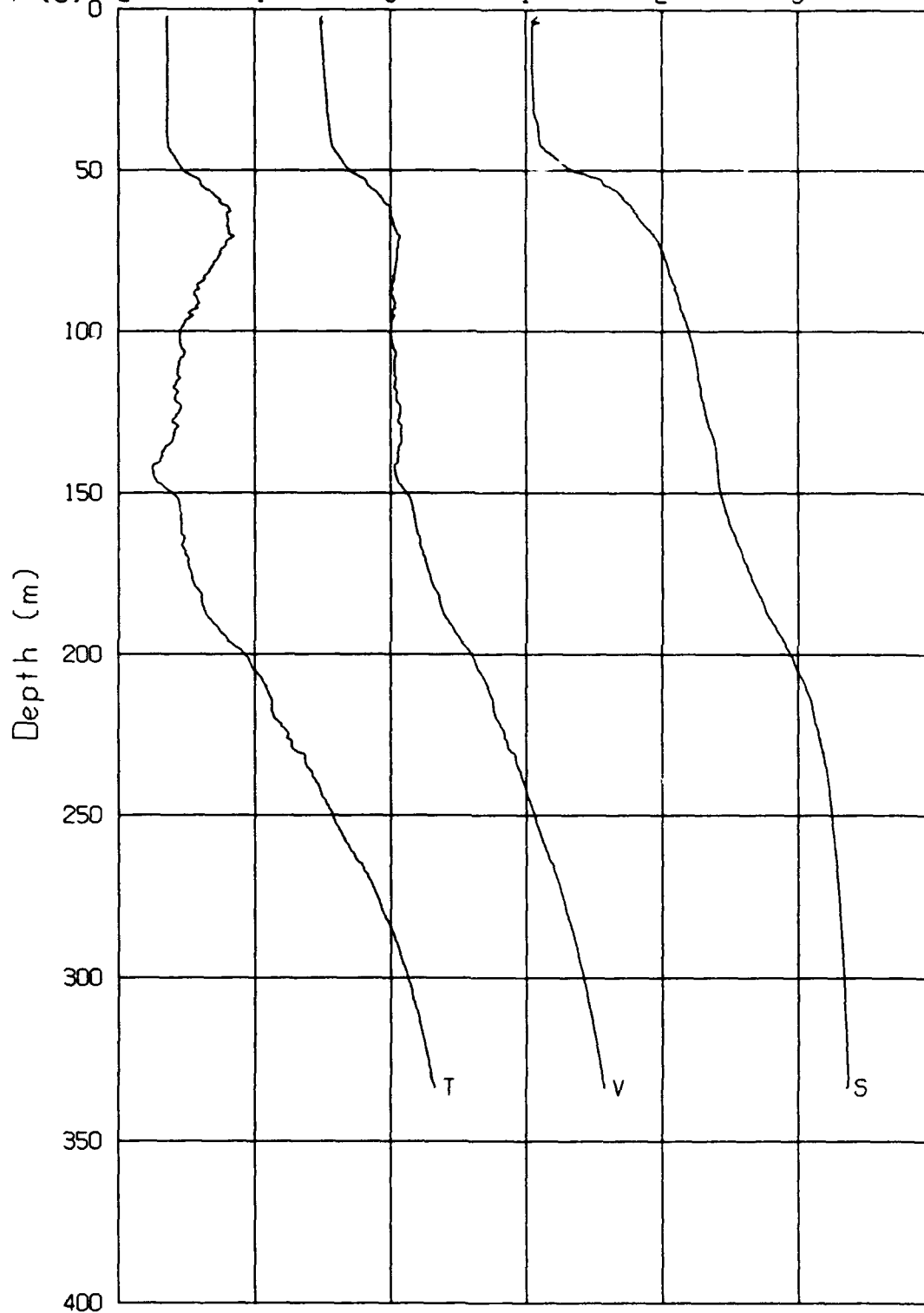
04-06-93 0934 CAST 018 72-38.1 N / 149-40.7 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



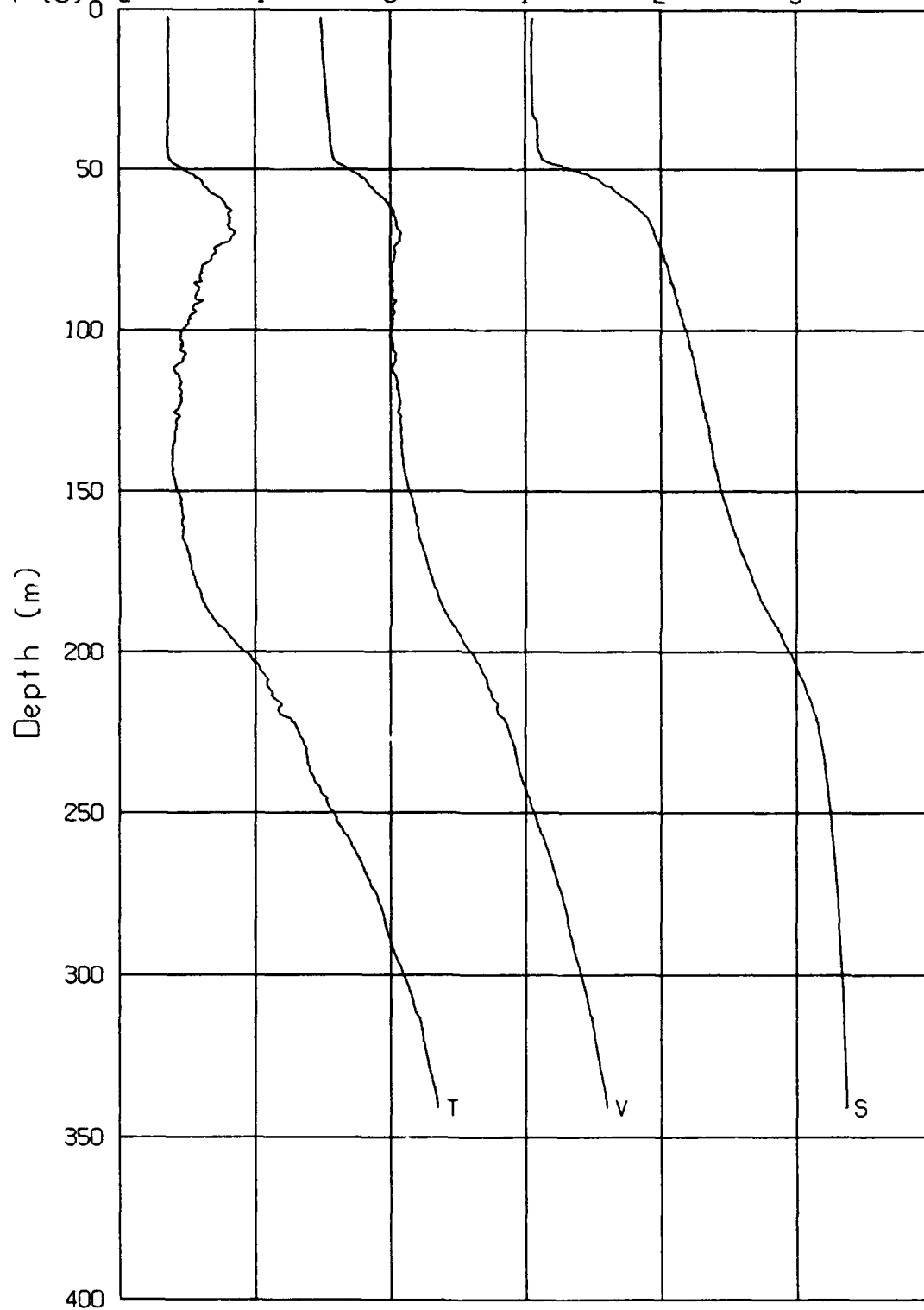
04-06-93 1147 CAST 019 72-38.2 N / 149-41.5 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



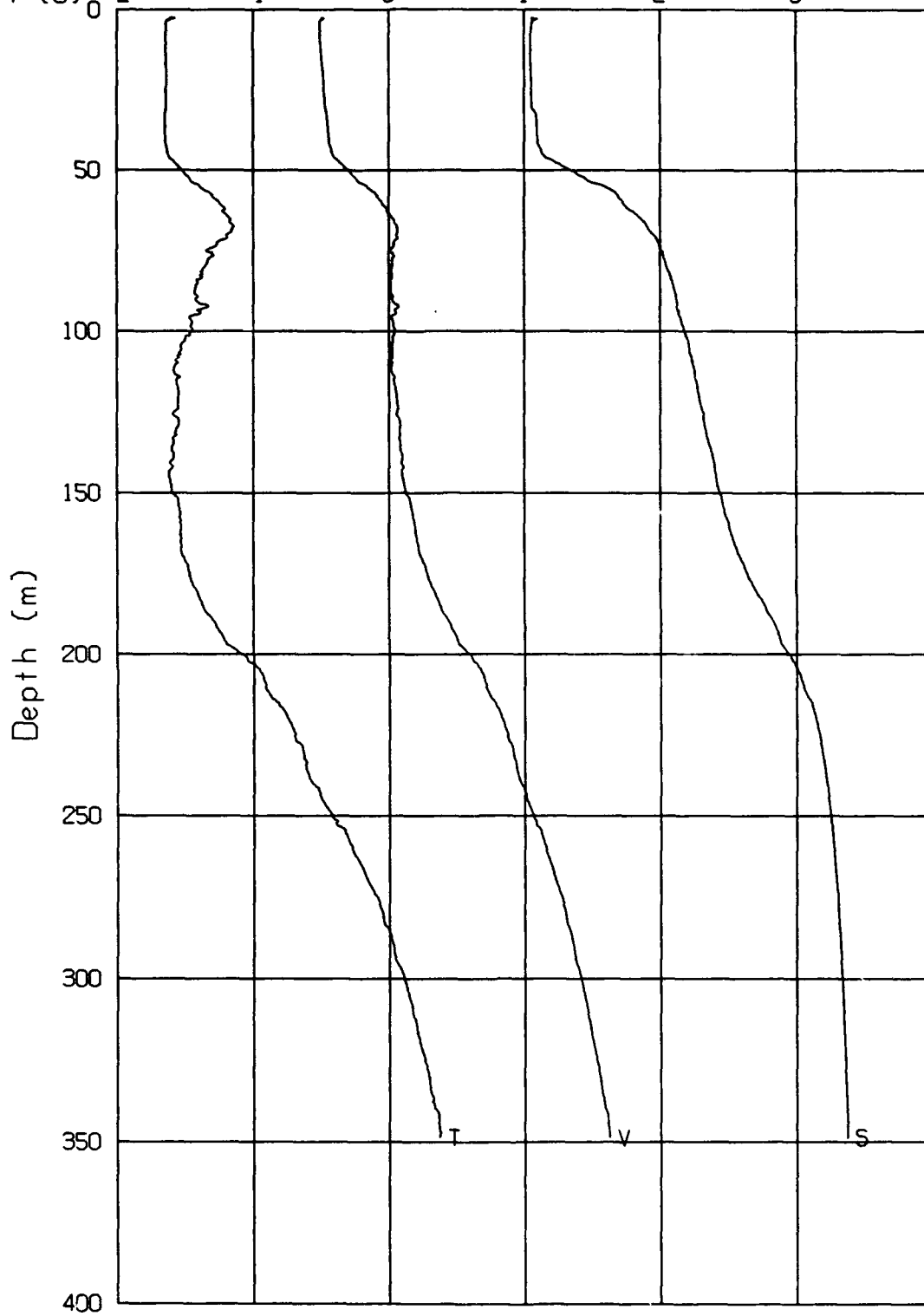
04-06-93 1617 CAST 020 72-38.5 N / 149-44.2 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



04-06-93 2140 CAST 021 72-38.6 N / 149-45.8 W

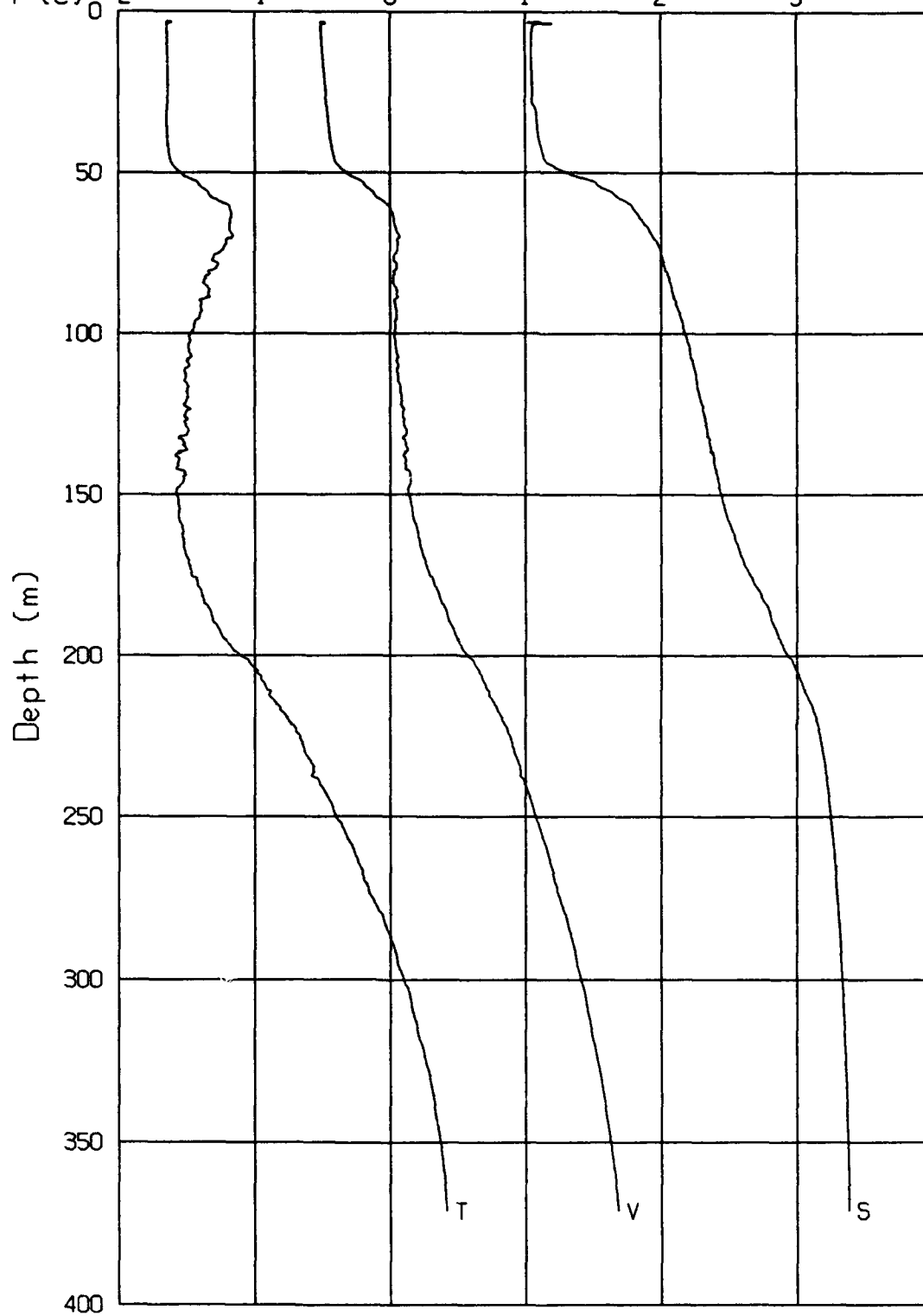
SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



B21

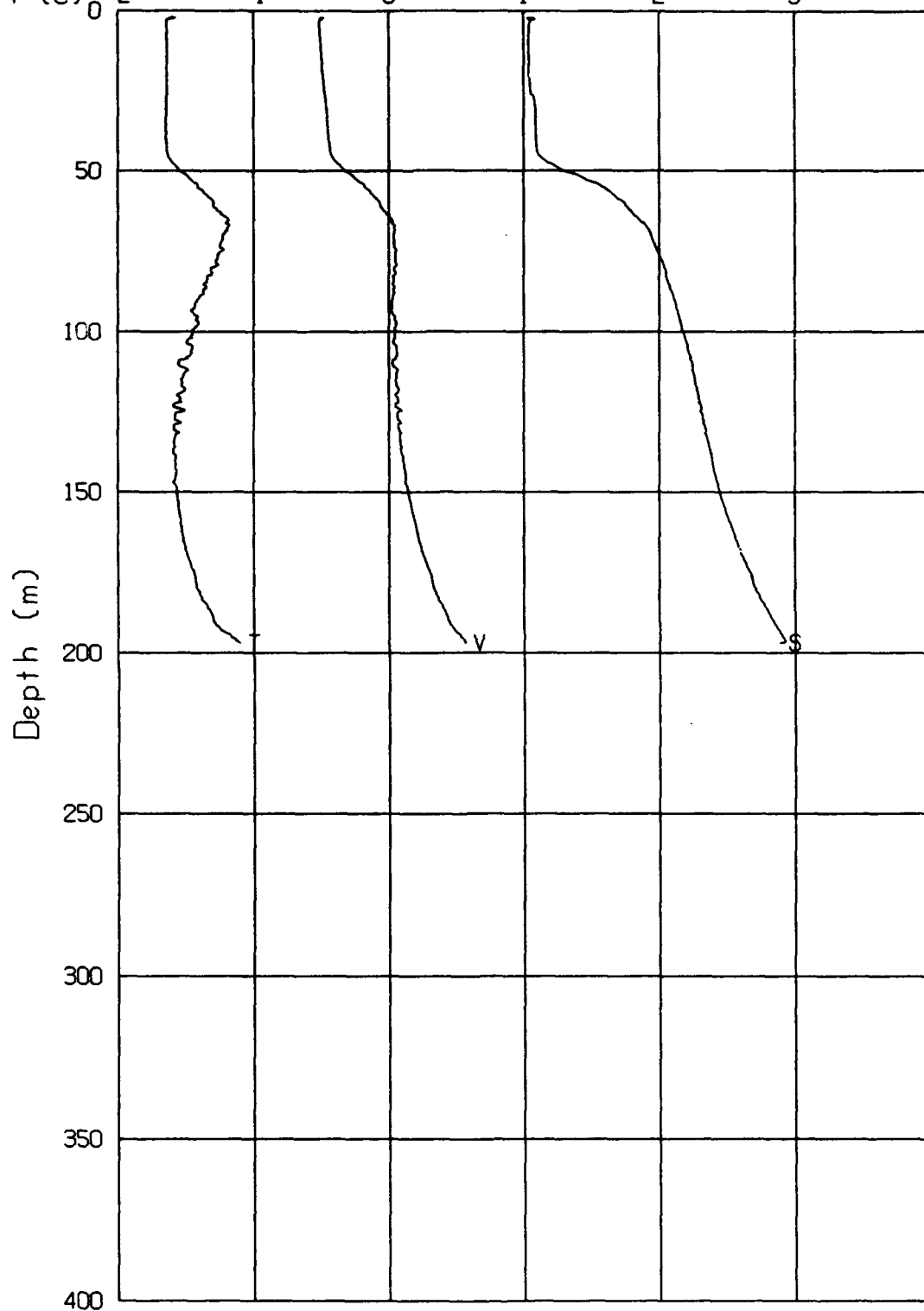
04-07-93 0751 CAST 022 72-38.5 N / 149-47.5 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



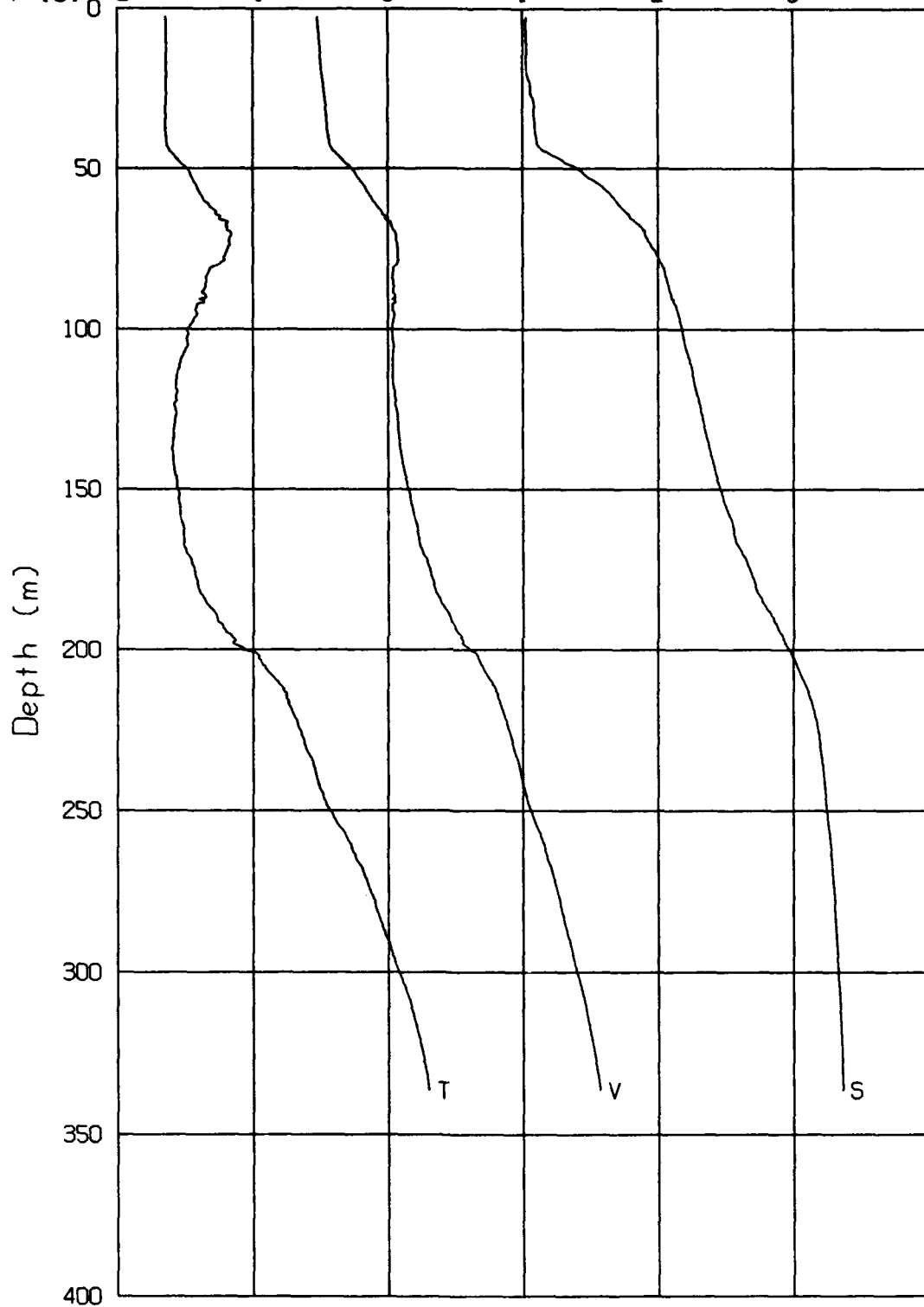
04-07-93 2014 CAST 023 72-38.1 N / 149-50.7 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



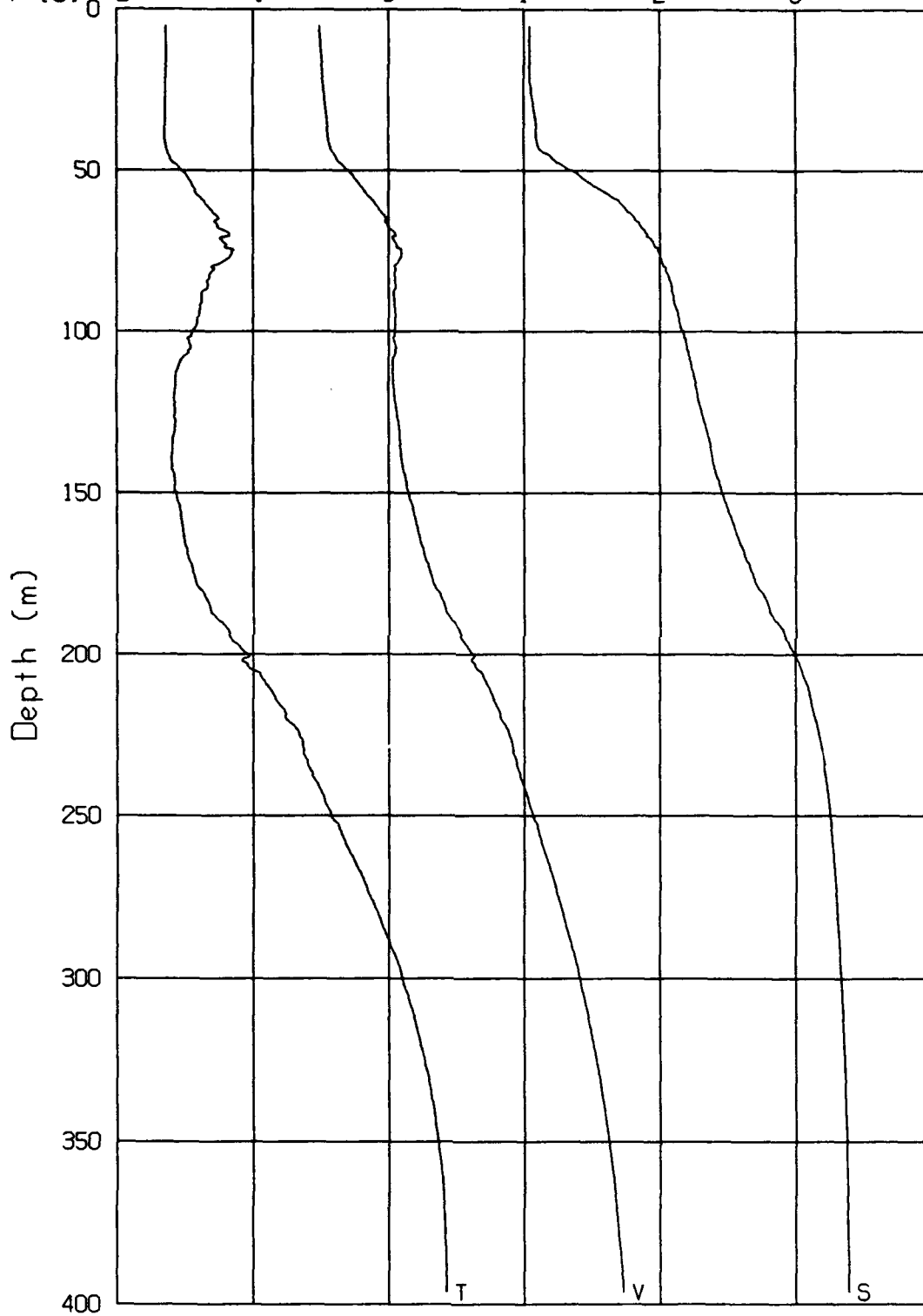
04-08-93 0914 CAST 024 72-37.8 N / 149-51.9 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



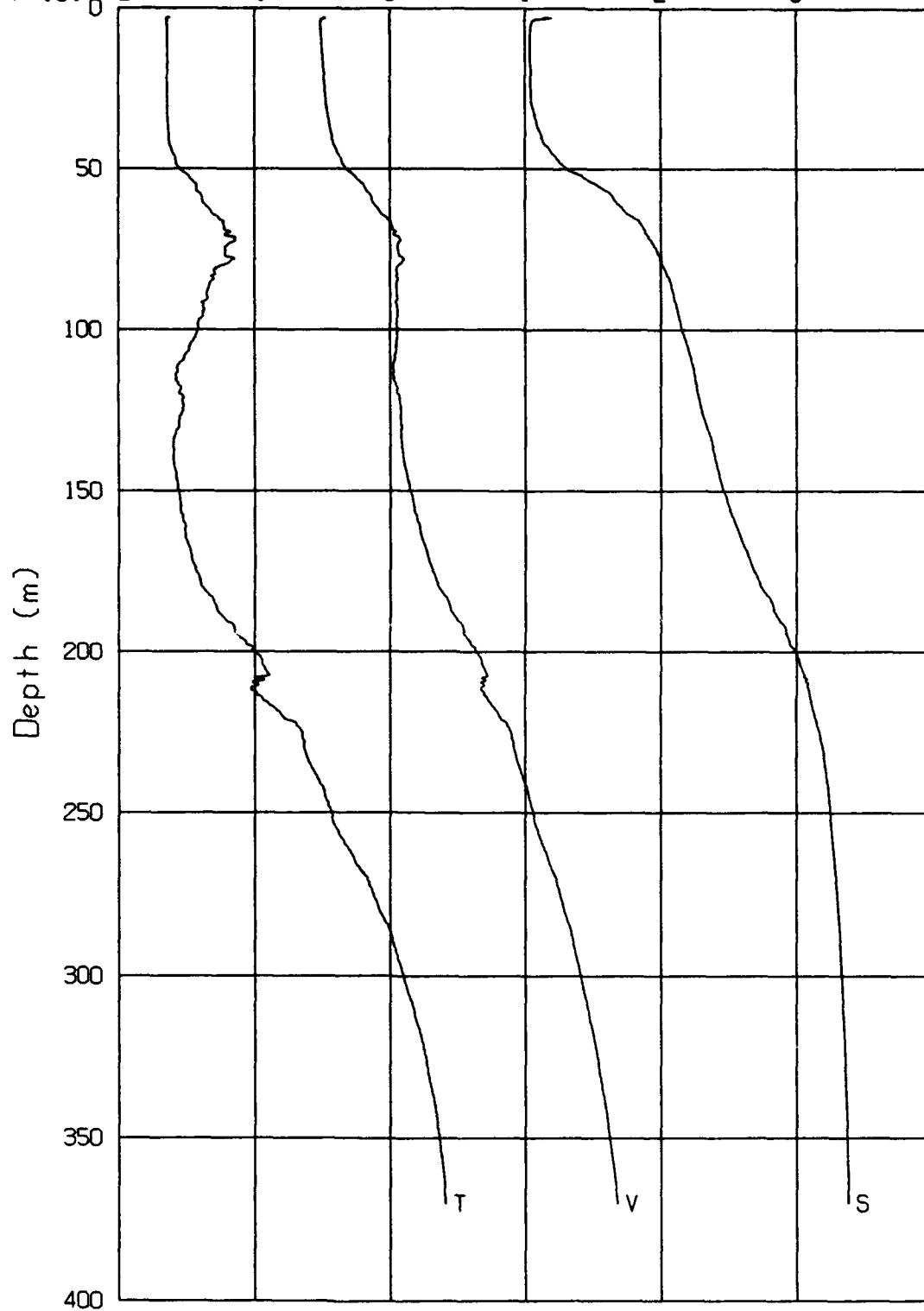
04-08-93 1844 CAST 025 72-37.5 N / 149-55.4 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



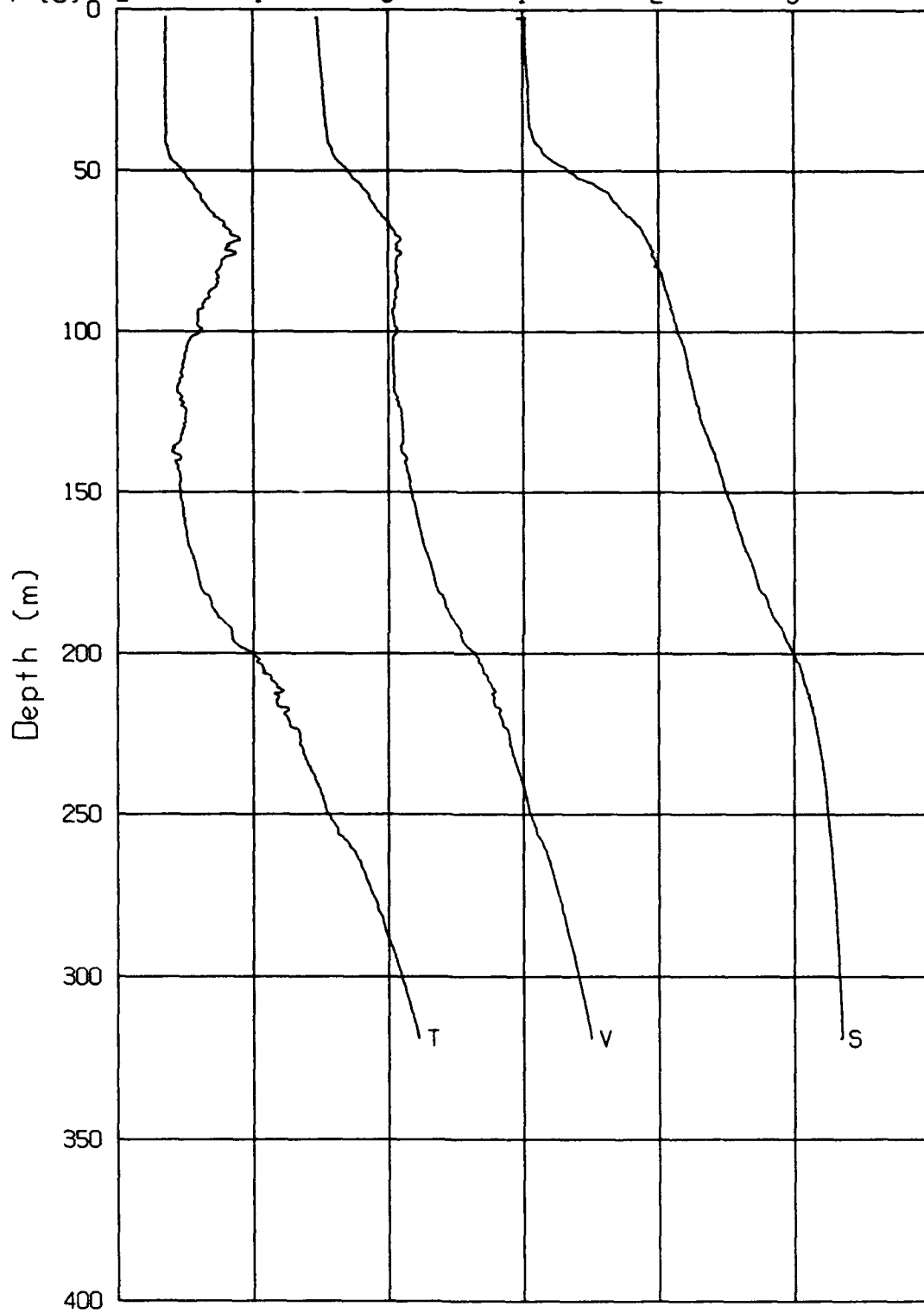
04-09-93 0831 CAST 026 72-37.3 N / 149-56.5 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



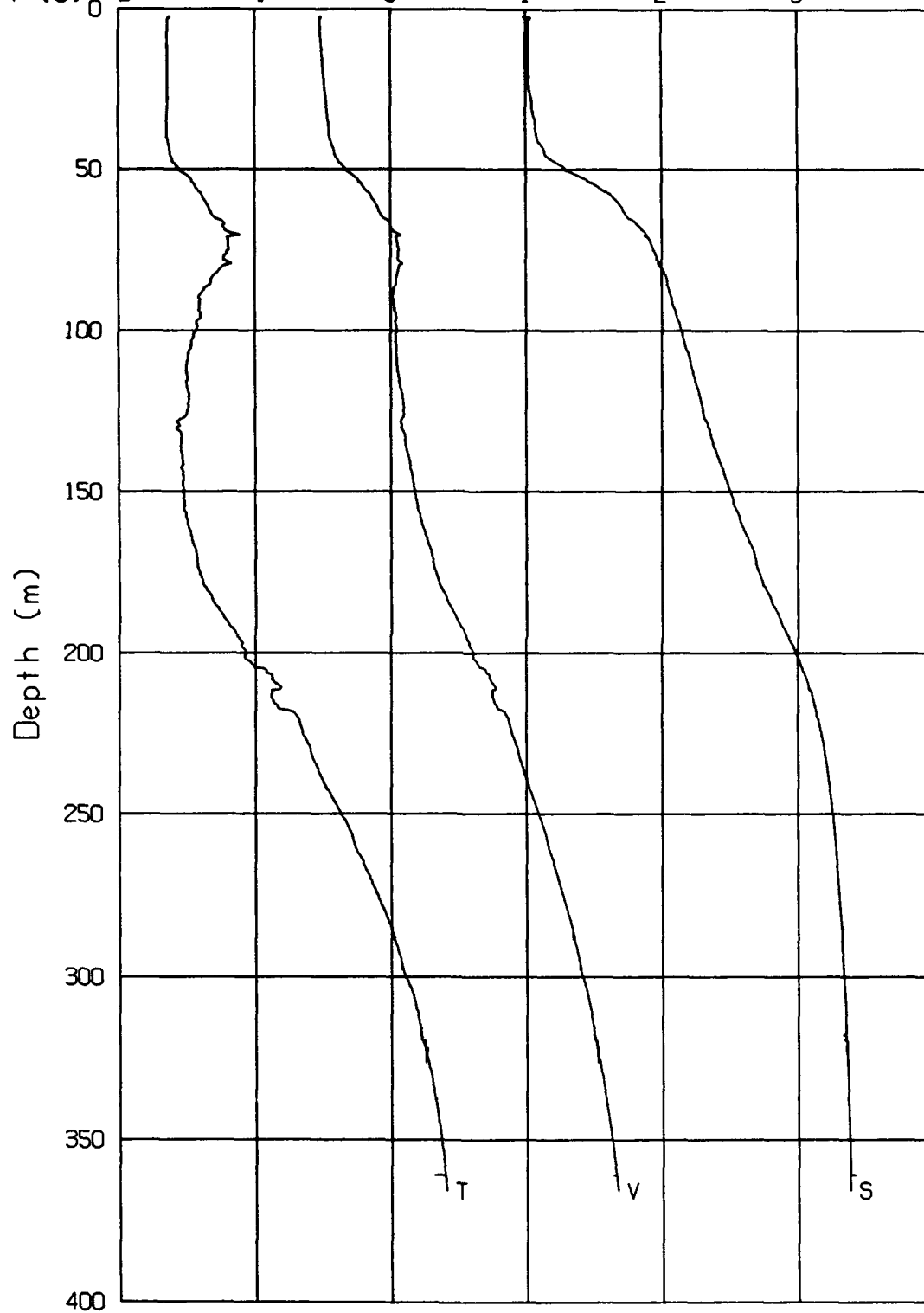
04-09-93 1427 CAST 027 72-37.3 N / 149-58.3 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



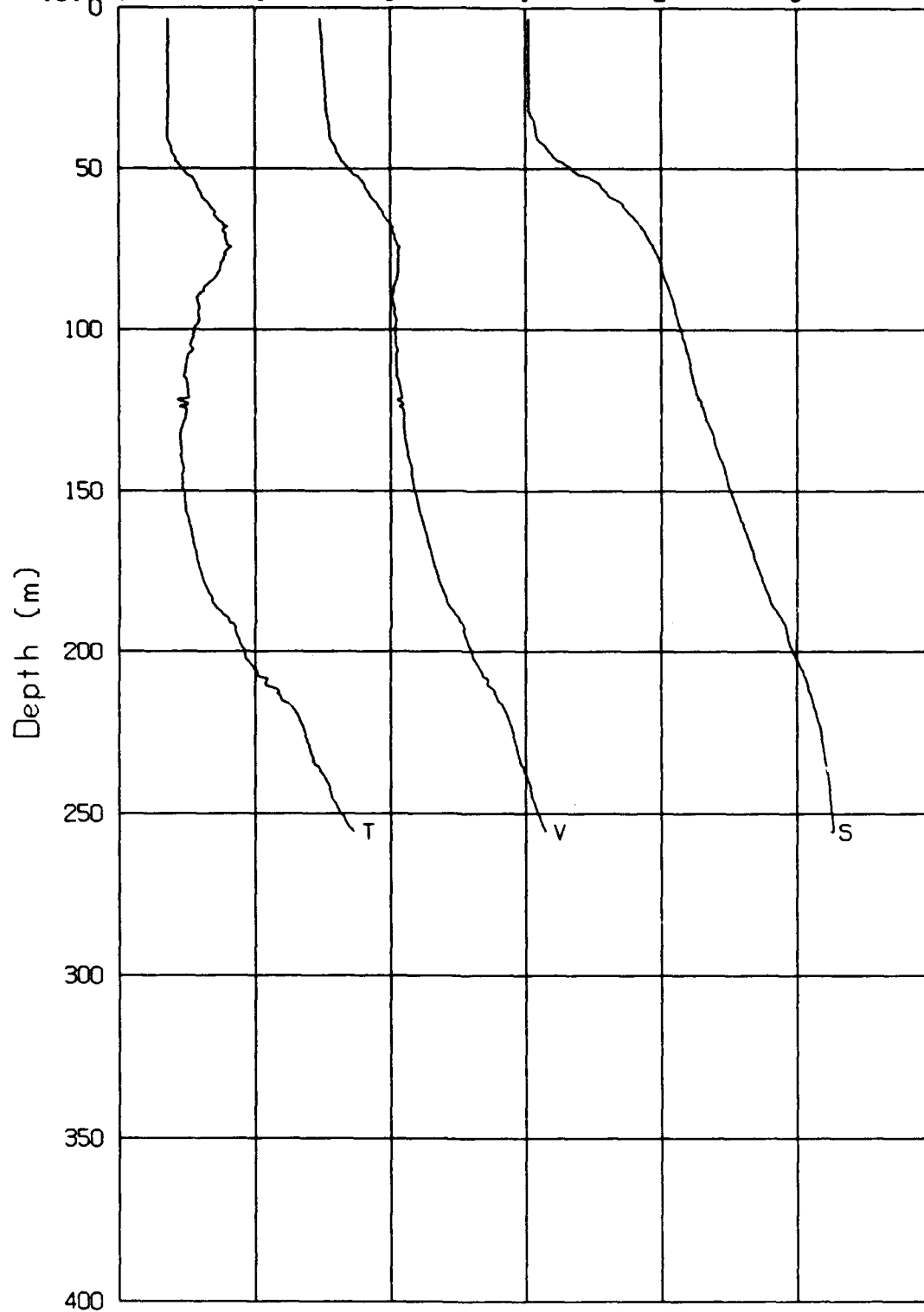
04-09-93 2239 CAST 028 72-36.9 N / 150-02.5 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (‰)	24	26	28	30	32	34	36
T (°C)	-2	-1	0	1	2	3	4



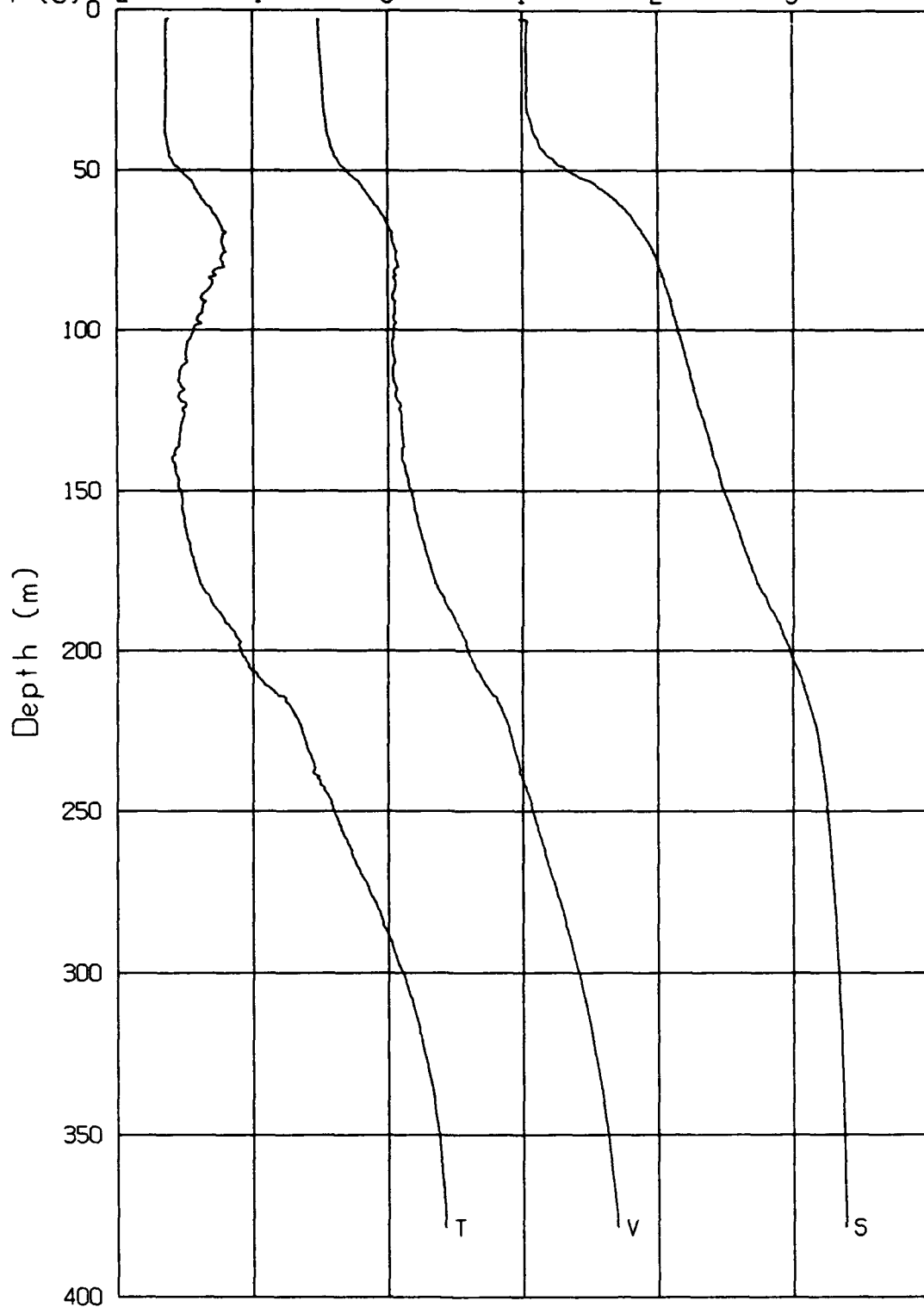
04-10-93 1232 CAST 029 72-36.9 N / 150-04.9W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



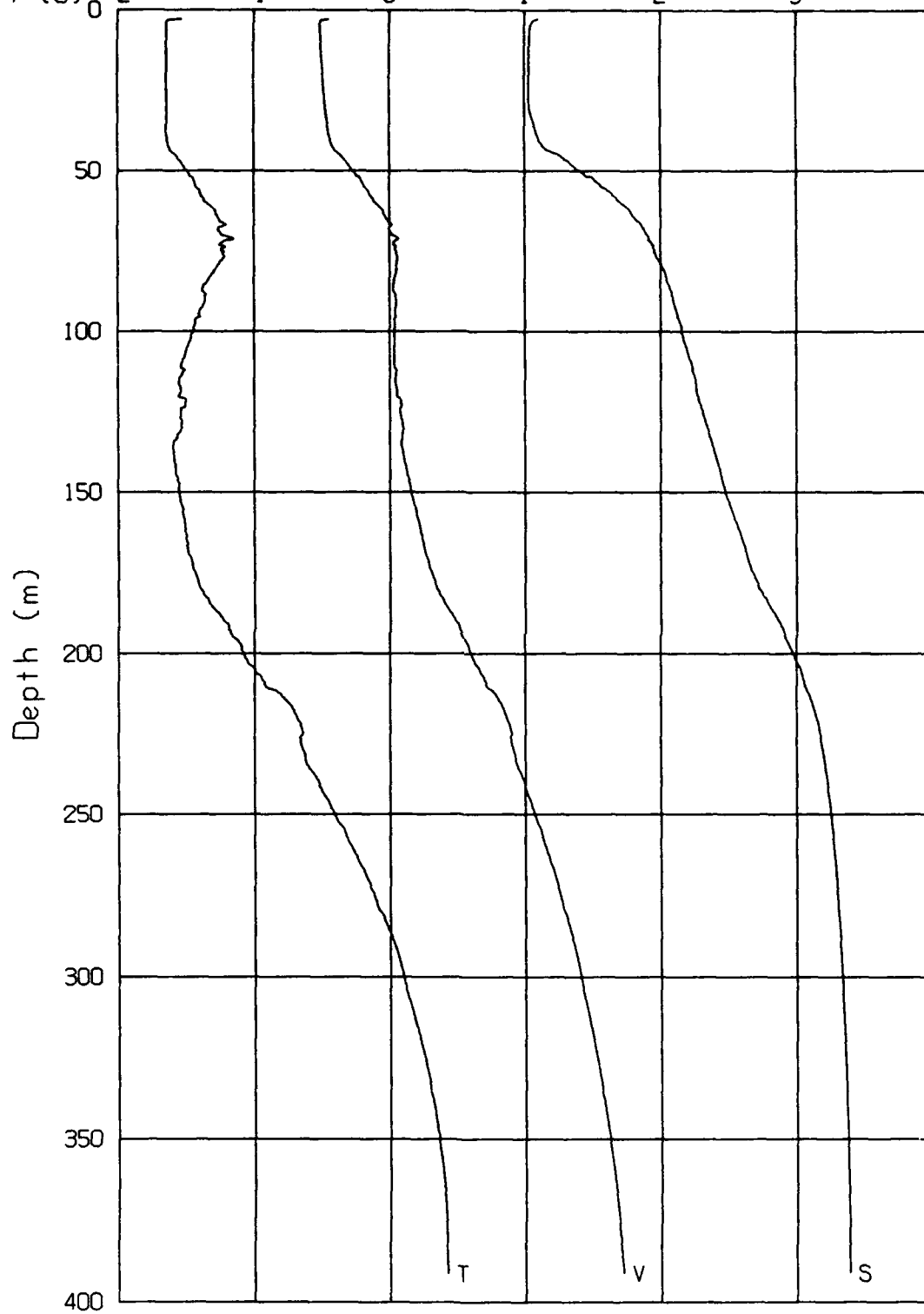
04-10-93 1750 CAST 030 72-36.9 N / 150-07.3 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (‰)	24	26	28	30	32	34	36
T (°C)	-2	-1	0	1	2	3	4



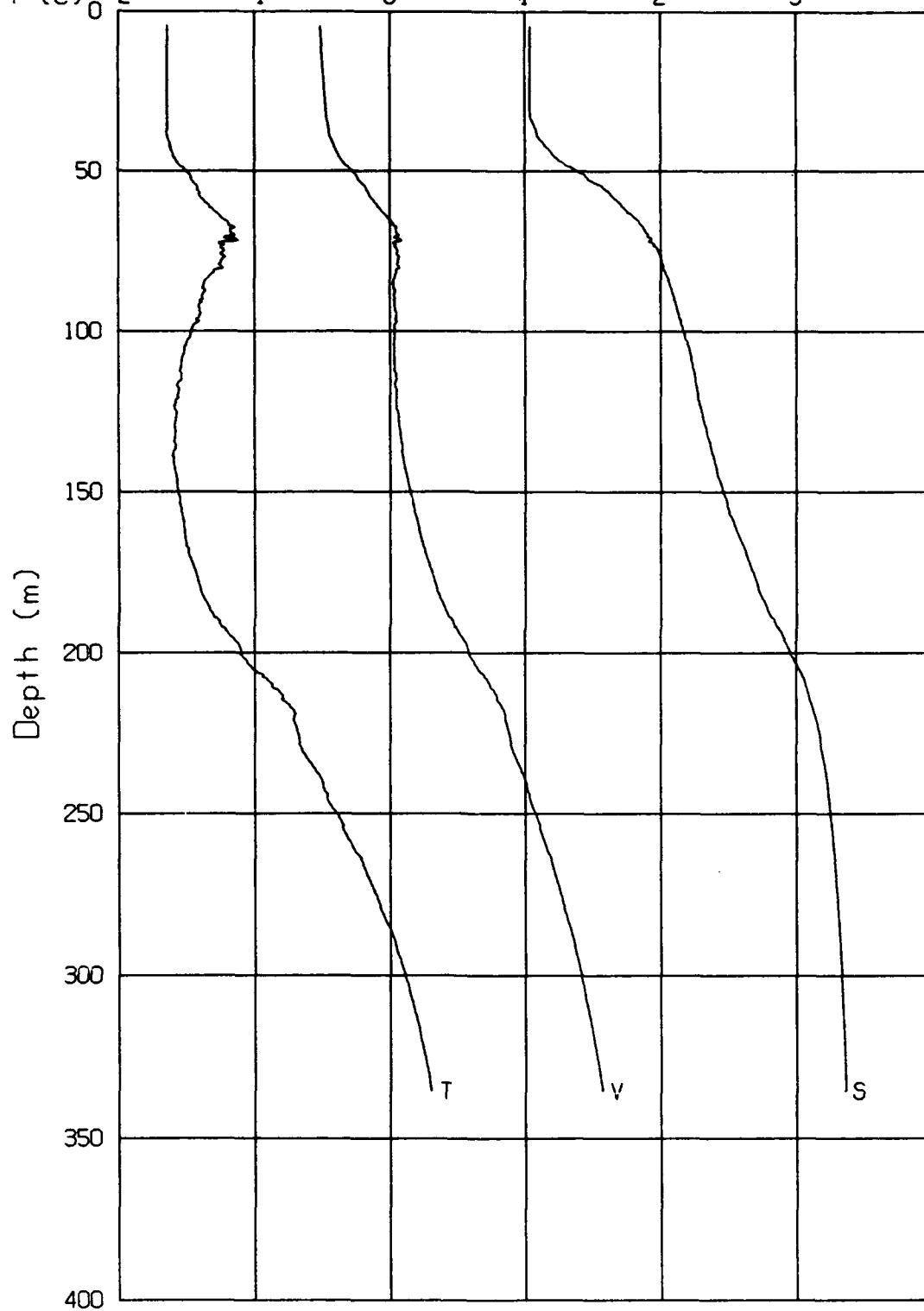
04-11-93 0656 CAST 031 72-36.9 N / 150-09.5 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



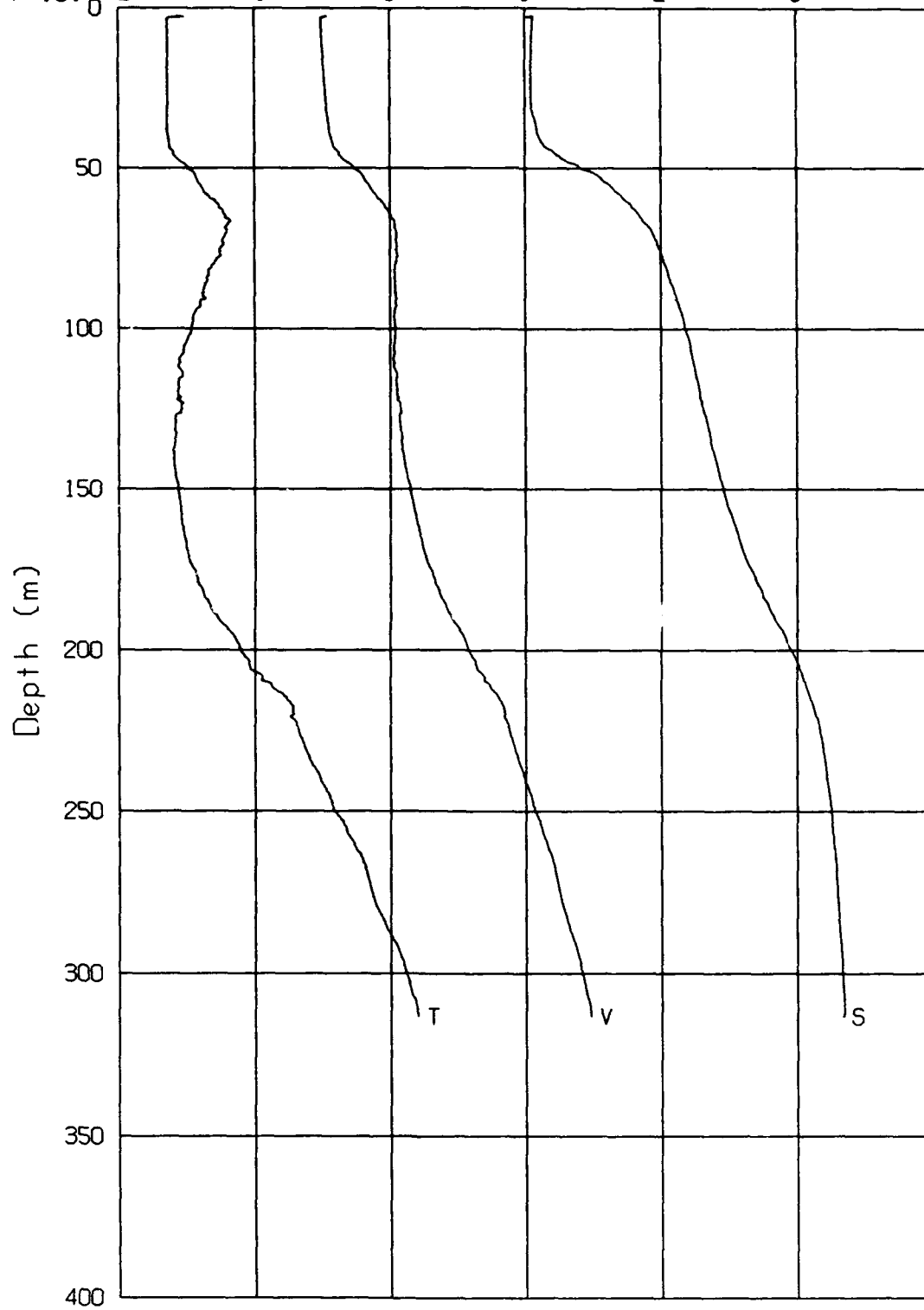
04-11-93 1424 CAST 032 72-36.9 N / 150-10.5 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



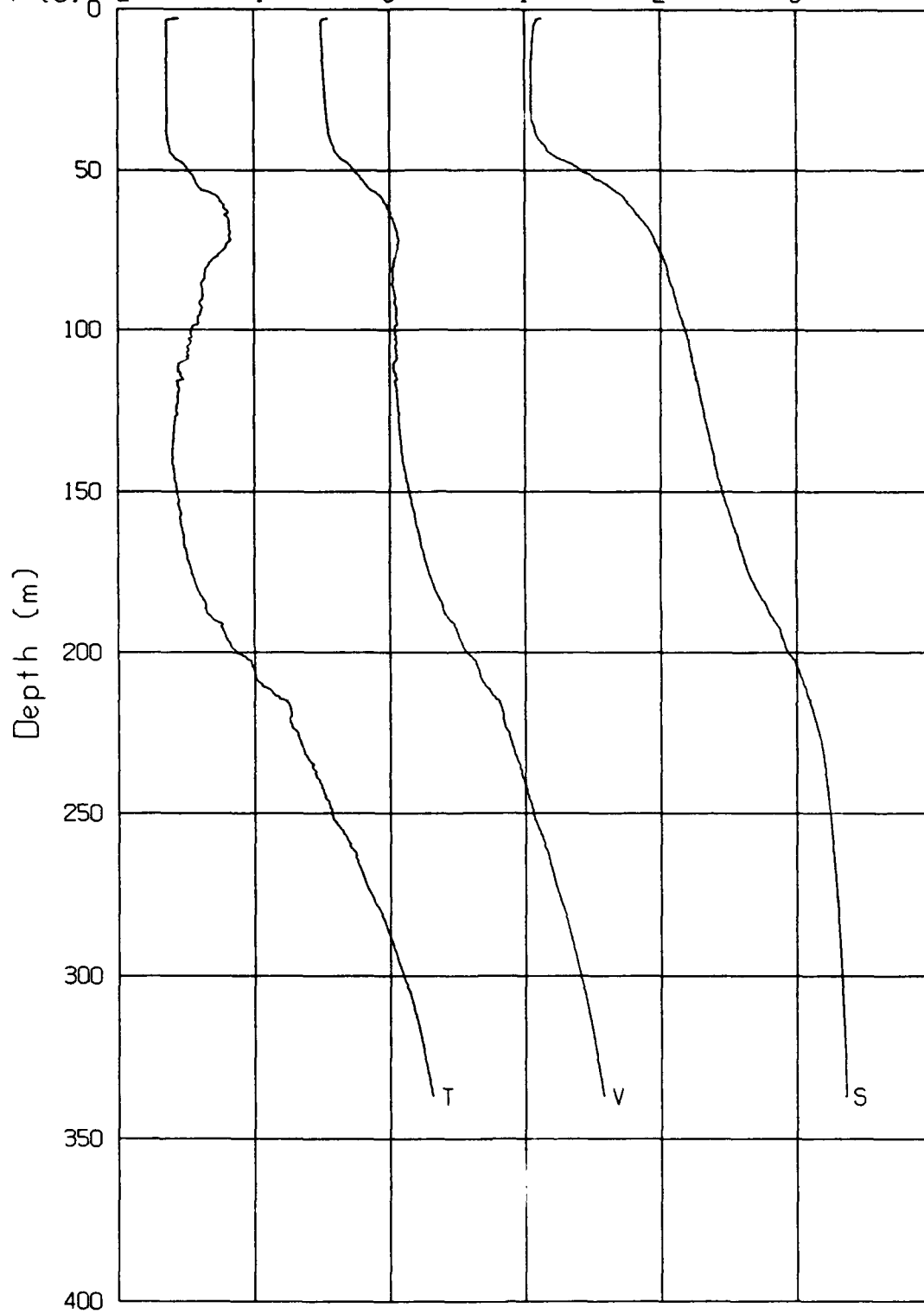
04-11-93 2340 CAST 033 72-37.2 N / 150-12.8 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



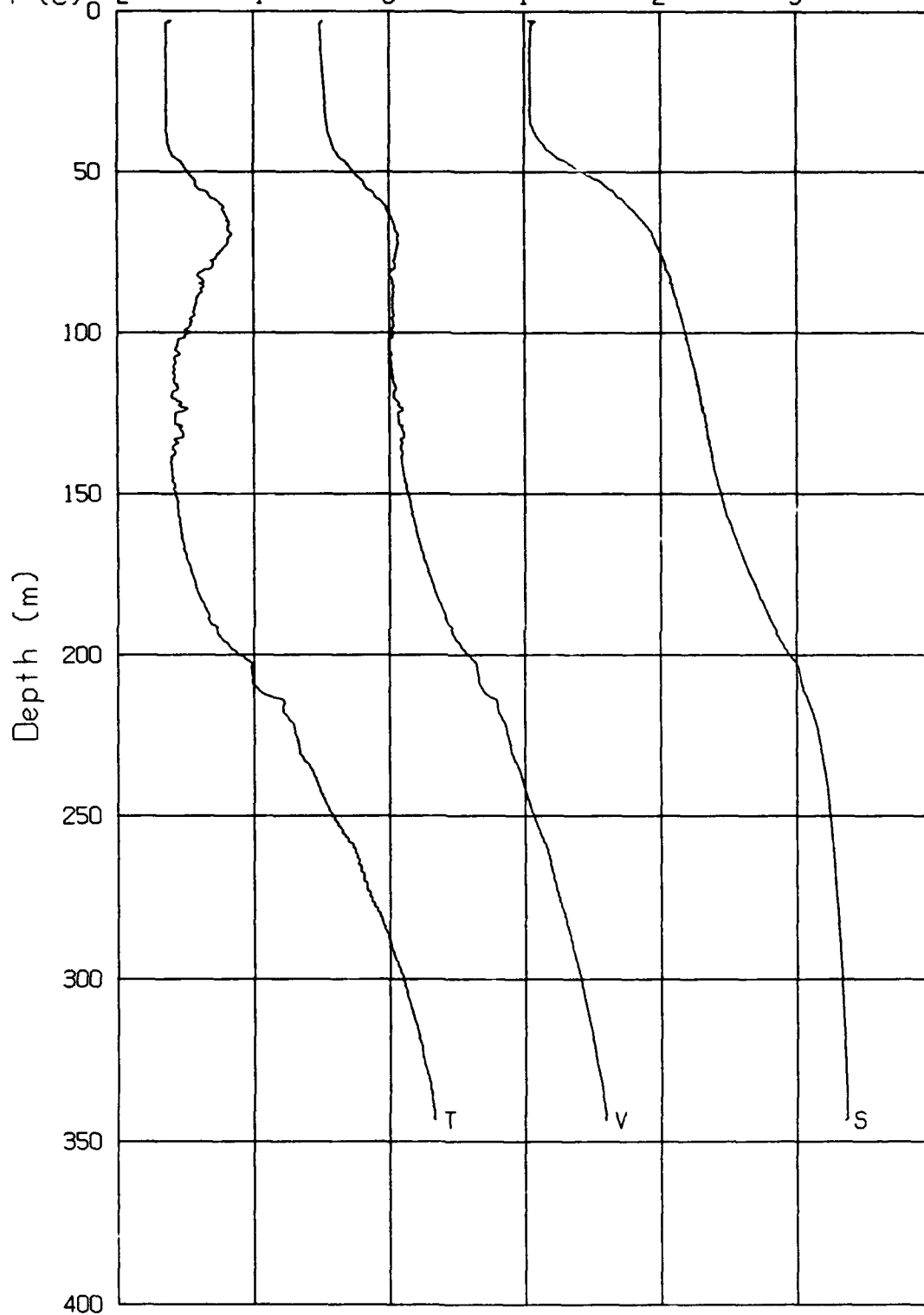
04-12-93 0746 CAST 034 72-37.4 N / 150-13.8 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (‰)	24	26	28	30	32	34	36
T (°C)	-2	-1	0	1	2	3	4



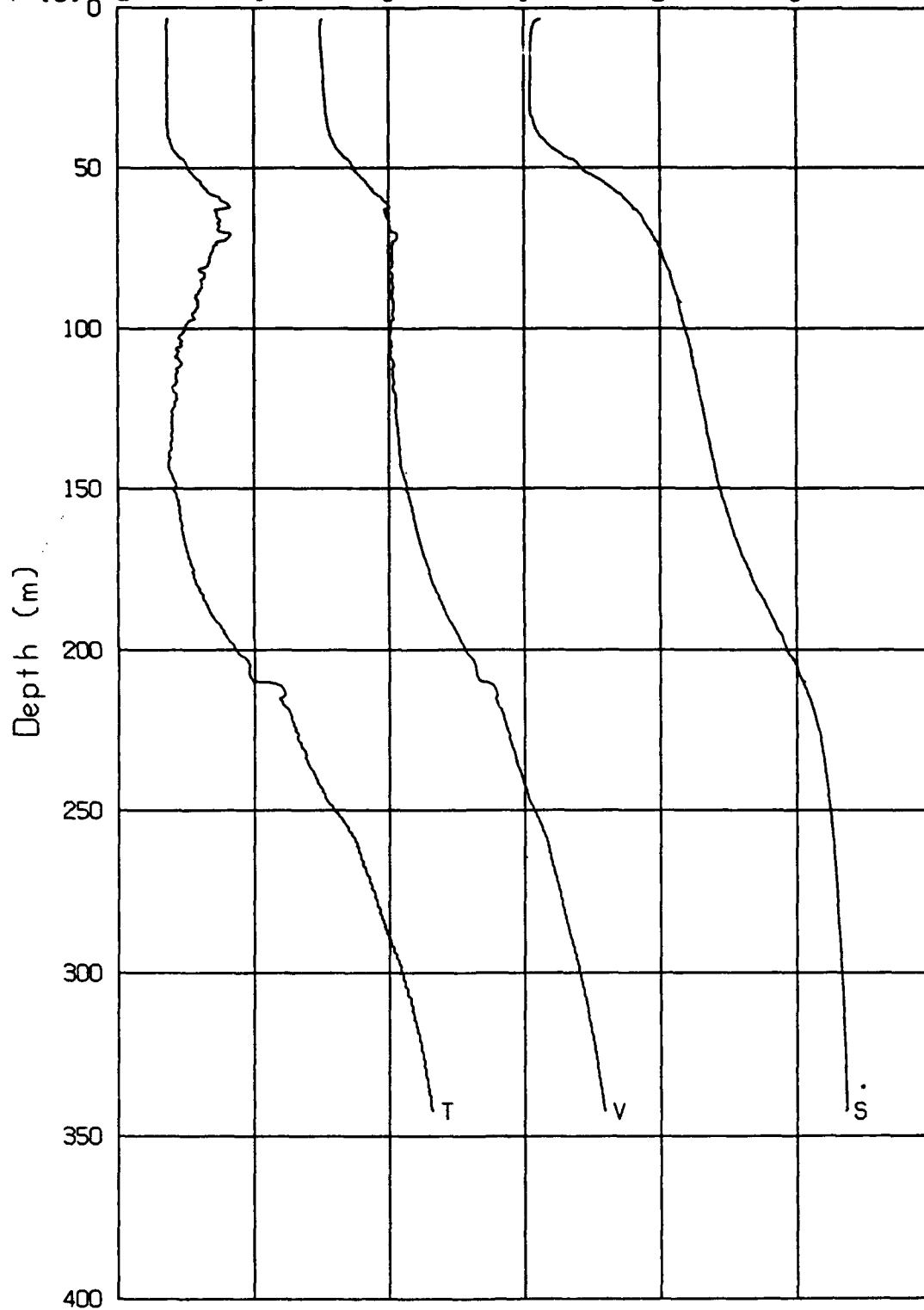
04-12-93 1450 CAST 035 72-37.4 N / 150-14.6 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



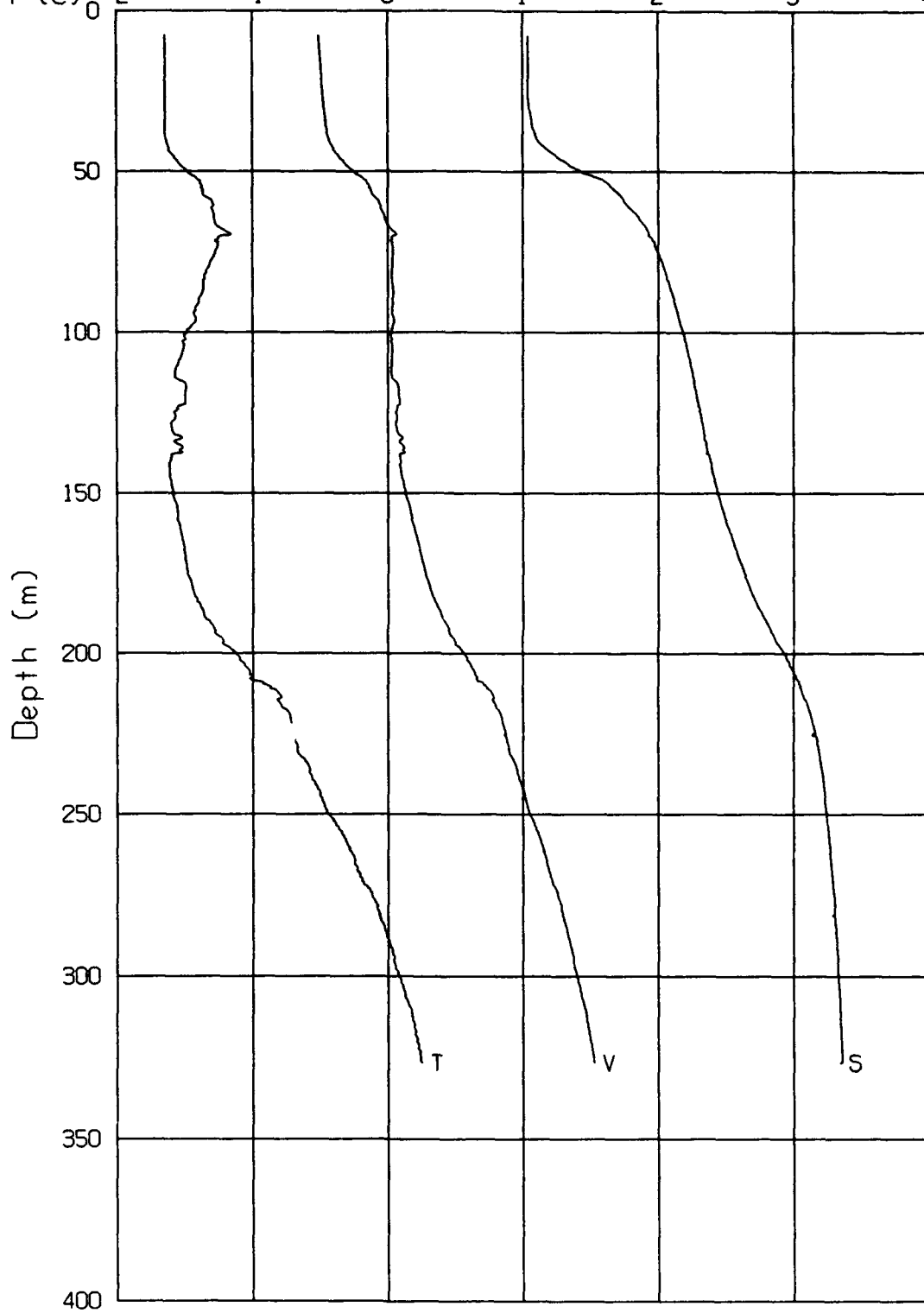
04-12-93 2248 CAST 036 72-37.5 N / 150-16.1 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



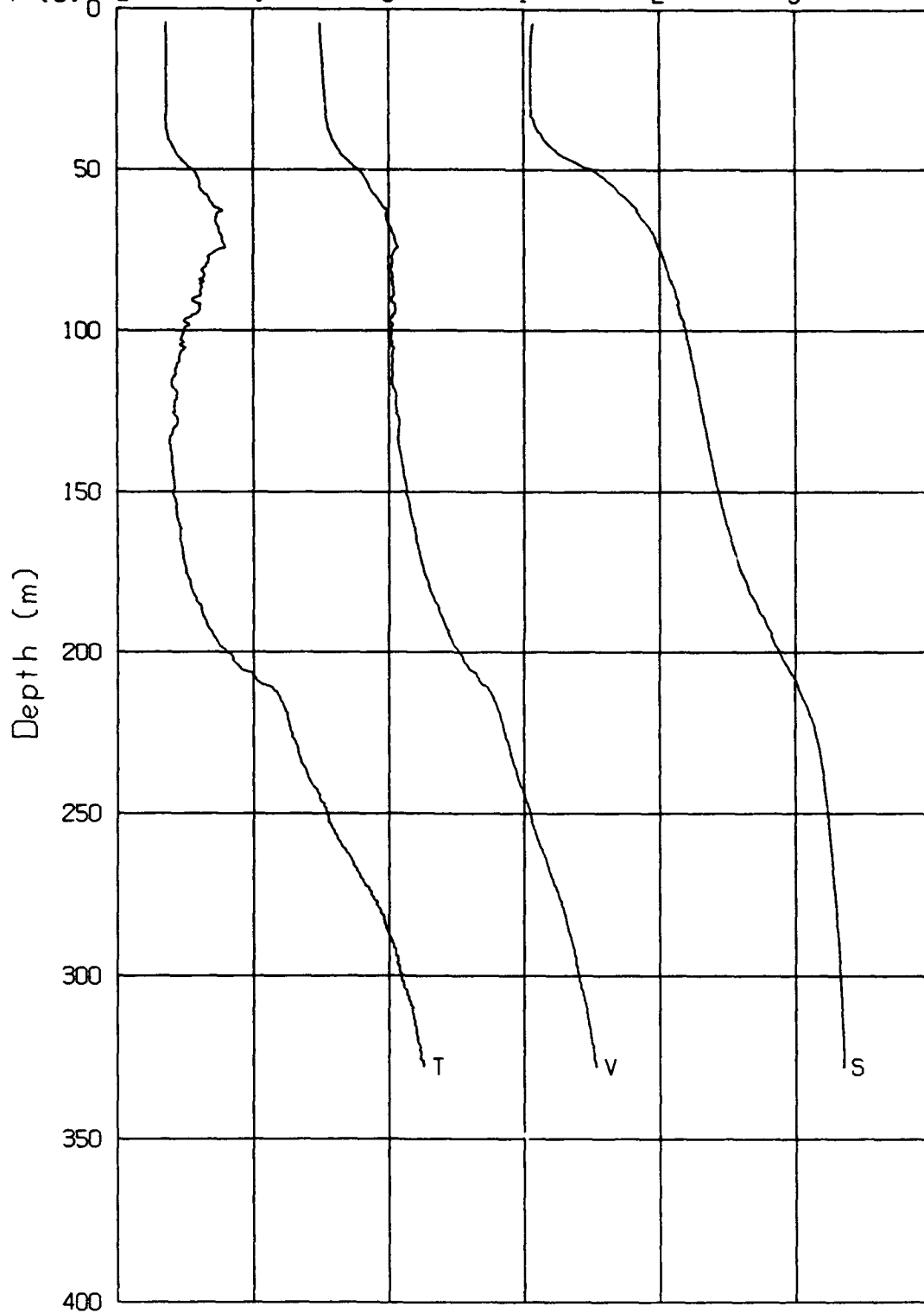
04-13-93 0754 CAST 037 72-37.7 N / 150-18.0 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (‰)	24	26	28	30	32	34	36
T (°C)	-2	-1	0	1	2	3	4



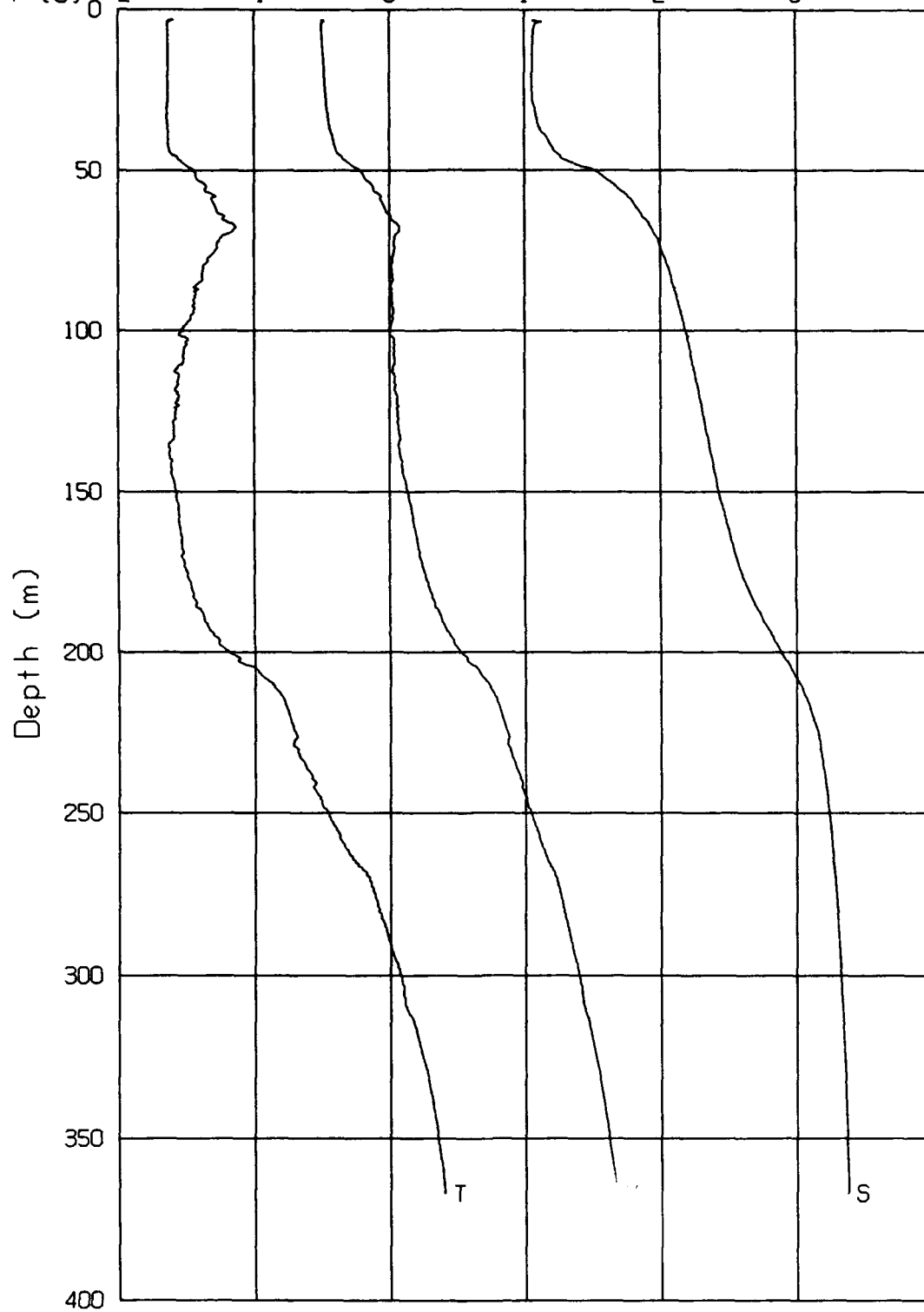
04-13-93 2320 CAST 038 72-38.0 N / 150-24.0 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



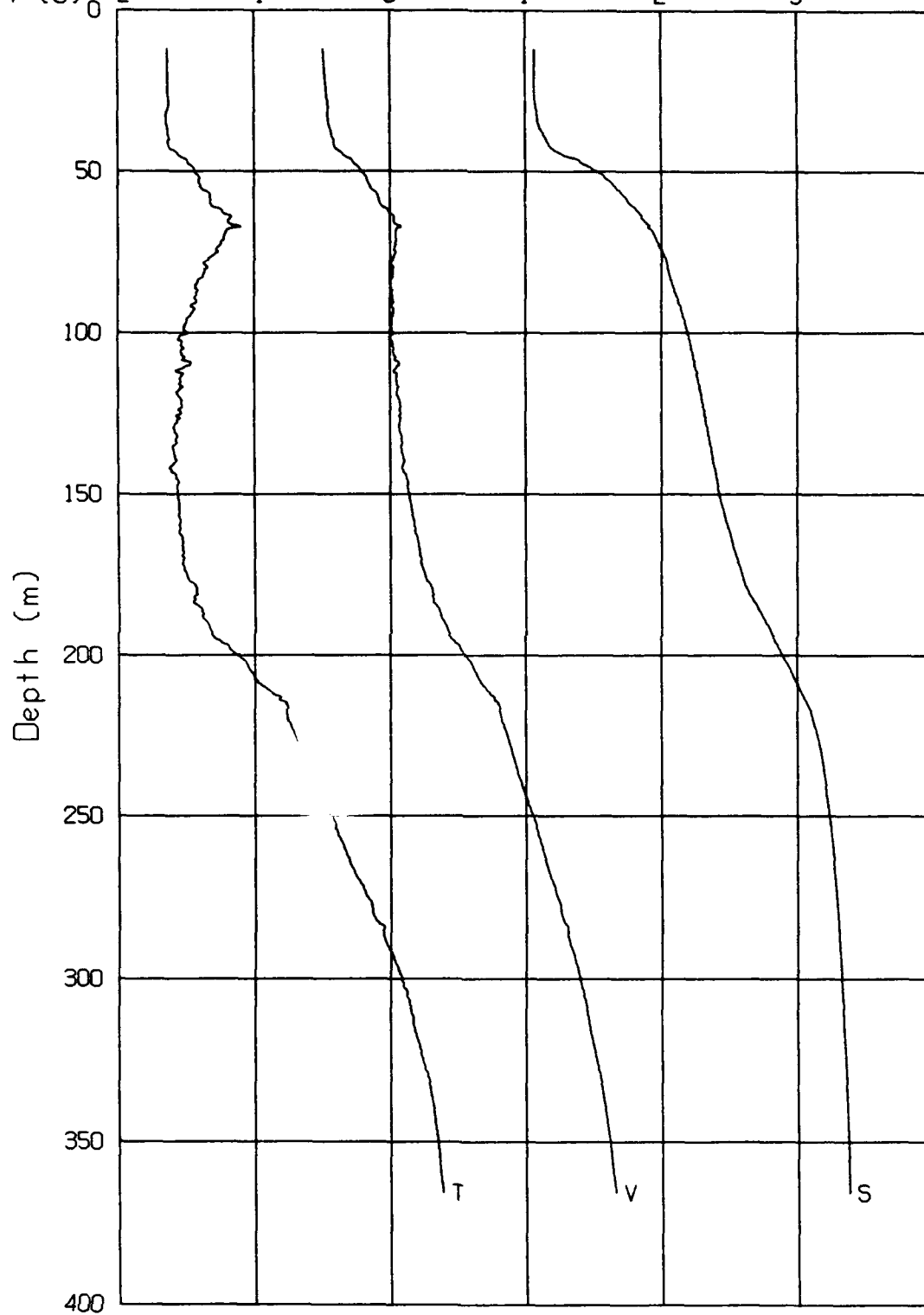
04-14-93 0635 CAST 039 72-38.1 N / 150-26.7 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



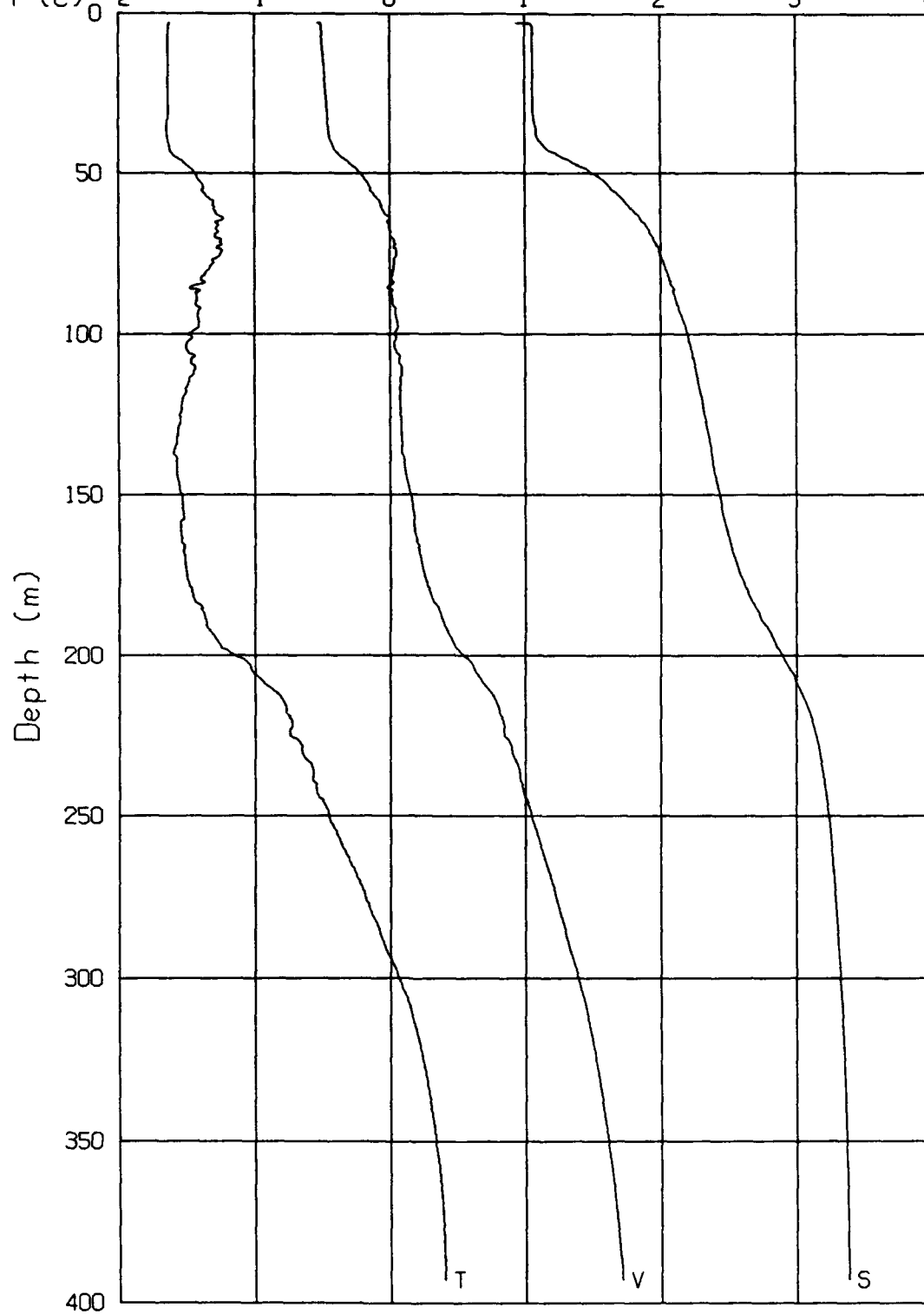
04-14-93 1418 CAST 040 72-38.1 N / 150-30.2 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



04-14-93 2134 CAST 041 72-38.3 N / 150-33.7 W

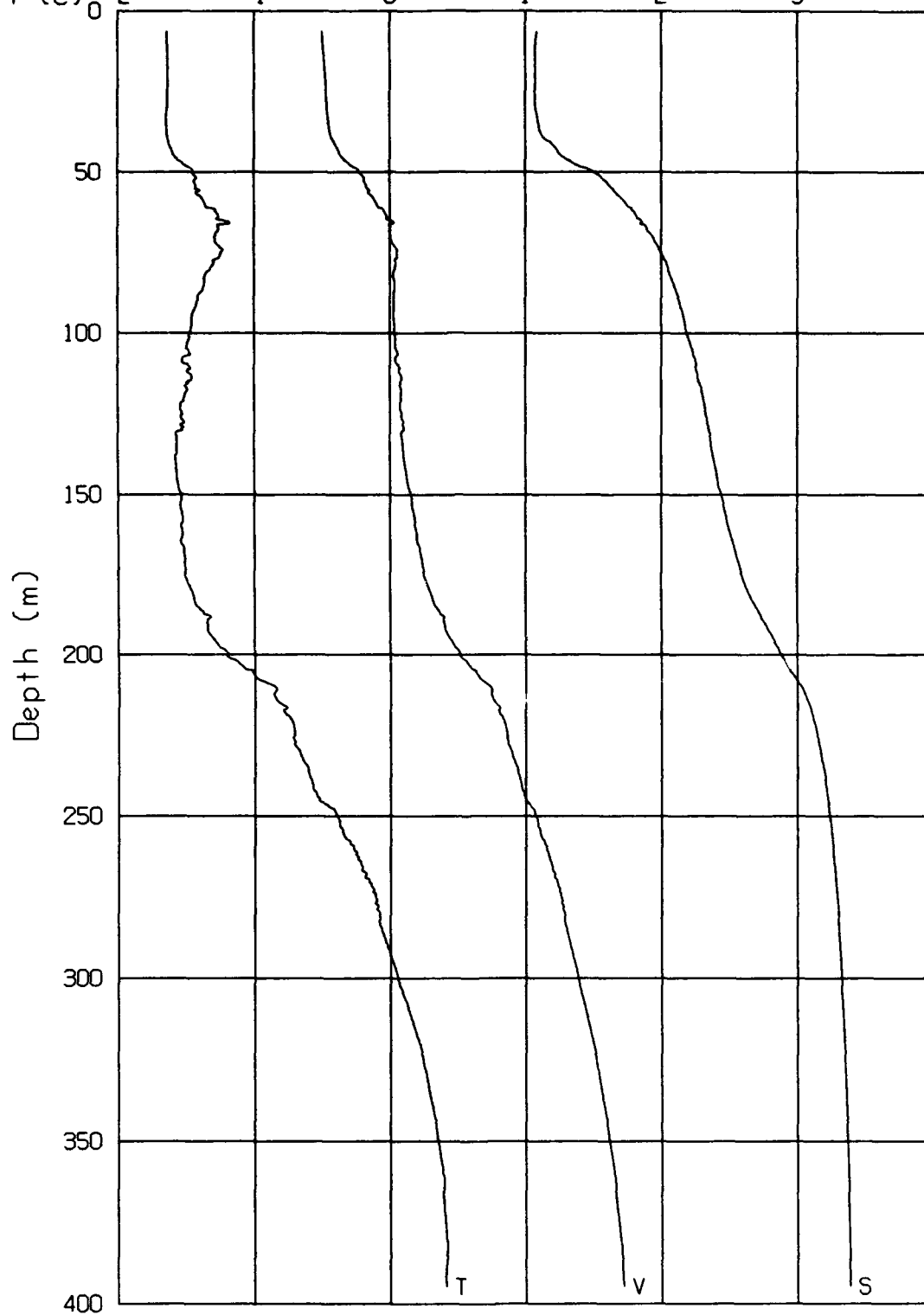
SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



B41

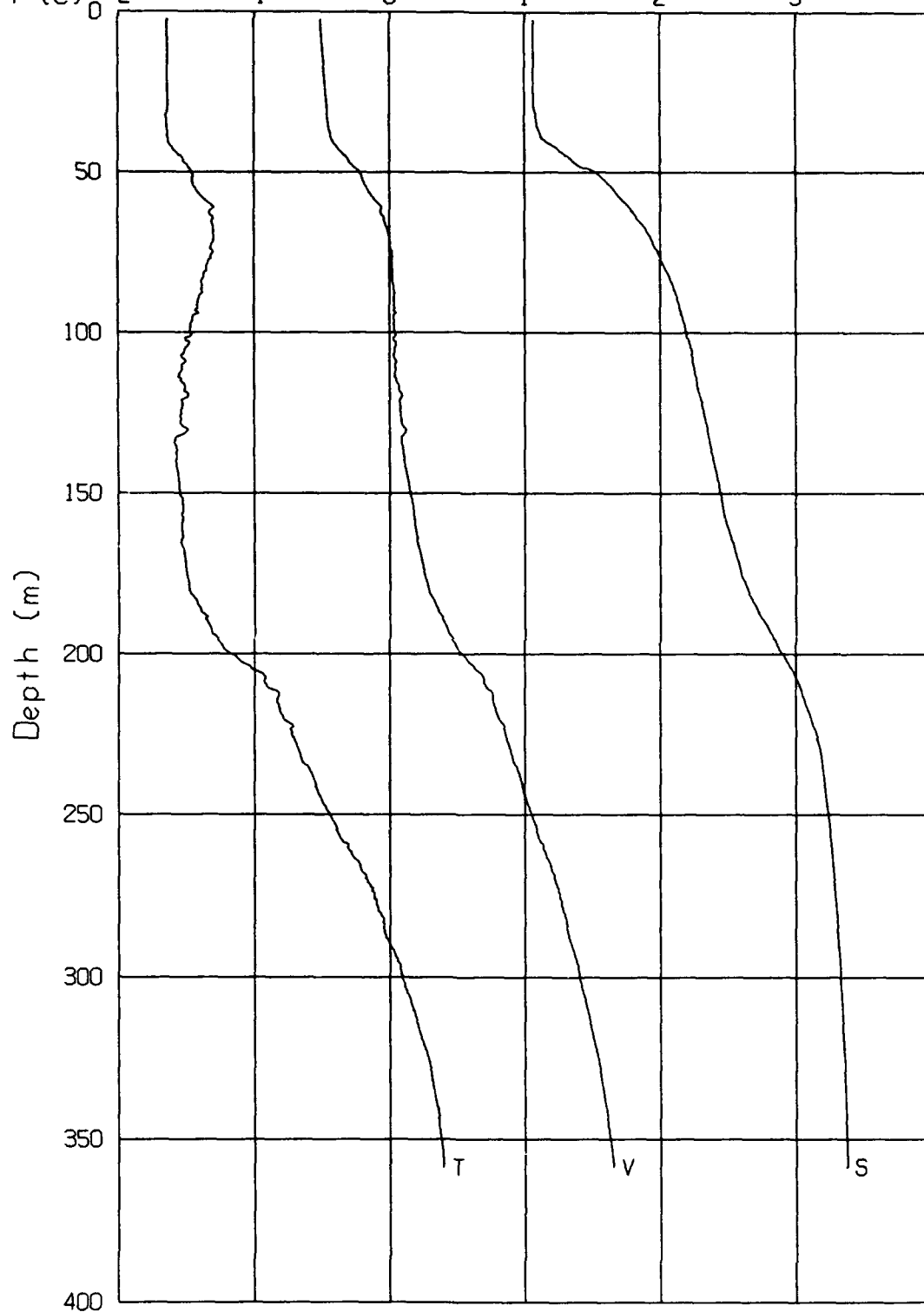
04-15-93 0621 CAST 042 72-38.8 N /150-36.1 W

SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



04-15-93 1407 CAST 043 72-38.3 N / 150-37.7 W

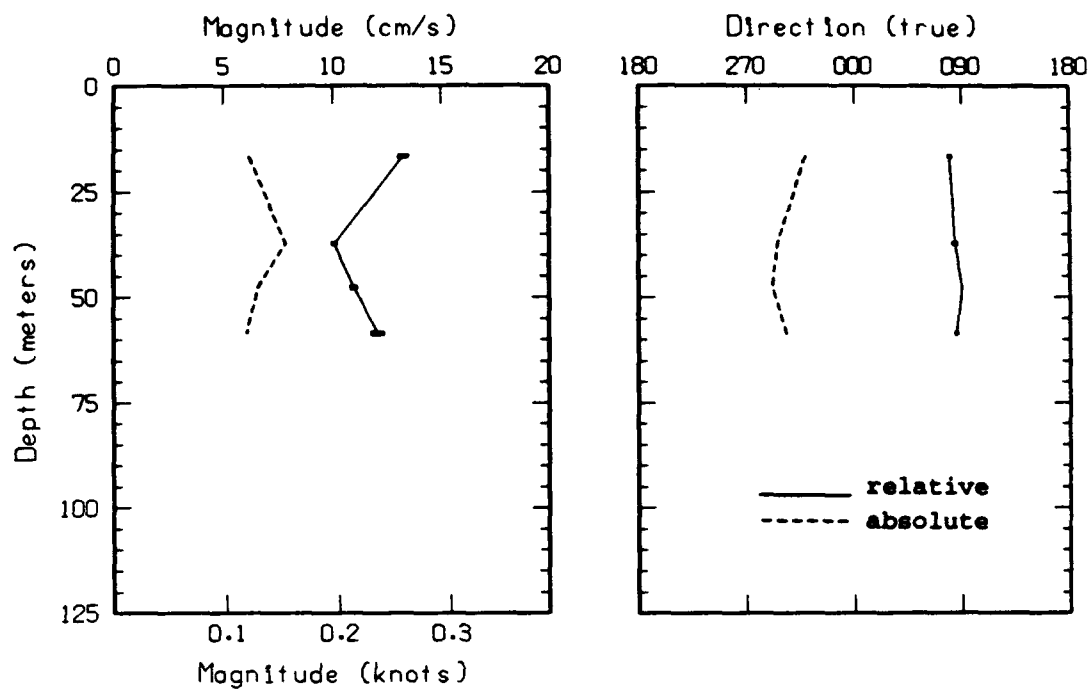
SV (m/s)	1420	1430	1440	1450	1460	1470	1480
S (o/oo)	24	26	28	30	32	34	36
T (C)	-2	-1	0	1	2	3	4



APPENDIX C **Current Meter Data**

mmdd	hhmm (Local)	Cast	Floe Drift Ave (s)	cm/s	Dir	Comments
0401	1635	1	60	17.3	278	
0404	1810	2	60	12.0	281	Time series at 70 m
0405	1745	3	5	10.0	295	
0408	1145	4	5	4.8	254	
0409	1645	5	5	9.9	268	
0410	1815	6	5	4.9	280	
0411	1456	7	5	5.3	289	Time series at 225 m
0413	0915	8	5	5.0	286	Time series at 220 m

04/01 1635L Cast 1

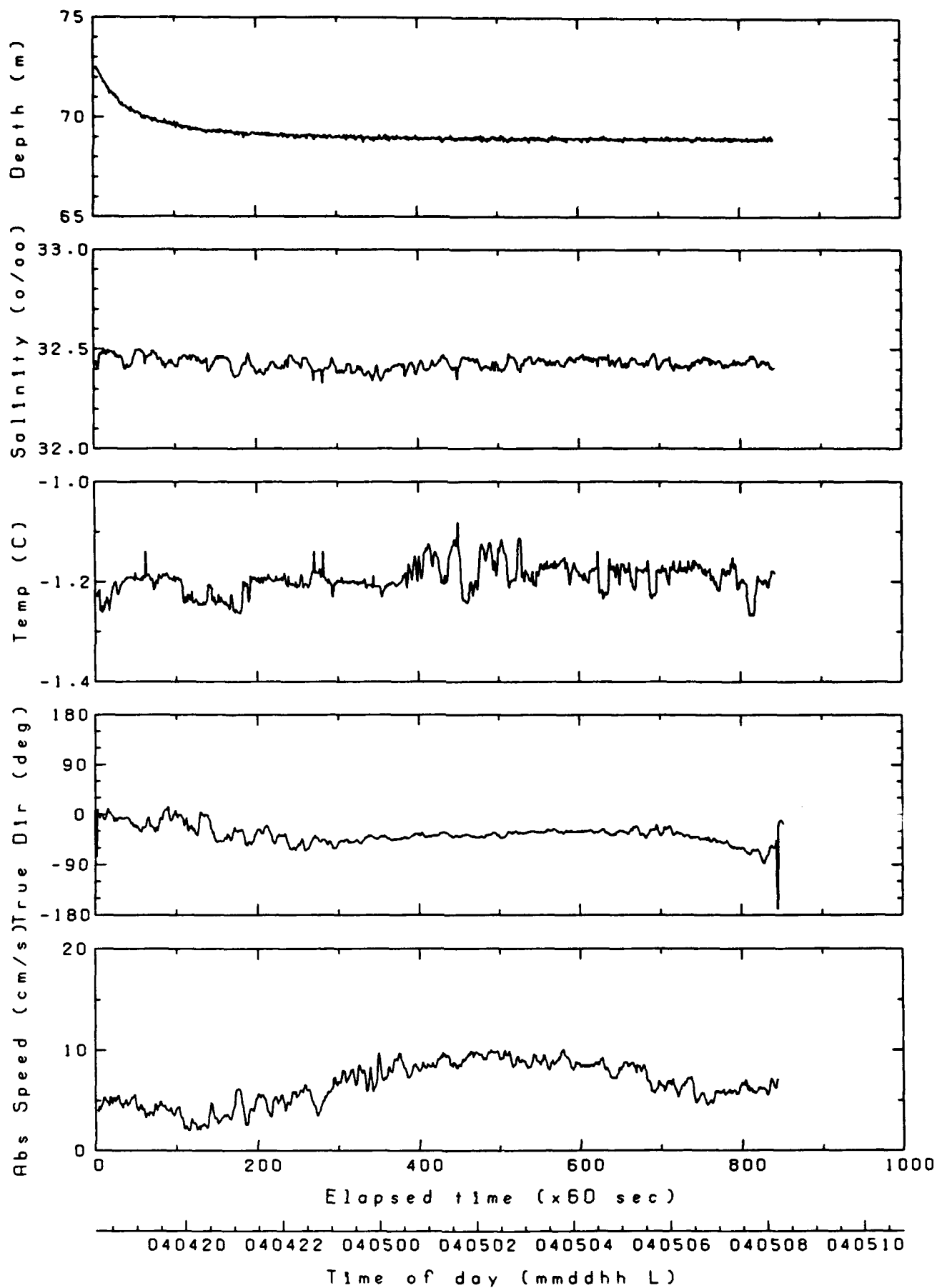


Magnetic bearing + 31 degrees = True bearing

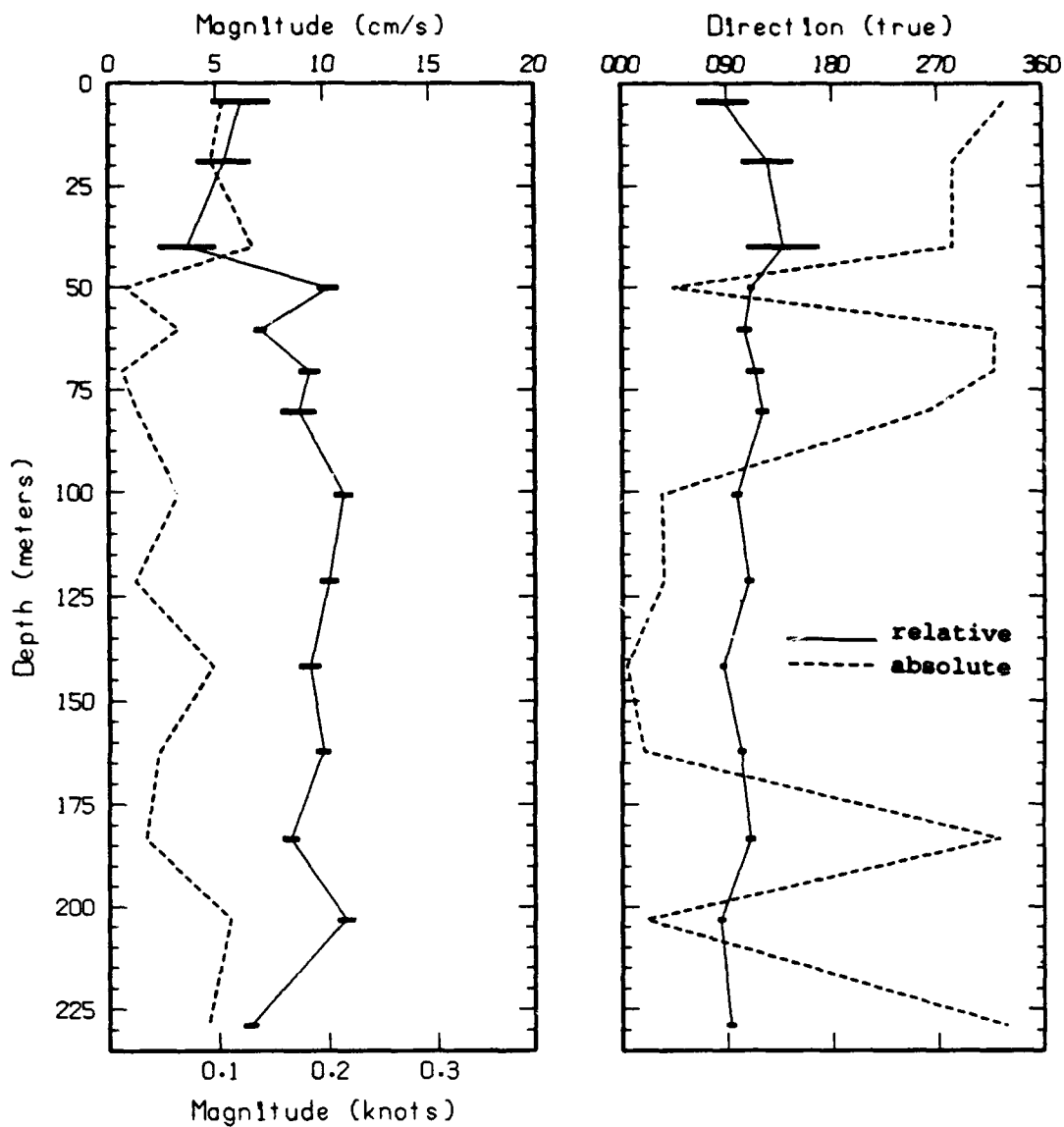
Floe drift speed = 17.3 cm/s

Floe drift direction = 278 degrees True bearing

04/04 1810L Cast 2



04/05 1745L Cast 3

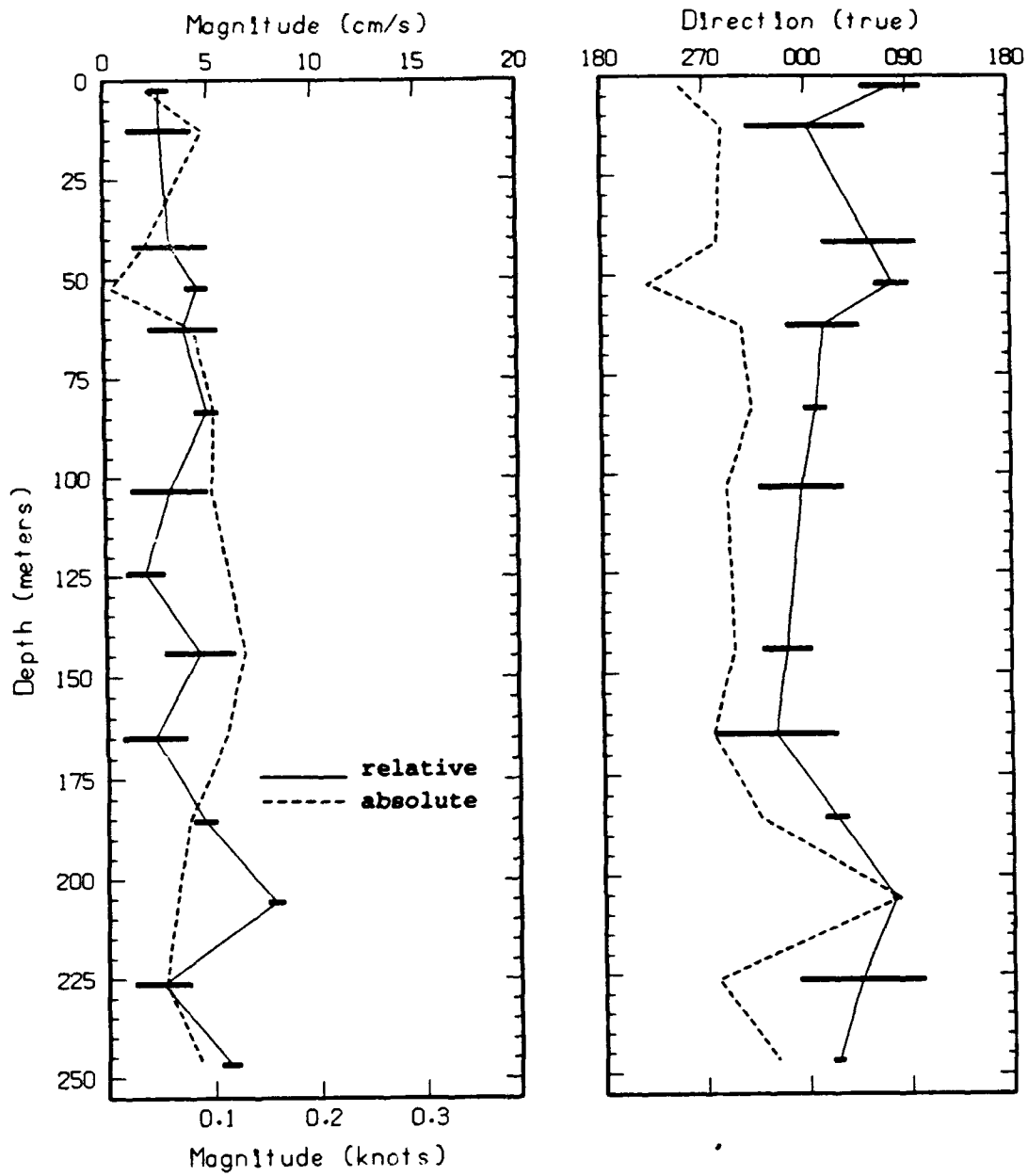


Magnetic bearing + 31 degrees = True bearing

Floe drift speed = 10.0 cm/s

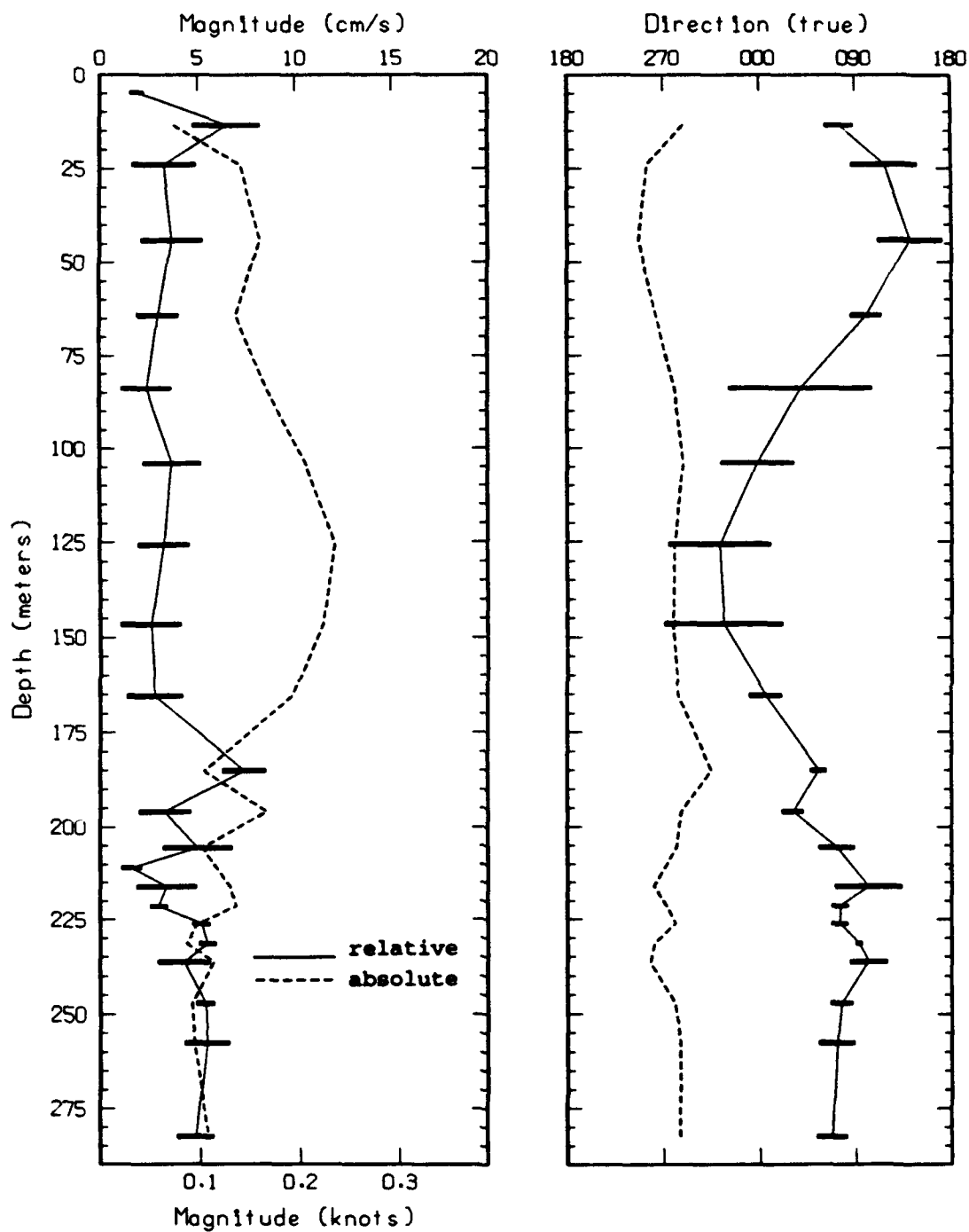
Floe drift direction = 295 degrees True bearing

04/08 1145L Cast 4



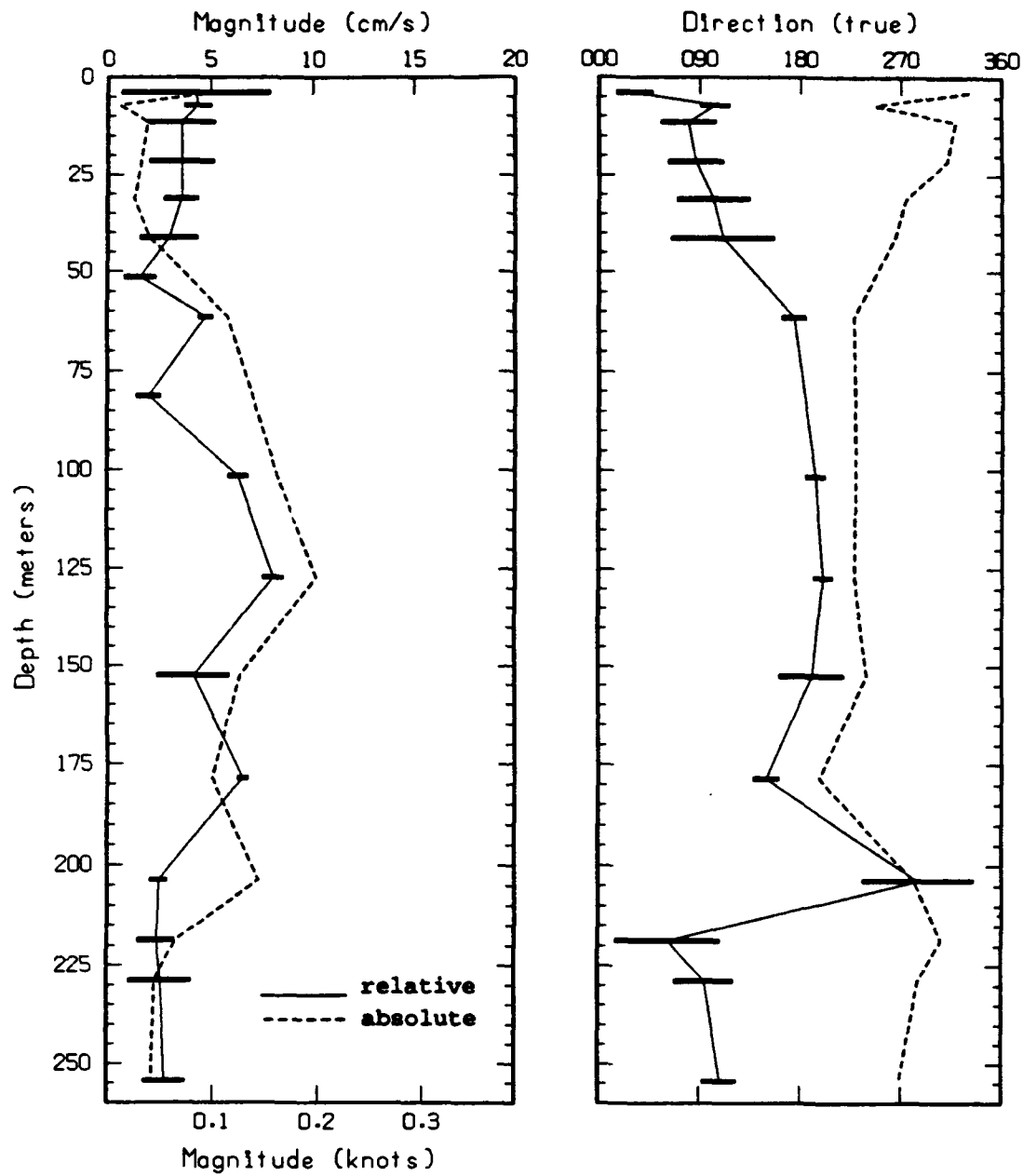
Magnetic bearing + 31 degrees = True bearing
 Floe drift speed = 4.8 cm/s
 Floe drift direction = 254 degrees True bearing

04/09 1645L Cast 5



Magnetic bearing + 31 degrees = True bearing
 Floe drift speed = 9.9 cm/s
 Floe drift direction = 268 degrees True bearing

04/10 1815L Cast 6

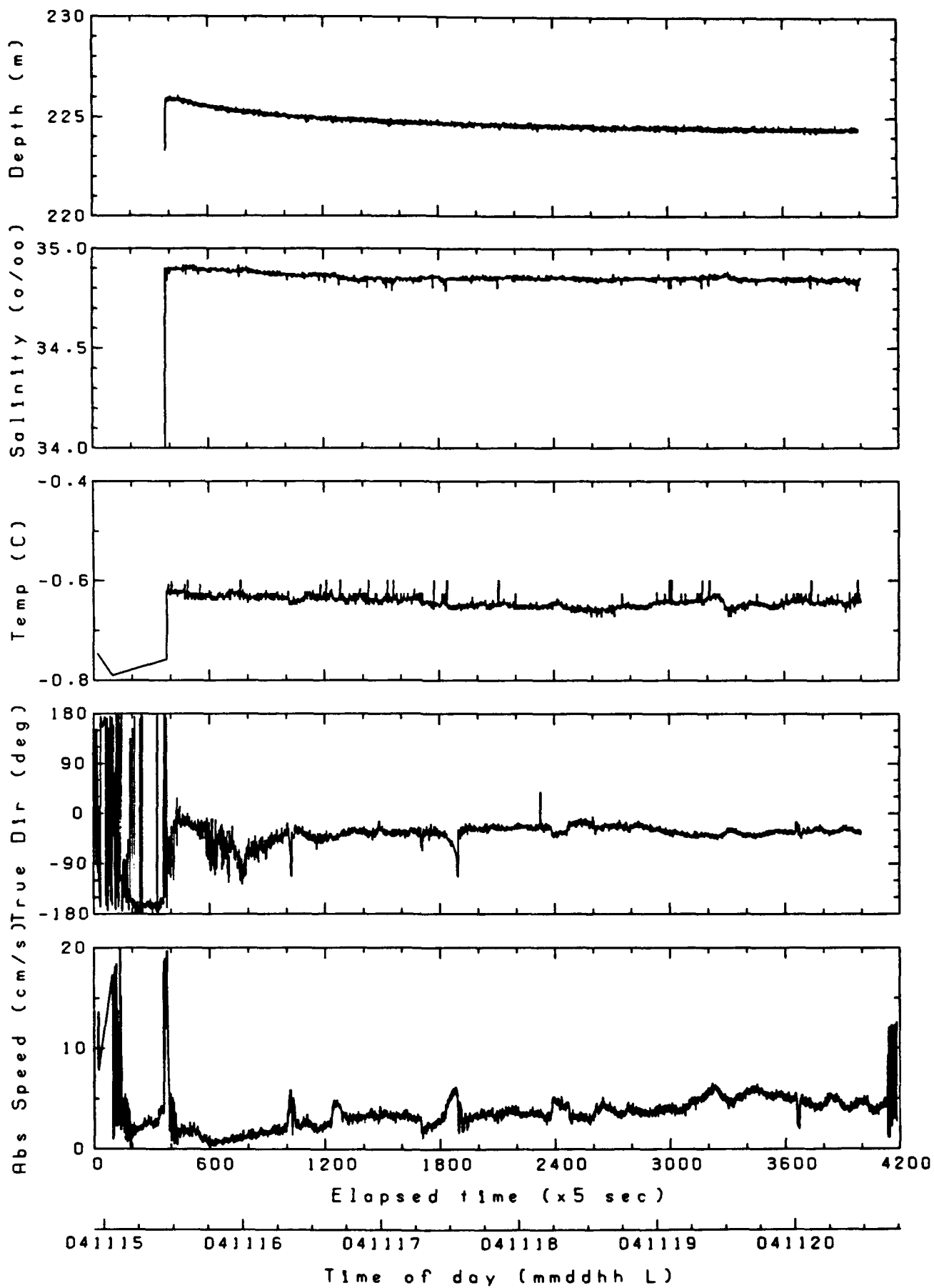


Magnetic bearing + 31 degrees = True bearing

Floe drift speed = 4.9 cm/s

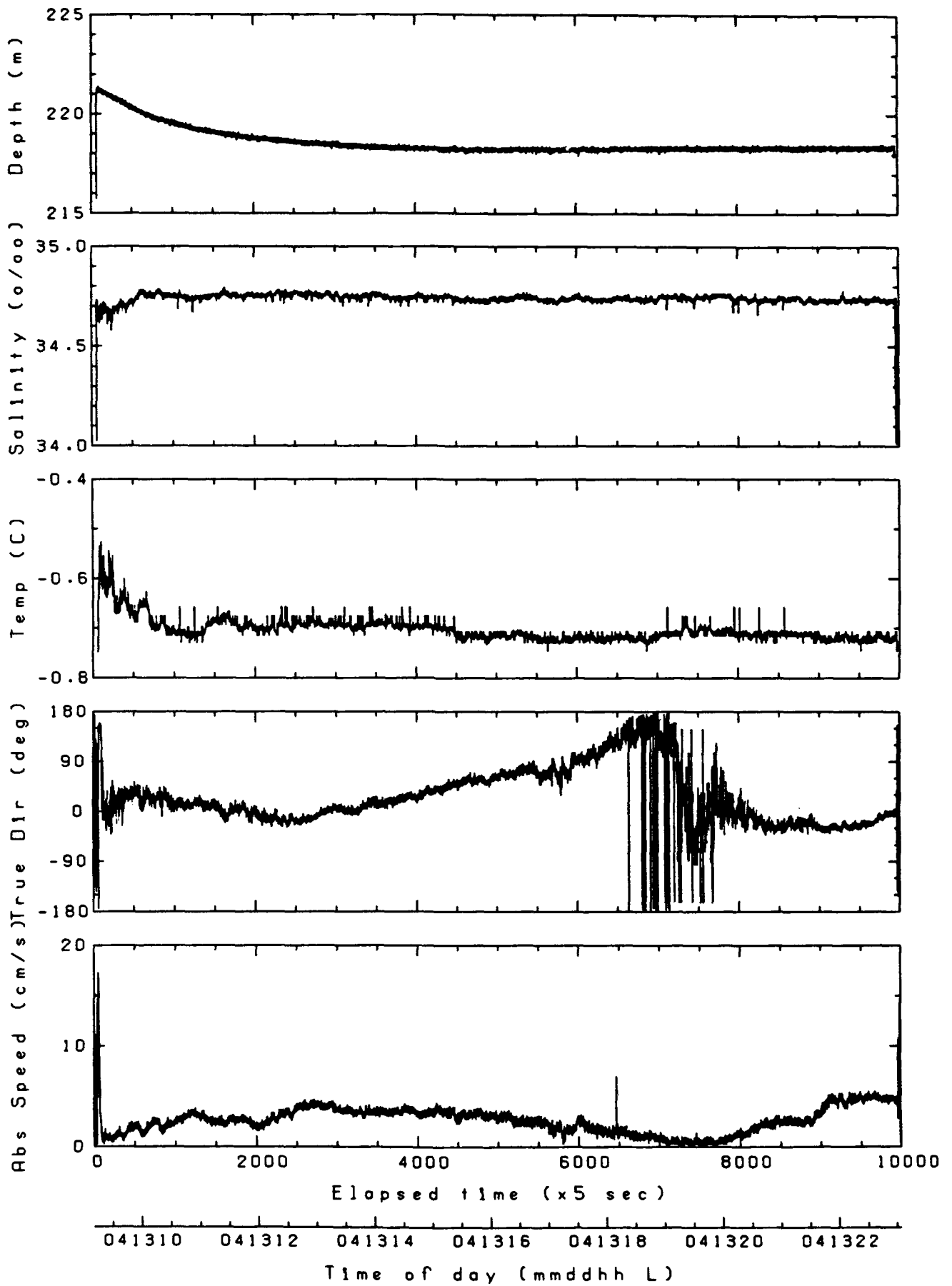
Floe drift direction = 280 degrees True bearing

04/11 1456L Cast 7



C7

04/13 0915L Cast 8

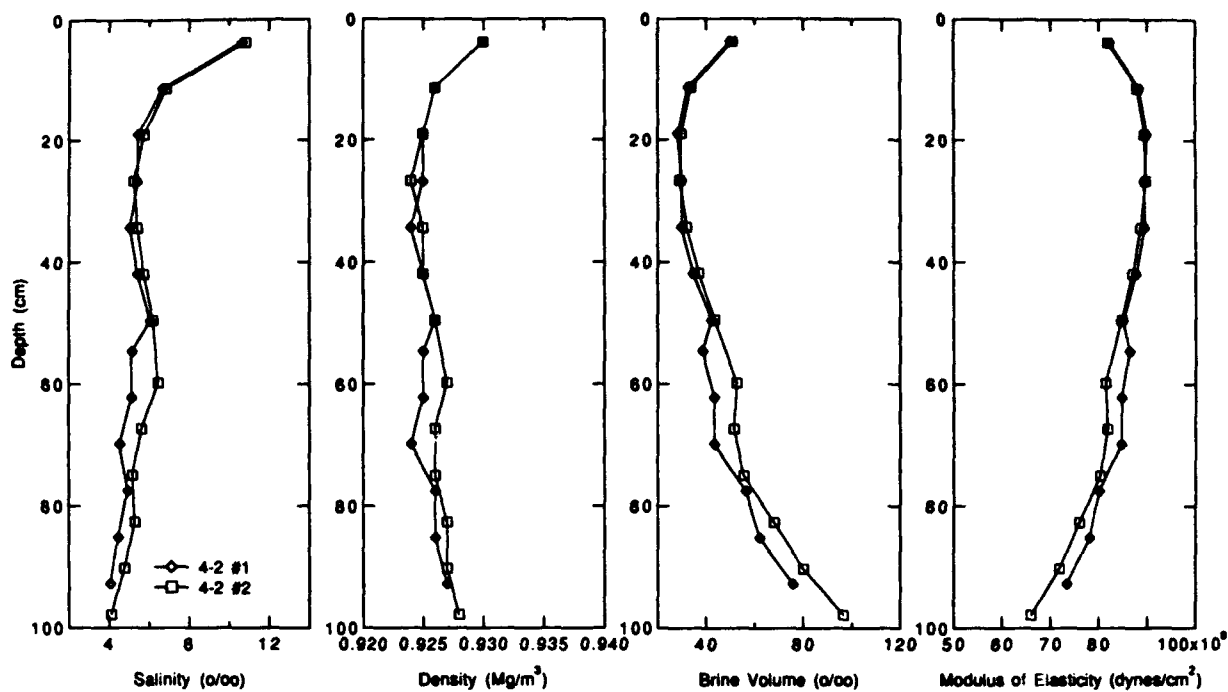


C8

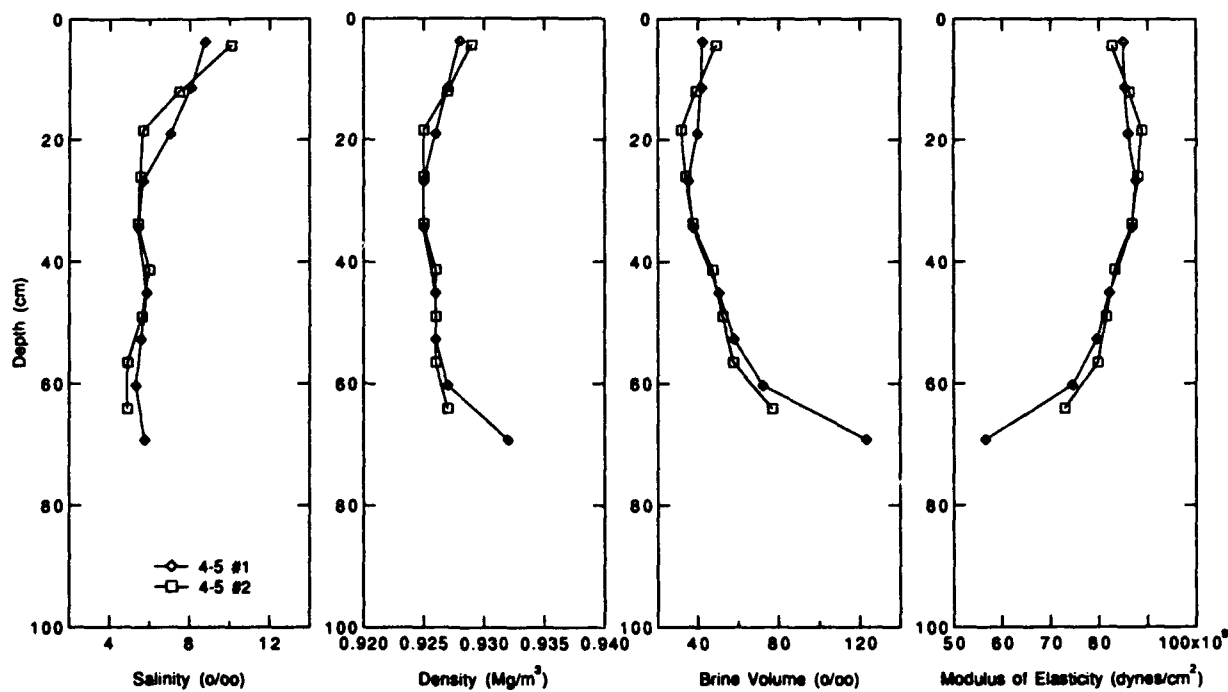
APPENDIX D

Ice Core Data

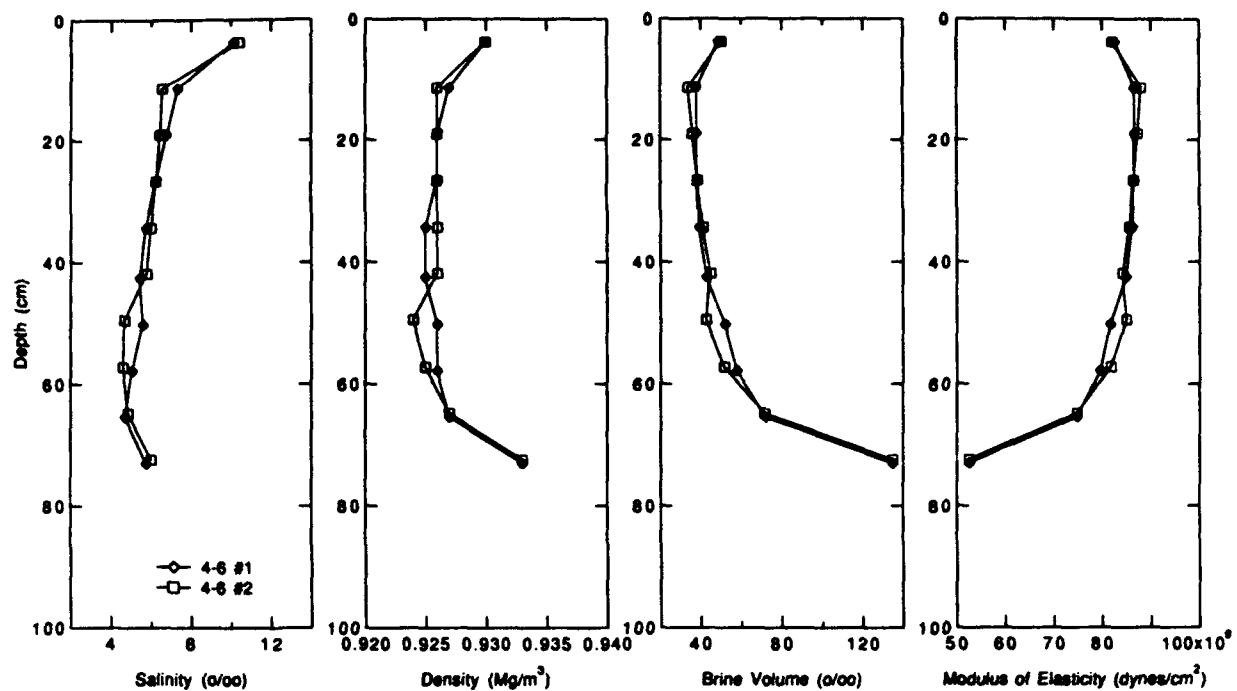
Core No.	Thickness (cm)	Surface Temp. (°C)	Comments
4-2 #1,2	102	-13.0	1.6 m apart
4-5 #1,2	74	-12.7	> 2 m apart
4-6 #1,2	76	-12.7	> 5 m apart
4-11 #1	84	-13.1	
#2,3	85	-13.6	0.5 m apart, >10 m from #1
4-12 #1,2	---	----	Retrozen melt ponds



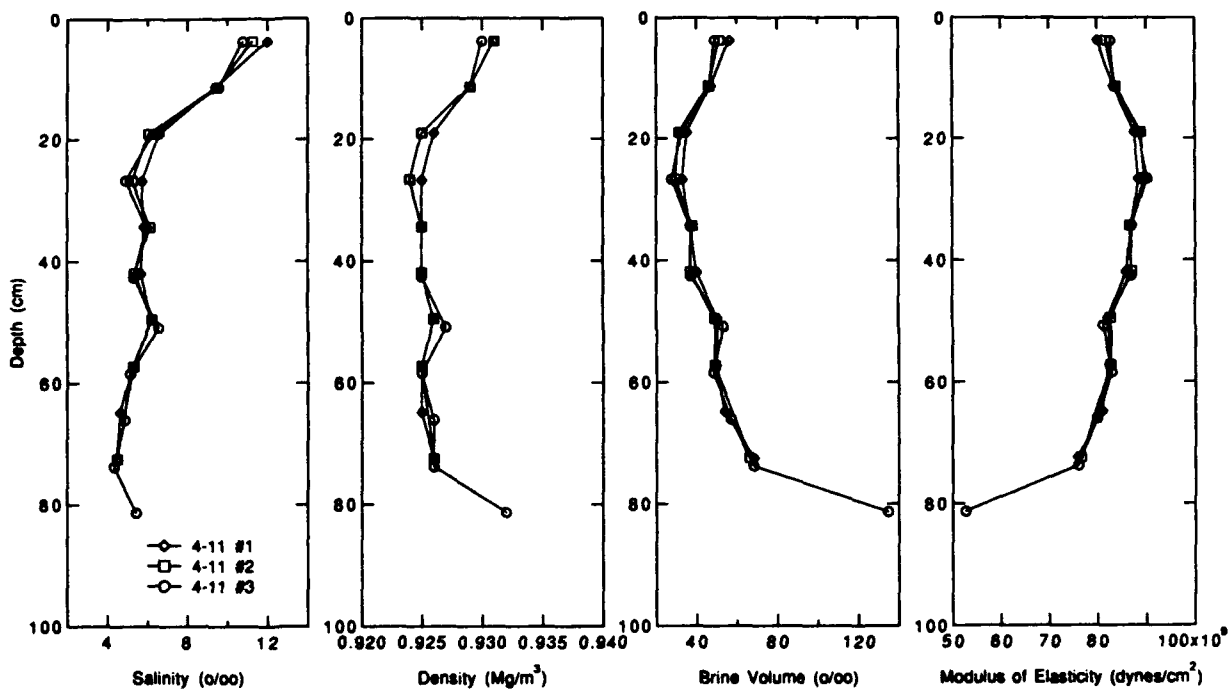
4/2 - #1, #2



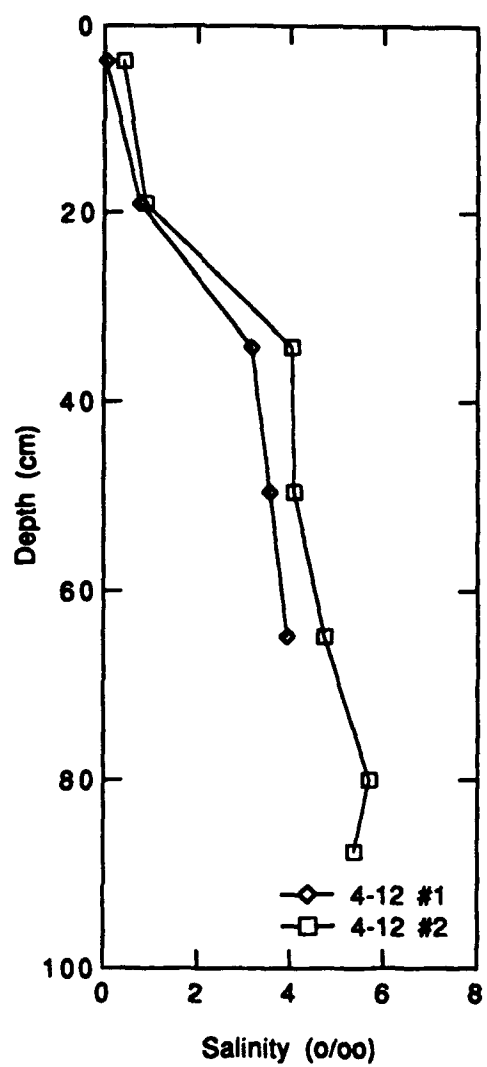
4/5 - #1, #2



4/6 - #1, #2



4/11 - #1, #2, #3



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