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Ice-Based Oceanographic Sea-Ice and Meteorological Data obtained over the N.E. Newfoundland Shelf, 1988-1989

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Canadian Data Report Of Hydrography and Ocean Sciences

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Les établissements des Sciences et levés océaniques dans les régions et à l'administration centrale ont cessé de publier leurs diverses séries de rapports en décembre 1981. Une liste complète de ces publications figure dans le volume 39, Index des publications 1982, du *Journal canadien des sciences halieutiques et aquatiques*. La série actuelle a commencé avec la publication du rapport numéro 1 en janvier 1982.

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ICE-BASED OCEANOGRAPHIC SEA-ICE AND METEOROLOGICAL DATA OBTAINED OVER THE N.E. NEWFOUNDLAND SHELF, 1988-1989

by

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ABSTRACT

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Fissel, D.B., A. van der Baaren, and C.L. Tang. 1989/Ice-Based Oceanographic, Sea-Ice and Meteorological Data Obtained over the N.E. Newfoundland Shelf, 1988-1989. Can. Data Rep. Hydrogr. Ocean Sci. No. 75: vii + 165 pp.

As one part of the LIMEX (Labrador Ice Margin Experiment) investigations, a two-year (1988-1989) oceanographic study was conducted. The overall objective of the project was to develop improved techniques for oceanic and sea-ice data collection using shore-based aircraft. This report presents the data collected in March-April, of 1988 and 1989, using shore-based helicopter logistics, along with a description of the techniques applied to acquire these data.

RÉSUMÉ

Fissel, D.B., A. van der Baaren, and C.L. Tang. 1989/Ice-Based Oceanographic, Sea-Ice and Meteorological Data Obtained over the N.E. Newfoundland Shelf, 1988-1989. Can. Data Rep. Hydrogr. Ocean Sci. No. 75: vii + 165 pp.

Dans le cadre de l'expérience LIMEX (expérience sur la marge glaciaire du Labrador), on a réalisé une étude océanographique de deux ans (1988-1989) dans le but de concevoir de meilleures techniques de collecte de données sur l'océan et les glaces marines au moyen d'aéronefs basés à terre. Le rapport suivant présente les données recueillies en mars et avril de 1988 et 1989, à l'aide d'un hélicoptère basé à terre, ainsi qu'une description des techniques mises en oeuvre pour obtenir ces données.

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1. INTRODUCTION

In recent years, several major scientific studies of the marginal ice zone have been conducted by various research groups. One of these, the Labrador Ice Margin Experiment or LIMEX (Tang et al., 1987; McNutt et al., 1988), has placed particular emphasis on remote observations to collect information on the physical environment, in support of more conventional sampling methods and for investigations involving numerical modelling of the marginal ice zone.

An important part of LIMEX, being undertaken by the Bedford Institute of Oceanography (BIO), is an investigation of sea-ice in relation to oceanographic properties, both at the ice margin and within the pack ice itself. This multiyear research project (Tang and Ikeda, 1987) involves collection of a comprehensive set of field data involving several sea-ice parameters, along with an examination of the relevant oceanographic and meteorological processes, which determine or otherwise influence the sea-ice.

In this report, we describe the preliminary results from one component of the BIO-LIMEX project. This project was aimed at developing improved techniques for oceanic and sea-ice data collection using shore-based aircraft for logistical support. Shore-based aircraft sampling is complimentary to ship-based data collection at the edge of the sea-ice, and remote sensing by means of satellite and other aircraft being conducted by other LIMEX investigators.

In this study, oceanographic sea-ice and meteorological observations were collected in March of both 1988 and 1989. The aircraft used was a helicopter, a Bell 206L Long Ranger, chartered from Universal Helicopters of Gander, Newfoundland. The helicopter was operated from communities at or near the east coast of Newfoundland.

Through development of modified or customized oceanographic instruments and equipment, a suite of coordinated data were obtained, consisting of:

(1) vertical profiles of temperature, salinity, density and ocean currents from just below the sea-ice to the sea bed;
(2) sea-ice velocities, wind speed and directional data obtained through deployment of satellite-tracked ice beacons from the helicopter;
(3) ancillary information on sea-ice thickness, roughness scales, floe sizes and distributions. A video camera mounted on the helicopter was used to continuously record images of the sea-ice while the helicopter was in transit between measurement sites.

Helicopter-based data collection operations were conducted during four periods:

- In 1988 on March 4-7 from St. Anthony, Newfoundland, March 26-April 2 from St. Anthony and Gander, Newfoundland, and;
- In 1989 on February 28, and again on March 23-25 from St. Anthony.

Typically, the helicopter operated over the pack-ice on two days during each period of field operations, but adverse weather conditions (passing storms and fog) caused delays between the first and second day of field sampling on some occasions.

Another component of this study involved the application of computer-based techniques to extract improved information on sea-ice using aircraft-based sensors: Side-looking Airborne Radar (SLAR) and a downward looking video camera. The results of this study component are being prepared as a separate report in the Canadian Contractor Report of the Hydrography and Ocean Sciences series.

2. SYNOPSIS OF ICE CONDITIONS

March-April, 1988--The sea-ice coverage experienced in 1988 exceeded average conditions but was considerably less than the maximum extent previously observed. Examination of the ice charts issued by AES Ice Central (Appendix A) illustrates the main features of the advance and subsequent retreat of sea-ice through March and April. A brief description of the sea-ice advance and retreat (see Figure 1) follows.

By early March, sea-ice was present as far south as 50°N and extended nearly to 50°W, a considerable distance (>300 km) from the coastline. However, extensive ares of open water occurred along the northern coast of Newfoundland from White Bay to Hare Bay, and Notre Dame Bay was completely free of sea-ice except for the landfast ice immediately adjacent to the coastline.

By March 13, the sea-ice had advanced shoreward into Notre Dame Bay and had extended southward, with scattered floes entering Bonavista Bay. At the same time, the offshore edge of the sea-ice retreated westward, generally confined to west of 51-52°W.

Over the next three weeks, the pattern of sea-ice advance to the south continued, while the lateral extent of the ice coverage was reduced. By April 3, the sea-ice reached its maximal southward extent; advancing to 47°N. The width of the pack-ice was now reduced to 200 km over the full length of the Newfoundland coastline. By April 3, the offshore half of the sea-ice had a mean concentration of only four-tenths, with the heavily concentrated ice (nine-tenths) having a typical lateral extent of only 80-90 km. An interesting feature observed on April 3 was a narrow tongue of scattered ice floes (2-tenths concentration), extending to the east along the northern side of the Grand Banks. Sea-ice was observed as far east as 47.5°W, possibly the result of strong advection from the main ice pack. Previous studies (eg. Greenberg and Petrie, 1988) indicate that strong, comparatively narrow, eastward currents can occur in this region, representing a convergence of inshore and offshore portions of the Labrador Current.

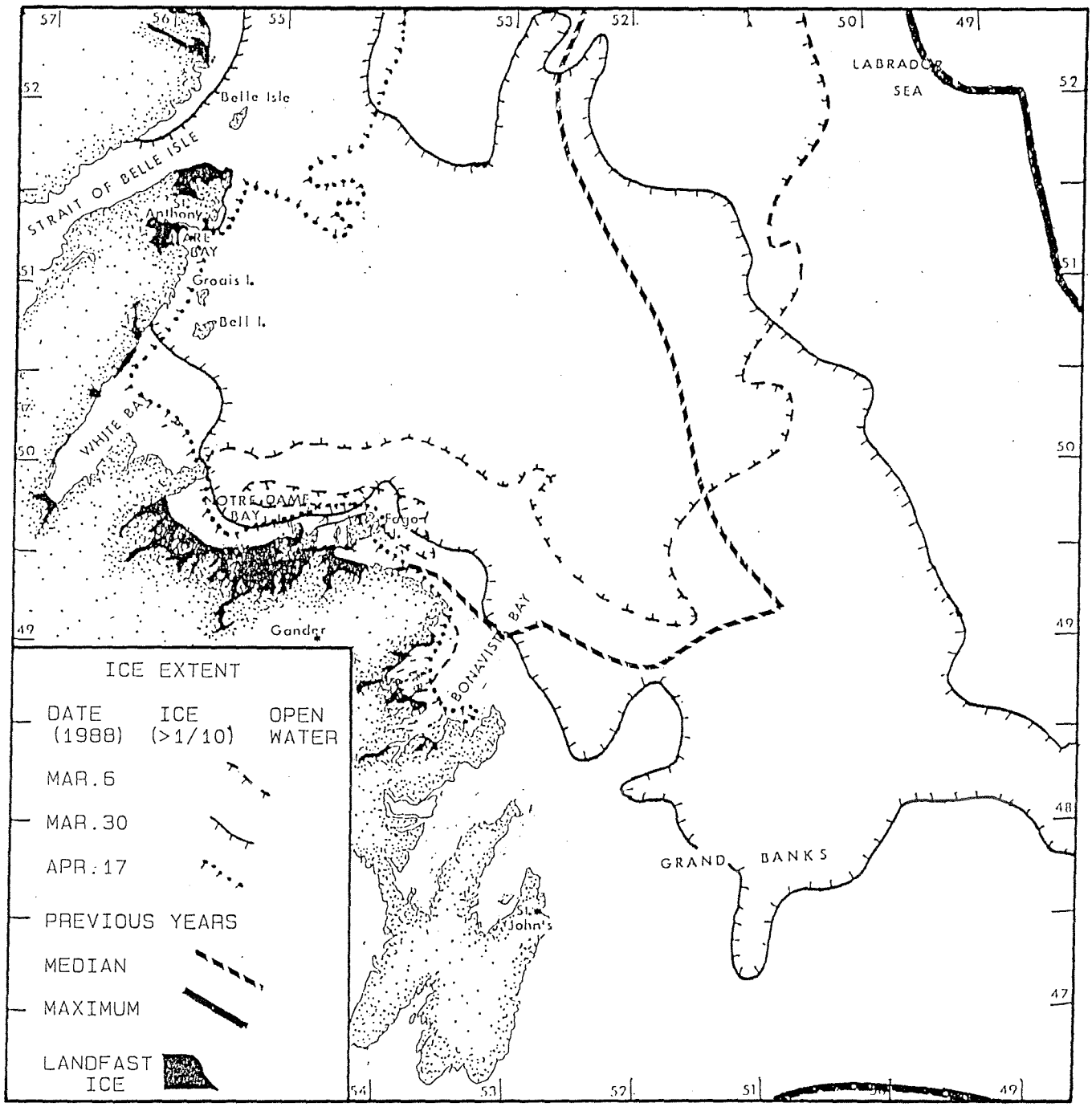


Figure 1: The spatial extent of sea-ice from the AES Ice Central charts of March 6, March 30 and April 17, 1988. Also shown are the median and maximum historical ice extent for late March, from Raney and Argus (1989).

Surface conditions experienced during helicopter operations also changed noticeably from early March to the latter part of March. By late March, the thin ice between the floes had turned to slush. In drilling through ice floes, rotten ice was encountered at the bottom of the floes.

Over the first ten days of April, large expanses of open water or low concentrations of sea-ice occurred in inshore regions, particularly off the Northern Newfoundland Peninsula and in Notre Dame Bay. However, on April 12-14, strong northerly winds drove the remaining sea-ice shoreward. By April 17, all sea-ice off the eastern Newfoundland coastline was limited to a narrow (<20 km) coastal band of heavily concentrated (nine+-tenths) ice, extending as far south as Bonavista Bay.

Through the remainder of April and into early May the coastal bands of sea-ice remained reasonably stationary, diminishing in extent due to melting.

1989--The sea-ice conditions of March-April, 1989 (Figure 2) extended over a larger area than in 1988. The large expanse of sea-ice coverage was related to persistent winds blowing from the west, which drove the core of the ice pack far from the coast during this period. These conditions also resulted in thin, new ice over a wide band of 50-100 km width, located immediately shoreward of the coastline, which hampered helicopter-based sampling. Another persistent feature of 1989 was the tongue of relatively thicker sea-ice originating in the Strait of Belle Isle, and advancing south-eastward into offshore portions of the large offshore embayment off the northern Newfoundland peninsula.

In early March, the sea-ice extended to 48°N just over the northern edge of the Grand Banks, with the thicker sea-ice found in the easternmost 100 km of its areal coverage. Maximal southward penetration of sea-ice occurred in mid-March. The northern portion of the Grand Banks was covered with thin grey-white sea-ice, with a prominent tongue of this thin ice extending as far south as 45.5°N, directly south of the Avalon Peninsula. The heavier pack-ice remained far offshore, extending as far east as the Flemish Cap in a broad tongue of five-tenths ice-cover.

By late March, the southward sea-ice limit had retreated to the position of early March; however, the southern Newfoundland coast was now clear of sea-ice as far north as Bonavista Bay. By mid-April, the entire eastern Newfoundland coast was clear of sea-ice with the exception of the tip of the northern peninsula and the entrance to the Strait of Belle Isle, where sea-ice from the Strait continued to move into the study area.

3. HELICOPTER-BASED FIELD OPERATIONS, 1988-1989

1988--(Sampling locations are shown in Figures 3 and 4a, with detailed measurement times and locations provided in Table 1.)

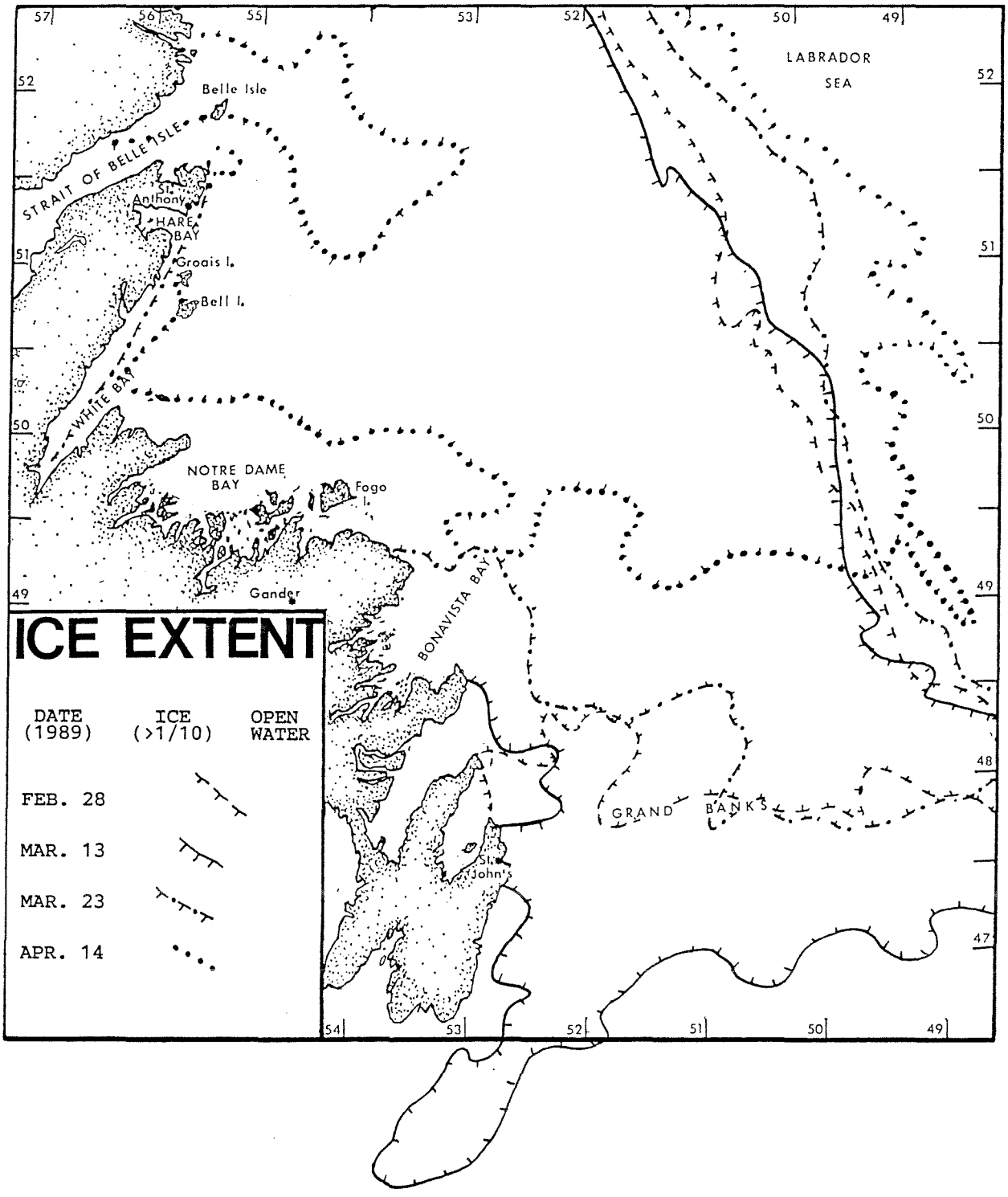


Figure 2: The spatial extent of sea-ice from the AES Ice Centre charts of February 28, March 13, March 23 and April 14, 1989.

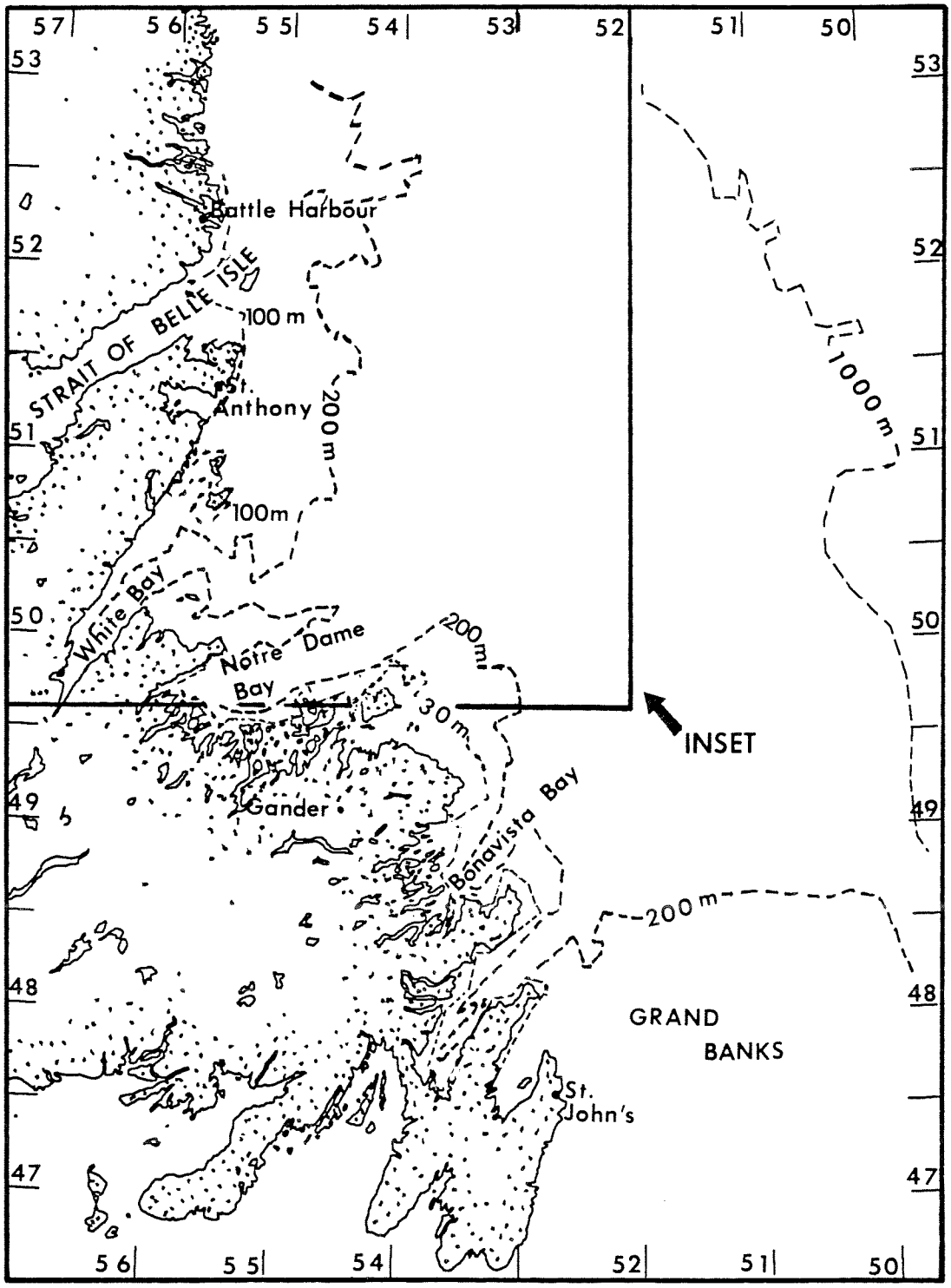
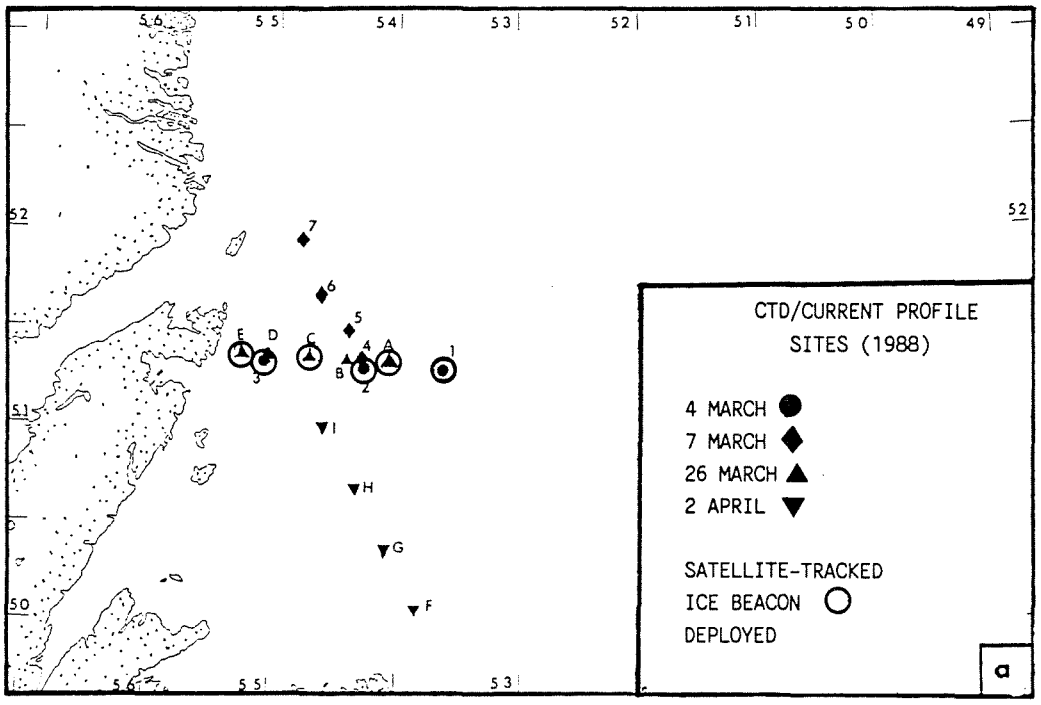


Figure 3: Location of study area off Newfoundland, and the major bathymetric features. Field operations were conducted in the area marked 'inset'.



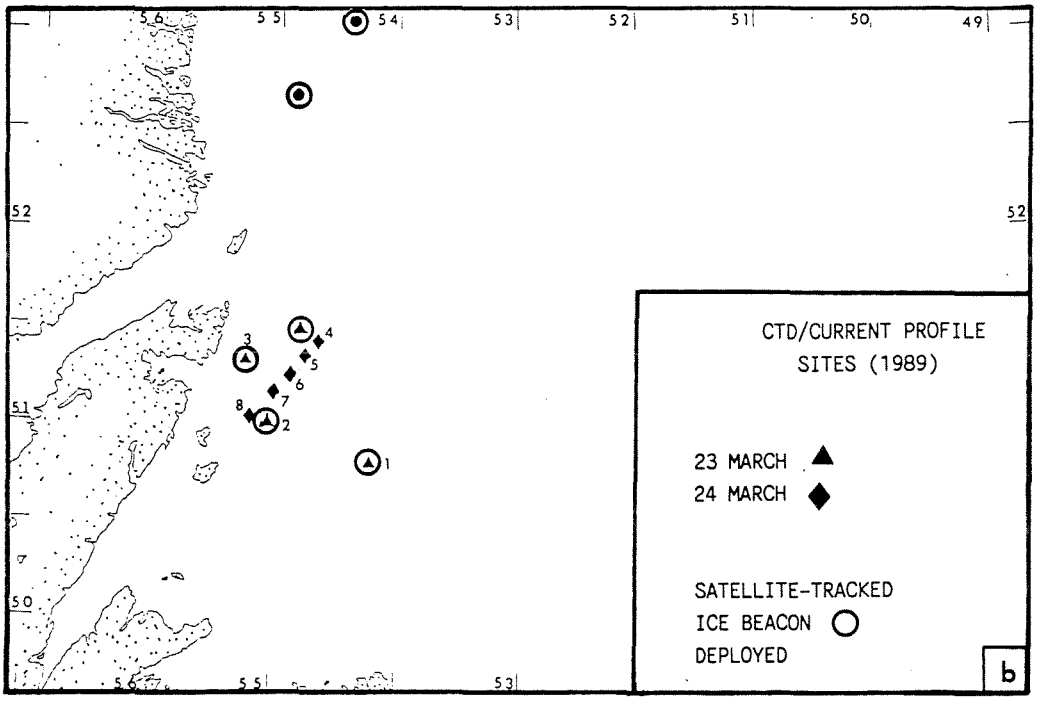


Figure 4: CTD and current profile measurement sites occupied in (a) 1988 on March 4, 7 and 26, and in (b) 1989 on March 23-24. Also shown (as open circles) are the sites where satellite beacons were deployed.

TABLE 1

Times, locations & ice conditions at each CTD/Current Profiling Site occupied in March & April, 1988 & 1989.

SITE	DATE	TIME (GMT)	DEPTH (m)	LATITUDE	LONGITUDE	WATER SAMPLE	ICE FLOE DIMENSIONS	ICE FLOE THICKNESS	SATELLITE BEACON ID	NOTE
	1988--CTD/CURRENT PROFILE SITES									
1	March 4	1345	298	51°19.5'N	53°35.6'W	N	20 x 20	4.0	3322	
2	March 4	1556	275	51°19.2'N	54°16.2'W	N	5 x 15	3.7	3326+	
3	March 4	1800	~190	51°20.8'N	55° 4.7'W	Y	23 x 30	1.6	2374	
4	March 7	1242	266	51°21.8'N	54°16.7'W	N	150 x 150	0.06	---	
5	March 7	1422	215	51°30.4'N	54°23.5'W	N	50 x 50	1.0	---	
6	March 7	1605	246	51°41.0'N	54°37.0'W	N	40 x 75	0.2	---	
7	March 7	1738	300	51°58.2'N	54°47.1'W	Y	10 x 10	0.25	---	
A	March 26	1338	245	51°21.3'N	54°04.1'W	N	15 x 20	0.75	8644	
B	March 26	1520	275	51°21.8'N	54°24.1'W	N	25 x 25	2.0	---	
C	March 26	1655	239	51°22.2'N	54°42.7'W	N	15 x 20	2.0	4457+	
D	March 26	1828	149	51°22.4'N	55°03.2'W	N	25 x 25	2.1	---	
E	March 26	1955	185	51°22.9'N	55°15.3'W	Y	25 x 35	2.3	8645	
F	April 2	1453	>330	50° 4.7'N	53°50.3'W	N	15 x 20	4.0	---	> NO
G	April 2	1636	285	50°23.3'N	54° 5.2'W	N	15 x 15	1.0	---	> CURRENT
H	April 2	1826	190	50°42.0'N	54°19.8'W	N	25 x 15	1.2	---	> PROFILES
I	April 2	1942	205	51° 0.5'N	54°35.9'W	Y	15 x 15	1.9	---	>
	1989--CTD/CURRENT PROFILE SITES									
1	March 23	1620	275	50°48.8'N	54°10.7'W	N	50 x 25	2.0	8660	
2	March 23	1900	195	51° 1.8'N	55° 5.8'W	N	50 x 30	1.25	8656+	
3	March 23	2100	190	51°20.3'N	55°15.8'W	Y	100 x 100	0.5	8658	
4	March 24	1530	190	51°27.7'N	54°39.6'W	N	100 x 75	1.0	---	>
5	March 24	1655	200	51°22.6'N	54°45.7'W	N	40 x 40	0.5	---	> NO
6	March 24	1835	175	51°16.6'N	54°54.0'W	N	45 x 30	0.3	---	> CURRENT
7	March 24	1955	166	51°10.4'N	55° 1.4'W	Y	200 x 100	0.5	---	> PROFILES
8	March 24	2120	196	51° 3.4'N	55°13.5'W	N	1800 x 1800	0.5	---	>
	March 25	1215	---	51°30.5'N	54°48.5'W	-	100 x 100	>1.5	8657	
	March 9	1452	---	52°34.5'N	54°19.5'W	-	30 x 25	2.0	4459*+	
	March 10	2015	---	52°40.4'N	54°25.5'W	-	40 x 40	2.0	8659	

* Beacon 4459 was moved on March 10 to a location much nearer beacon 8659.

\+ Beacon with anemometer.

March 2	G. Pierlot (Arctic Sciences Ltd.) and J. Maloney (Universal Helicopters) arrived in St. Anthony
March 3	Preparations for offshore flights completed.
March 4	Satellite beacons were deployed and CTD/current profile data collected at three sites.
March 5-6	Delayed due to bad weather
March 7	CTD/current profiles obtained at four sites.
March 8	Helicopter returned to Gander; equipment demobilized.
March 22-23	G. Pierlot arrived in Gander; equipment mobilized; helicopter flew to St. Anthony
March 24	CTD/current profiles were obtained at five sites; three satellite beacons were deployed.
March 25-28	Poor visibility in St. Anthony area precluded any flying; helicopter returned to Gander.
Mar 29-Apr 1	Waiting on weather to improve in Gander.
April 2	CTD/current profiles were obtained at four sites.

1989--(Sampling locations are shown in Figure 4b.)

Feb 26-27	Equipment mobilized onto helicopter from Goose Bay by G. Pierlot (Arctic Sciences Ltd.) and Wayne Massie (Universal Helicopters).
February 28	Offshore operations were carried out from St. Anthony where the ice charts indicated some thicker ice could be found in a large area containing otherwise very thin ice. Initially, the helicopter traveled due eastward, but encountered only very thin ice (category 4 or 5). At 16 miles from the coast, the helicopter changed heading to NNE, along which thicker ice was expected. After traveling a further 39 km (62 miles), to a location of 52°33°N 54°37°W, no suitable ice for operations was found. (Two landings were made on this ice, but in both cases the ice was too thin to safely conduct operations.) Sea-ice data were collected on video throughout the outward flight leg.
March 1	Following consultations with the Scientific Authority, further operations were postponed until the latter half of March, as a result of the very thin sea-ice present.

March 9-10	Two of the satellite beacons (originally planned for deployment from St. Anthony), were deployed by DFO personnel involved in seal research. The beacons were deployed on March 9, with one beacons (4459) relocated on March 10.
March 21-22	G. Pierlot arrived in Gander; the helicopter was mobilized and arrived in St. Anthony (pilot: J. Maloney). One of the four satellite beacons was sent by commercial carrier to St. Anthony, as there was no space available in the helicopter.
March 23	Flew offshore from St. Anthony and collected CTD/current profiles at three sites. Satellite beacons were also deployed at each site.
March 24	Conducted CTD/current profile operations at five sites operating from St. Anthony. The CTD and current profile instrumentation was lost at the last site due to failure of the cable on the winch. The current profile data (stored internally) for the day was also lost.
March 25	The last satellite beacon was deployed off St. Anthony. The helicopter then returned to Gander and demobilization was started.
March 26	Equipment demobilization was completed - G. Pierlot returned to Halifax, N.S.

Positional Accuracy--During the helicopter operations of March 4, 7 and 26, 1988, navigation was conducted by dead reckoning, as derived from aircraft speed and heading, with the estimated positional accuracy limited to ± 5 km. However, on March 4 and 26, the satellite beacon positional data was applied to improve the positional accuracy to 1 km or better. By April 2, 1988 a LORAN-C unit had been installed in the helicopter. As a result, positional accuracy for each on-ice measurement site was further improved to 300 m (estimated).

For the 1989 operations, the helicopter was equipped with a LORAN-C unit, resulting in the improved positional accuracy at each CTD/current profile measurement site.

4. SATELLITE-TRACKED ICE BEACON DATA, 1988-89

4.1 INSTRUMENT DESCRIPTION

Of the 12 satellite ice beacons used in this study, 11 were manufactured by MetOcean Data Systems, Dartmouth, N.S., while the other unit (2374) was manufactured by Hermes Electronics, Dartmouth, N.S. These units provided measurements of ice floe position, and hence velocity, as well as ice surface temperature and battery voltage. Four of the beacons were equipped with R.M.

Young anemometers, providing measurements of wind velocity components and beacon (or ice floe) heading, but not ice temperature. The beacon manufactured by Hermes Electronics measured only positions. All ice beacons operated through the ARGOS satellite system.

A summary of the duration of each satellite beacon data set is found in Table 2. Note that most units continued to operate after the stop date given in Table 2, but were no longer on a moving ice floe.

TABLE 2

Satellite Beacon Position/Velocity and Ice Surface Temperature Data Summary

ID #	Start Date	Reason	Stop Date	Reason
1988				
3322	88/03/04	deployment	88/03/22	in water
3326	88/03/04	deployment	88/03/31	in water
2374	88/03/04	deployment	88/04/10	restrained by landfast ice
8644	88/03/26	deployment	88/04/28	unit failed
4457	88/03/26	deployment	88/04/13	restrained by landfast ice
8645	88/03/26	deployment	88/04/13	restrained by landfast ice
1989				
4459	89/03/09	deployment	89/03/23	unit failed
8659	89/03/09	deployment	89/04/09	in water
8656	89/03/23	deployment	89/04/18	fisherman recovered
8658	89/03/23	deployment	89/04/22	in water
8660	89/03/23	deployment	89/04/13	in water
8657	89/03/25	deployment	89/04/15	in water

The nominal operating specifications for the MetOcean satellite ice beacons, as supplied by the manufacturer, are:

SENSOR OPTIONS	RANGE	RESOLUTION	ACCURACY
Ice Surface Temp.	-25.5 to 0°C	0.1°C	±1°C
Air Temperature	-40 to +11°C	0.2°C	±1°C
Barometric Pressure	900 to 1053 mBars	0.15 mBars	±1 mBar
Wind Speed	0-60 m/s	0.48 m/s	±10%, speeds >10 m/s; ±1 m/s, speeds <10 m/s
Wind Direction	0 to 355°	<1°	±5°
Battery Voltage	+5 to 17.6 volts	0.2 volts	±0.2 volts

The positional accuracy of the ice beacons varied among the beacons, depending primarily on the stability of the oscillator within each beacon. Tests conducted over a few days at stationary locations, just prior to deployment, indicated that the standard deviation in latitude or longitude varied from 0.15 to 0.5 km.

4.2 DATA PROCESSING

Tape Conversion--From each monthly System ARGOS data tape, all positional and sensor data were extracted onto disk files on Arctic Sciences' Dual UNIX computer system. The data are logically grouped by the set of records obtained during each satellite overpass. The data groups consist of a variable number of sensor values (usually numbering from 1 to 15) obtained at 1-minute intervals, along with a position; the position is often derived from a previous data group, particularly if the current data group is of short duration.

At this stage, the data were separated into two streams. The first contained all positional data along with the concurrent sensor values. All redundant positional data was removed from this data set. The second data stream was a complete time series of all available sensor data, including measurements obtained during satellite overpasses which did not result in an updated position.

The data sampling rate was irregular, according to the satellite orbits and the number of other platforms transmitting to the satellite. The average number of sensor values received each day was 12 while the number of daily positions was less, typically 8 to 10. Within each day, a data gap occurred between 0000 and 0600 GMT when satellites were not overhead, and no data could be transmitted.

The most comprehensive data set was obtained from the anemometer beacons, which transmitted the current and previous five hourly data values; for these beacons, only 1 or 2 hourly samples were missed each day.

Error Removal--Errors were detected through inspection of time series plots of each measured quantity. For positional data, all single point deviations from the time series curve, having amplitudes exceeding twice the standard deviation during the stationary tests, were eliminated from the data record. The number of erroneous positional measurements range from two to seven per data set.

A similar technique of visual examination of the sensor data, plotted on an expanded scale, was used to detect and eliminate erroneous values.

4.3 ICE VELOCITIES

Time series of ice velocity were computed as displacements in latitude and longitude divided by time. In order to avoid positional uncertainties

contaminating the derived velocity components, the minimum allowable elapsed time (T min) between successive readings was chosen as 4.75 hours or 0.198 days. Given a mean standard deviation (σ) in positional components of 0.35 km, the minimum velocity uncertainty (90 percent level) is estimated as:

$$V\ (\max) = \frac{2 * \sqrt{2} * \sigma}{T\ \min}$$
$$= 5\ \text{km/day}$$

Data Display - Position/Velocity Measurements--Information on the duration of each satellite-tracked ice beacon positional data set is summarized in Table 2. The positional and velocity data, along with ice surface temperature measurements (following error removal), are presented in Appendix A.

A composite plot of the tracks for all 1988 ice beacons is presented in Figures 5 and 6, while the 1989 ice beacon tracks are displayed in Figures 7 and 8. The measurements were concentrated over the Newfoundland continental shelf from Strait of Belle Isle to Notre Dame Bay.

Six of the ice beacons had the ice melt from beneath them and became drifting buoys. The time at which the beacon entered the water could be estimated to within approximately one to two days on the basis of sensor data (surface ice temperature or wind components) and the general sea-ice conditions reported on the AES Ice Centre Charts. Of the satellite beacons deployed on March 4, 1988 unit 3326 traveled a considerable distance to the south (Figure 6), passing through the southern limits of the seasonal ice near 47°N in late March. In 1989, three beacons (8658, 8659 and 8660) entered the water as the ice floes moved out of the pack ice and melted. One of these beacons (8660), along with a second beacon (8656), still on an ice floe, were recovered by local fishermen operating out of Twillingate, Newfoundland.

4.4 SURFACE WINDS AND ICE FLOE ORIENTATION

Hourly interpolated time series velocity data were computed using simple linear interpolation technique. The same algorithm was applied to compute hourly time series of wind data, including a rotation of the coordinate system from magnetic to geographic frame of reference. Information on record duration is given in Table 3.

Sensor data acquired from the four beacons equipped with anemometers (3326, 4457, 4459 and 8656) are presented in Appendix B. The hourly wind data is displayed as easterly and northerly components, and as vector stick plots. Note that the wind directions are presented using the oceanographic direction convention; i.e. the direction represents the direction the wind is blowing to. Also shown in Appendix B are plots of the compass heading (corrected to degrees true) for each ice floe.

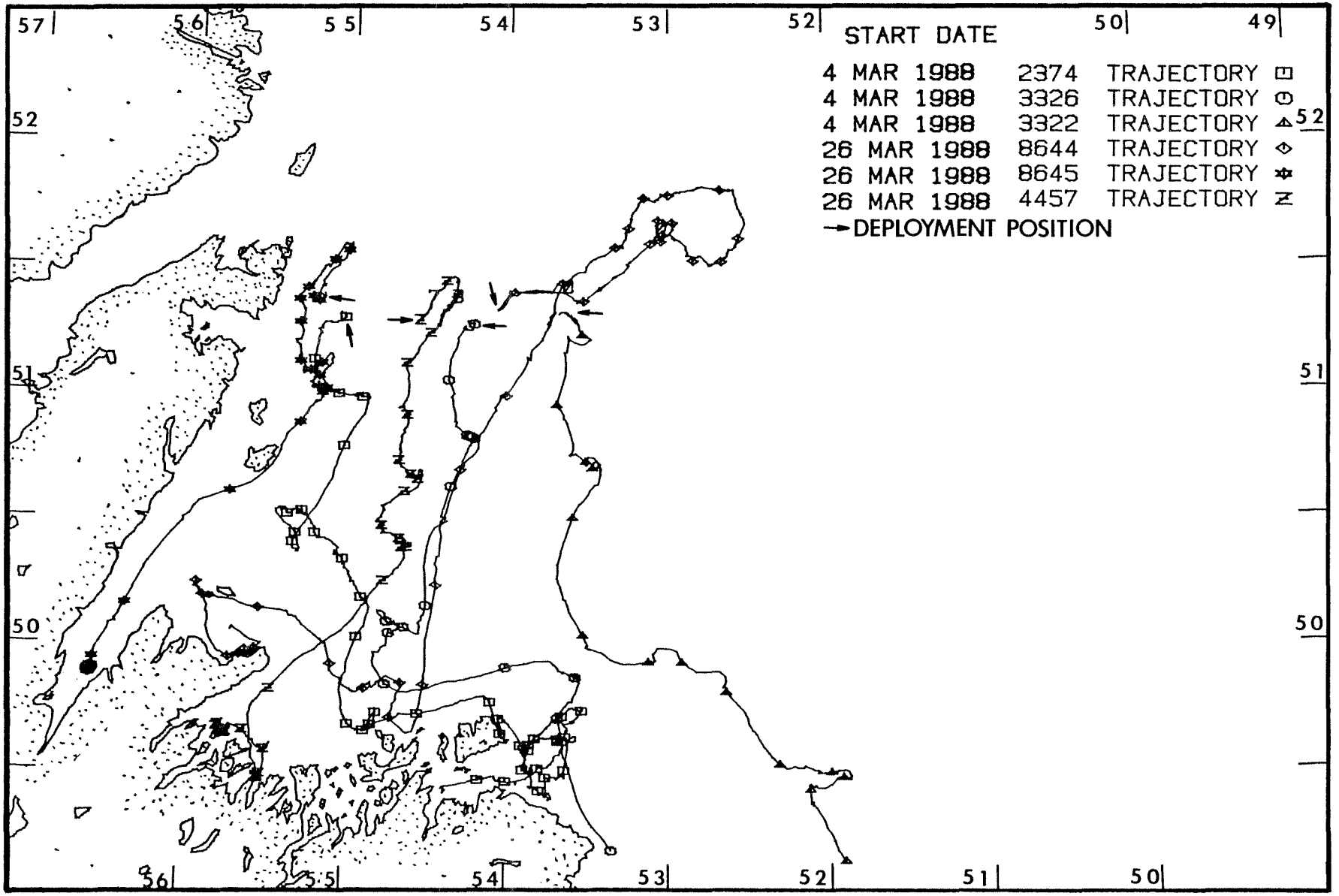


Figure 5: Composite plot of all satellite-tracked ice beacon data acquired in 1988 north of 49°N. Each ice beacon is identified by a unique symbol plotted on the first position of each new day.

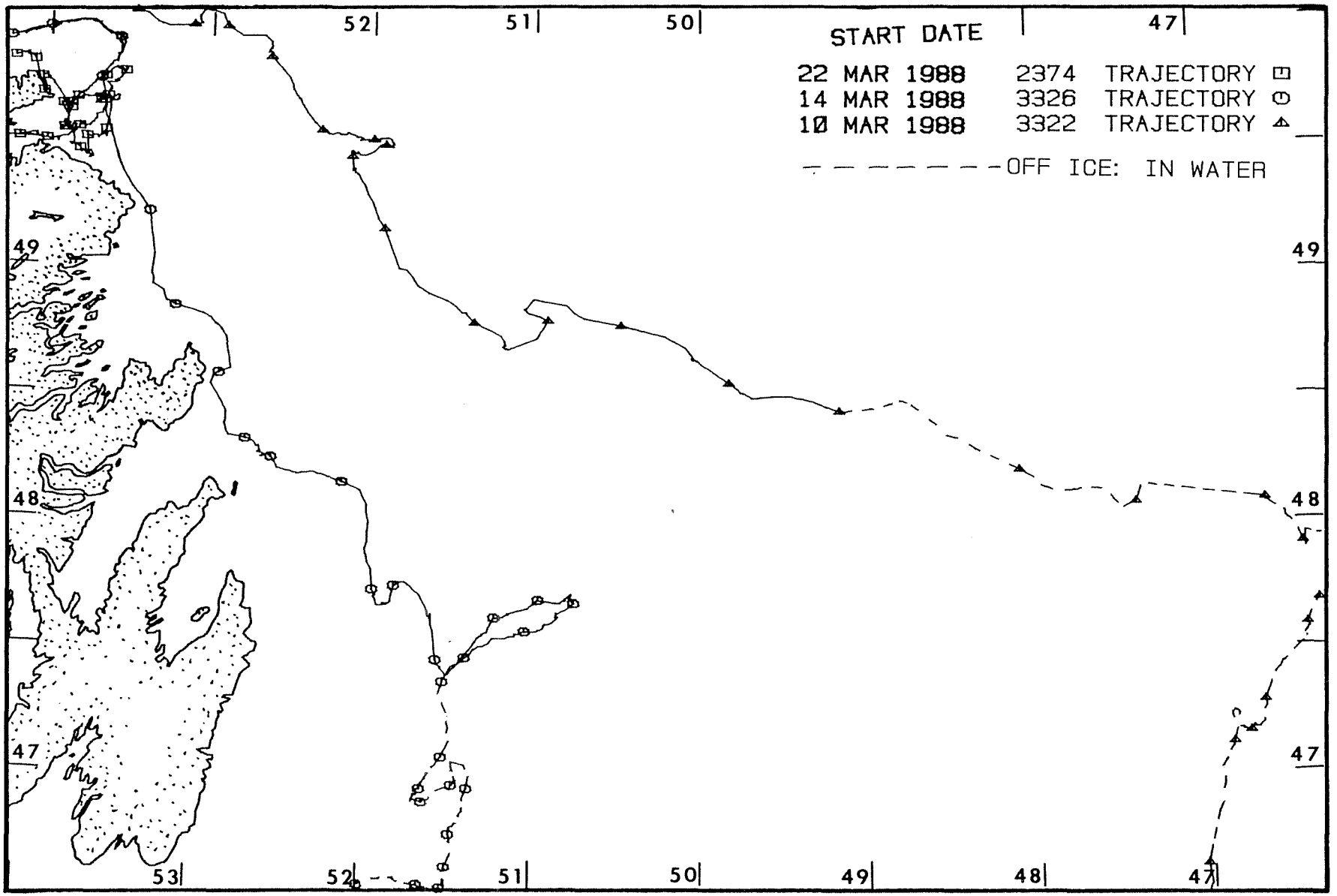


Figure 6: Composite plot of all satellite-tracked ice beacon data acquired in 1988 south of 49°N. Each ice beacon is identified by a unique symbol plotted on the first position of each new day.

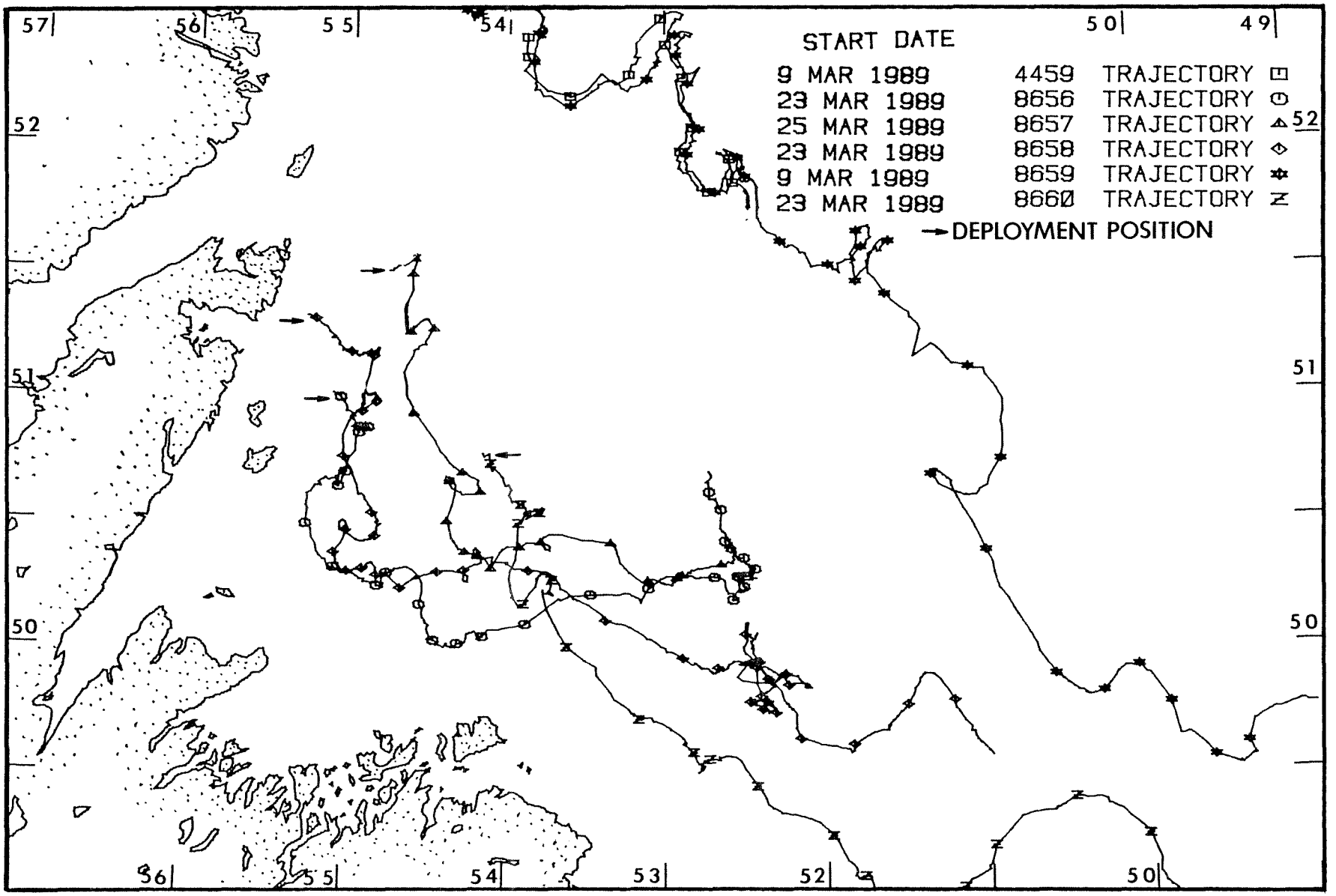


Figure 7: Composite plot of all satellite-tracked ice beacon data acquired in 1989 north of 49°N. Each ice beacon is identified by a unique symbol plotted on the first position of each new day.

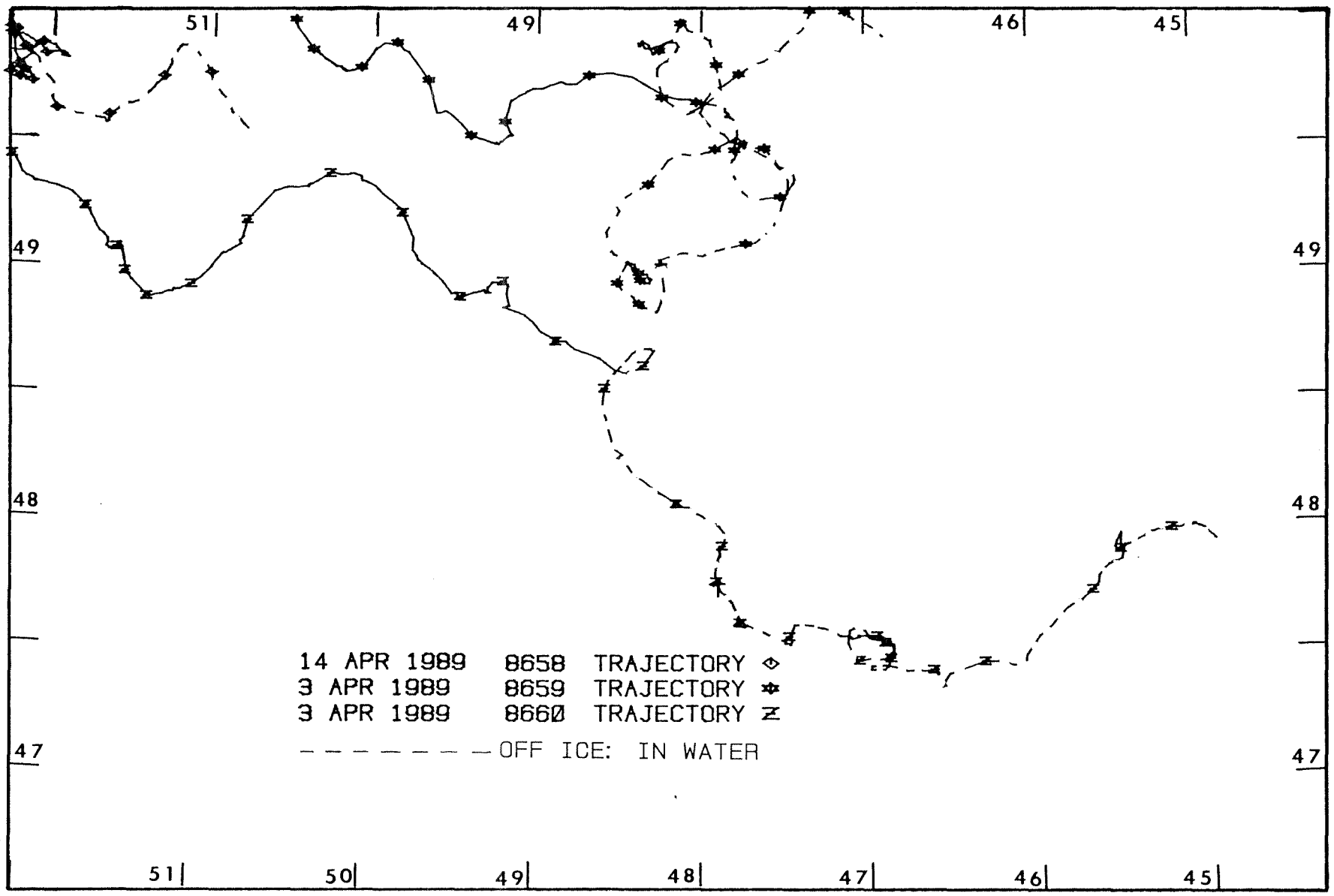


Figure 8: Composite plot of all satellite-tracked ice beacon data acquired in 1989 south of 49°N. Each ice beacon is identified by a unique symbol plotted on the first position of each new day.

TABLE 3

Summary of Start and Stop Times
for Anemometer Data from Satellite-Tracked Ice Beacons

ID #	Channel	Start Date	Reason	Stop Date	Reason
1988					
3326	wind east	88/03/04	deploy	88/03/31	wind channels failed
3326	wind north	88/03/04	deploy	88/03/31	wind channels failed
3326	heading	88/03/04	deploy	88/04/30	end of record
4457	wind east	88/03/26	deploy	88/04/30	end of record
4457	wind north	88/03/26	deploy	88/04/30	end of record
4457	heading	88/03/26	deploy	88/04/30	end of record
1989					
4459	wind east	89/03/09	deploy	89/03/23	unit failed
4459	wind north	89/03/09	deploy	89/03/23	unit failed
4459	heading	89/03/09	deploy	89/03/23	unit failed
8656	wind east	89/03/23	deploy	89/04/18	end of record
8656	wind north	89/03/23	deploy	89/04/18	end of record
8656	heading	89/03/23	deploy	89/04/18	end of record

4.5 SURFACE ICE TEMPERATURES

Seven of the eight satellite beacons which did not have anemometers were equipped with temperature sensors mounted in the base of the buoy hull. The edited temperature data (as measured during each satellite overpass) from these beacons is displayed in Appendix C.

5. TEMPERATURE, SALINITY AND VELOCITY PROFILES MEASURED BENEATH SEA-ICE FLOES, 1988-1989

5.1 CTD DATA

Measurement Times and Locations--Profile measurements of temperature and salinity were obtained beneath the sea-ice on March 4, 7, 26 and April 2 in 1988, and on March 23 and 24 in 1989. The measurement times and locations are detailed in Table 1, with the CTD station locations displayed in Figure 4.

Instrumentation--Temperature and salinity profile data were collected with a Guildline model 8706 digital CTD probe (Arctic configuration) and a Guildline model 87102 control unit. The probe carried three sensors: a thermometer, a pressure transducer and a conductivity cell. It transmitted data to the surface control unit in digital form along a single-conductor cable. The same cable was used to lower the instrument. Data were recorded on a digital cassette tape recorder. Sampling at 25 times per second, the CTD was lowered at approximately 1.0 to 1.5 m/s, which corresponds to a mean displacement between samples of about 6 to 9 cm. The manufacturer's specifications for the sensors and their associated electronics are shown in the following table.

SPECIFICATIONS FOR GUILDLINE CTD

Function	Range	Accuracy	Resolution	Stability	Response Time
C*	0.1 to 40ppt	±0.005ppt	±0.001ppt	±0.002ppt/6 mos.	<50 ms
T	-2°C to 30°C	±0.005°C	±0.0005°C	±0.005°C/6 mos. ±0.002°C/30 days	<50 ms
P	to 500 dbar	±0.15%F.S.	±0.01%F.S.		<50 ms

*Specifications for conductivity are given as equivalent salinities.

Other equipment used for the project included:

(1) Guildline Arctic winch containing 250 m of useable single conductor wire;
(2) Eight inch ice auger drill unit;
(3) Tanaka TIA-305 gas-powered drill unit;
(4) Datamarine model 3000 portable depth sounder (range to 300 m);
(5) Water sampling bottle.

Modifications were made to the equipment and procedures based on the experience gained in previous projects working from the pack ice off Labrador (eg. Fissel, Pierlot and Byrne, 1988). The Guildline CTD probe was stored in a special wooden crate, which had been insulated and included a small heater unit powered from the helicopter's 28 V supply. This insulated crate kept the CTD from cooling excessively between profiling operations. In addition, the Guildline CTD conductivity cell was filled and sealed with an isopropyl alcohol solution while being transported between stations. The unit was lowered through the ice hole with the alcohol in place, and then the rubber plugs were removed once the probe was in the comparatively warm ocean water. This procedure eliminated occurrences of seawater freezing within the conductivity cell while the instrument was exposed to low air temperatures. Finally, the water sampling bottle was also stored in an insulated box with

external heating supplied from the helicopter heater. Water samples were collected only at the last CTD station occupied each day. In 1989, a prototype version of a water sampling bottle (Richards and Melling, 1987), designed for use in cold air temperatures, was borrowed from the Institute of Ocean Sciences, Sidney, B.C.

Data Processing--The Guildline CTD data, stored as digital values on cassette tape, were transferred to an IBM PC-compatible computer through a 24-line parallel interface. The raw data consists of 22 bit words of temperature, pressure and conductivity ratio, along with two 12 bit reference voltages.

The first step in data processing involved eliminating any data scans within correct channel counts, and then converting the raw data into engineering units. Data outside the following ranges were automatically removed: 0 to 300 dbar in pressure, -5° to 40°C in temperature, and 0.5 to 0.8 in conductivity ratio. Data sampled at low fall rates (less than 0.3 m/s), in which sensor response is seriously degraded (Perkin and Lewis, 1982), were also removed from the records.

The next step involved determining and eliminating spurious data values (i.e. spikes). These erroneous values were determined by calculating point to point vertical gradients of temperature and conductivity. Any point which caused a gradient to exceed one of four tolerance levels was eliminated. The tolerance levels were chosen as ten times the mean gradient (using a centred first difference with a 3 m bin size). The choice of the tolerance levels was based on empirical testing, and the levels are listed below:

Level	Temperature	Conductivity Ratio
1	0.1875	0.001875
2	0.4375	0.004375
3	0.6875	0.006875
4	0.1	0.0010

After despiking, the data were processed to account for mismatched response times of the sensors on the instrument. The algorithm that was used was taken from Perkin and Lewis, 1982. The results of laboratory calibrations, carried out on the CTD before and after data collection in December 1987 and May 1988, were then applied to the data. The calibrations were carried out at the Seimac Instrument Facility, to nominal accuracies of 0.02 degrees Celsius (for temperature), 0.01 (salinity) and 0.5 decibar (pressure). Salinity samples collected in the field in both 1988 and 1989 were also compared with raw data values. Linear corrections were then derived from these calibration values for temperature and conductivity ratios (Figure 9).

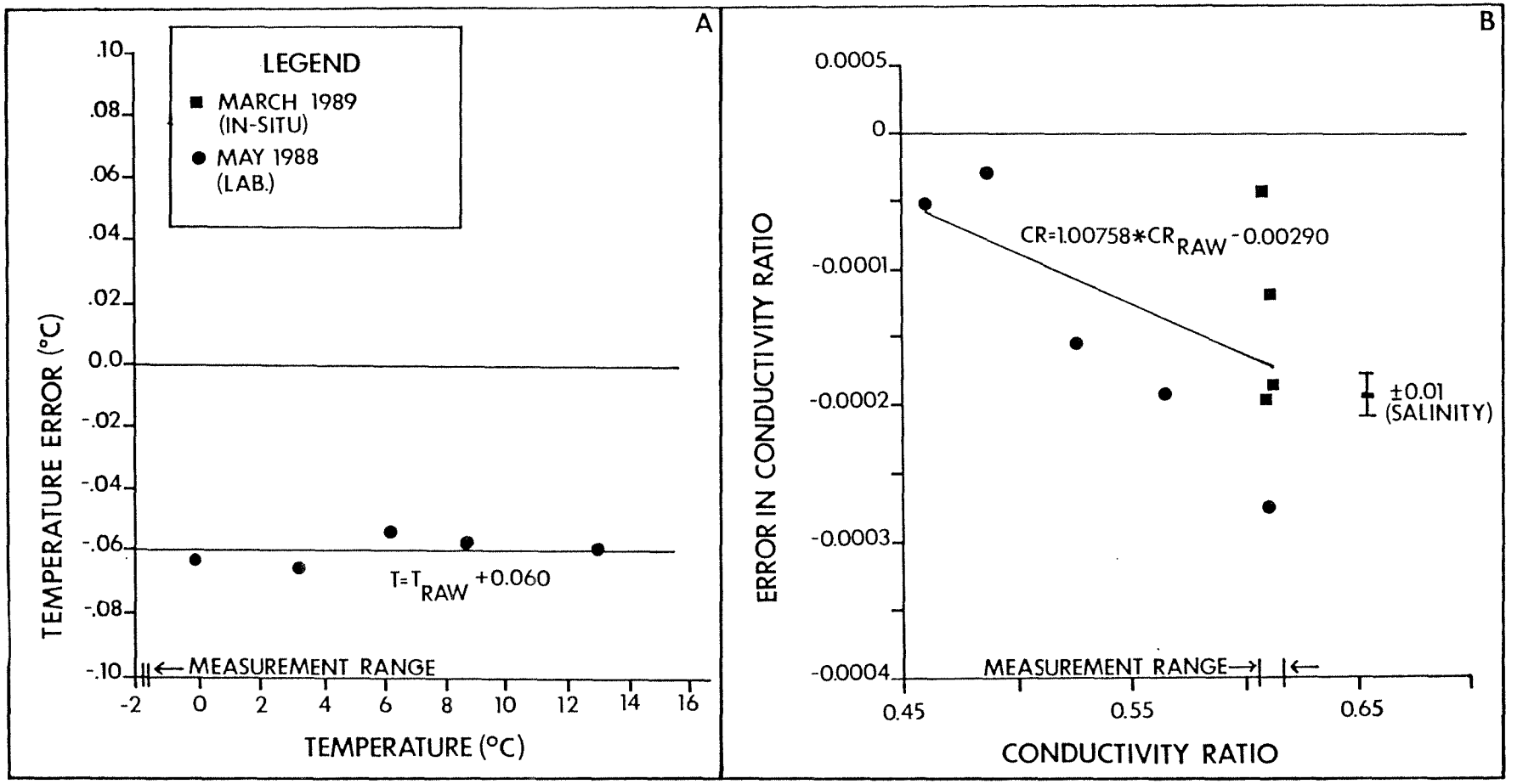


Figure 9: Calibration data and computed linear correction equations for (A) temperature and (B) conductivity.

Salinities were computed using the Practical Salinity Scale 1978 (Lewis 1981). Density is presented in the form of:

$$\text{sigma}_t = (\text{density} - 1) \times 10^3$$

where the density was computed based on the UNESCO Equation of State Seawater (Millero and Poisson, 1981). For this report, the reduced densities, often referred to as sigma-t values, are computed for pressures of one standard atmosphere, rather than at in situ pressures. The units of reduced density are kg/m^3. The freezing point temperature (Millero 1978) was also computed.

No corrections were deemed necessary for pressure measurements, as they were well within instrument specifications. However, for each measured profile, the pressure data were shifted by a constant amount in order to adjust for pressure offsets resulting from variations in atmospheric pressure. The offsets to the pressure data varied from 1.19 to 1.74 decibars, among the measurement sites.

The final stage of processing consisted of some fine-tuning procedures, where remaining erroneous values in temperature, salinity, or sigma_t were flagged. In some cases in the 1988 data set, there were sections where the temperature channel seemed to have had the least significant bit shifted by a value of 2^n, where n was some integer. The data was readjusted by this shifted value, and salinity, sigma_t and the freezing temperature were recalculated. Also, some data points were interpolated through gaps that resulted from earlier processing.

Data Displays--The CTD data are presented in Appendix D as vertical profile plots. Summary listings are also provided for each CTD data profile.

The CTD data is also displayed in the form of: vertical cross-sections of temperature and salinity for each day of operation (Figures 10 to 15) and TS diagrams (Figures 16 to 18).

5.2 CURRENT PROFILES

Profiles of ocean currents beneath the sea-ice were collected with an E.G. & G. Smart acoustic current meter (SACM). This instrument was mounted approximately 3 m directly beneath the Guildline CTD unit. This instrument measured vector averaged velocity components and temperature. Data was recorded in onboard Random Access Memory (RAM), and the unit was housed in a lightweight, compact (6 inch diameter) pressure case. The instrument was operated through a 20 mA current loop (SAIL) interface. For field operations, commands were issued with an HP-85 microcomputer. The SACM has the following nominal specifications, as supplied by the manufacturer:

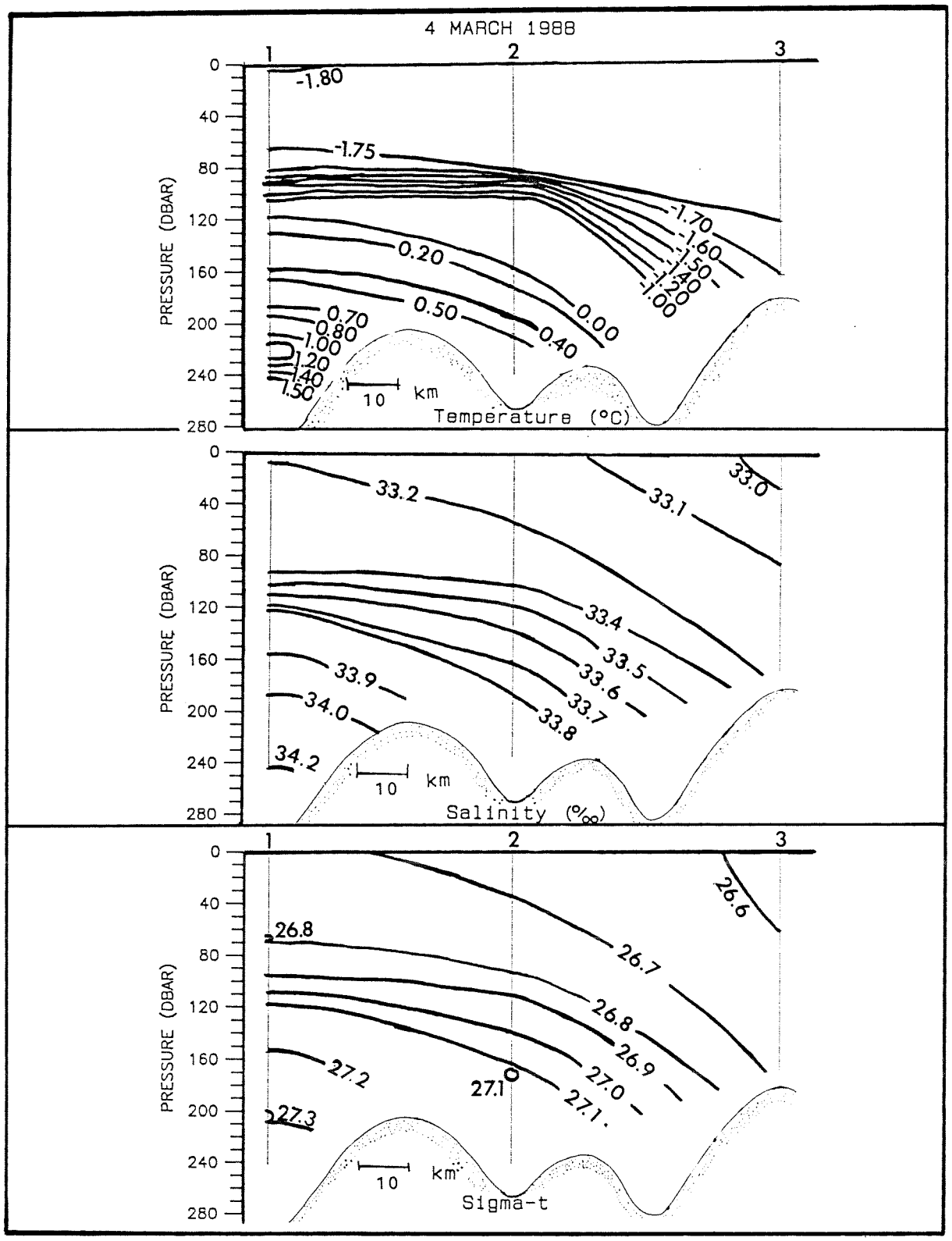


Figure 10: Plots of temperature, salinity and density contours on a vertical cross-section, derived from the observations of March 4, 1988.

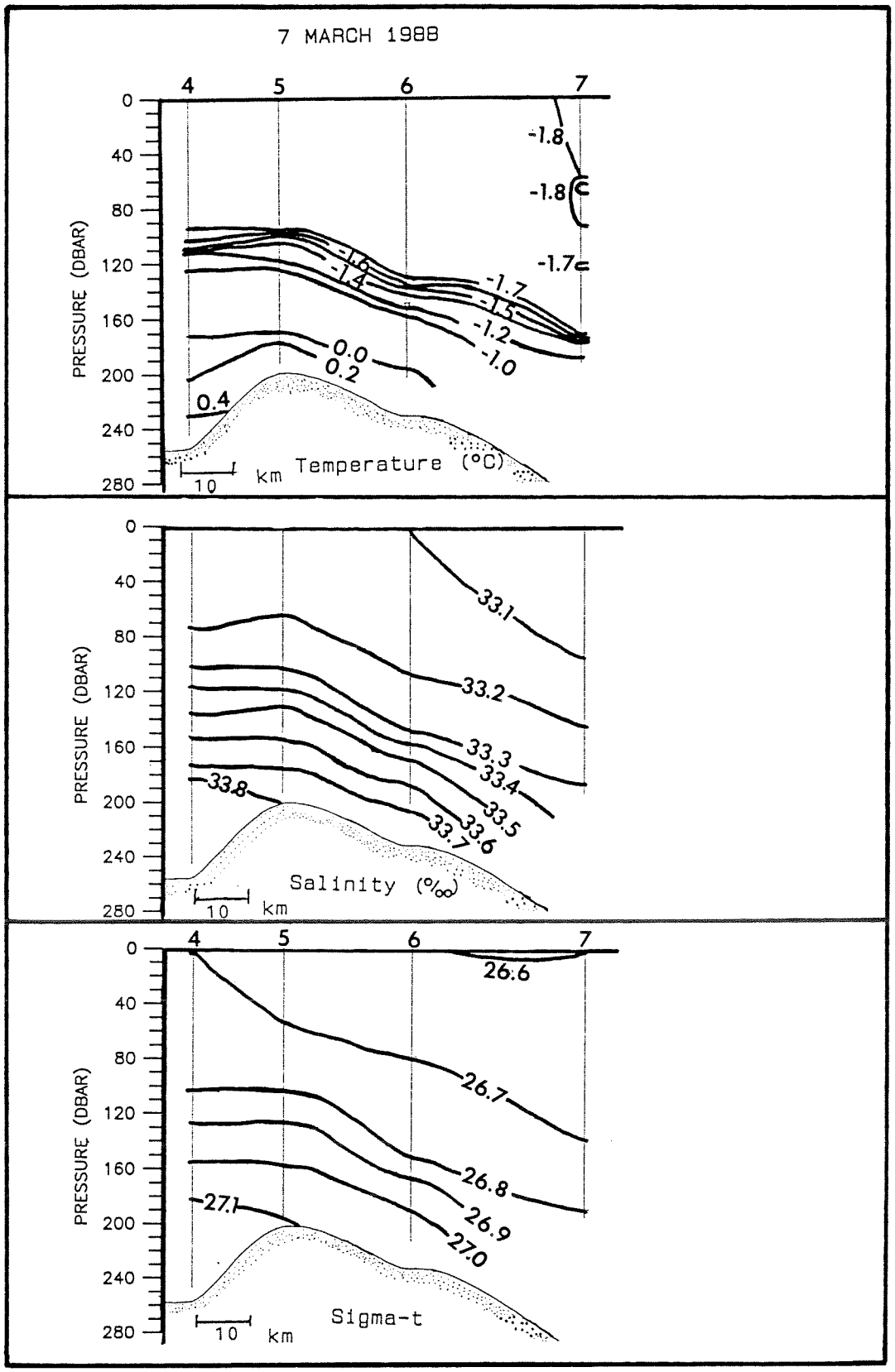


Figure 11: Plots of temperature, salinity and density contours on a vertical cross-section, derived from the observations of March 7, 1988.

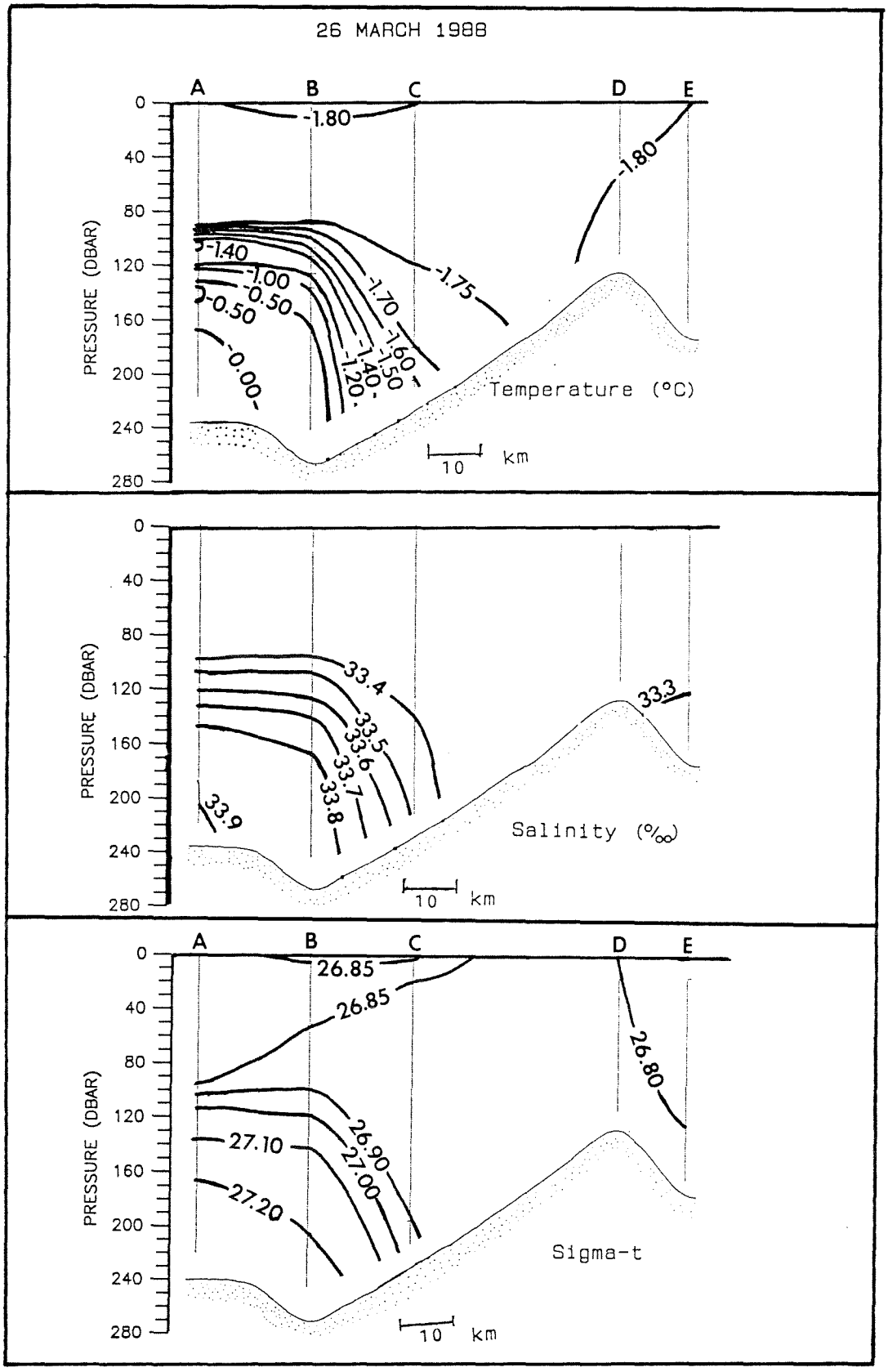


Figure 12: Plots of temperature, salinity and density contours on a vertical cross-section, derived from the observations of March 26, 1988.

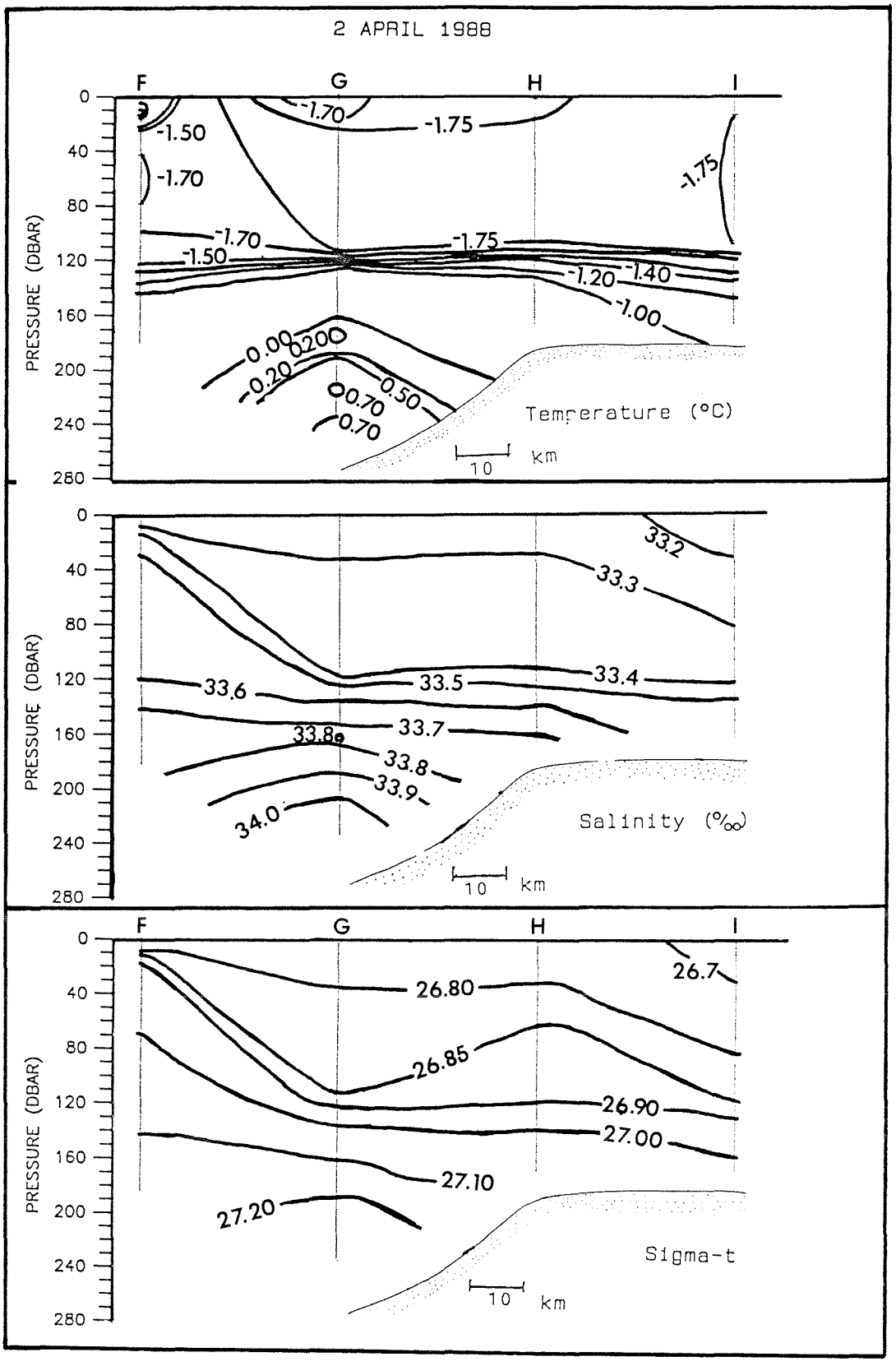


Figure 13: Plots of temperature, salinity and density contours on a vertical cross-section, derived from the observations of April 2, 1988.

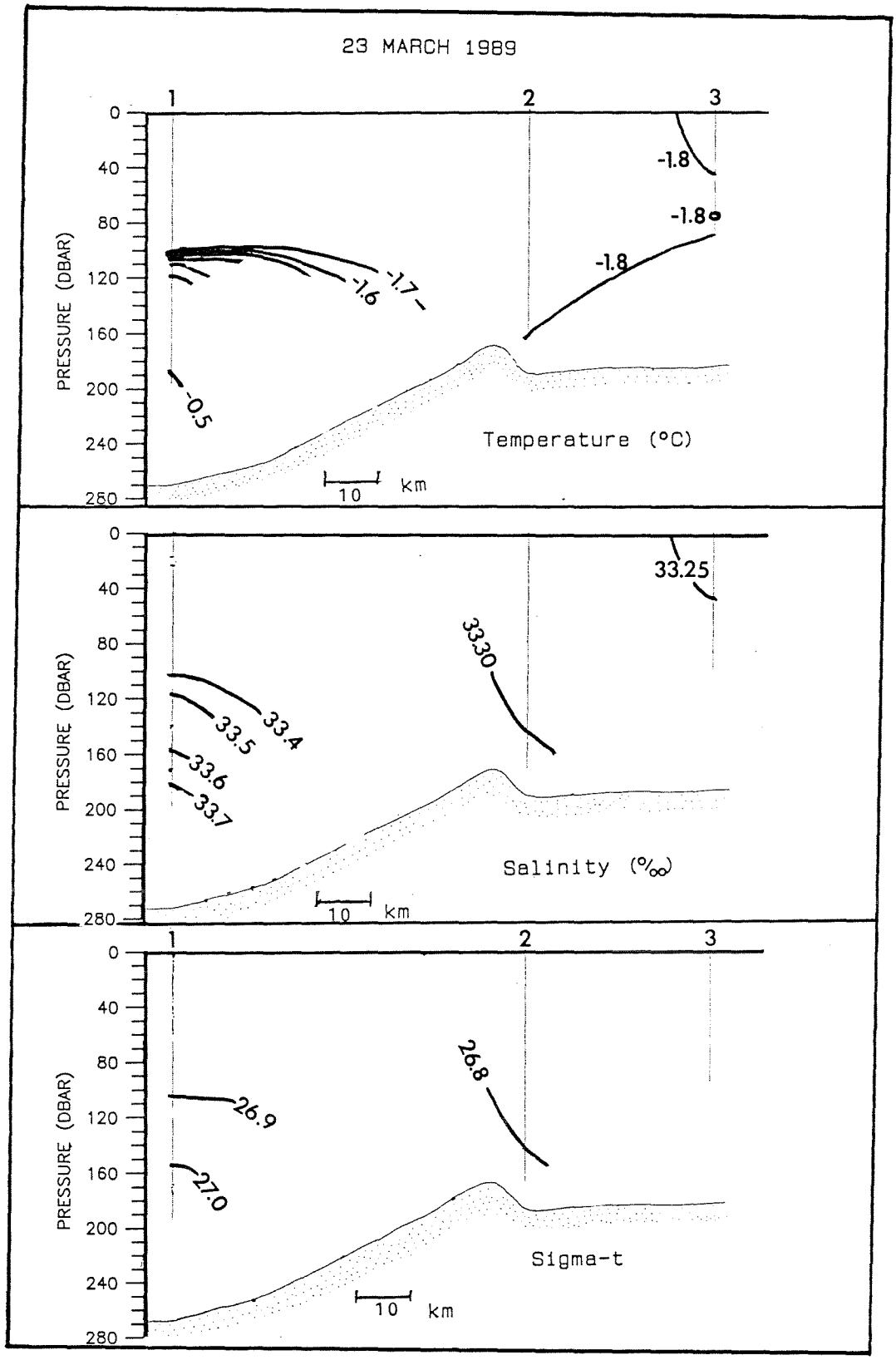


Figure 14: Plots of temperature, salinity and density contours on a vertical cross-section, derived from the observations of March 23, 1989.

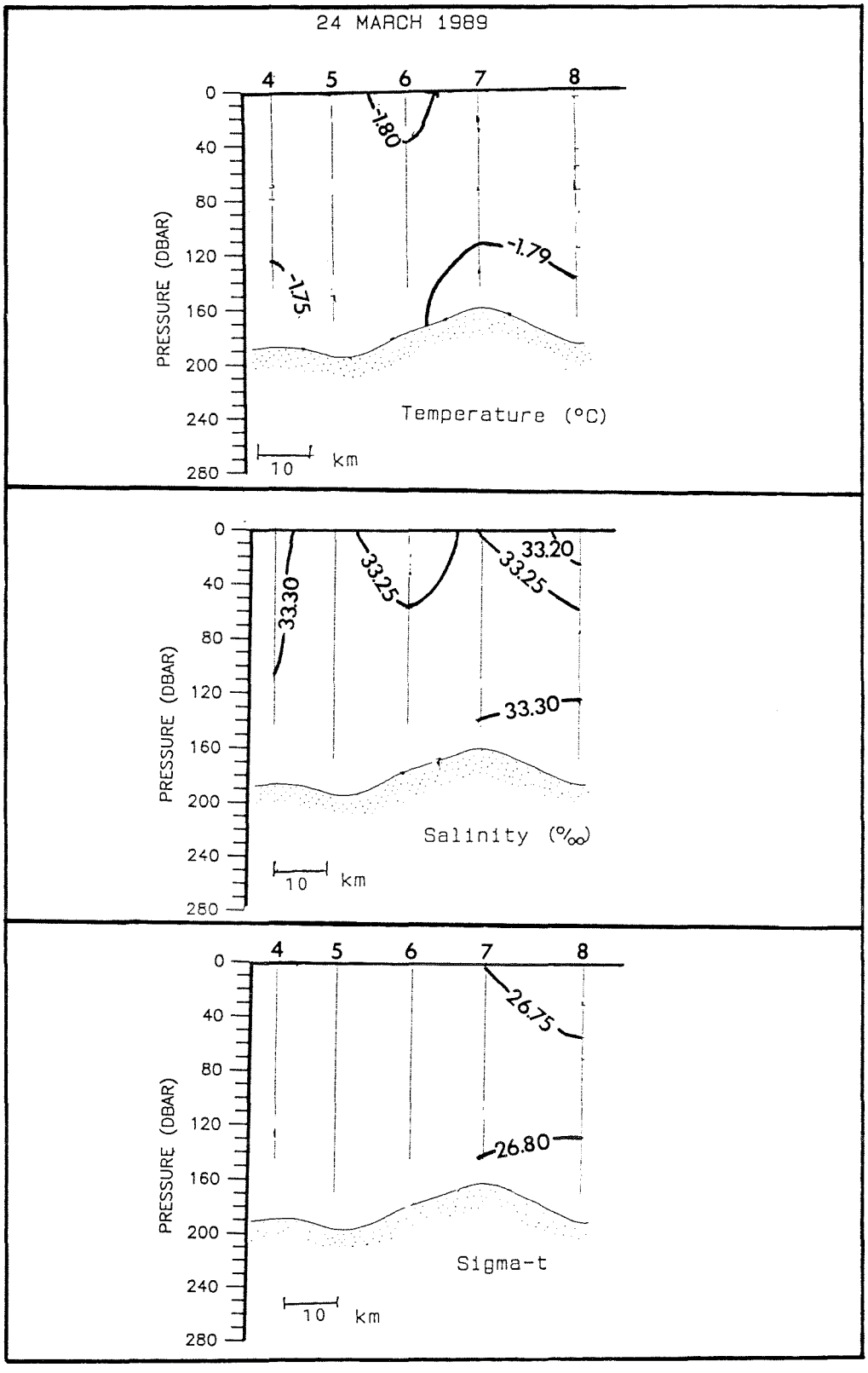
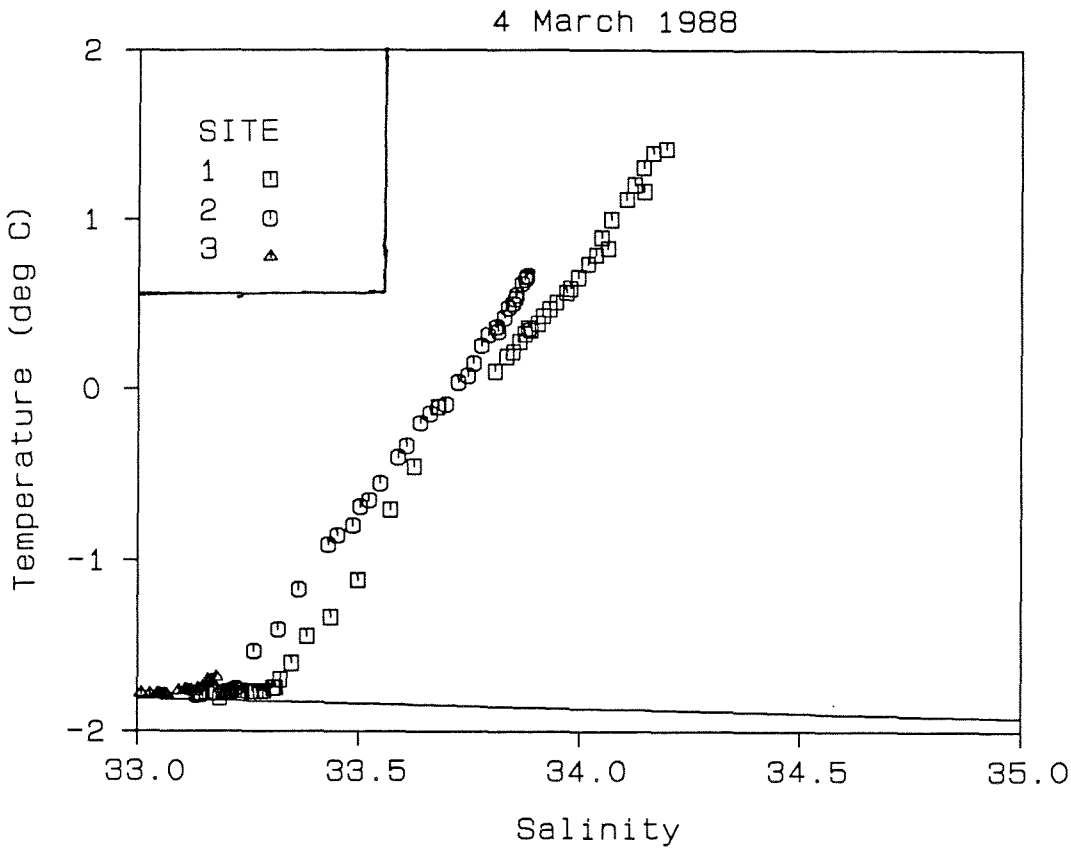


Figure 15: Plots of temperature, salinity and density contours on a vertical cross-section, derived from the observations of March 24, 1989.



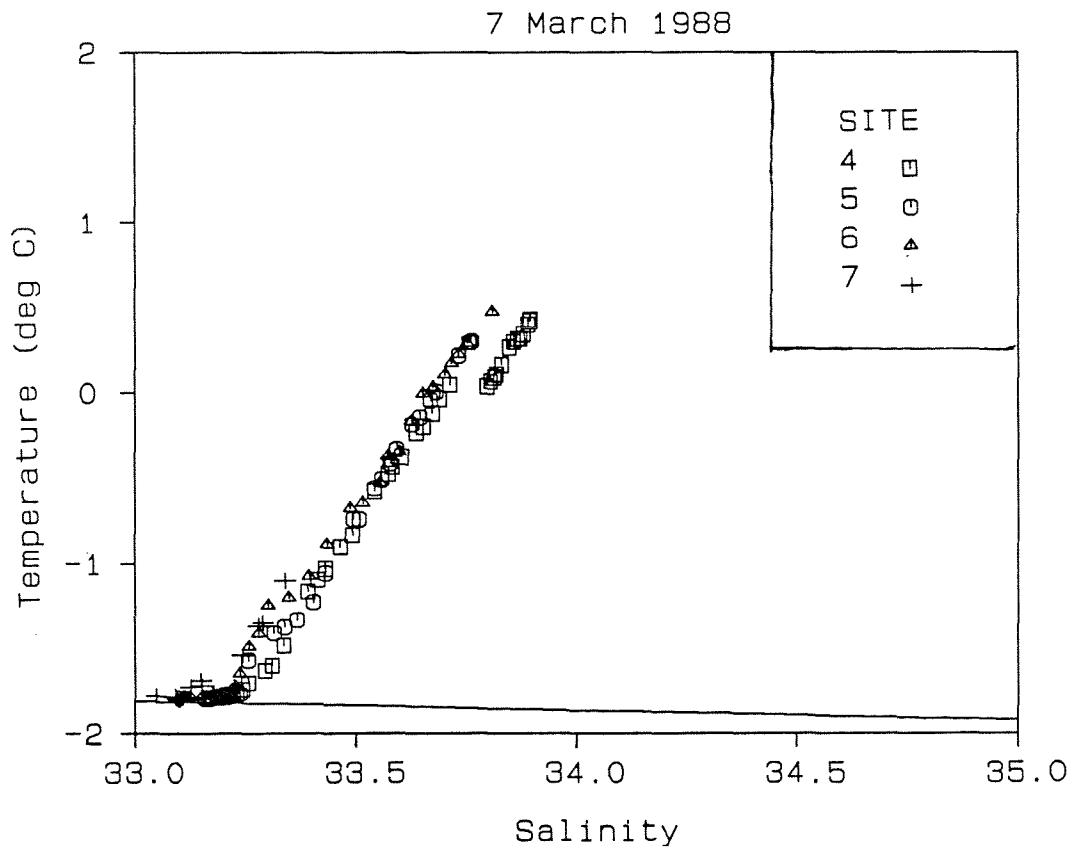
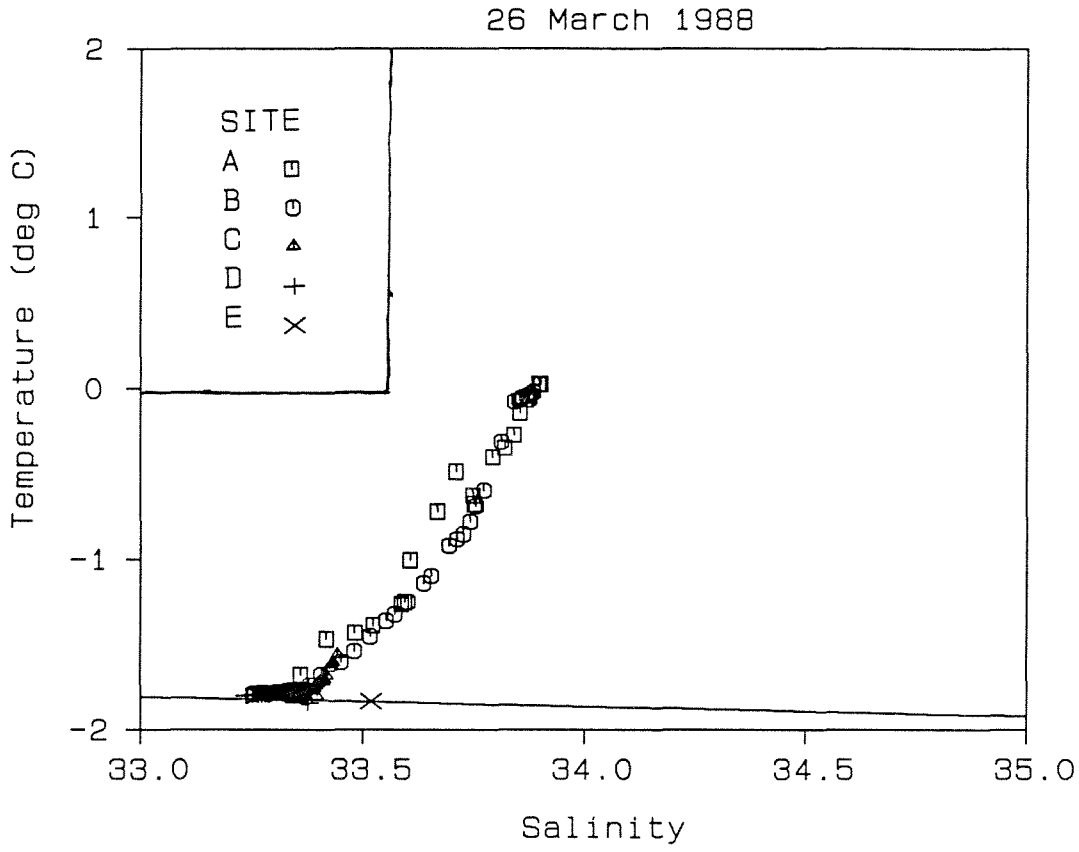


Figure 16: Temperature-salinity diagram of CTD data obtained on March 4 and 7, 1988.



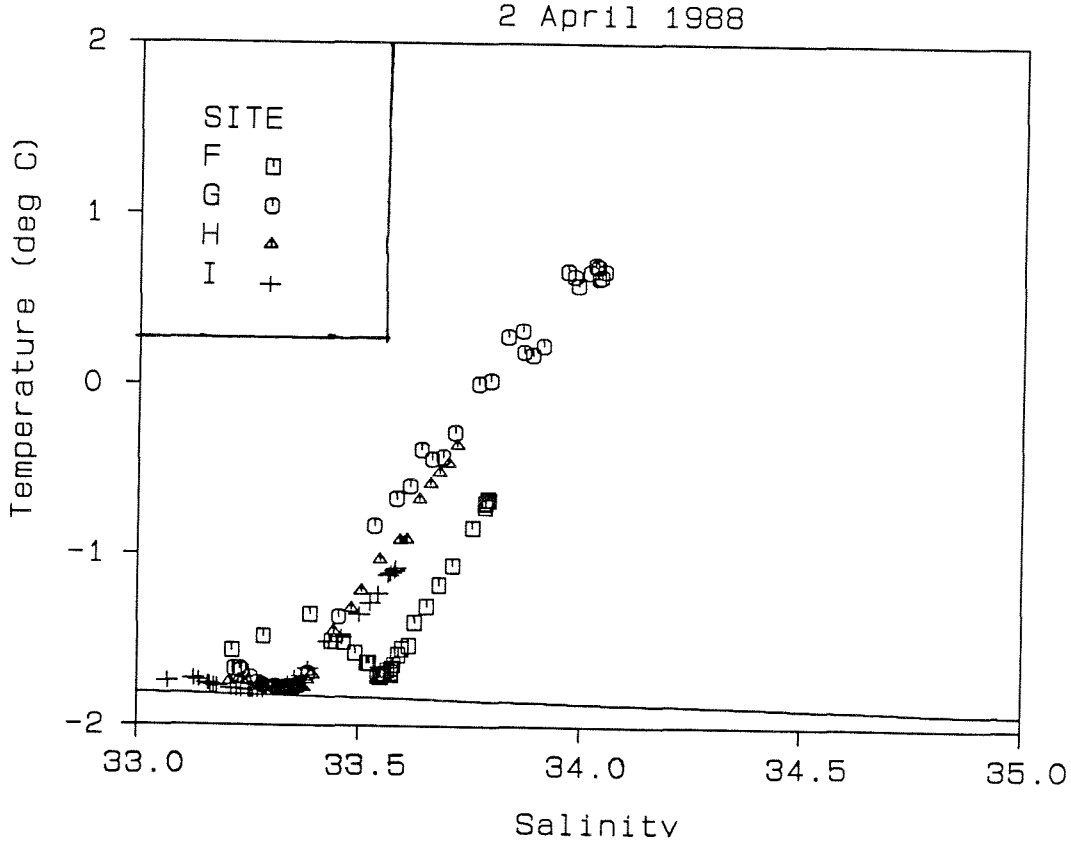
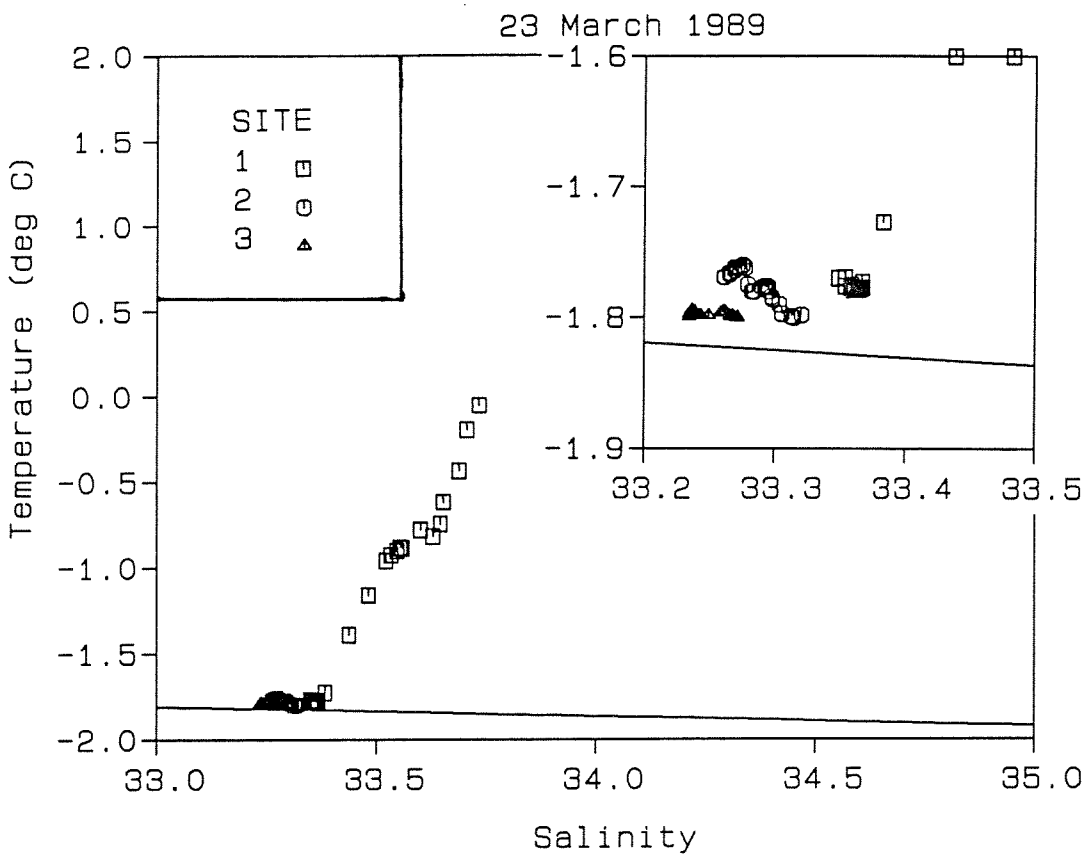


Figure 17: Temperature-salinity diagram of CTD data obtained on March 26 and April 2, 1988.



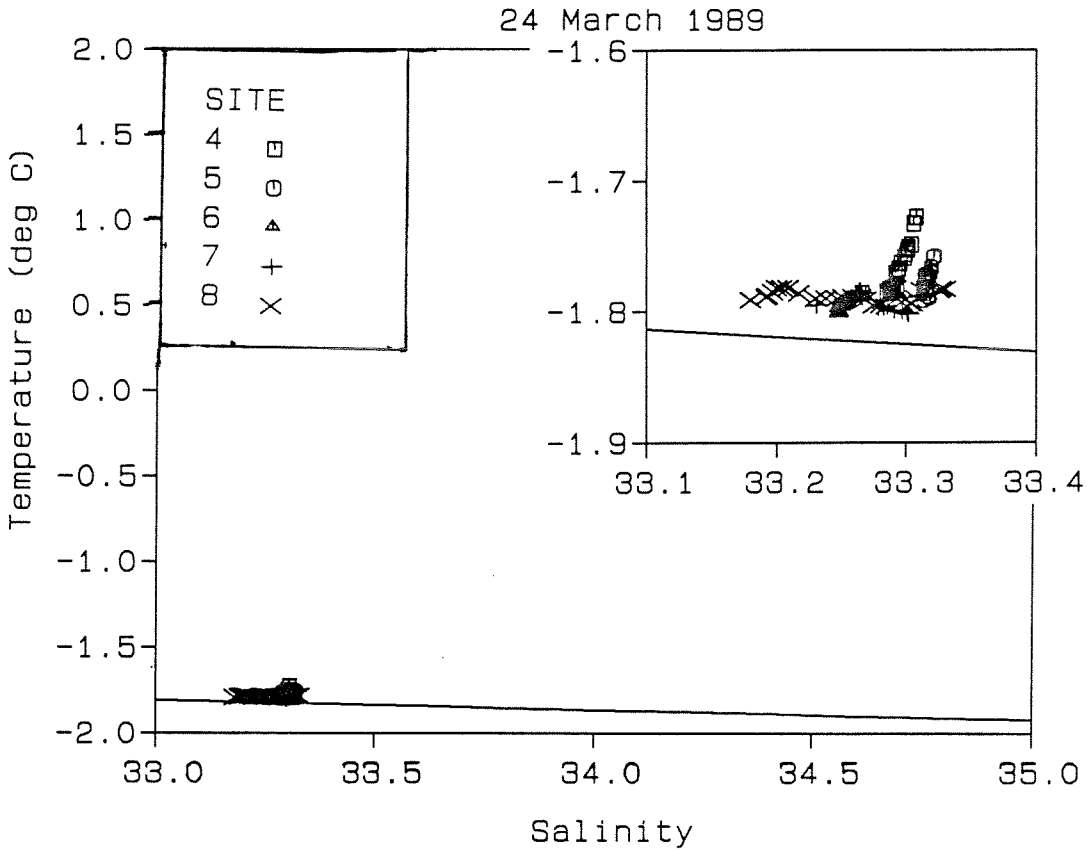


Figure 18: Temperature-salinity diagram of CTD data obtained on March 23 and 24, 1989.

PARAMETER	ACCURACY	RESOLUTION	RANGE	RESPONSE TIME
Speed	+/-1.0 cm/sec or +/-3% whichever is greater	0.1 cms/sec	0-360 cm/sec	0.2 sec
Direction	+/-15.0°	0.1°	0-360°	0.2 sec
Temperature	+/-10.05°C	0.01°C	-2°C to +35°C	1 min.

The SACM instruments were lowered continuously at descent rates of 0.9-1.25 m/s. On raising the instruments back to the surface, sampling was conducted at a sequence of discrete measurement depths: 10, 20, 30, 40, 50, 100 and 200 m and immediately beneath the bottom of the sea-ice. Sampling at each depth was conducted for two minutes or longer.

The SACM was mounted in a custom-made protective frame designed to protect the acoustic sensor assembly from mechanical damage due to impact with the sea-ice while being lowered through the ice hole. The frame was retractable so it could be moved up and clear of the sensors once the instrument was beneath the ice; this eliminated errors due to distortion of flows around the protective frame.

Originally, the SACM was to be modified to permit activating the unit for each individual measurement profile. For data collection in 1988, the time required to obtain the necessary parts exceeded the lead time for the first field operations of this project. As a result, the instrument sampling was begun each morning prior to helicopter departure. This necessitated sampling at 10 second intervals, rather than a more rapid sampling rate, so as not to exceed the capacity of the RAM storage within the instrument. In 1989, the instrument was modified so it could be activated at each measurement site, which permitted use of a more rapid sampling rate of 1 second.

The times and locations of current profile data are identical to those of the CTD data set (see Table 1 and Figure 4).

Upon completion of field operations each day, the data stored in the RAM of the SACM were transferred to a data cartridge tape via an HP-85 microcomputer. Later, the data were loaded onto Arctic Sciences' minicomputer system for data processing.

Time series plots of the raw data were produced to identify the data segments of interest: the step-wise recording at discrete depth on the up-cast and the continuous profiling on the down-cast. The former data segments were clearly evident, in the velocity components of all three complete data sets, as comparatively steady measurements occurring at each measurement depth, separated by large fluctuations while the probe was moved upward between measurement levels.

In 1988, for the March 4 and March 7 data sets, a time lag of 7 minutes 30 seconds and 6 minutes 15 seconds, respectively, was evident throughout each day. The data recorded on March 26 was on time to within one 10 second sampling interval. The cause of the time lag is not known, but may indicate a recording problem during the first part of data sampling.

No useable data were obtained from the April 2, 1988 operations, because the instrument was inadvertently set to record 10 minute averages instead of 10 second averages. The cause of this problem is not clear. However, the 10 minute sampling interval is the default selection of the instrument's microprocessor. It may be that the microprocessor was accidentally reset, perhaps through a power interruption, resulting in the much longer sampling interval.

For each segment of velocity measurements obtained at a constant measurement level, basic quantities (mean, standard deviation, maximum and minimum values) were computed for the easterly and northerly velocity components and temperature. The velocity components were rotated to geographical coordinates from the magnetic frame of reference of the raw data (magnetic variation of 27 degrees). In these computations, the first 30-60 seconds of measurements were excluded as comparatively large fluctuations were often evident, presumably due to turbulence associated with the vertical movement through the water column. The time duration of the averages ranged from 50 to 140 s. Standard deviations were usually 0.02 m/s or less, although in a few instances larger fluctuations raised levels up to 0.09 m/s. The standard error in the estimate of the mean had typical and maximum values of 0.012 m/s or less and up to 0.05 m/s, respectively. Since the magnitude of the computed velocity means (up to 0.3 m/s) was usually considerably larger than the estimated standard error, the velocity profiles computed from the step-wise data segments are considered to be reasonable representation of actual conditions.

The velocity profiles derived from the down-cast, when the probe was being lowered continuously, do not agree with the step-wise results from the up-cast. The velocity profiles from the continuously descending mode tend to be more erratic, with the derived amplitudes from a running mean amounting to only 20-30 percent of the step-wise levels. At best, the continuously descending mode of sampling provides a rough indication of occurrence of marked vertical shears in velocity but cannot be used to reliably estimate flow magnitudes.

Data Displays--The current profile data obtained on March 4, 7 and 26 are presented in Appendix E, in the form of vertical profile plots and data listings. Note that all velocity data are relative to the surface (ice floe) movement and that the velocity components, u and v represent an eastward and northward flow direction, respectively.

6. REFERENCES

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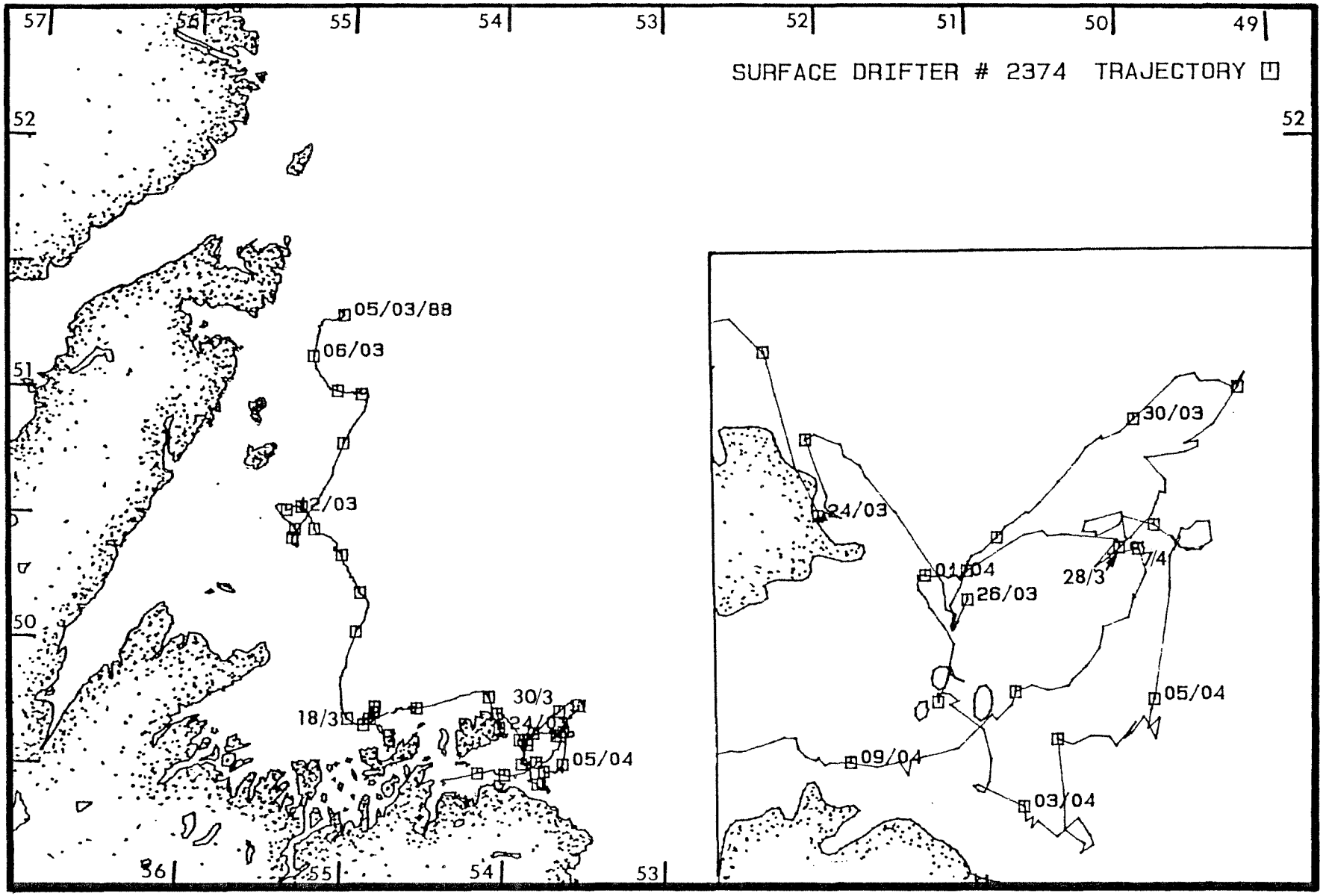
Tang, C.L., M. Ikeda, S.D. Smith, L. McNutt, S. Digby-Argus, F. Carsey, J. Crawford, B. Holt, A. Lohanick, P. Wadhams, W. Winsor, W.L. Thomas III, 1987. Southern Labrador marginal ice zone study - a pilot field program of LIMEX. Can. Tech. Rep. Hydrog. Ocean Sci., No. 99.

APPENDIX A


SURFACE DRIFTER # 2374 TRAJECTORY
57
56
55
54
53
52
51
50
49
05/03/88
06/03
12/03
18/3
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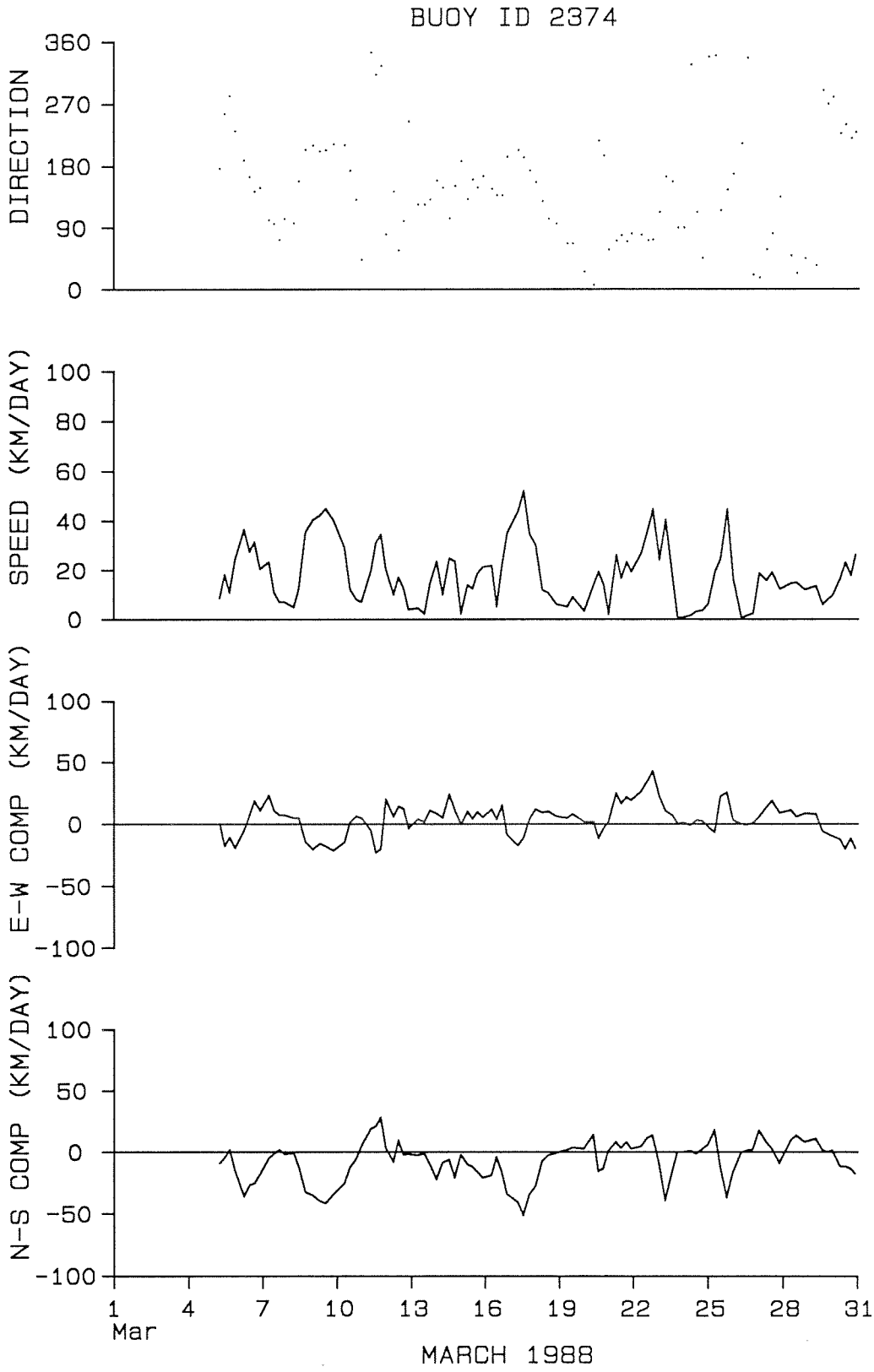
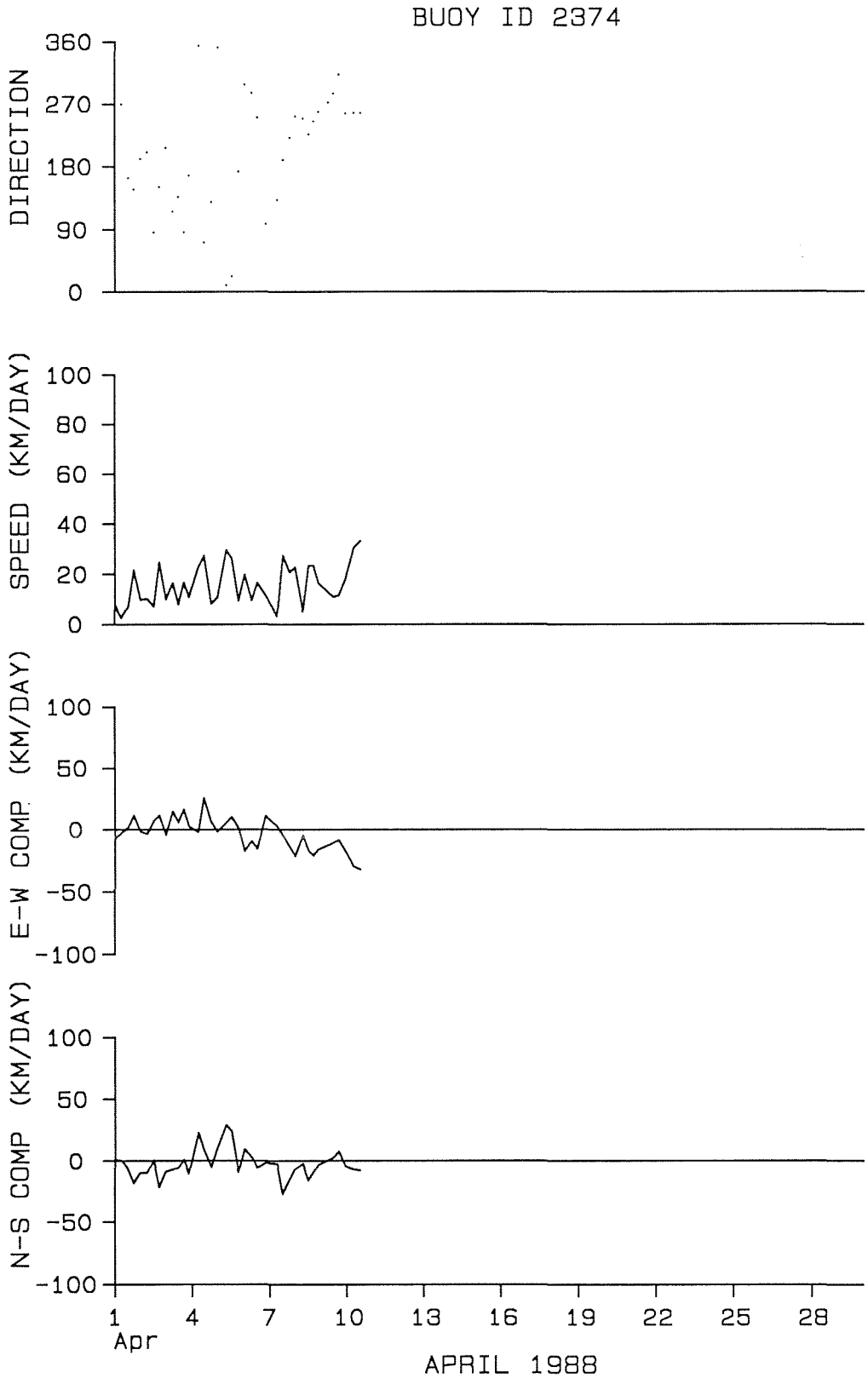
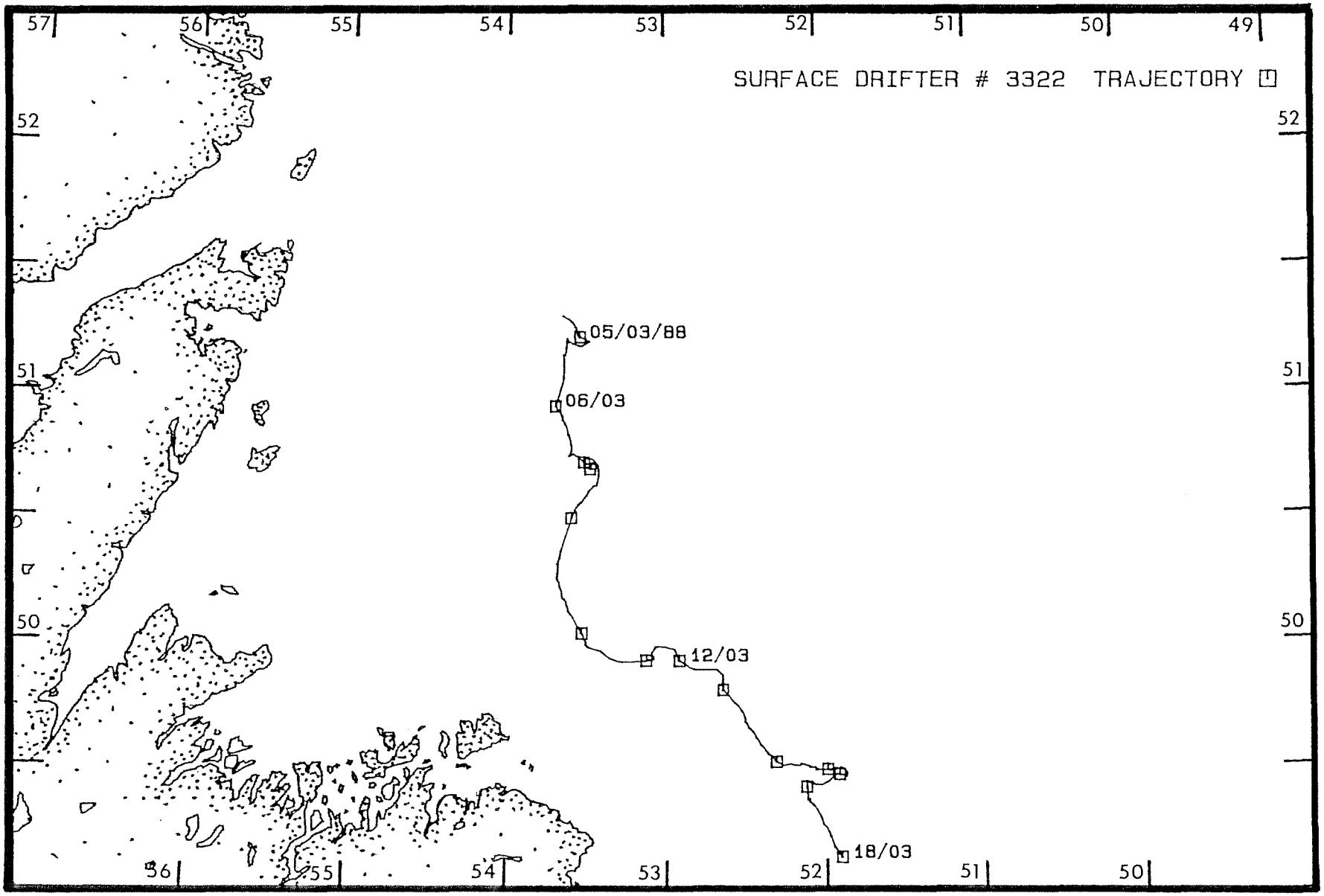
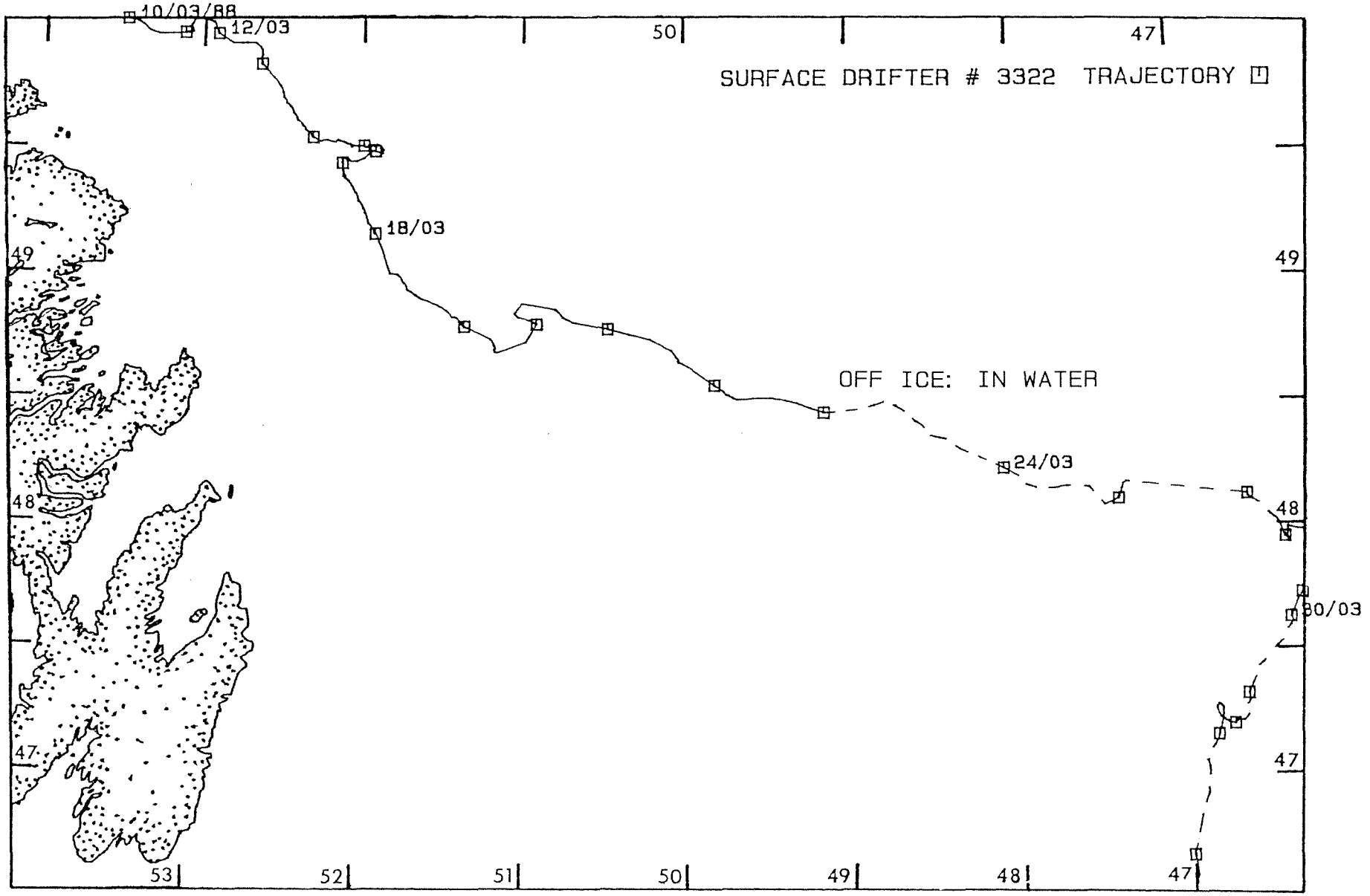
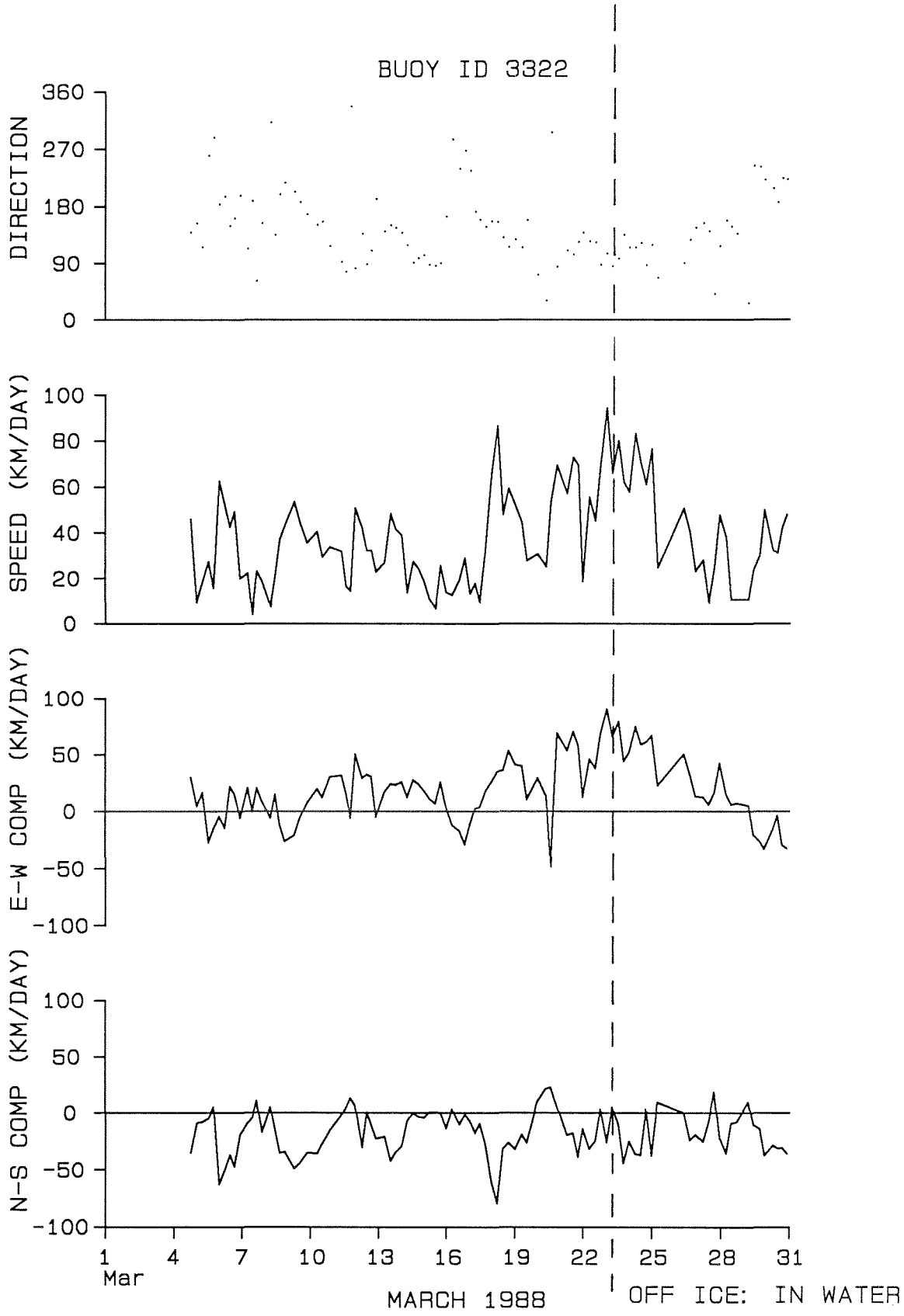
26/03
28/3
7/4
05/04
09/04
03/04

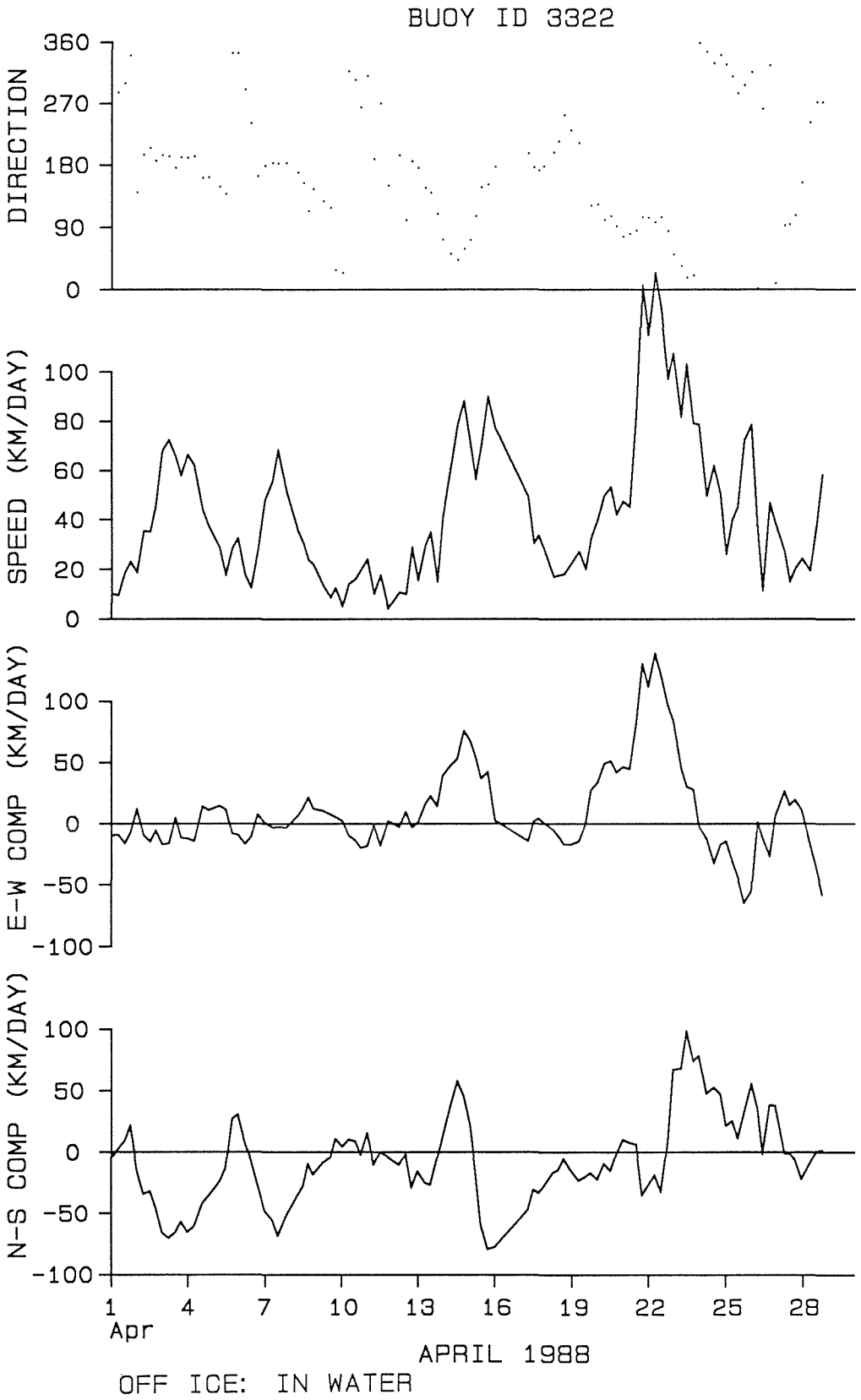

BUOY ID 2374
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
1
Mar
4
7
10
13
16
19
22
25
28
31
MARCH 1988


BUOY ID 2374
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
1
Apr
4
7
10
13
16
19
22
25
28
APRIL 1988


SURFACE DRIFTER # 3322 TRAJECTORY
57
56
55
54
53
52
51
50
49
52
51
50
05/03/88
06/03
12/03
18/03


SURFACE DRIFTER # 3322 TRAJECTORY
10/03/88
12/03
18/03
24/03
30/03
OFF ICE: IN WATER
50
47
49
48
47
53
52
51
50
49
48
47


BUOY ID 3322
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
1
Mar
4
7
10
13
16
19
22
25
28
31
MARCH 1988
OFF ICE: IN WATER


BUOY ID 3322
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
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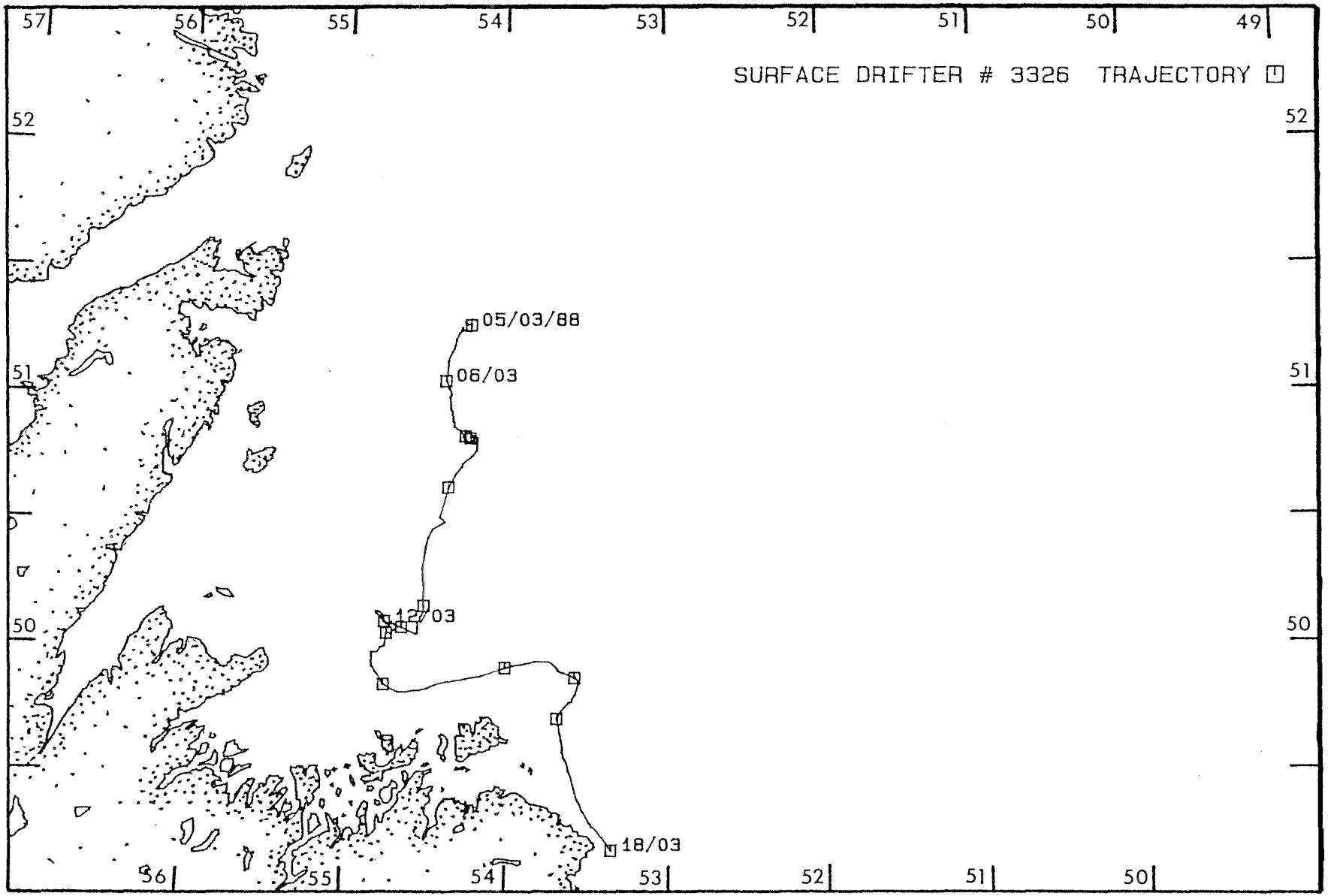
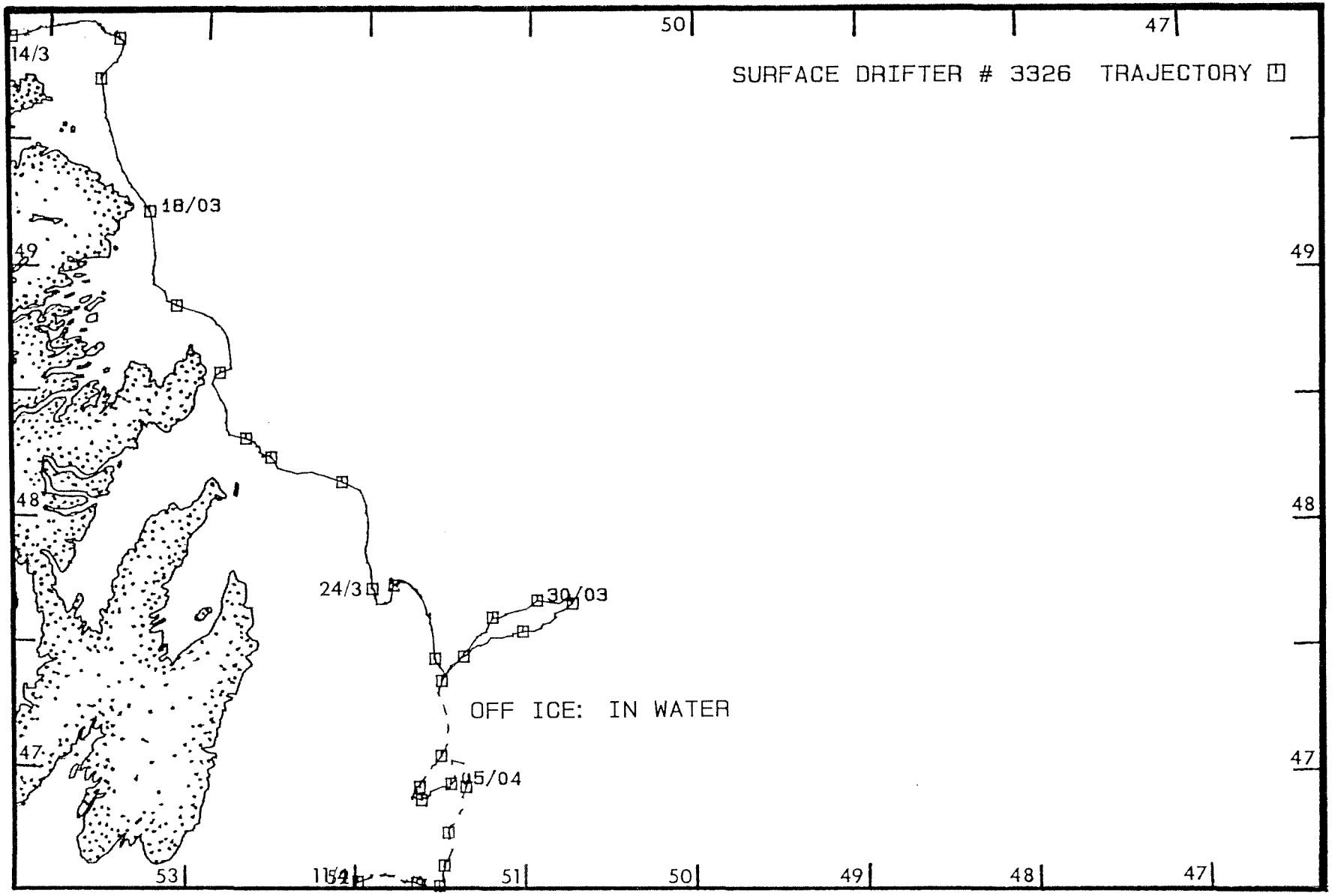
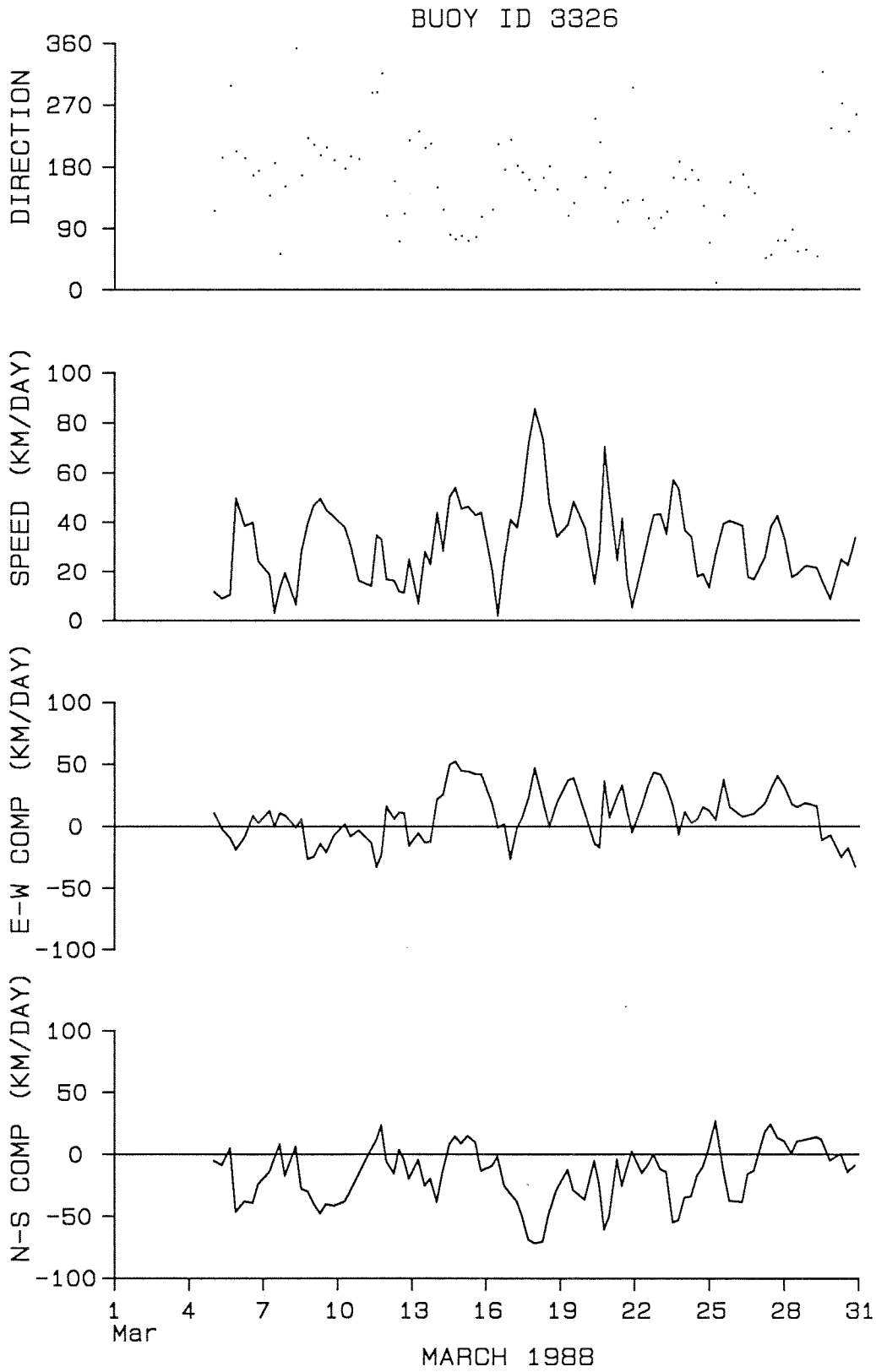
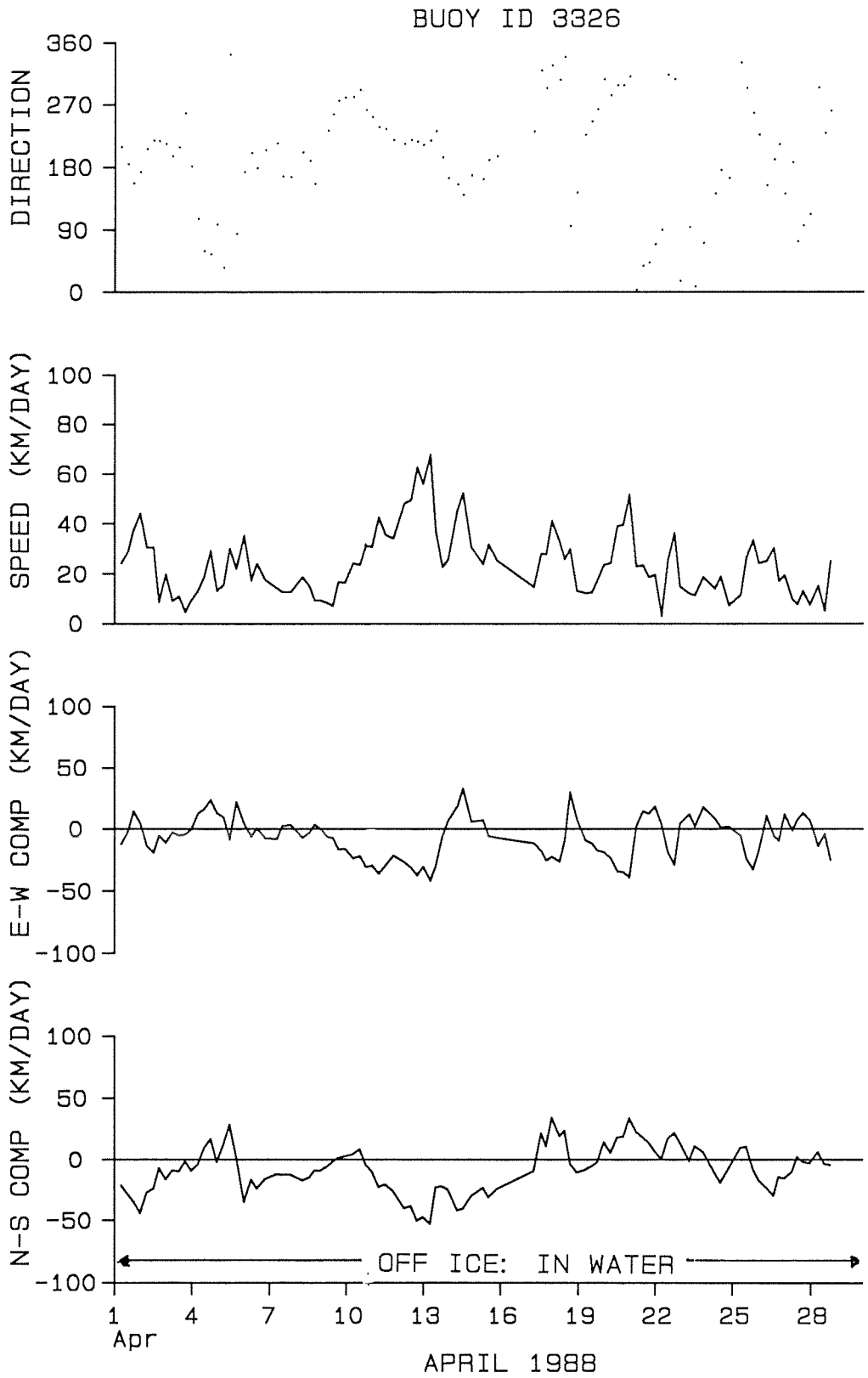
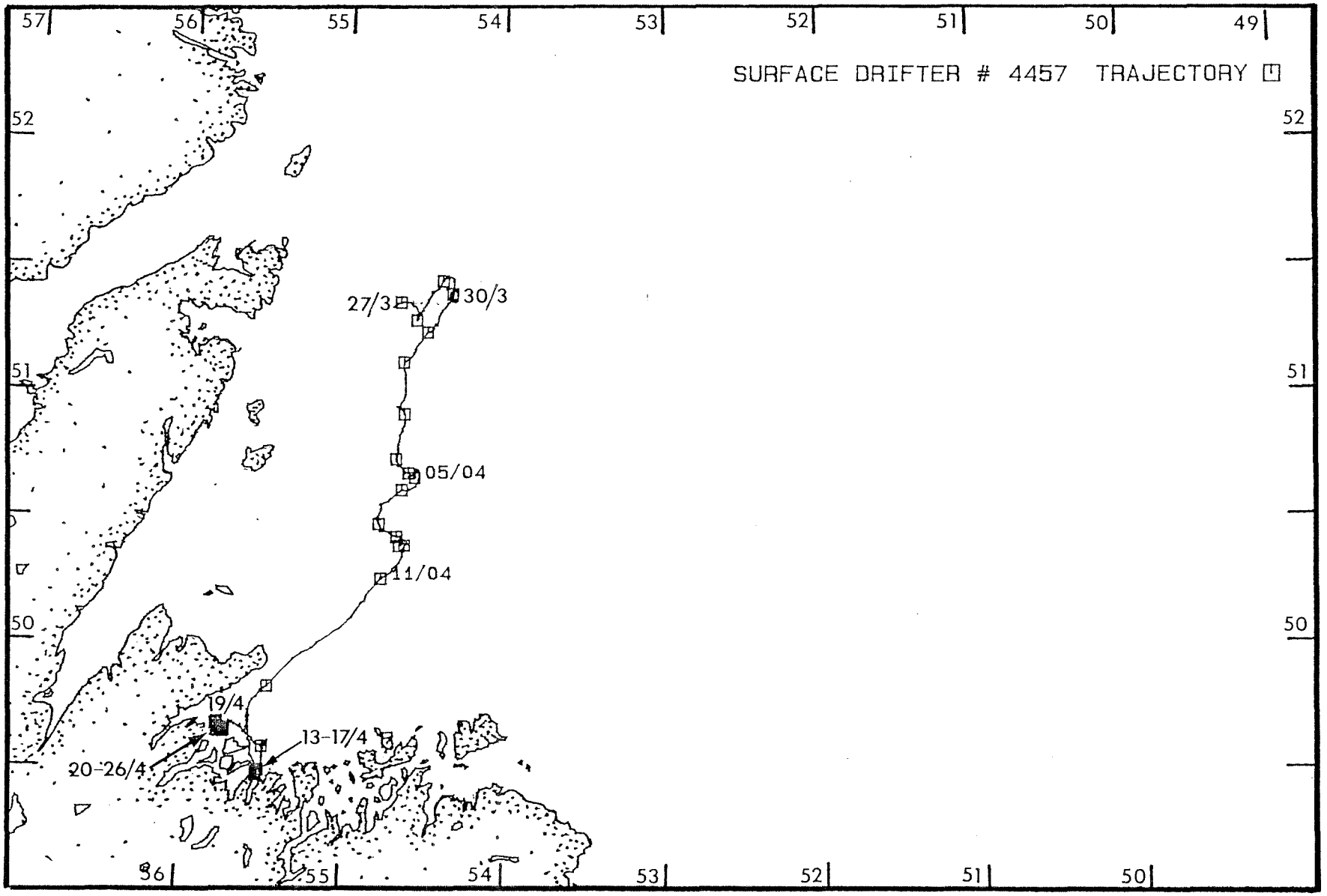
-50
-100
1
4
7
10
13
16
19
22
25
28
Apr
APRIL 1988
OFF ICE: IN WATER

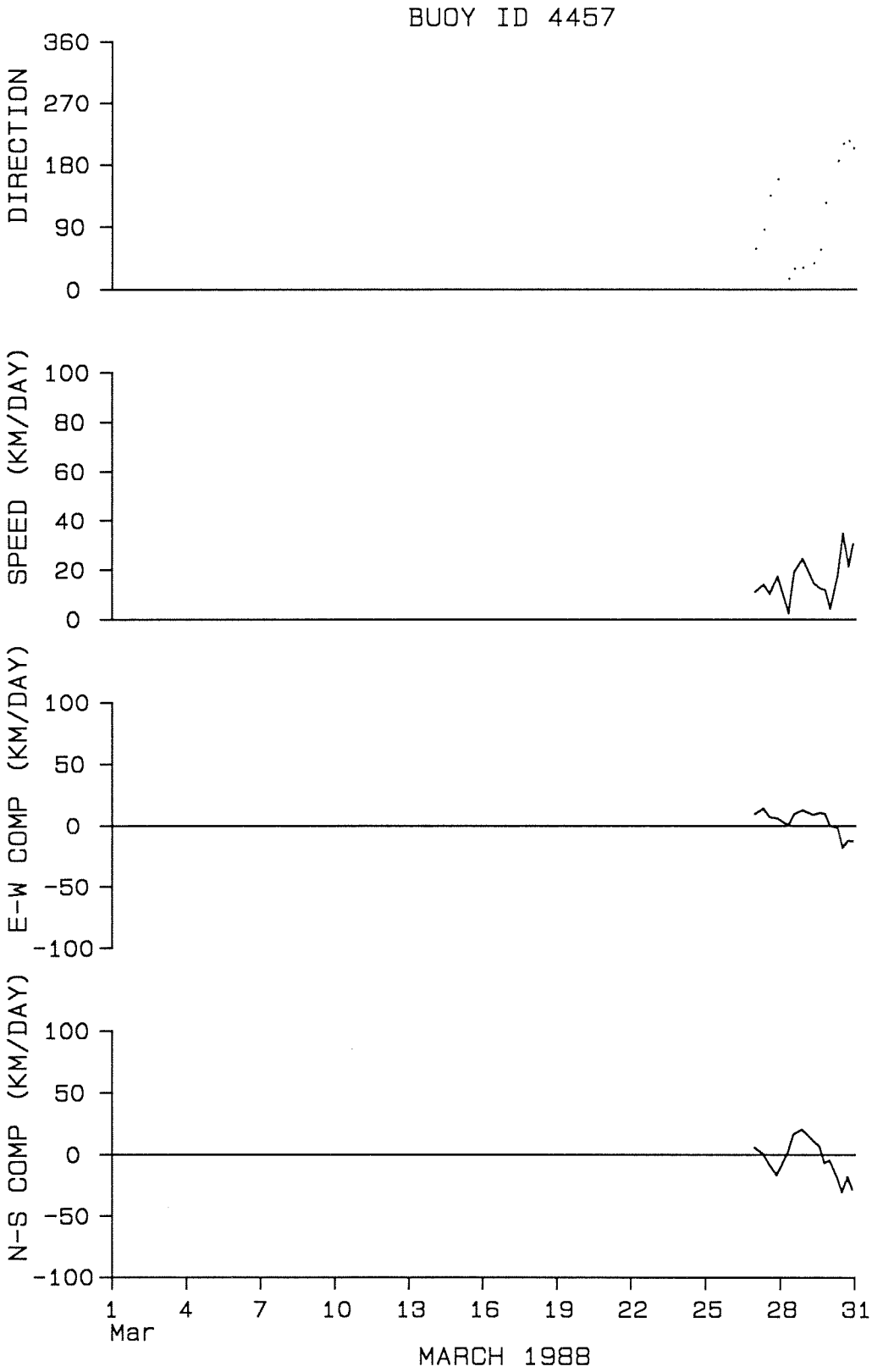

SURFACE DRIFTER # 3326 TRAJECTORY
57
56
55
54
53
52
51
50
49
52
51
50
05/03/88
06/03
12/03
18/03

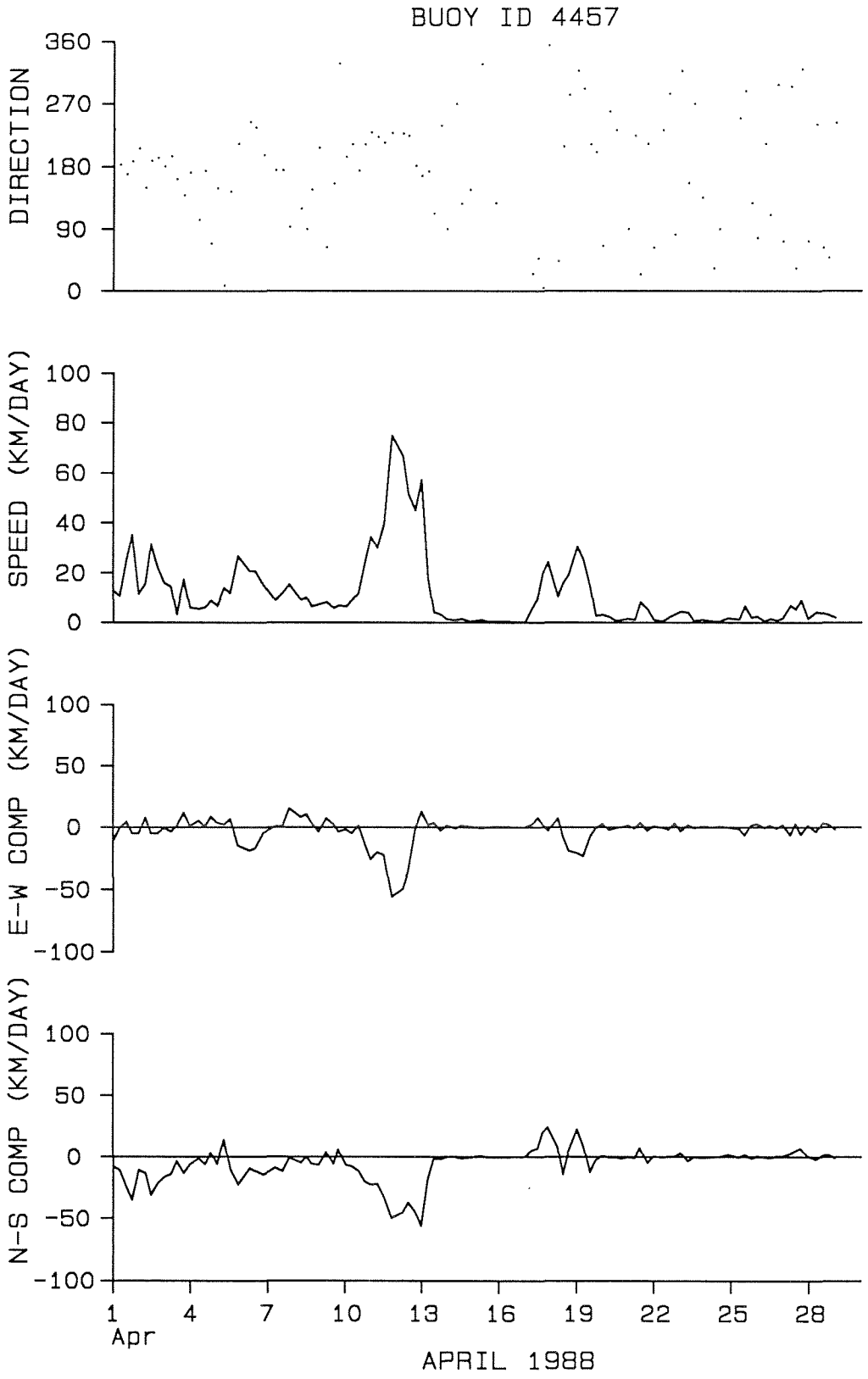

SURFACE DRIFTER # 3326 TRAJECTORY
14/3
18/03
24/3
30/03
OFF ICE: IN WATER
45/04
50
47
49
48
47
53
51
50
49
48
47

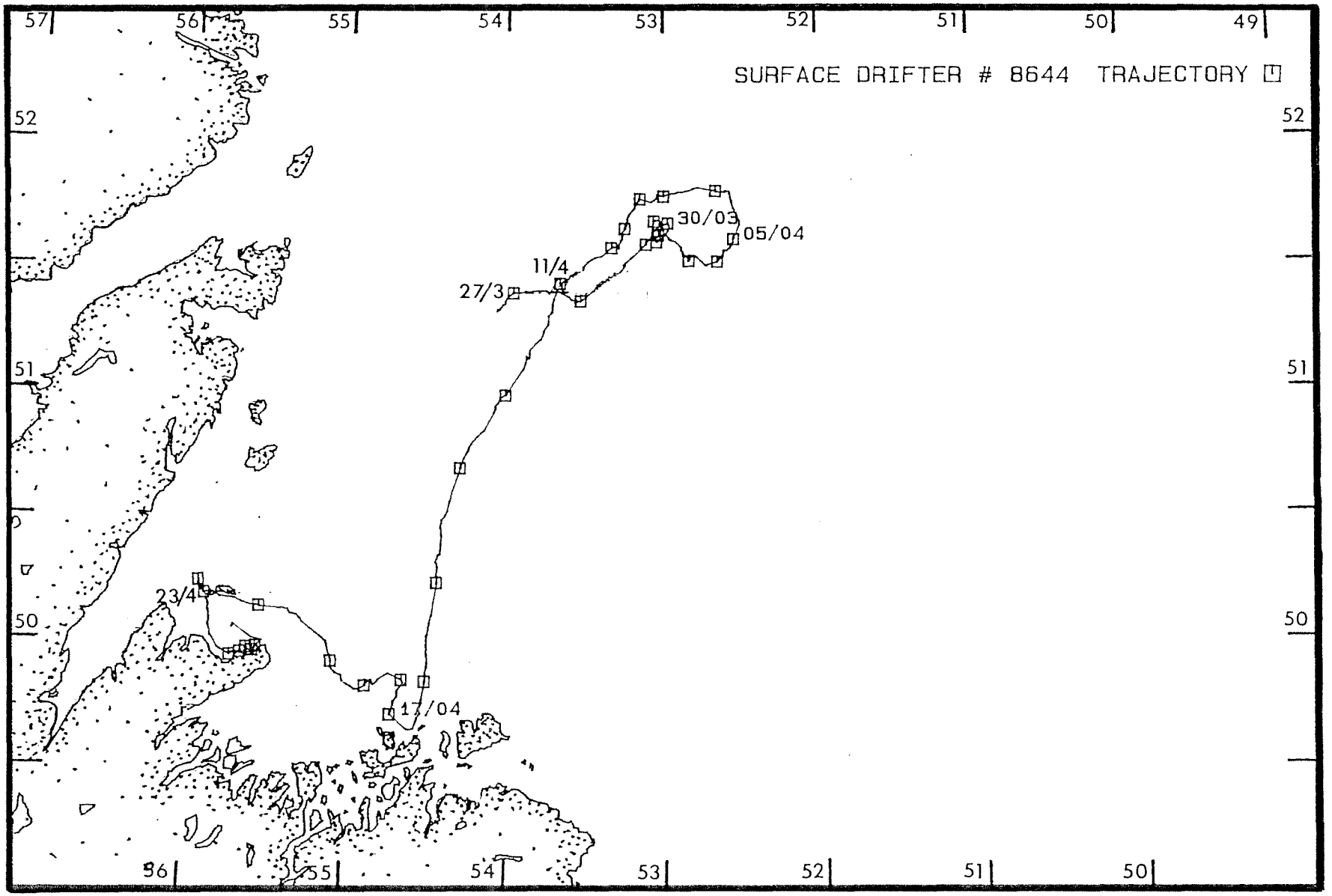

BUOY ID 3326
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
1
Mar
4
7
10
13
16
19
22
25
28
31
MARCH 1988

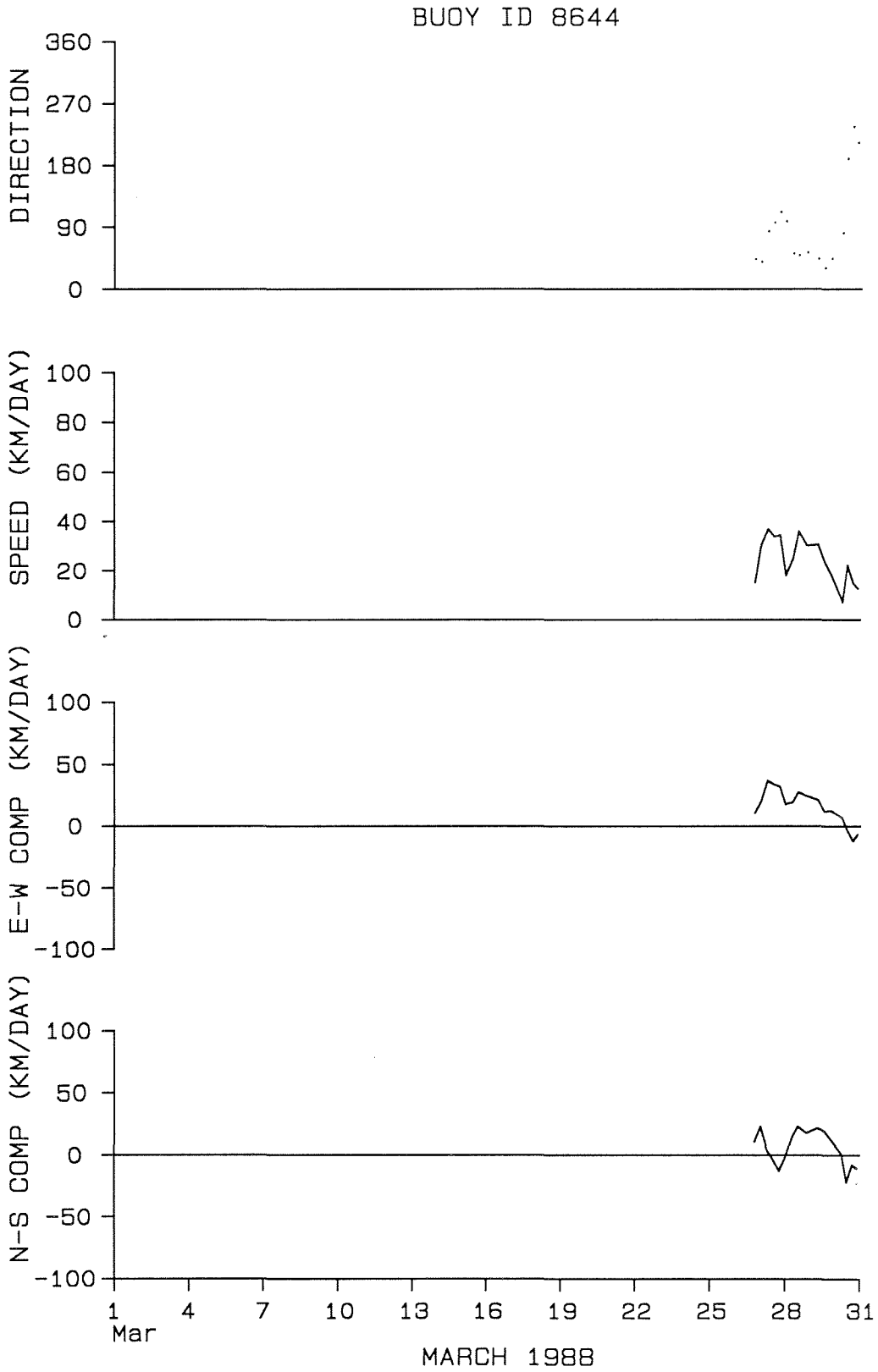

BUOY ID 3326
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
OFF ICE: IN WATER
1
Apr
4
7
10
13
16
19
22
25
28
APRIL 1988

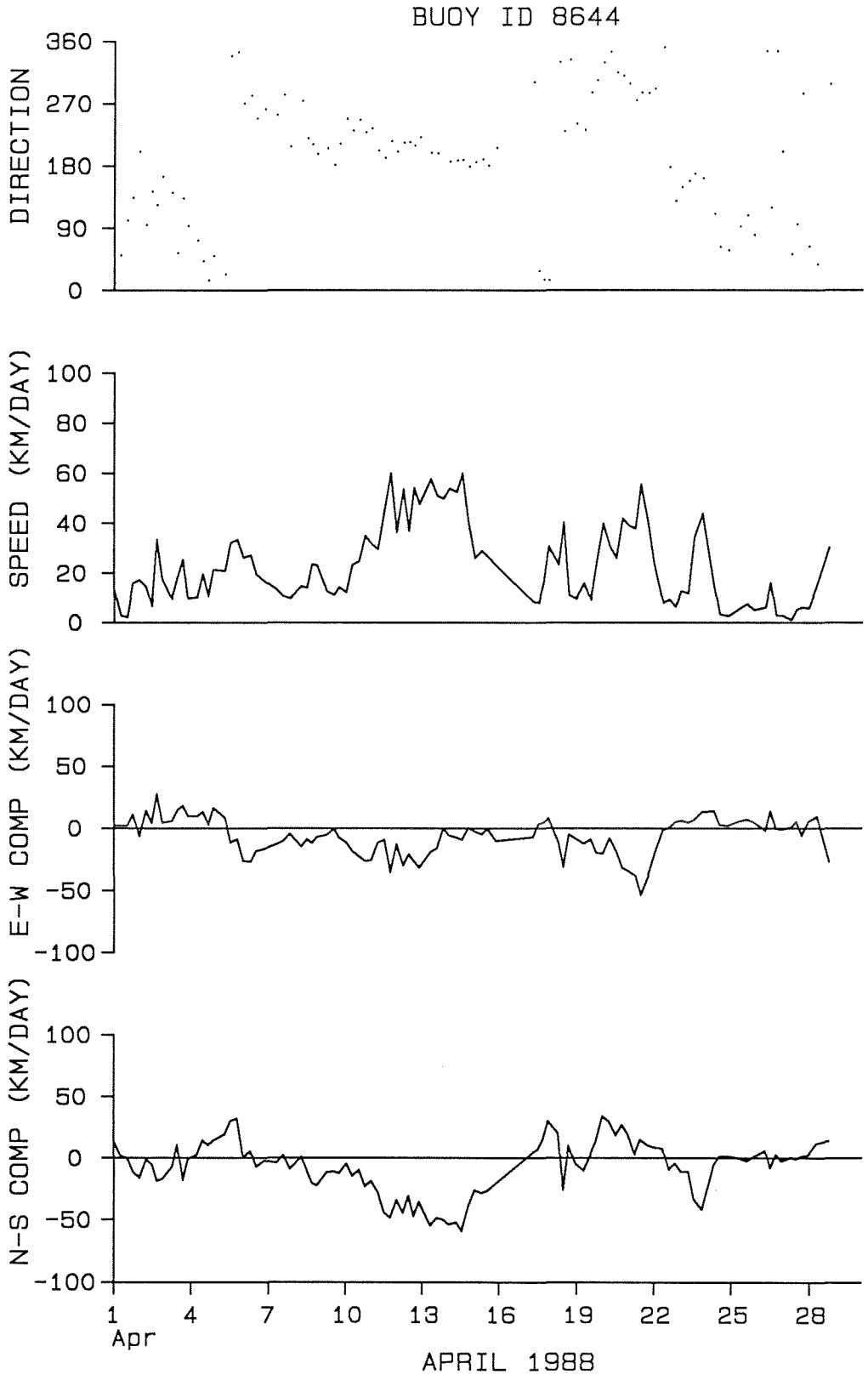

SURFACE DRIFTER # 4457 TRAJECTORY
57
56
55
54
53
52
51
50
49
52
51
50
27/3
30/3
05/04
11/04
19/4
13-17/4
20-26/4


BUOY ID 4457
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
1
Mar
4
7
10
13
16
19
22
25
28
31
MARCH 1988


BUOY ID 4457
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
1
Apr
4
7
10
13
16
19
22
25
28
APRIL 1988


SURFACE DRIFTER # 8644 TRAJECTORY
57
56
55
54
53
52
51
50
49
52
51
50
30/03
05/04
11/4
27/3
23/4
17/04


BUOY ID 8644
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
1
Mar
4
7
10
13
16
19
22
25
28
31
MARCH 1988


BUOY ID 8644
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
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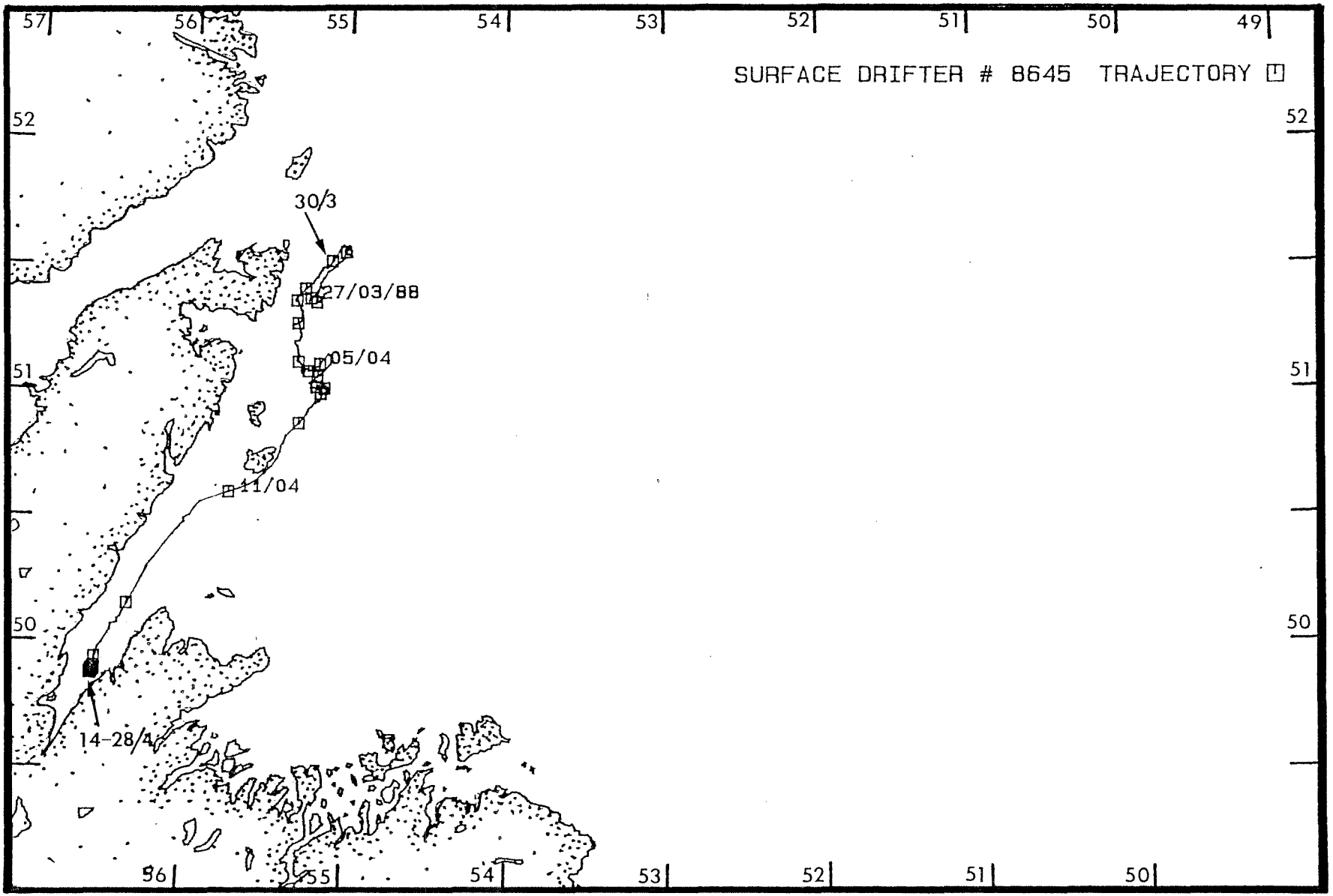
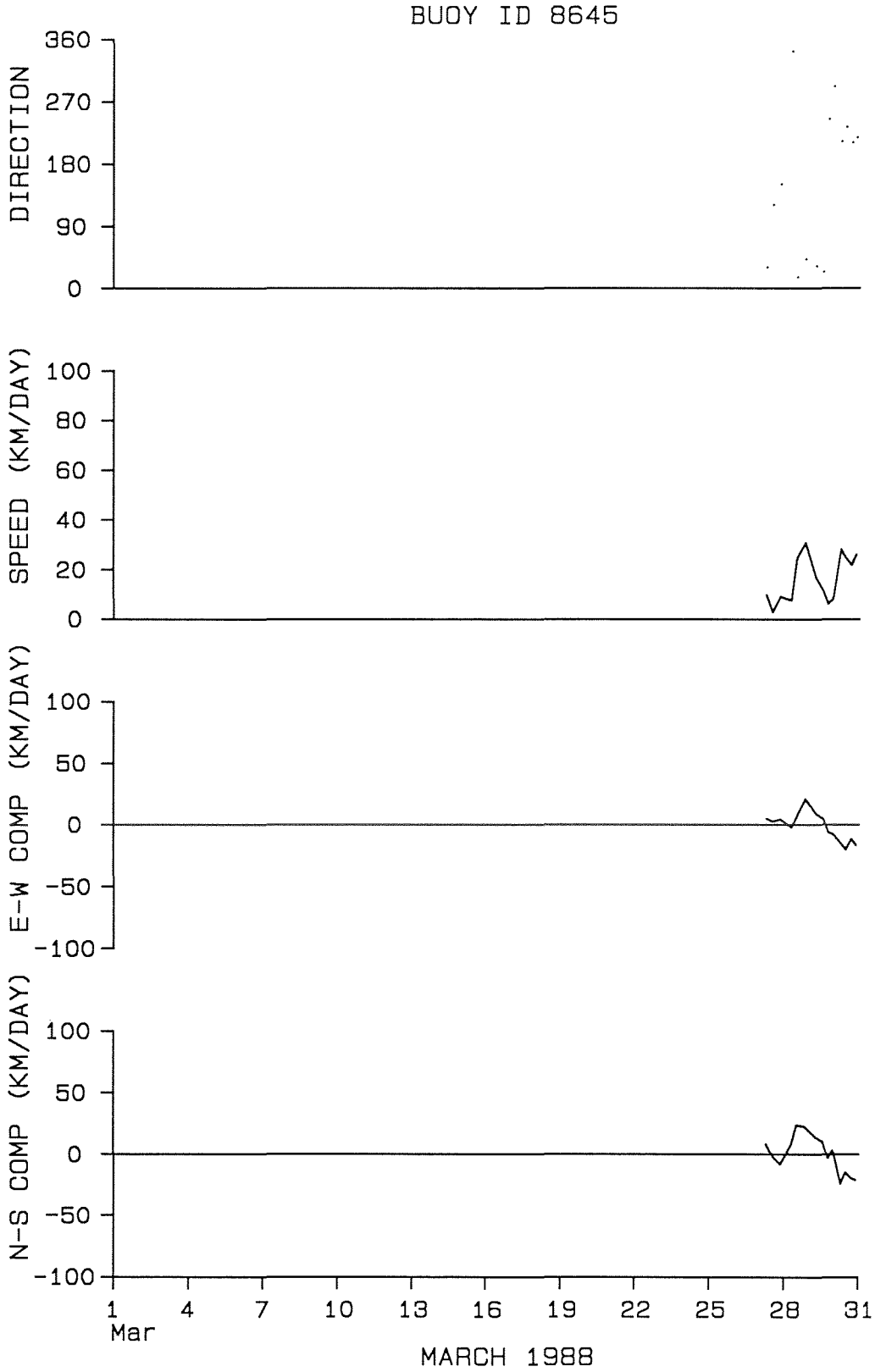
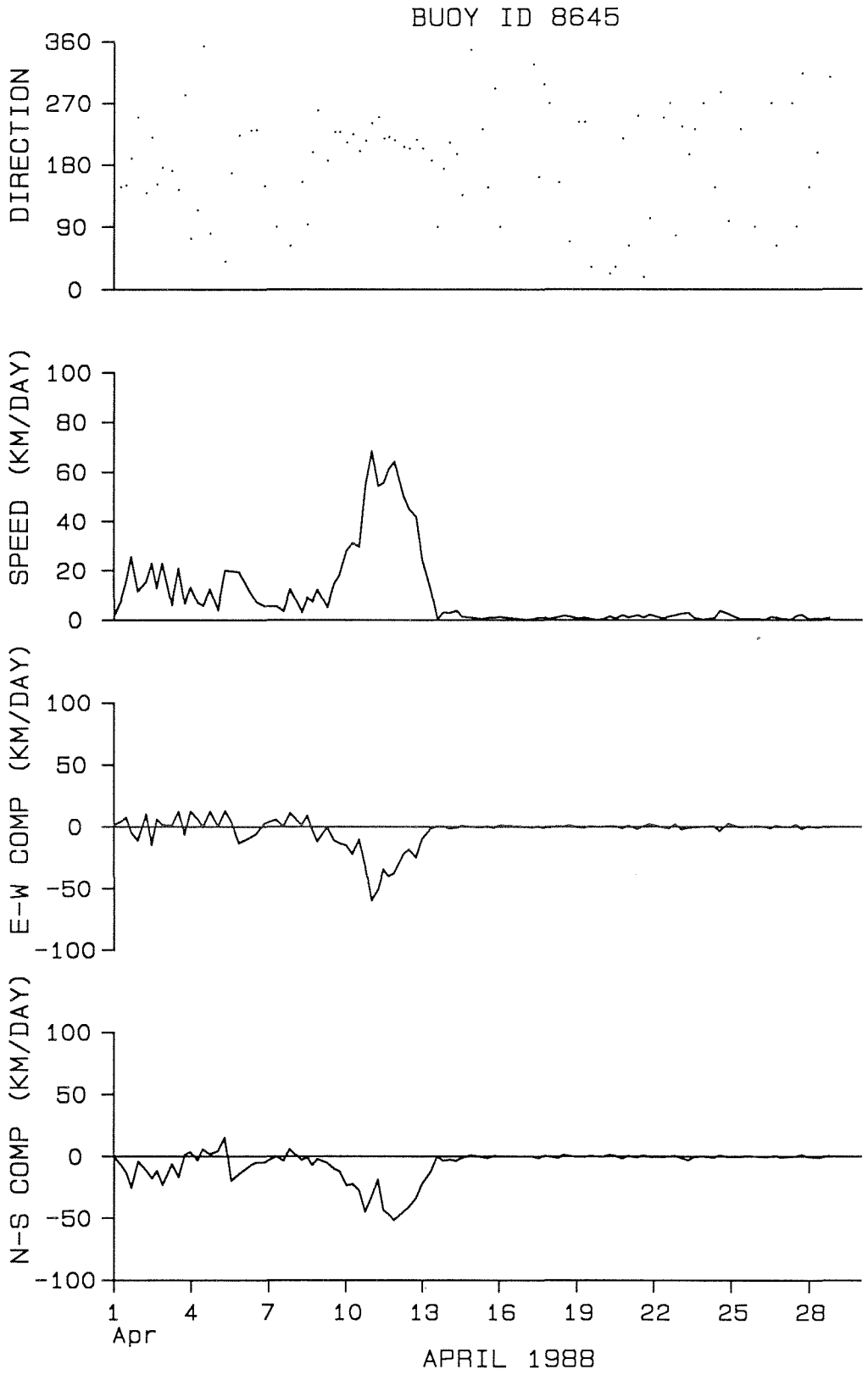
0
-50
-100
1
Apr
4
7
10
13
16
19
22
25
28
APRIL 1988


SURFACE DRIFTER # 8645 TRAJECTORY
57
56
55
54
53
52
51
50
49
52
51
50
30/3
27/03/88
05/04
11/04
14-28/4


BUOY ID 8645
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
1
Mar
4
7
10
13
16
19
22
25
28
31
MARCH 1988


BUOY ID 8645
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
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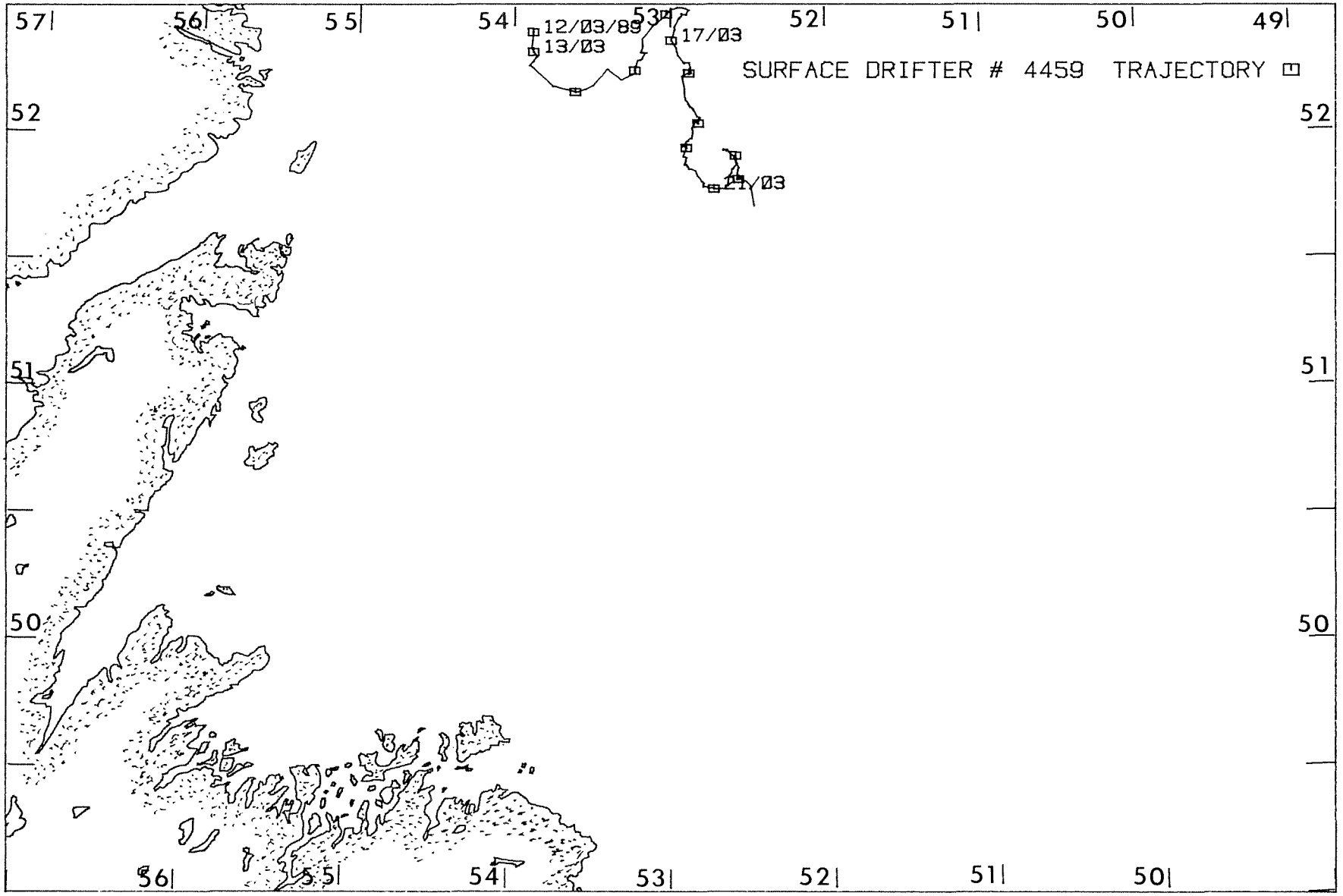
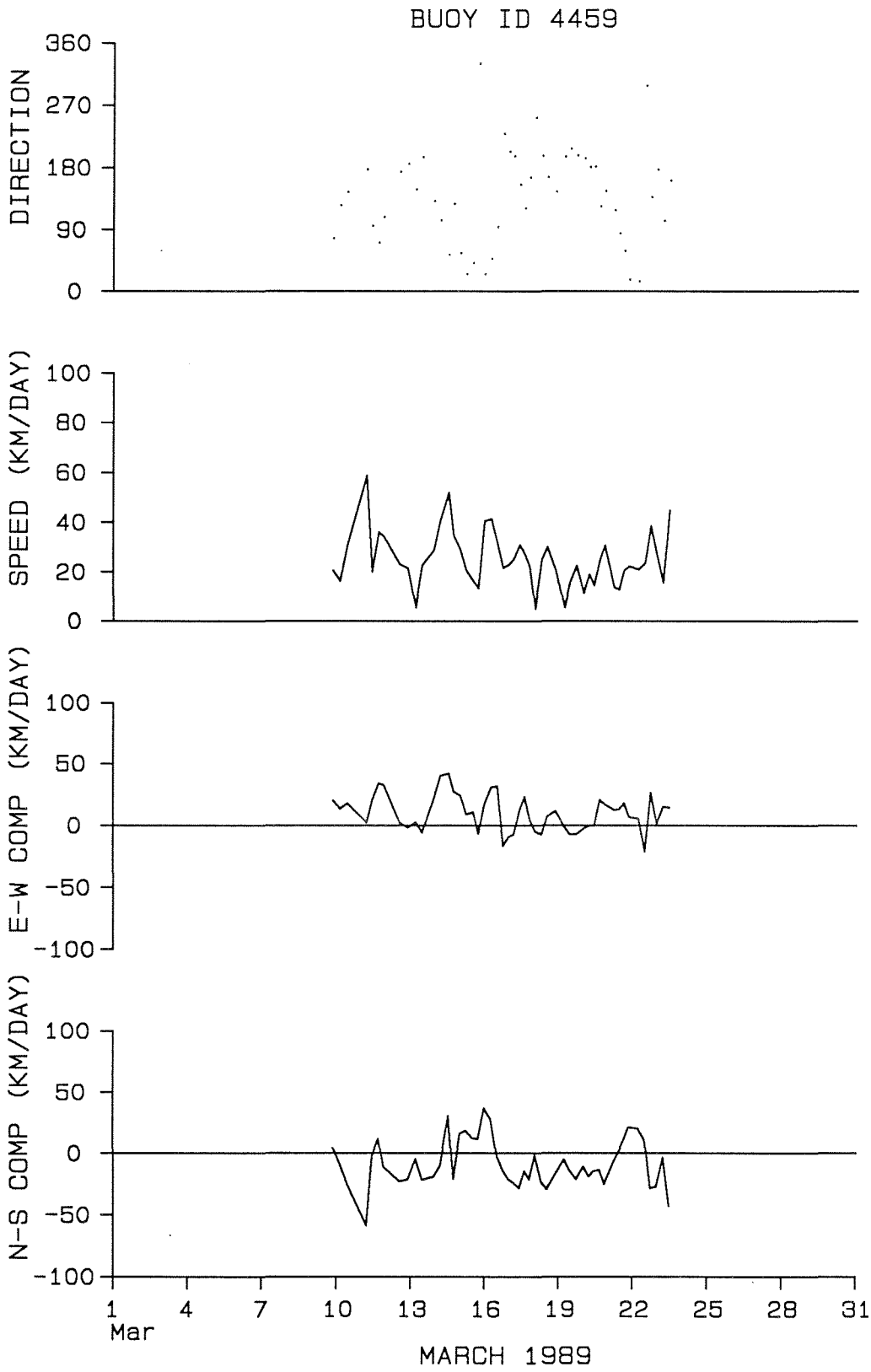
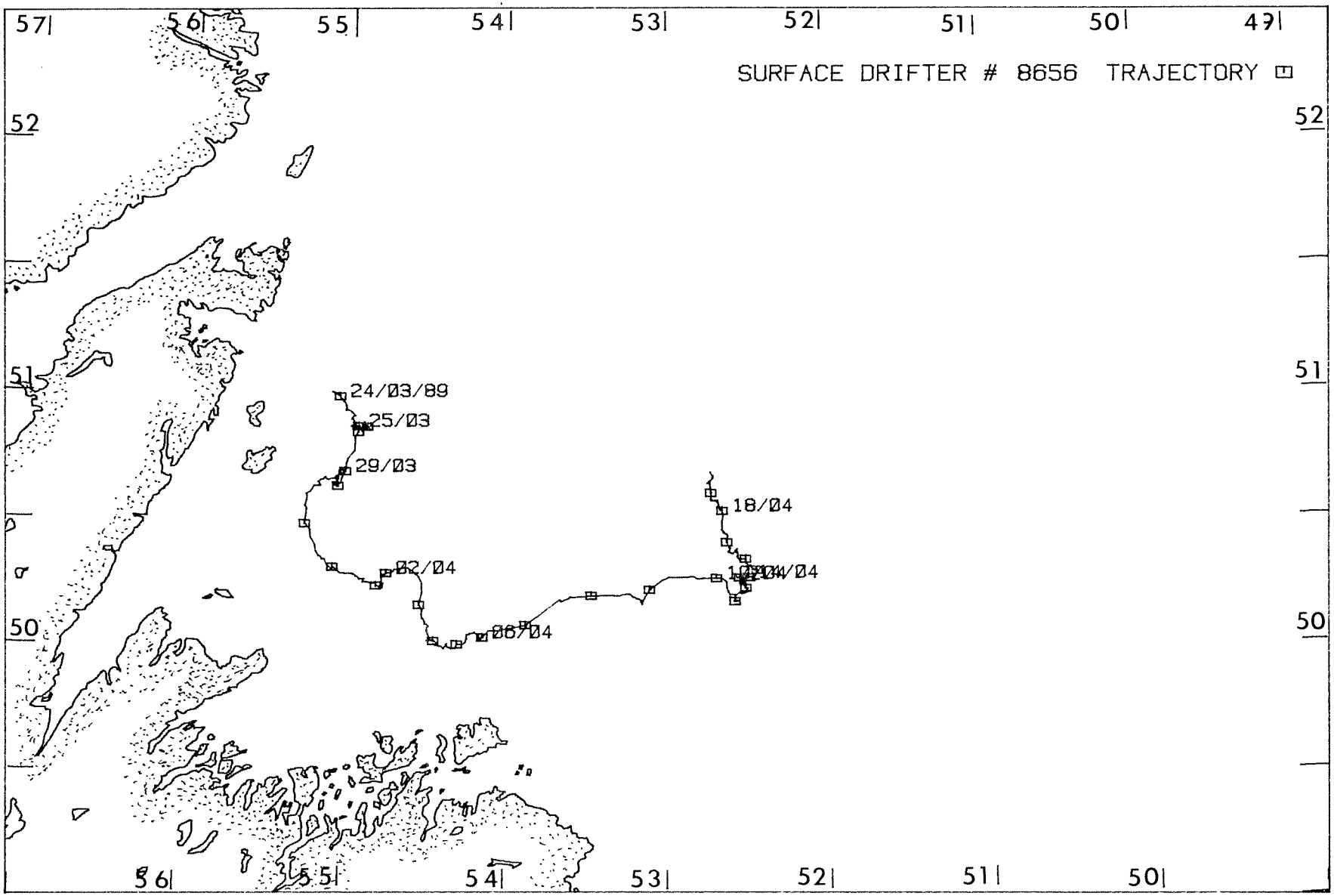
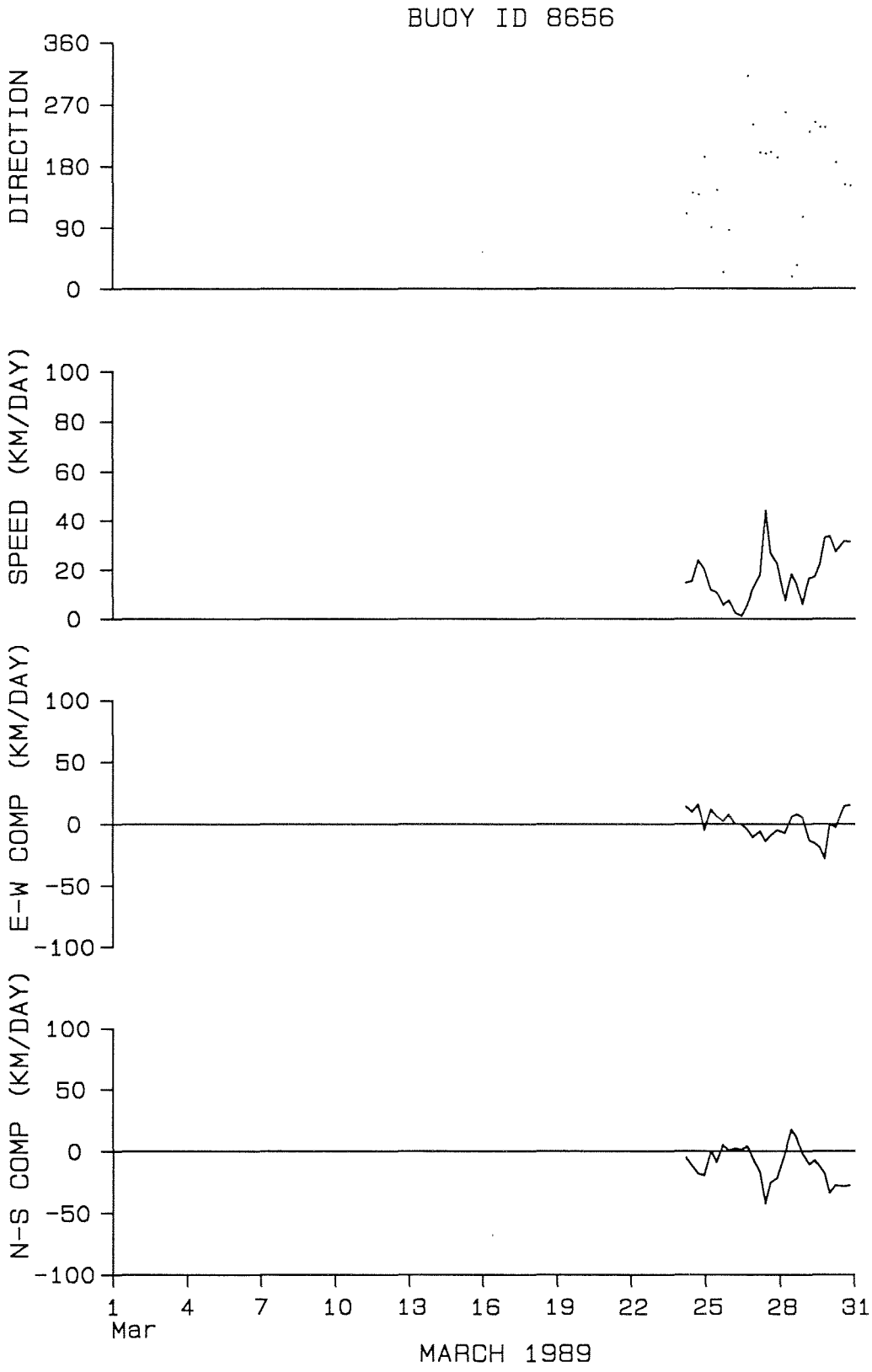
0
-50
-100
1
Apr
4
7
10
13
16
19
22
25
28
APRIL 1988


SURFACE DRIFTER # 4459 TRAJECTORY
12/03/89
13/03
17/03
21/03
57
56
55
54
53
52
51
50
49
52
51
50


BUOY ID 4459
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
1
Mar
4
7
10
13
16
19
22
25
28
31
MARCH 1989


SURFACE DRIFTER # 8656 TRAJECTORY
57
56
55
54
53
52
51
50
49
52
51
50
24/03/89
25/03
29/03
02/04
06/04
18/04
04/04


BUOY ID 8656
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
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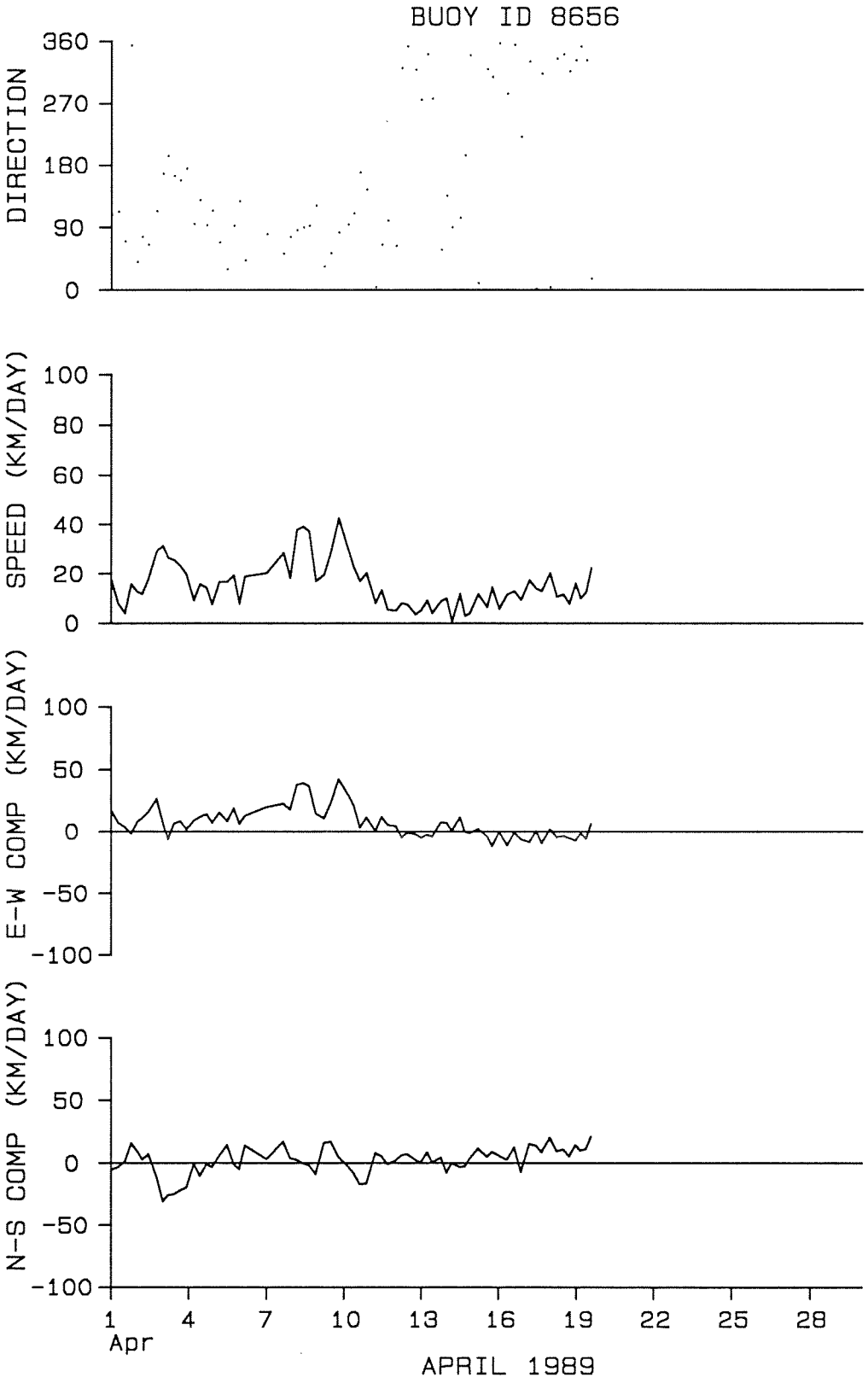
-50
-100
1
Mar
4
7
10
13
16
19
22
25
28
31
MARCH 1989


BUOY ID 8656
DIRECTION
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270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
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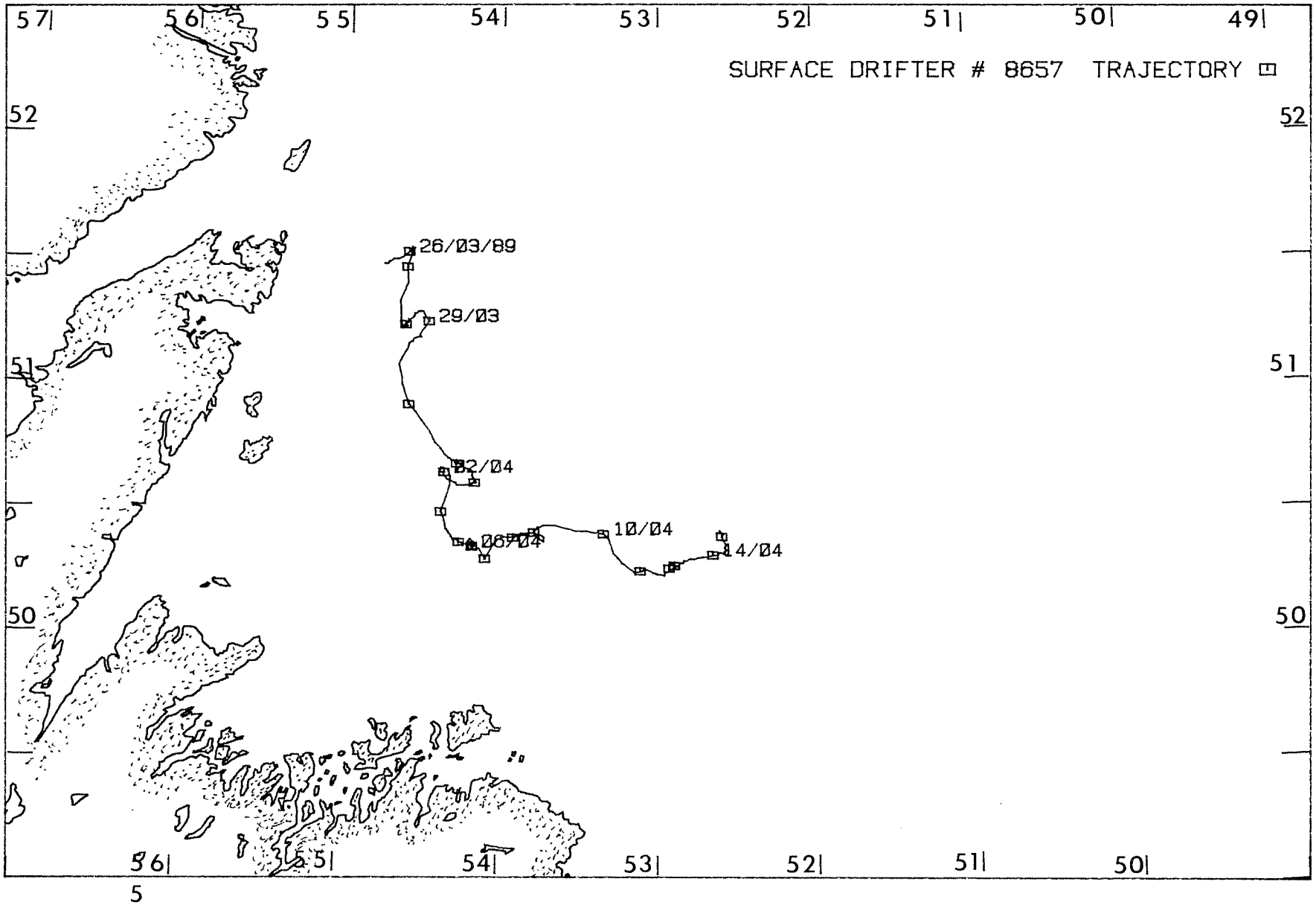
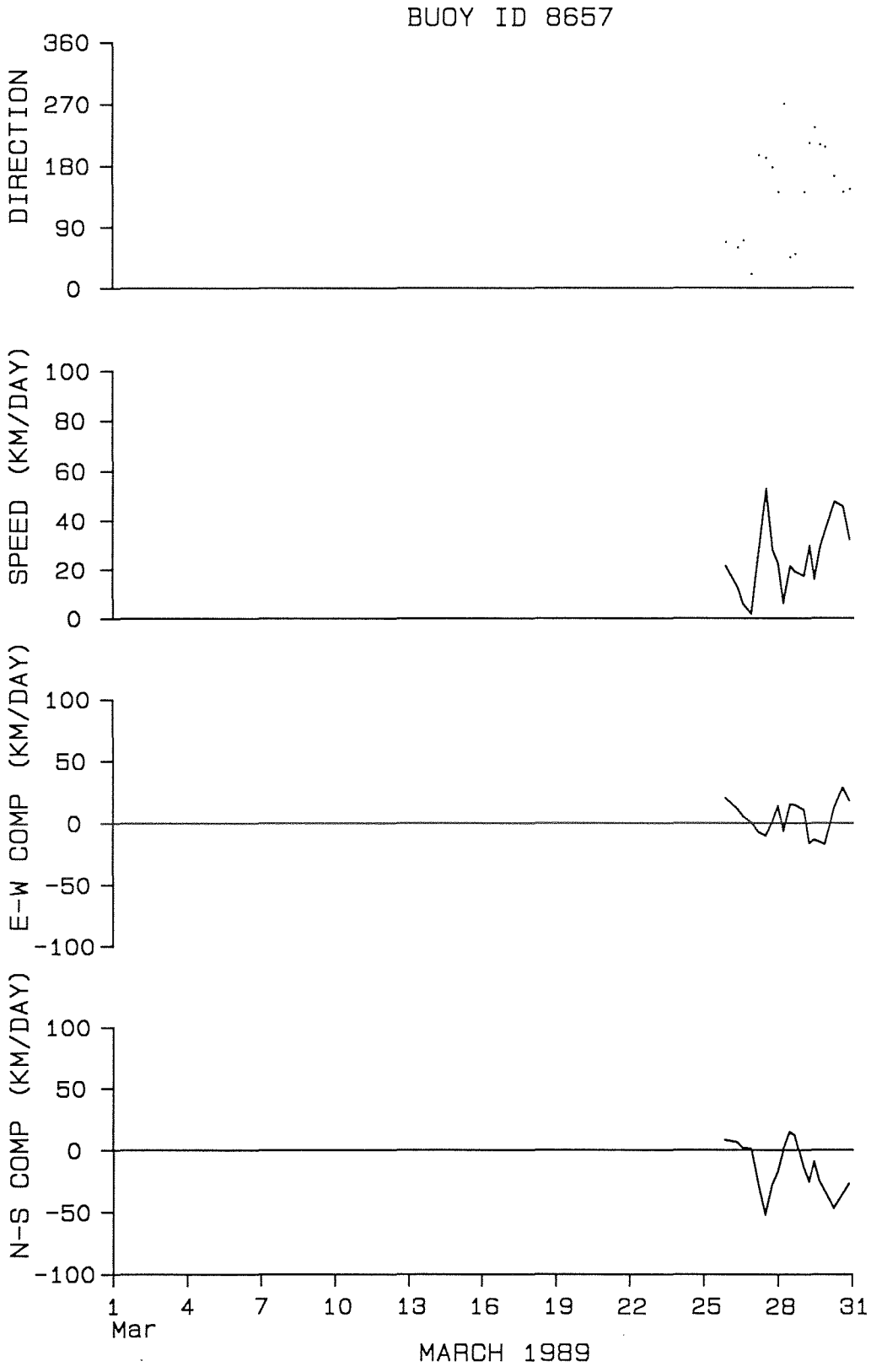
-50
-100
1
Apr
4
7
10
13
16
19
22
25
28
APRIL 1989


SURFACE DRIFTER # 8657 TRAJECTORY
57
56
55
54
53
52
51
50
49
52
51
50
26/03/89
29/03
02/04
06/04
10/04
14/04


BUOY ID 8657
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
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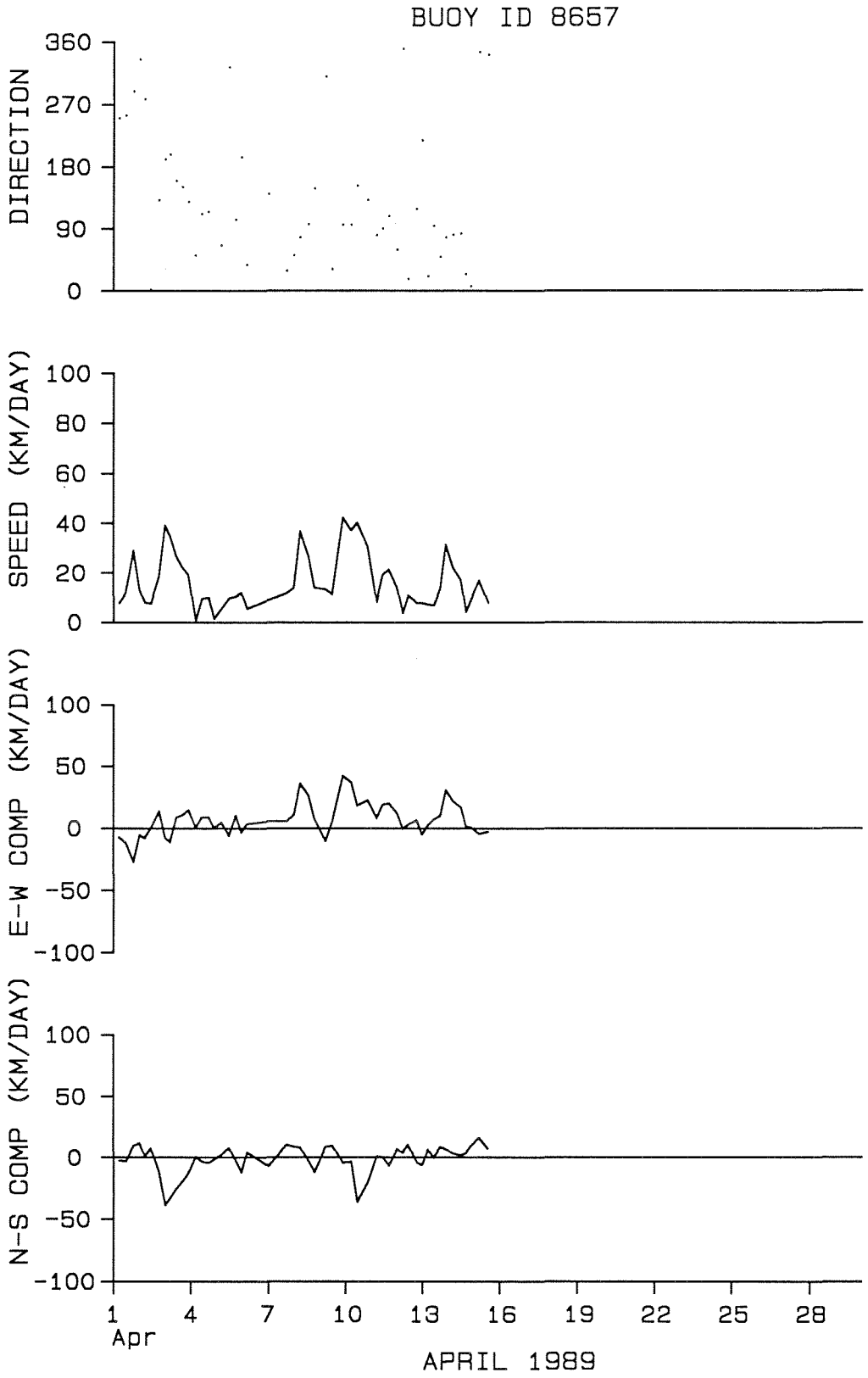
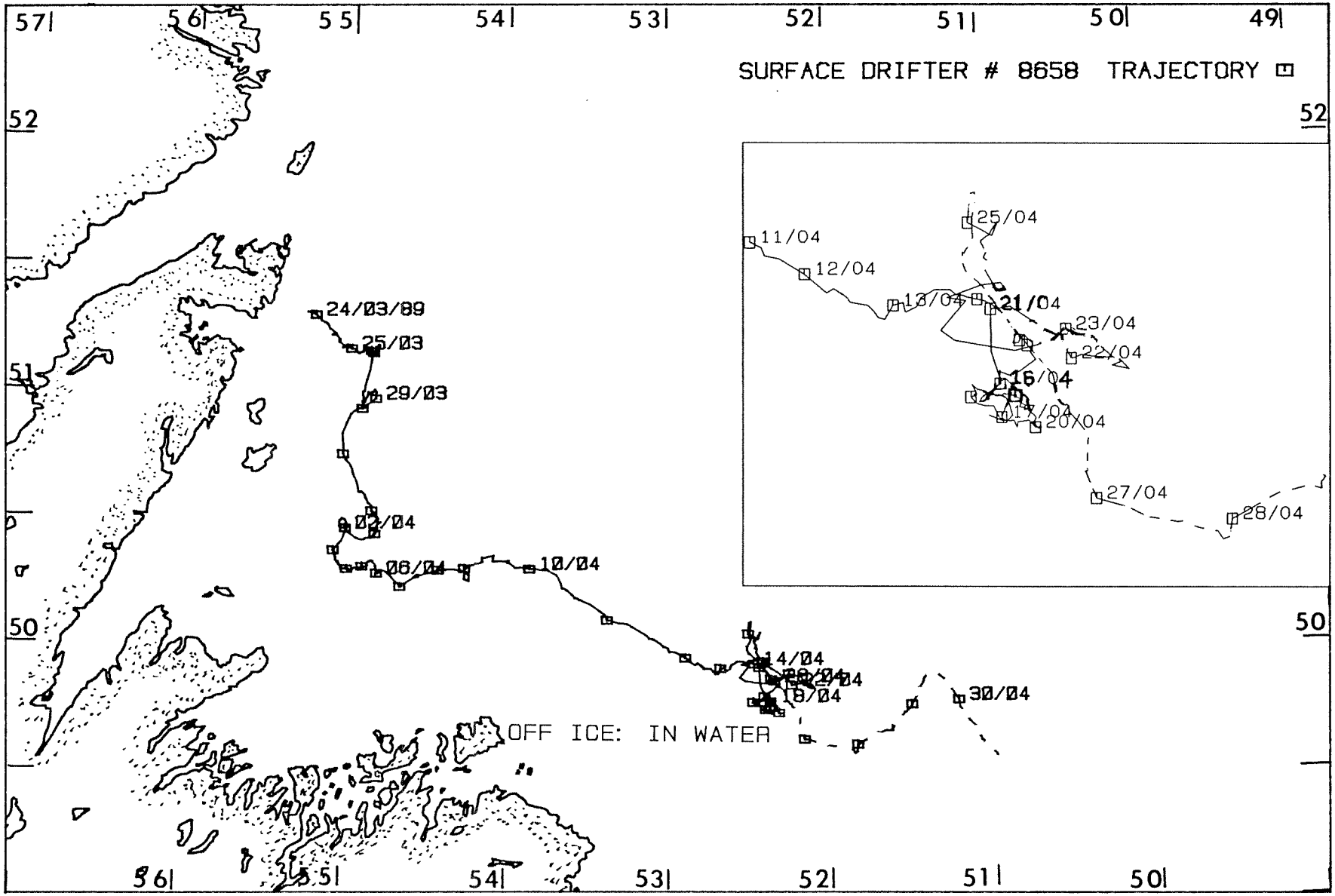
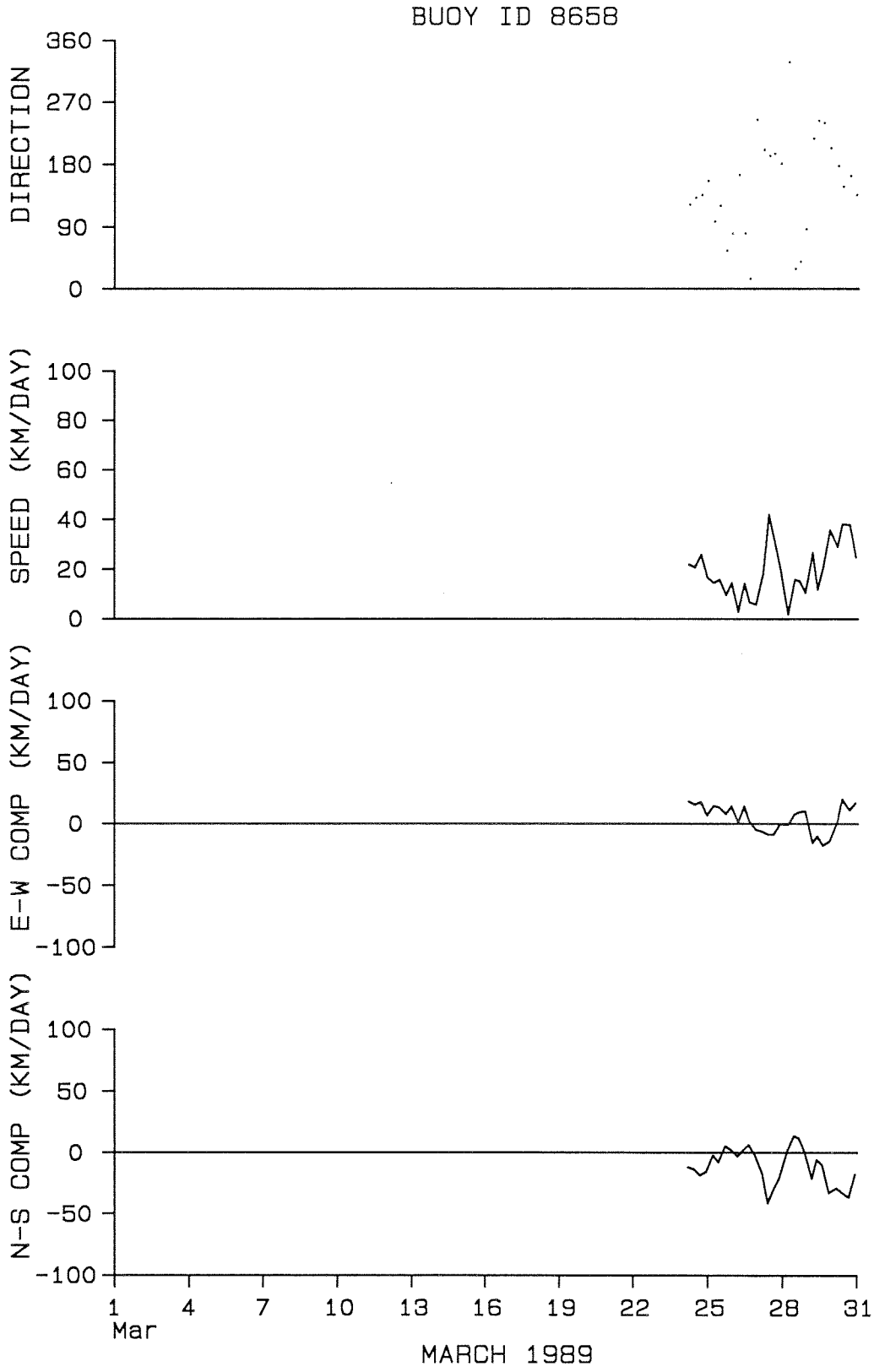
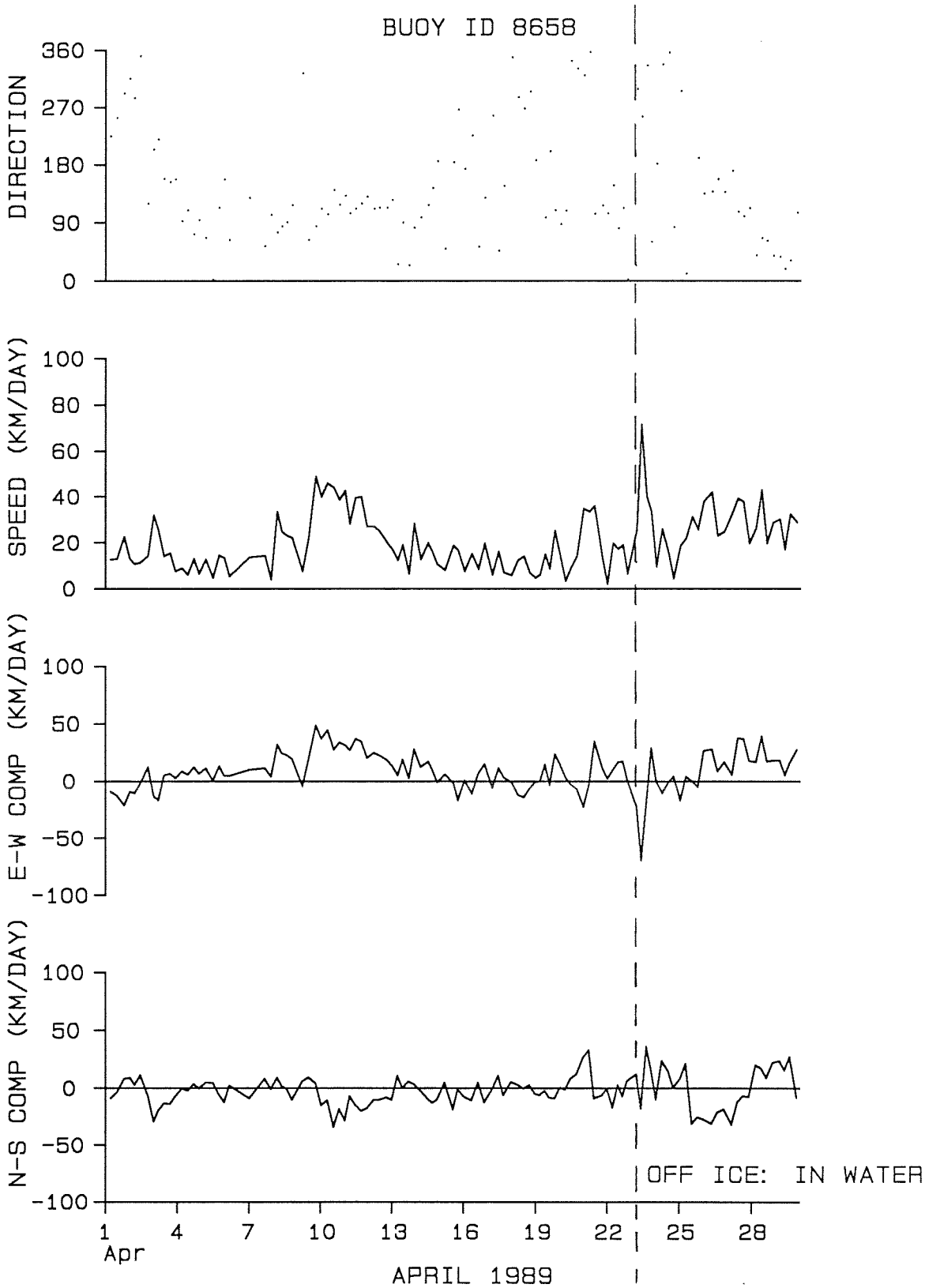
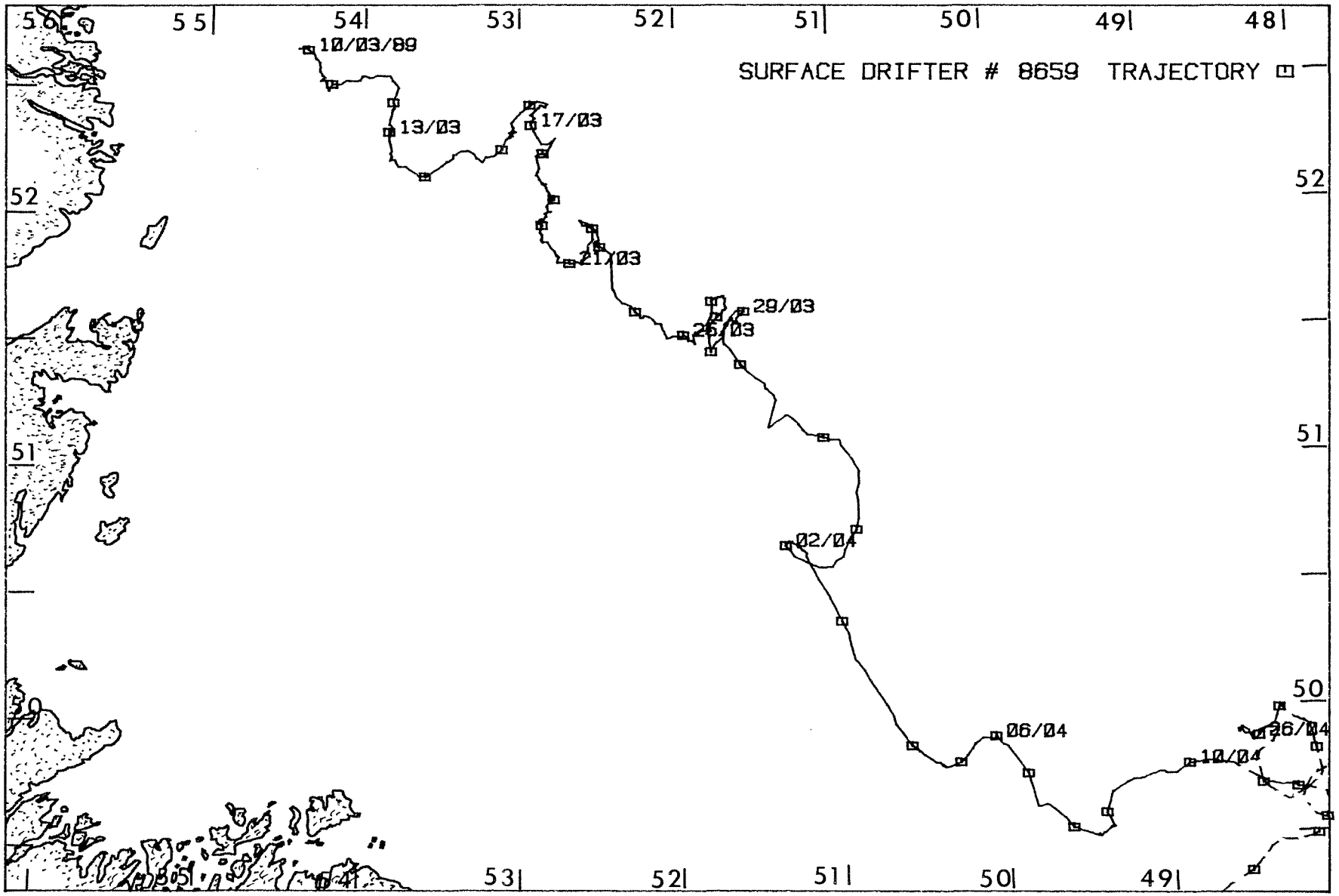
-50
-100
1
Mar
4
7
10
13
16
19
22
25
28
31
MARCH 1989

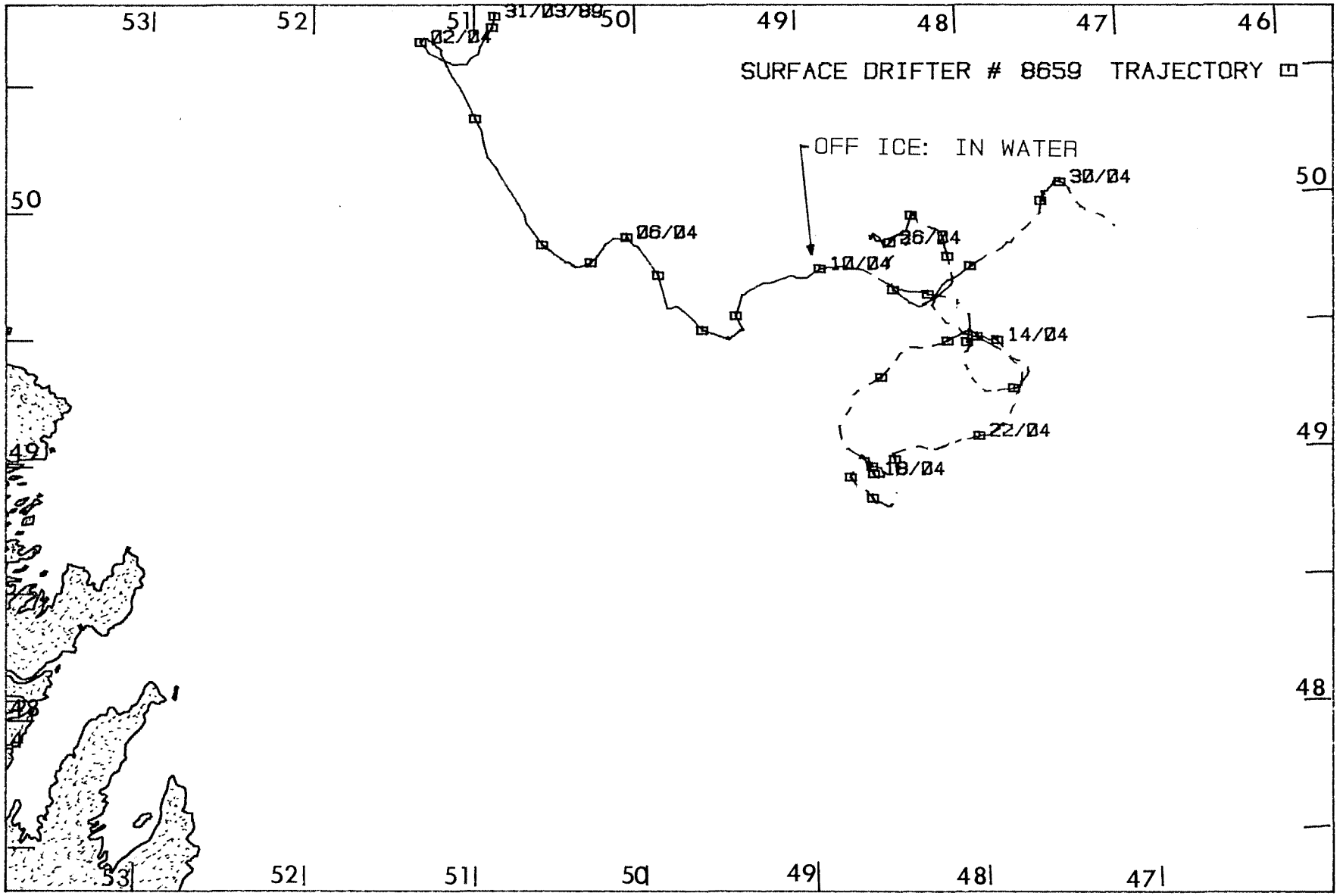

BUOY ID 8657
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
1
Apr
4
7
10
13
16
19
22
25
28
APRIL 1989

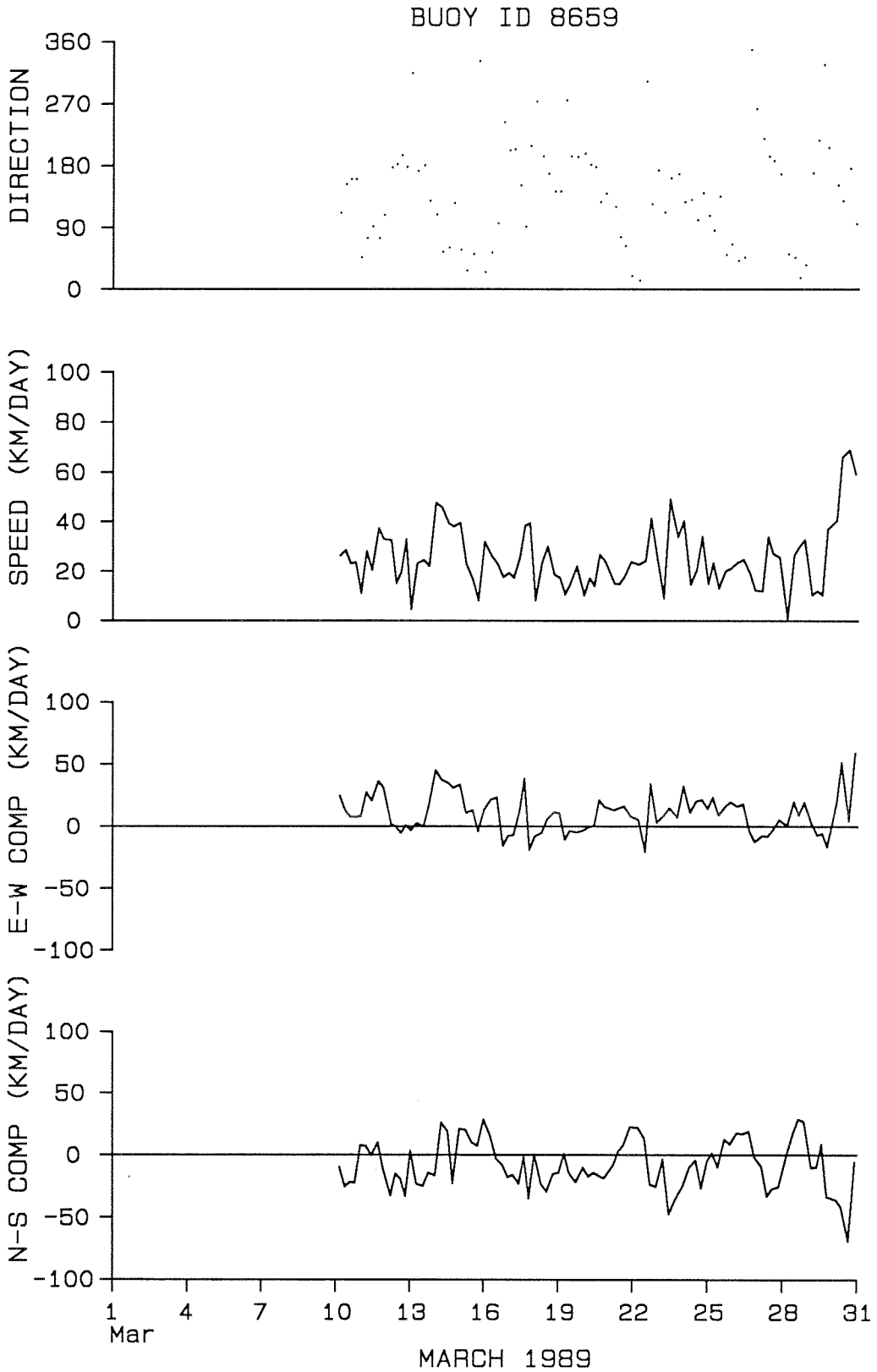

SURFACE DRIFTER # 8658 TRAJECTORY
OFF ICE: IN WATER
57
56
55
54
53
52
51
50
49
24/03/89
25/03
29/03
02/04
06/04
10/04
14/04
18/04
30/04
11/04
12/04
13/04
21/04
23/04
22/04
16/04
20/04
27/04
28/04
25/04


BUOY ID 8658
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
1
Mar
4
7
10
13
16
19
22
25
28
31
MARCH 1989


BUOY ID 8658
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
OFF ICE: IN WATER
1
Apr
4
7
10
13
16
19
22
25
28
APRIL 1989


SURFACE DRIFTER # 8659 TRAJECTORY
10/03/89
13/03
17/03
21/03
25/03
29/03
02/04
06/04
10/04
26/04
56
55
54
53
52
51
50
49
48
52
51
50
53
52
51
50
49


SURFACE DRIFTER # 8659 TRAJECTORY
OFF ICE: IN WATER
31/03/89
02/04
06/04
10/04
26/04
30/04
14/04
22/04
18/04
53
52
51
50
49
48
47
46


BUOY ID 8659
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
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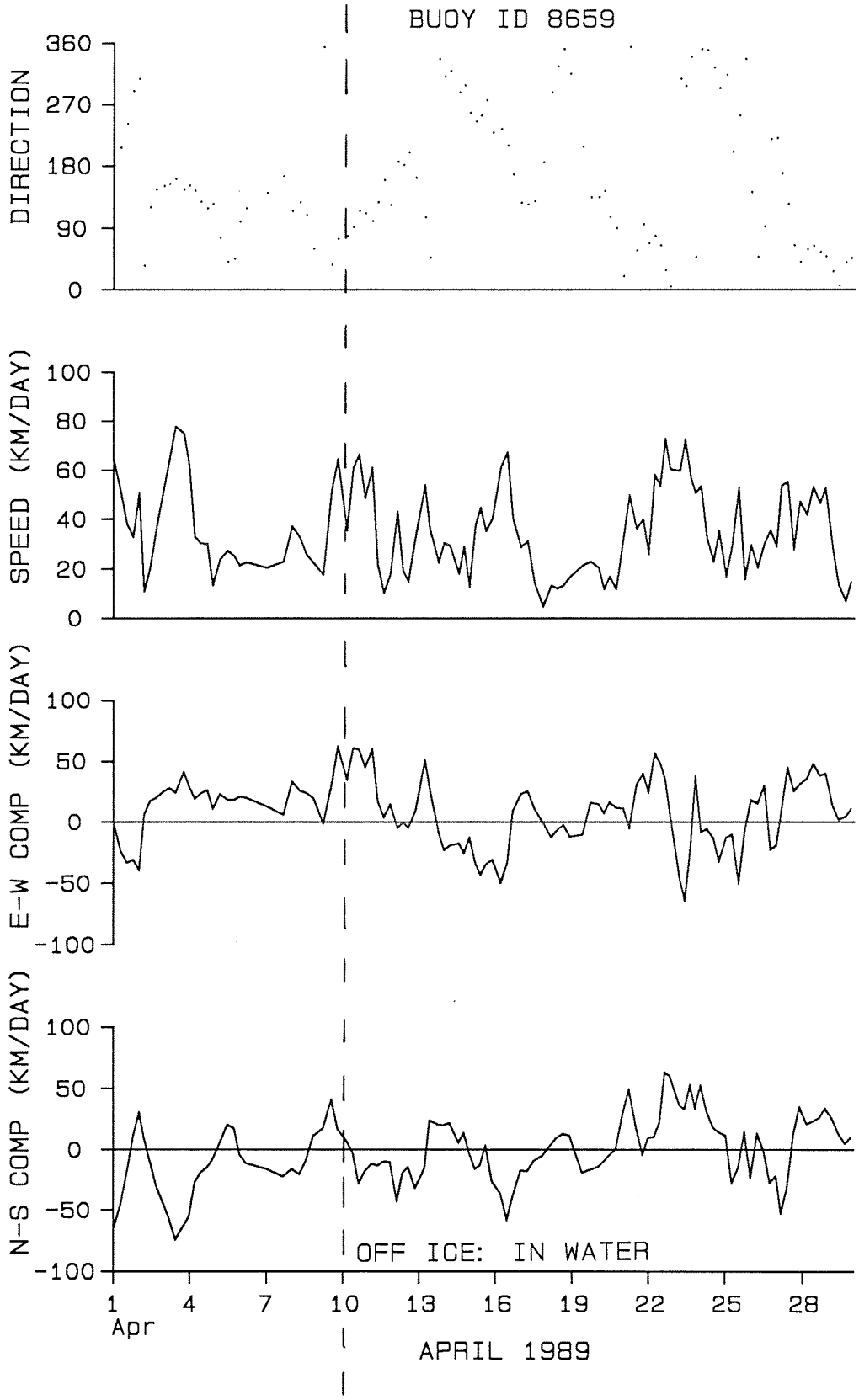
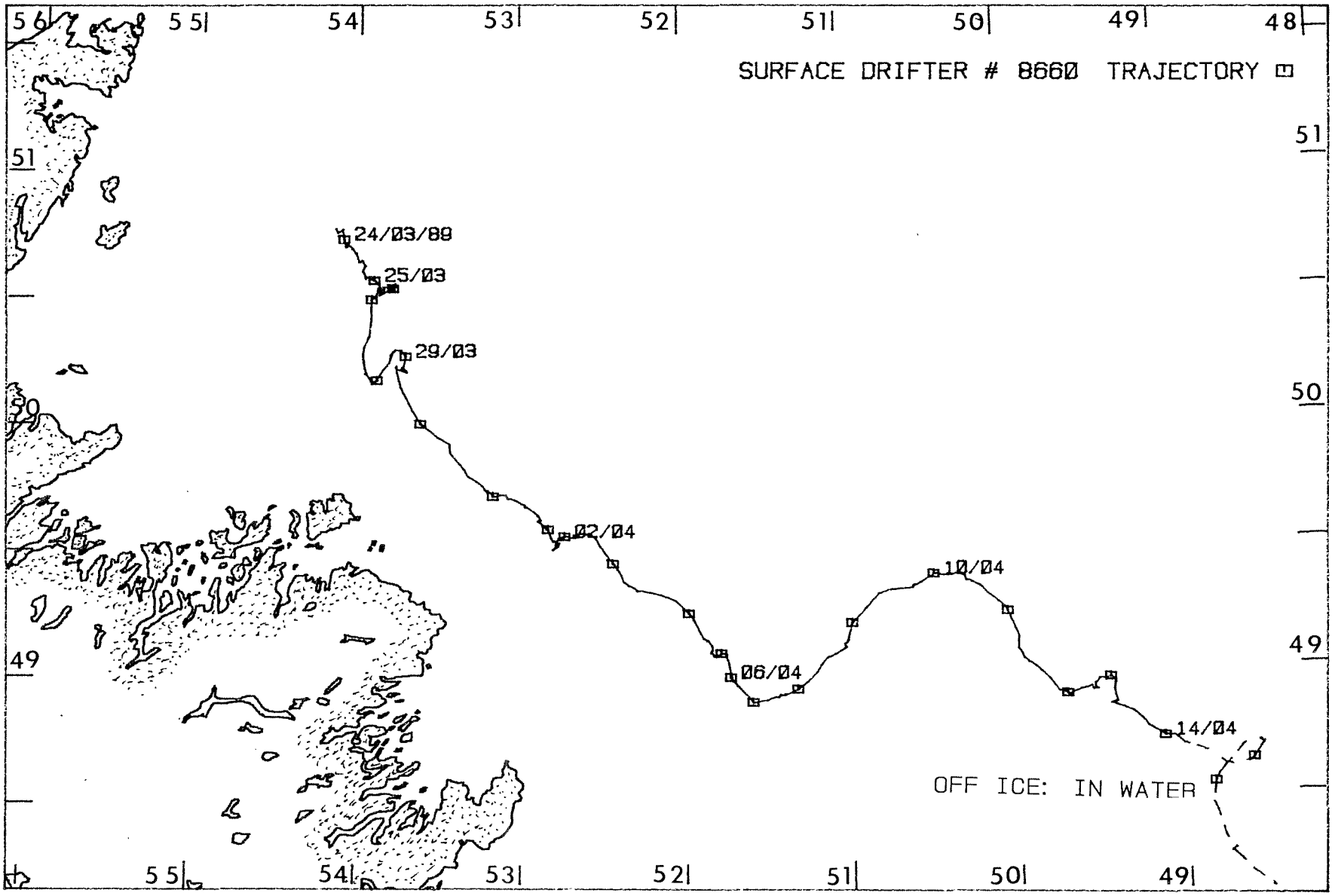
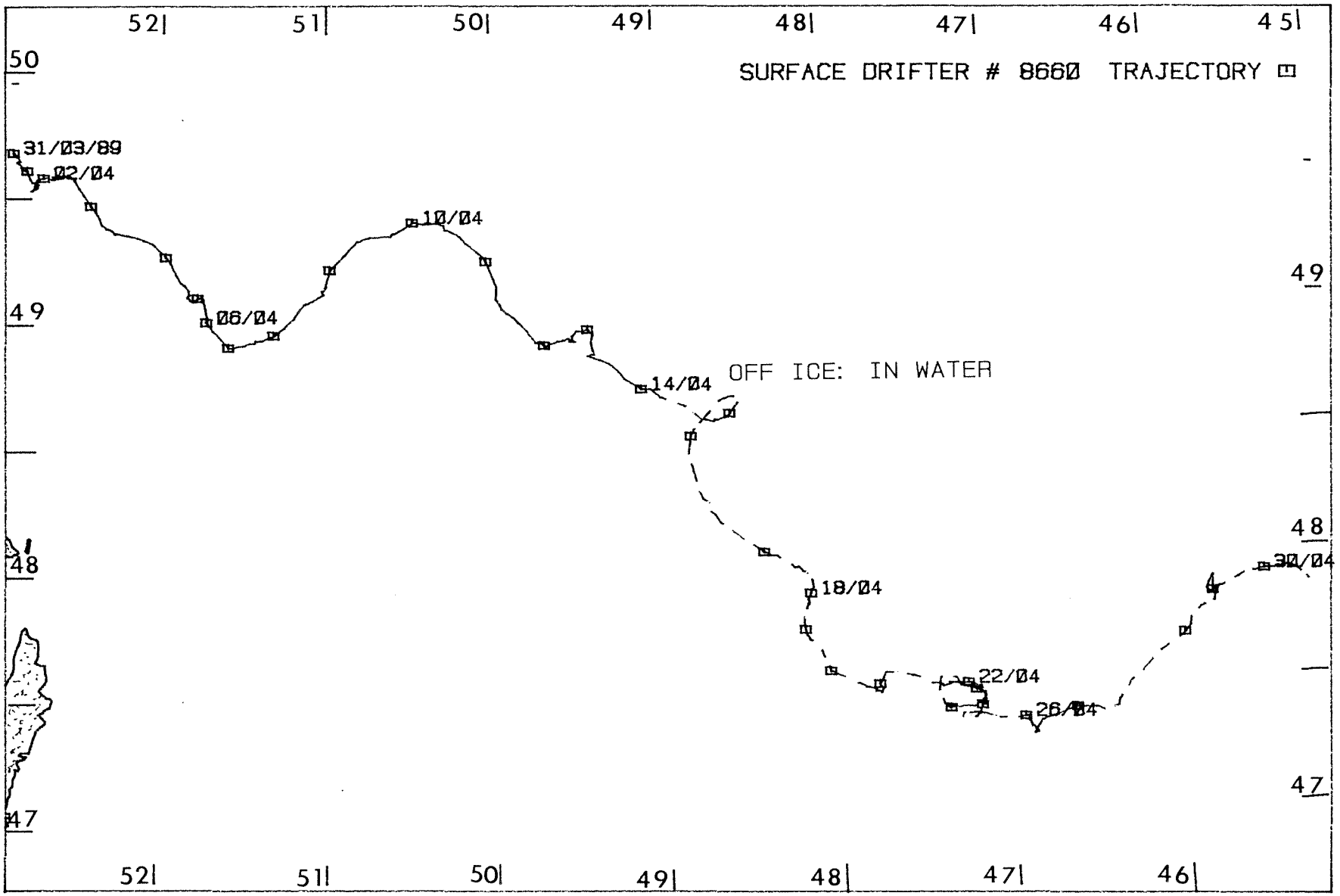
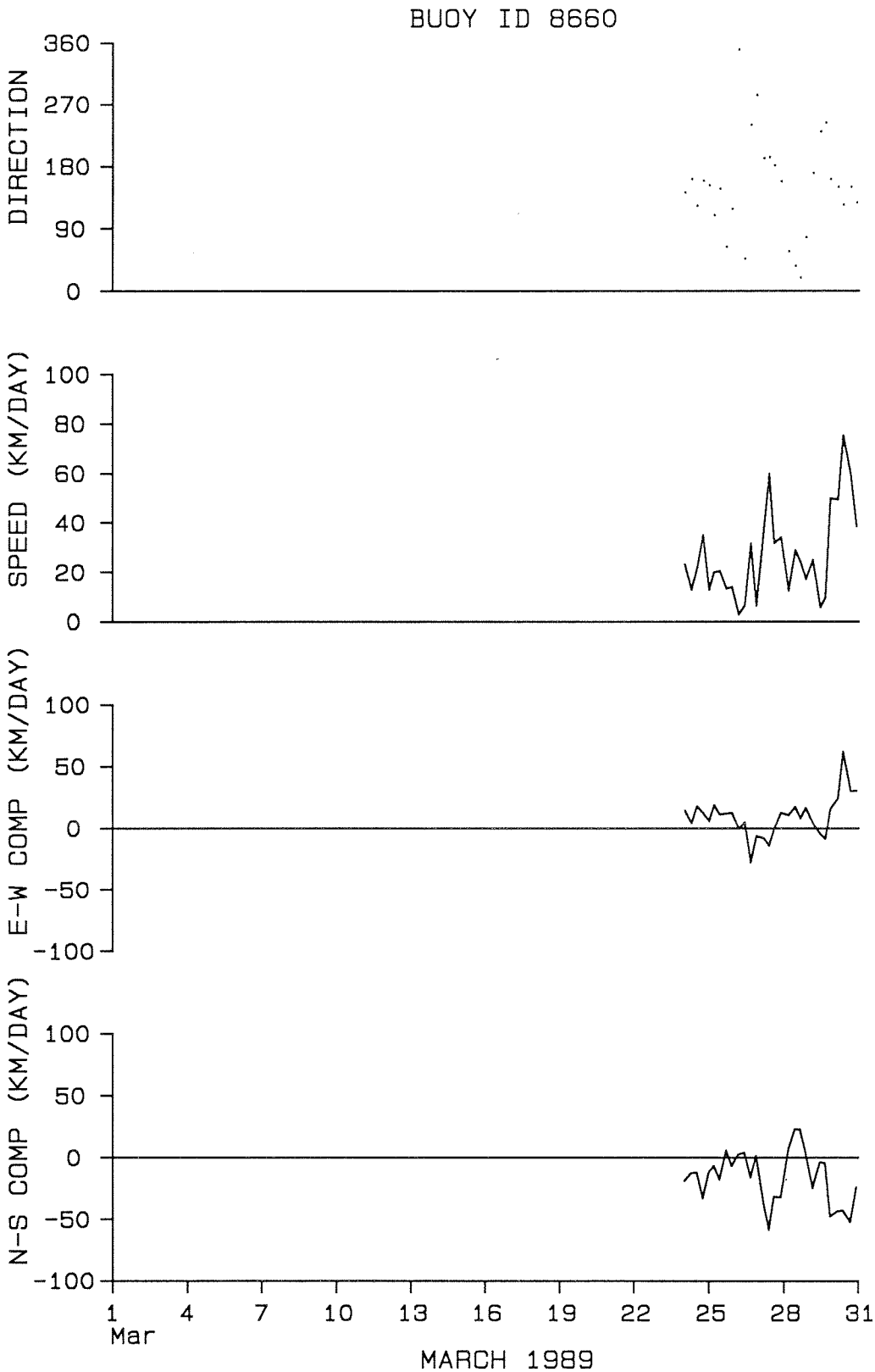
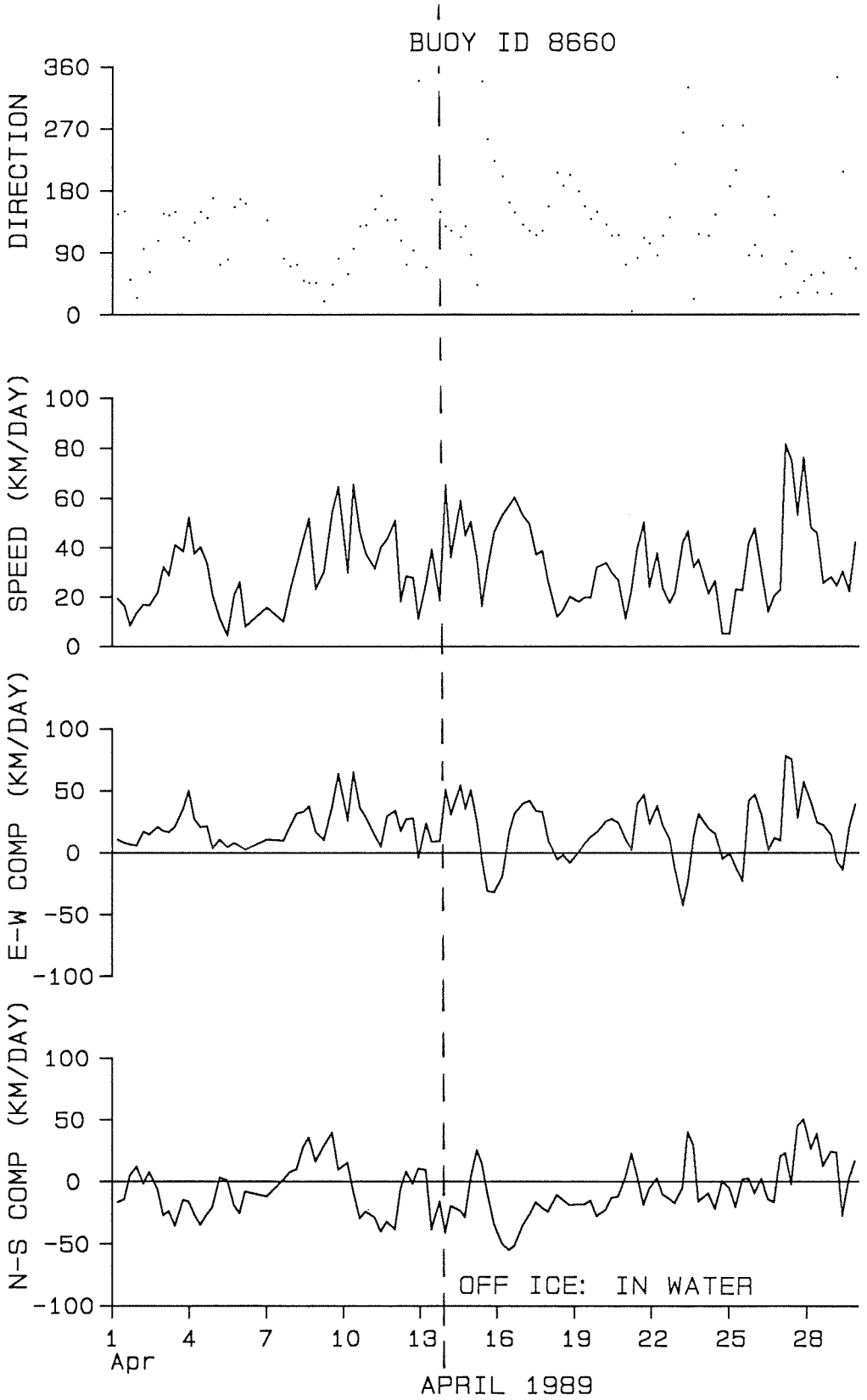
-50
-100
1
Mar
4
7
10
13
16
19
22
25
28
31
MARCH 1989


BUOY ID 8659
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
OFF ICE: IN WATER
1
Apr
4
7
10
13
16
19
22
25
28
APRIL 1989

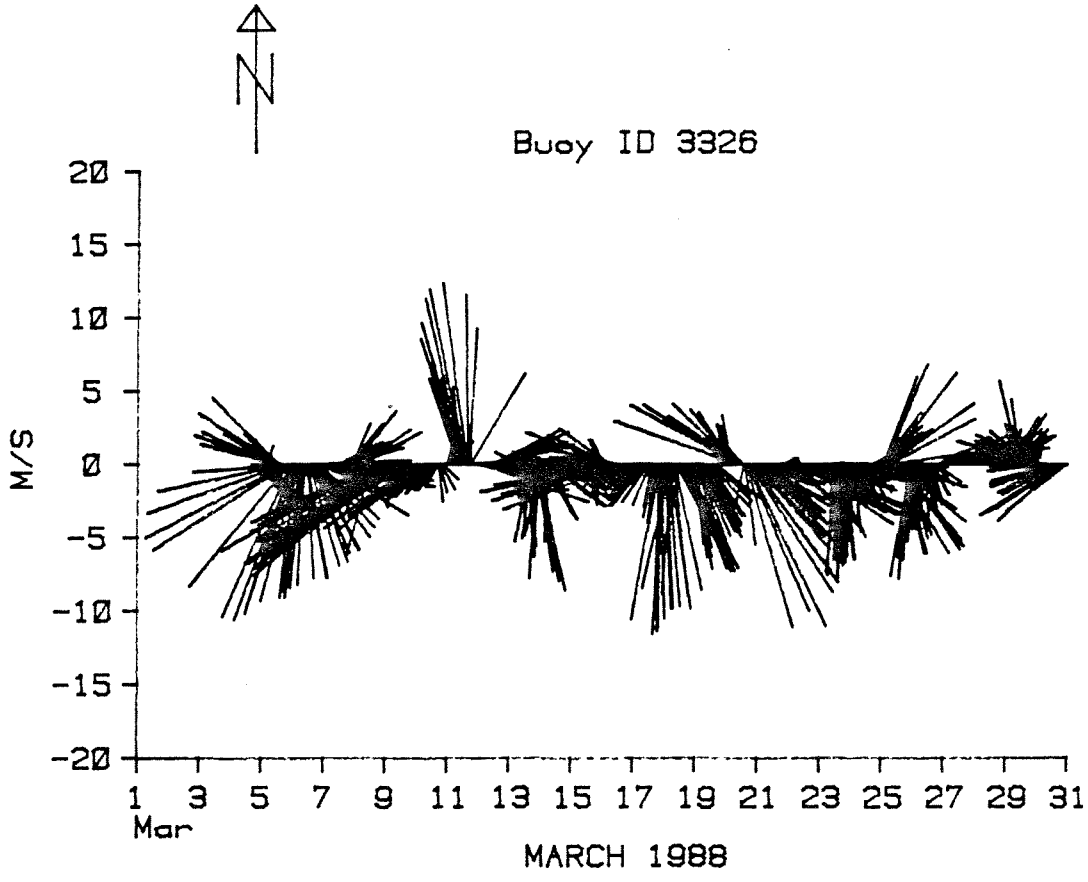

SURFACE DRIFTER # 8660 TRAJECTORY
24/03/89
25/03
29/03
02/04
06/04
10/04
14/04
OFF ICE: IN WATER
56
55
54
53
52
51
50
49
48
51
50
49

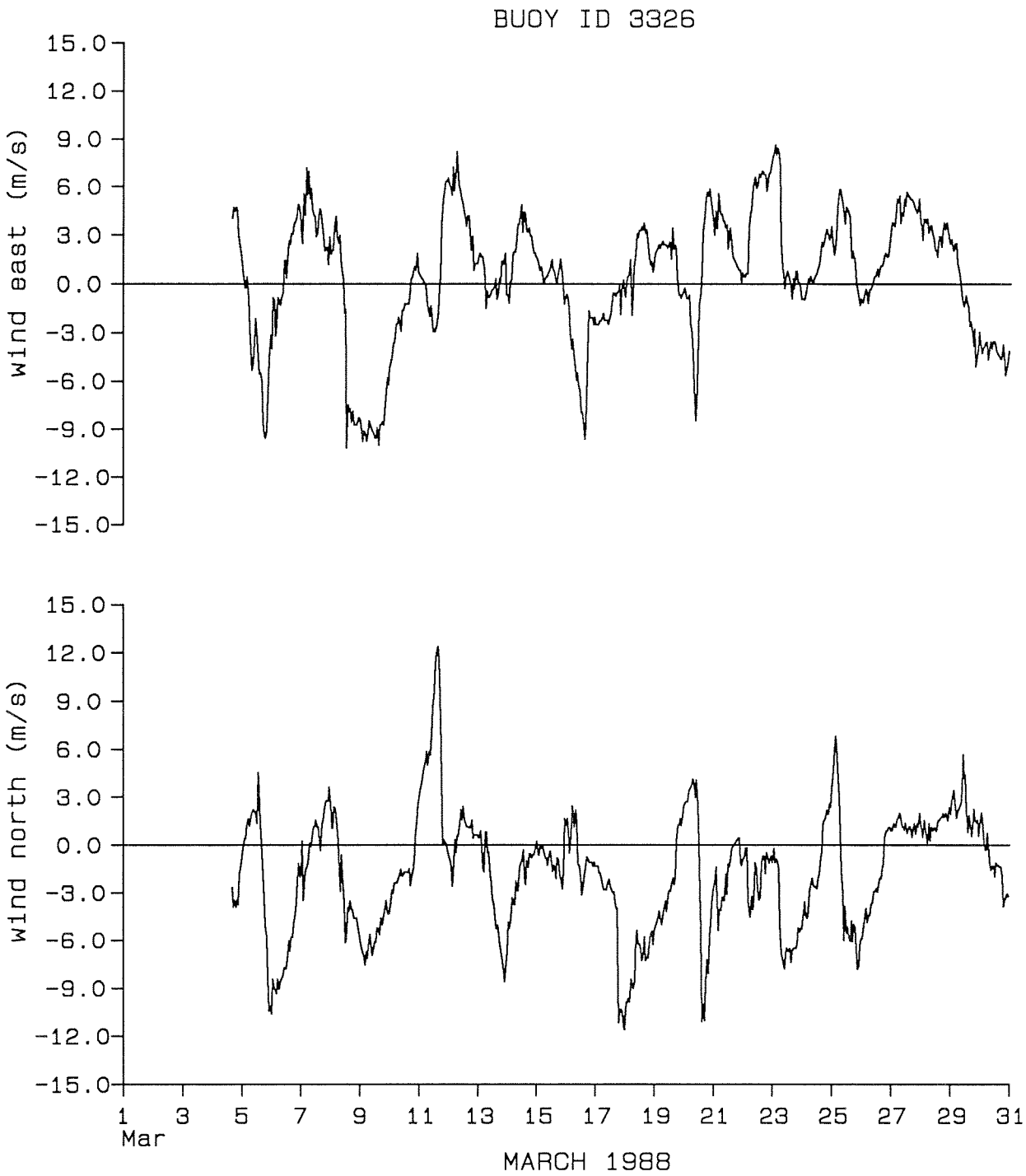

SURFACE DRIFTER # 8660 TRAJECTORY
OFF ICE: IN WATER
31/03/89
02/04
06/04
10/04
14/04
18/04
22/04
26/04
30/04
52
51
50
49
48
47
46
45
50
49
48
47

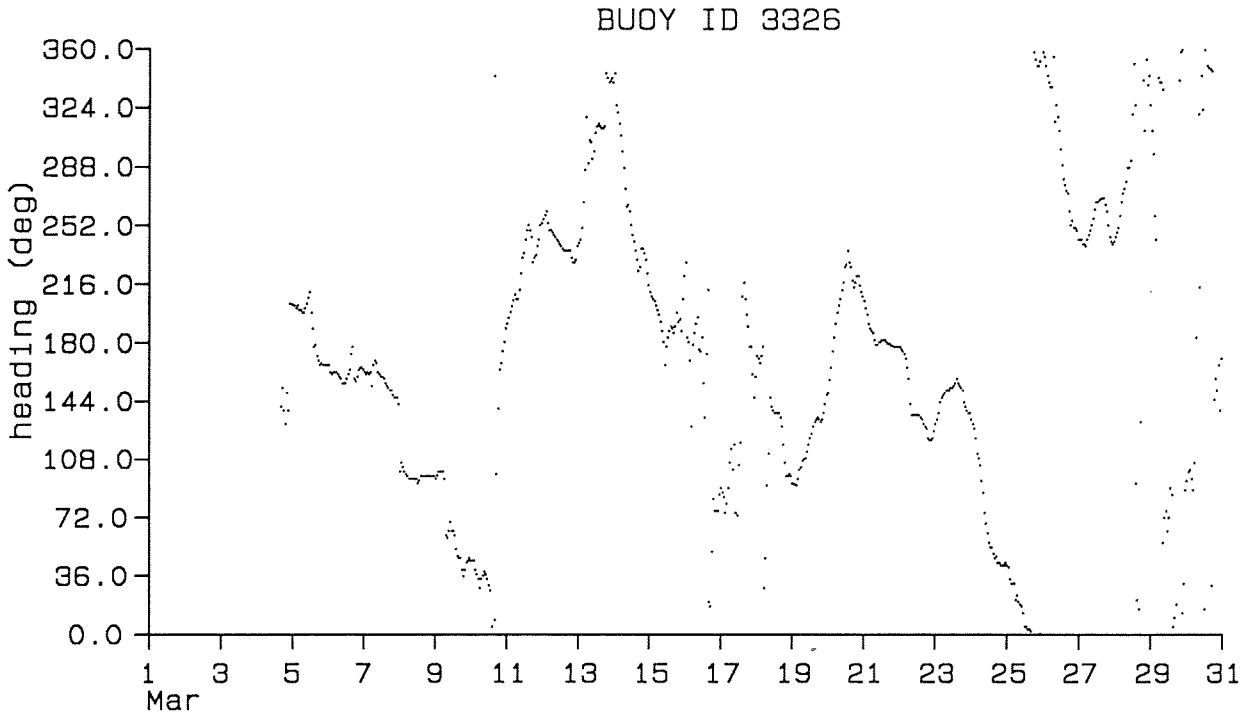

BUOY ID 8660
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
1
4
7
10
13
16
19
22
25
28
31
Mar
MARCH 1989

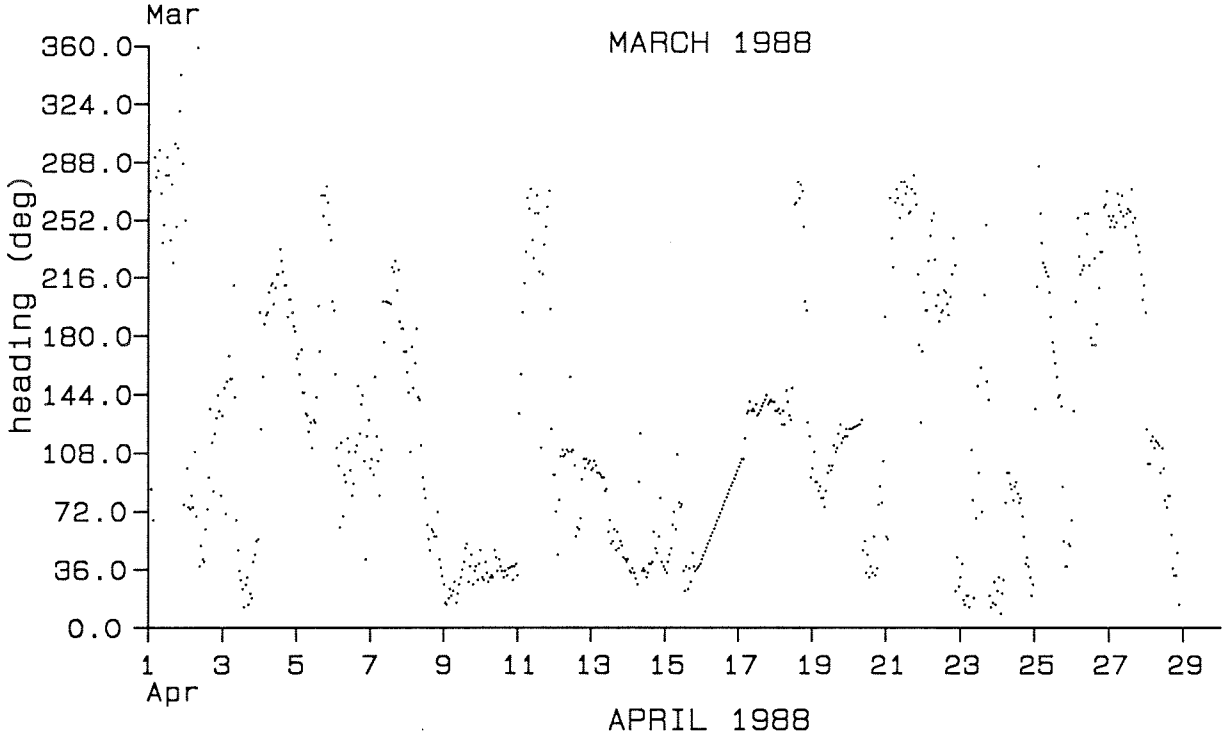

BUOY ID 8660
DIRECTION
360
270
180
90
0
SPEED (KM/DAY)
100
80
60
40
20
0
E-W COMP (KM/DAY)
100
50
0
-50
-100
N-S COMP (KM/DAY)
100
50
0
-50
-100
OFF ICE: IN WATER
1
Apr
4
7
10
13
16
19
22
25
28
APRIL 1989

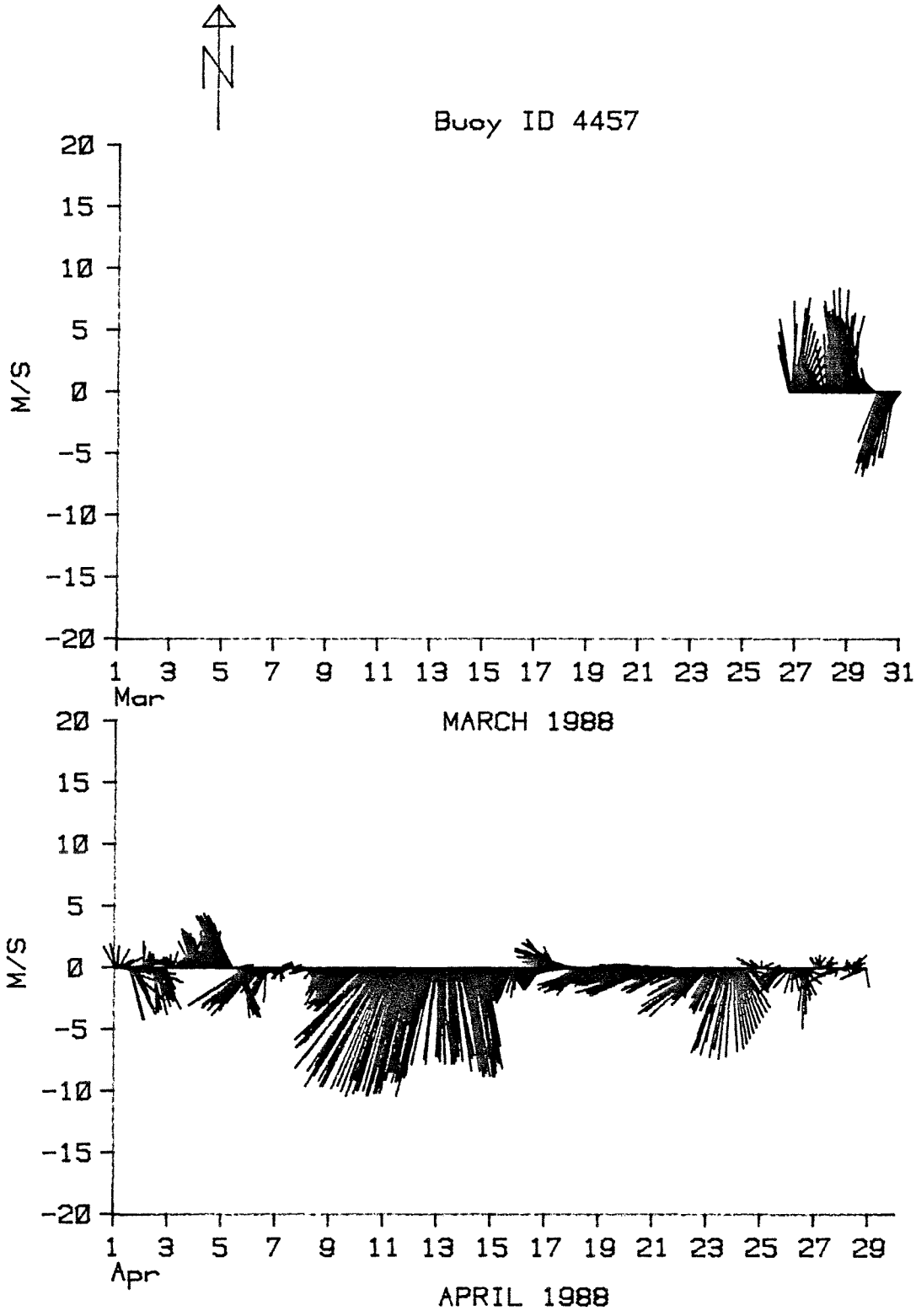
APPENDIX B

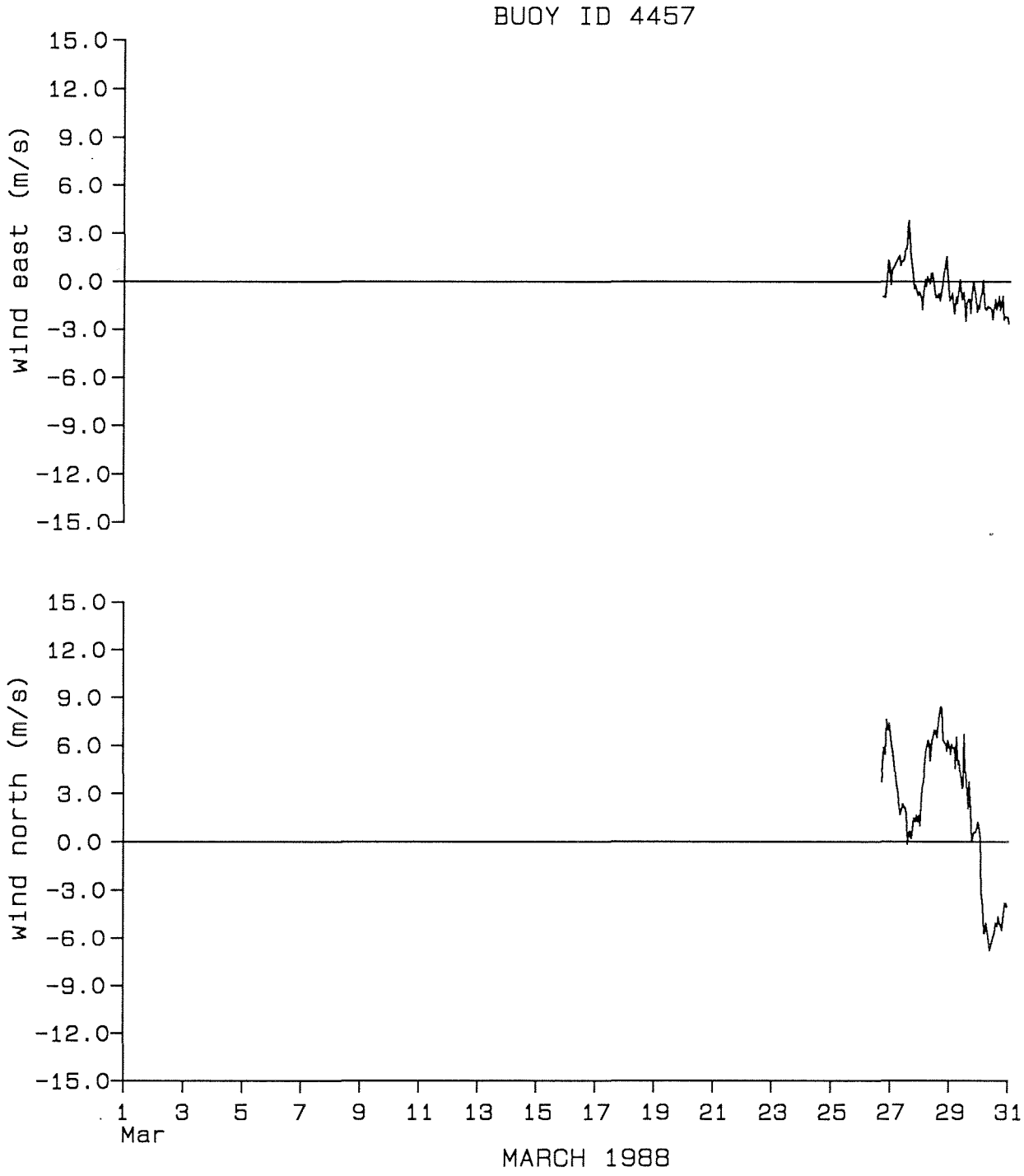

N
Buoy ID 3326
20
15
10
5
0
-5
-10
-15
-20
M/S
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
Mar
MARCH 1988

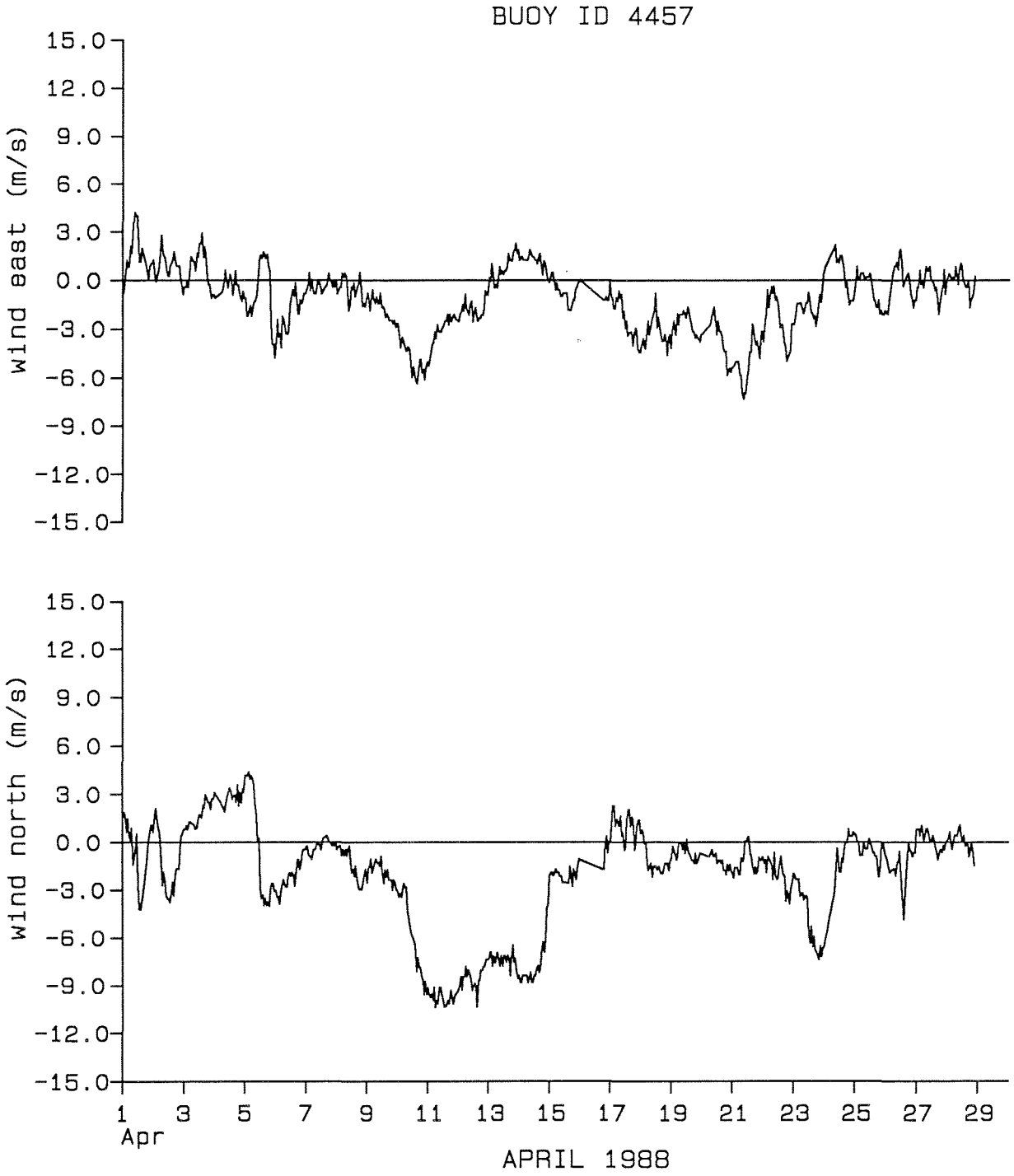

BUOY ID 3326
wind east (m/s)
15.0
12.0
9.0
6.0
3.0
0.0
-3.0
-6.0
-9.0
-12.0
-15.0
wind north (m/s)
15.0
12.0
9.0
6.0
3.0
0.0
-3.0
-6.0
-9.0
-12.0
-15.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1988

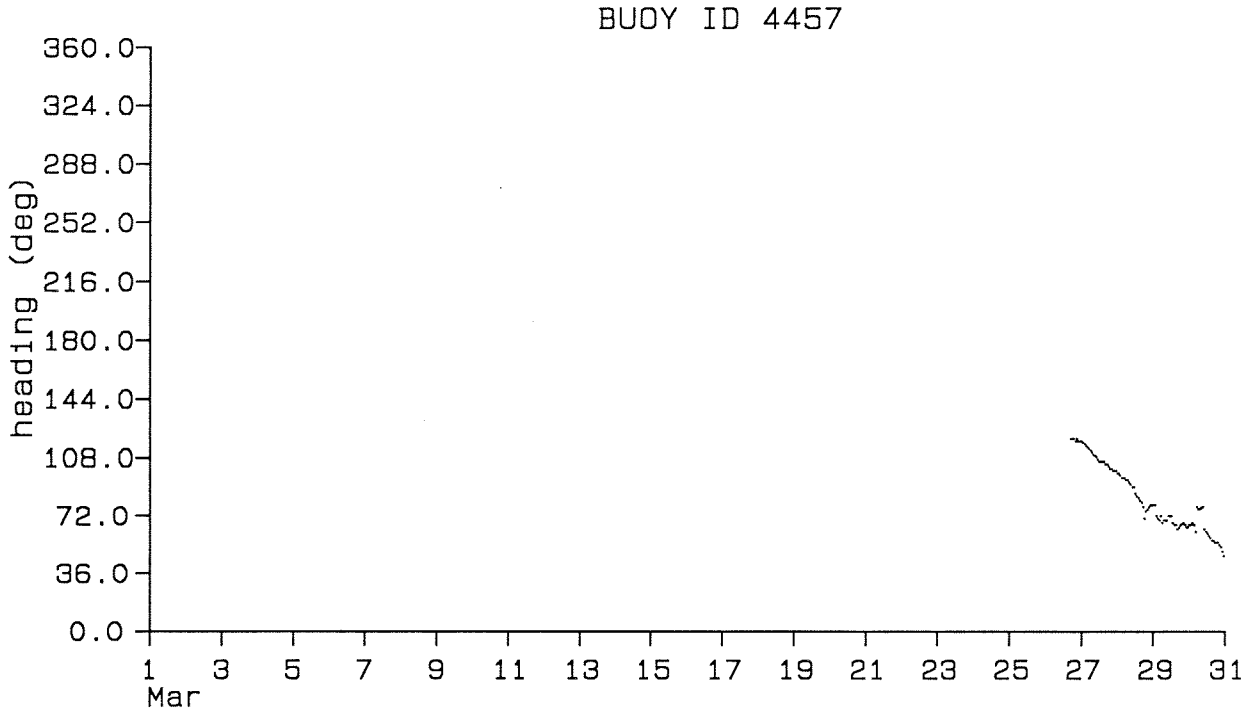

BUOY ID 3326
heading (deg)
360.0
324.0
288.0
252.0
216.0
180.0
144.0
108.0
72.0
36.0
0.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1988

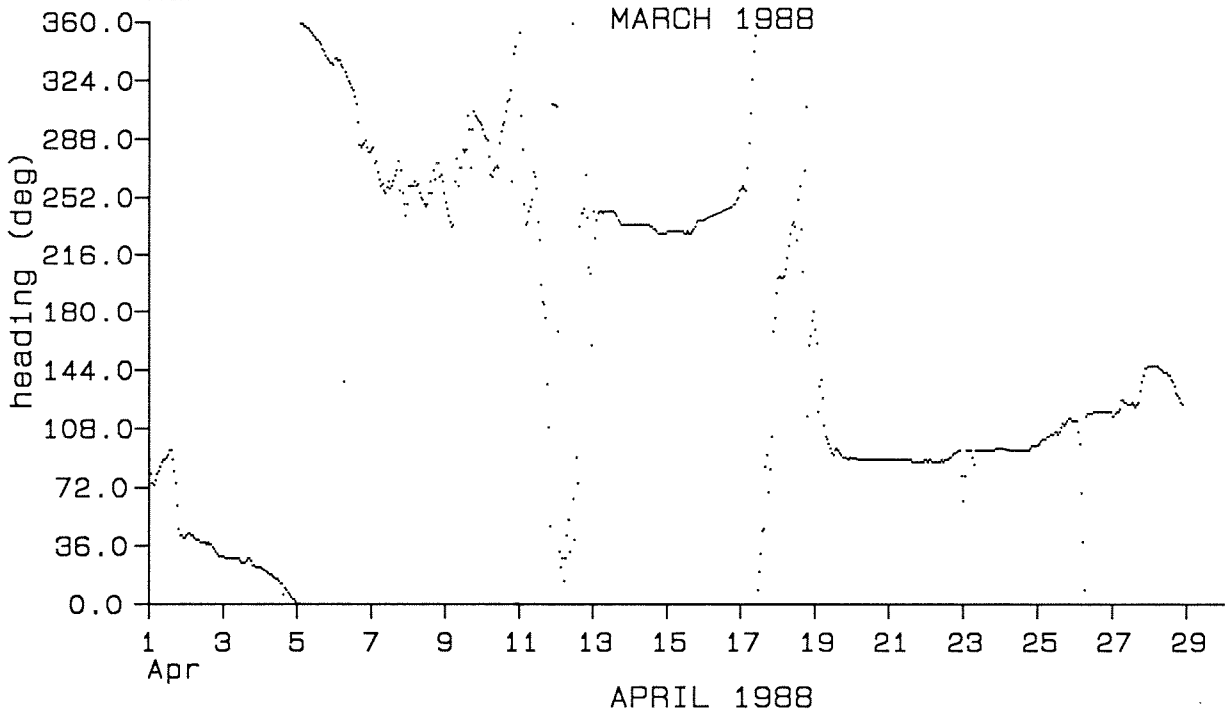

heading (deg)
360.0
324.0
288.0
252.0
216.0
180.0
144.0
108.0
72.0
36.0
0.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1988

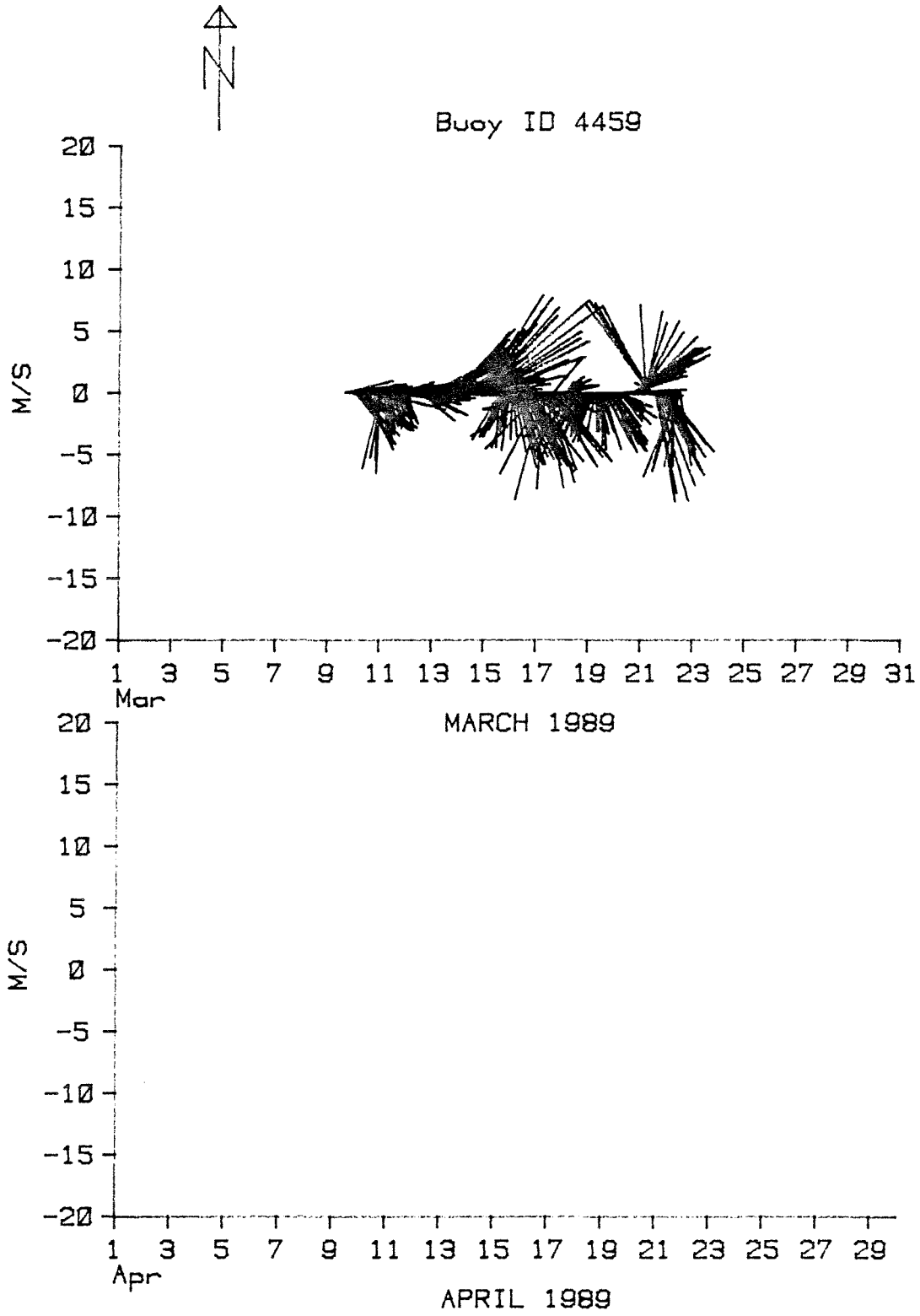

N
Buoy ID 4457
20
15
10
5
0
-5
-10
-15
-20
M/S
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1988
20
15
10
5
0
-5
-10
-15
-20
M/S
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1988

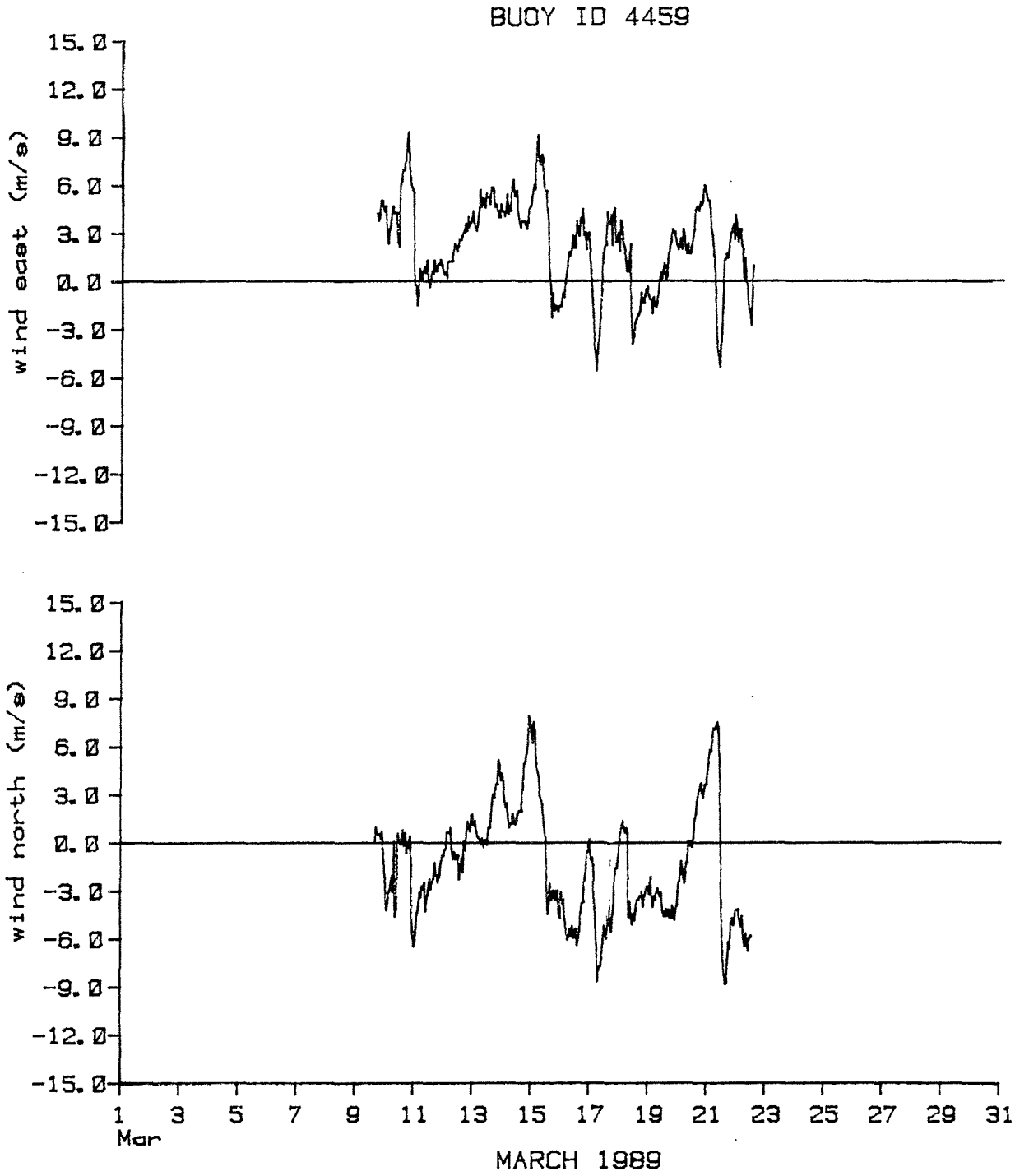

BUOY ID 4457
wind east (m/s)
15.0
12.0
9.0
6.0
3.0
0.0
-3.0
-6.0
-9.0
-12.0
-15.0
wind north (m/s)
15.0
12.0
9.0
6.0
3.0
0.0
-3.0
-6.0
-9.0
-12.0
-15.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1988

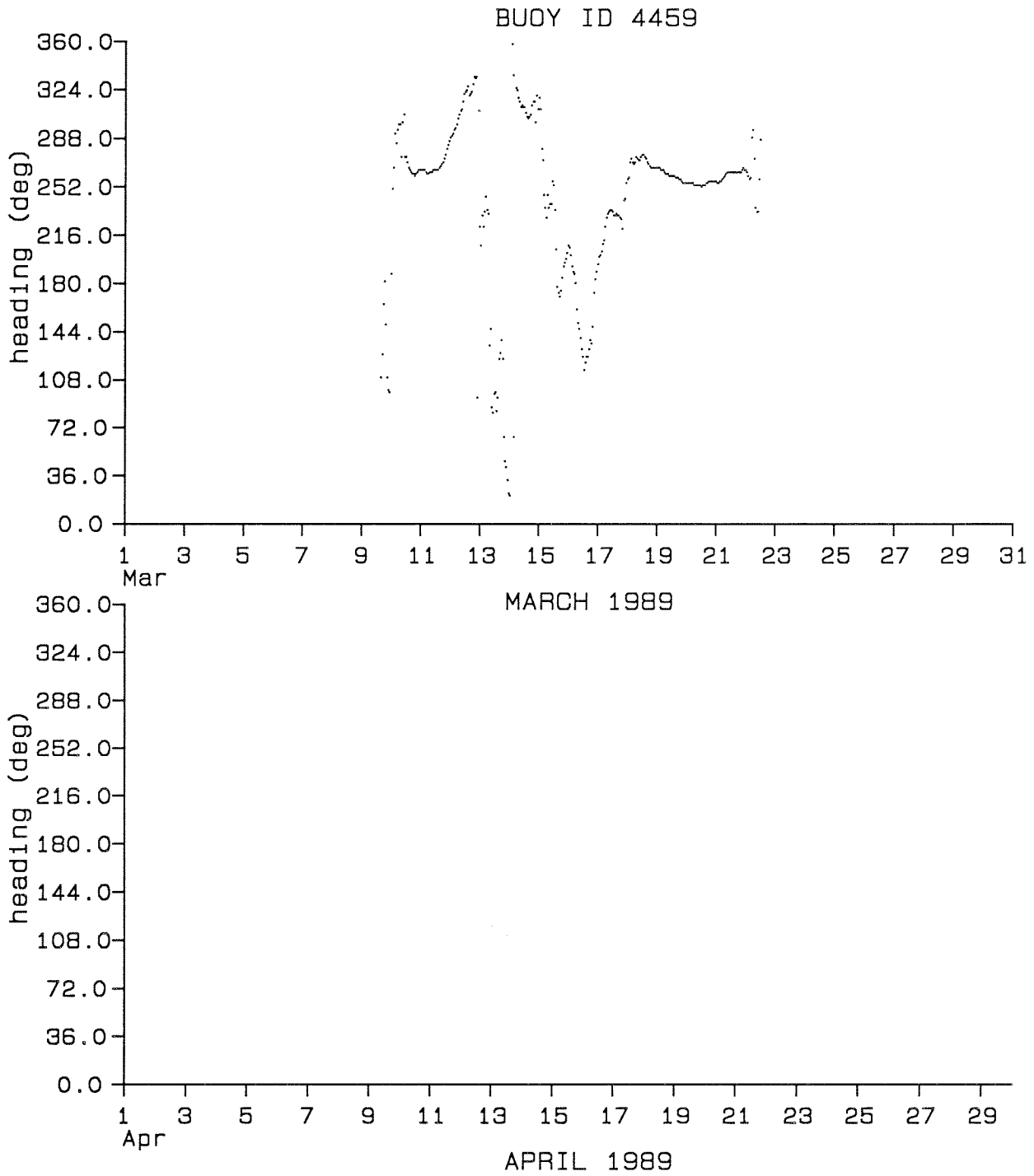

BUOY ID 4457
wind east (m/s)
15.0
12.0
9.0
6.0
3.0
0.0
-3.0
-6.0
-9.0
-12.0
-15.0
wind north (m/s)
15.0
12.0
9.0
6.0
3.0
0.0
-3.0
-6.0
-9.0
-12.0
-15.0
1 Apr
3
5
7
9
11
13
15
17
19
21
23
25
27
29
APRIL 1988

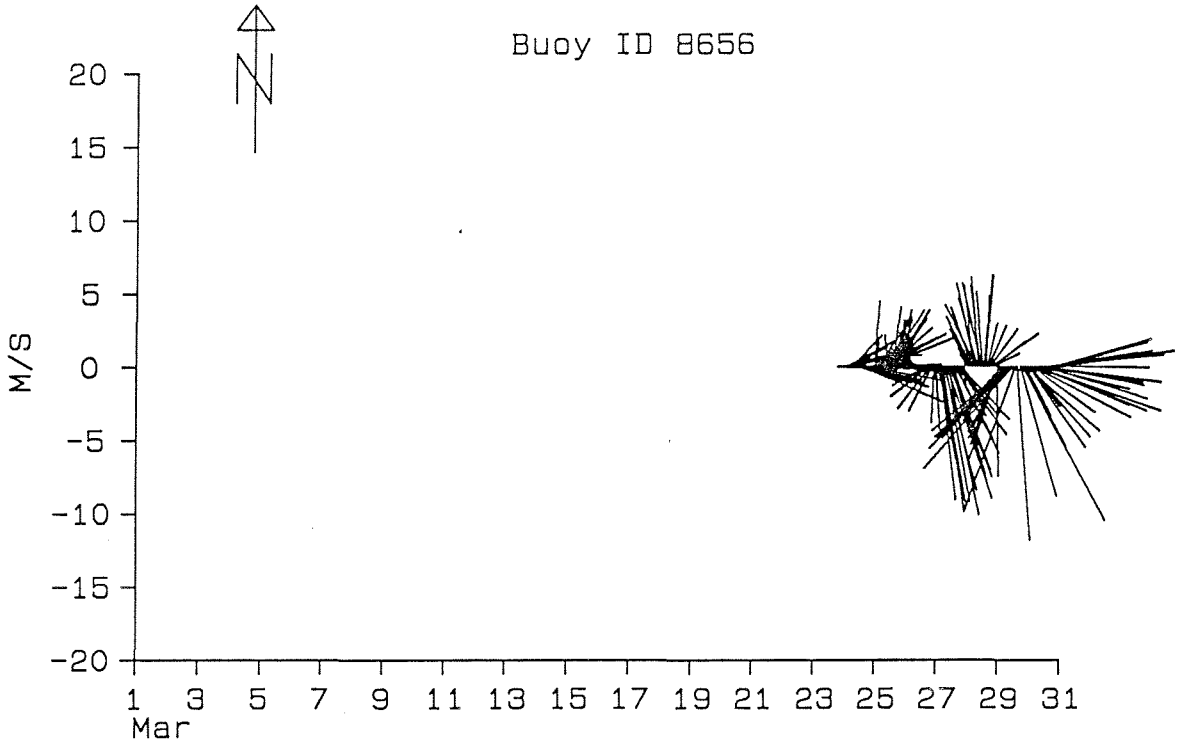

BUOY ID 4457
heading (deg)
360.0
324.0
288.0
252.0
216.0
180.0
144.0
108.0
72.0
36.0
0.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1988

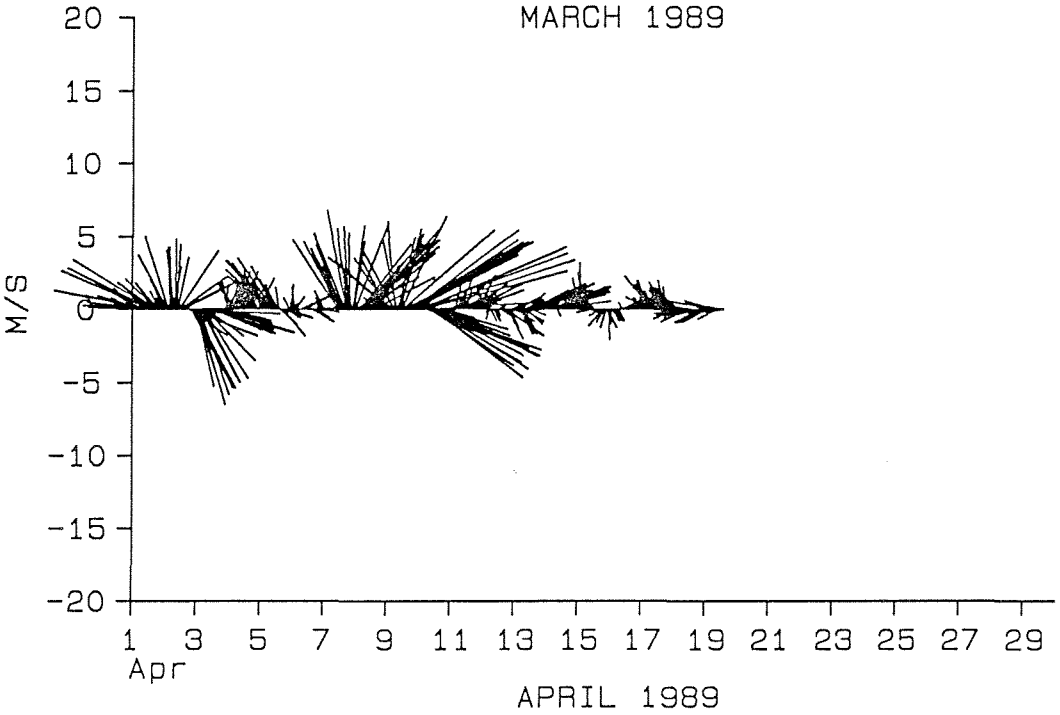

heading (deg)
360.0
324.0
288.0
252.0
216.0
180.0
144.0
108.0
72.0
36.0
0.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1988

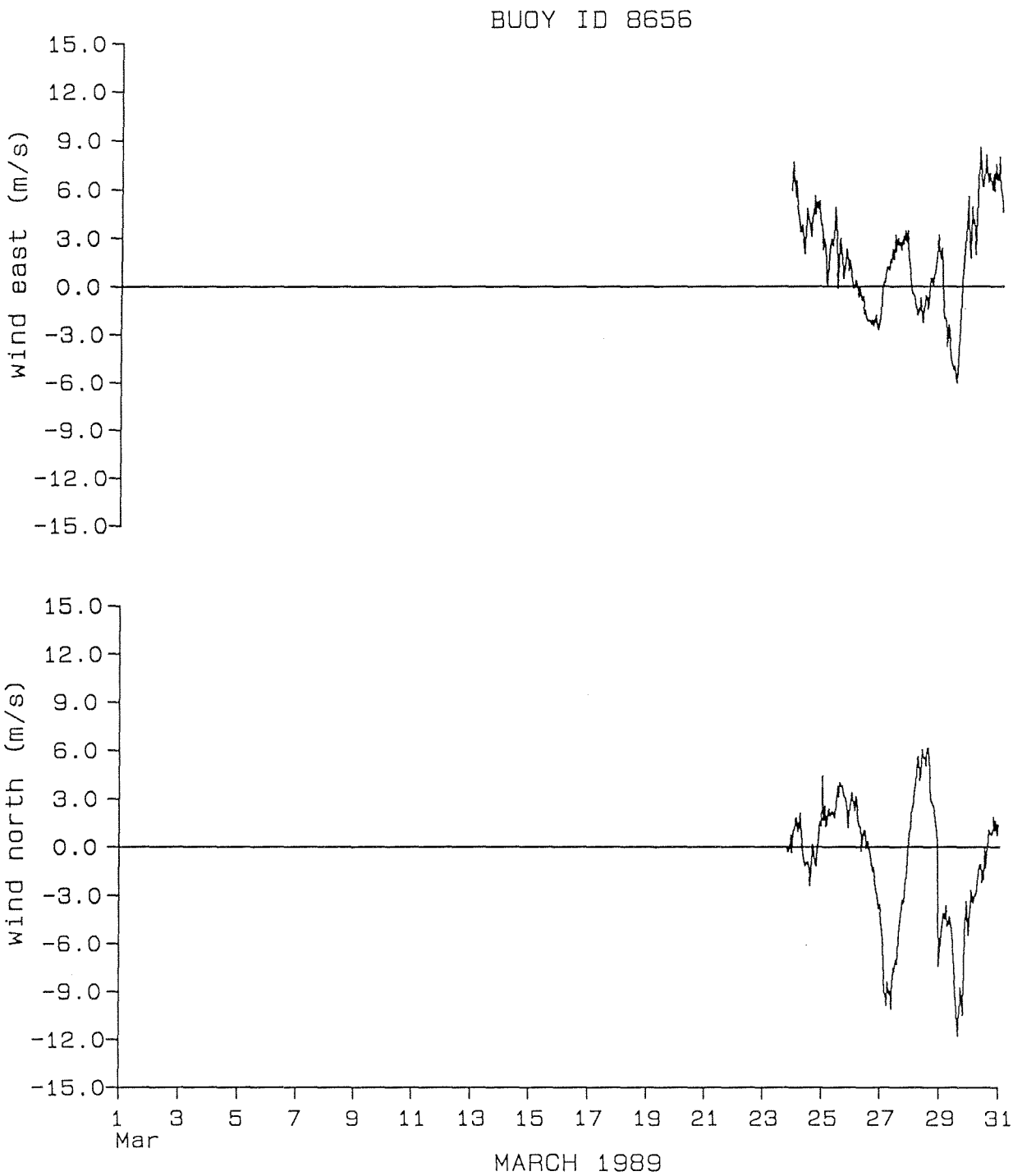

N
Buoy ID 4459
20
15
10
5
0
-5
-10
-15
-20
M/S
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1989
20
15
10
5
0
-5
-10
-15
-20
M/S
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1989

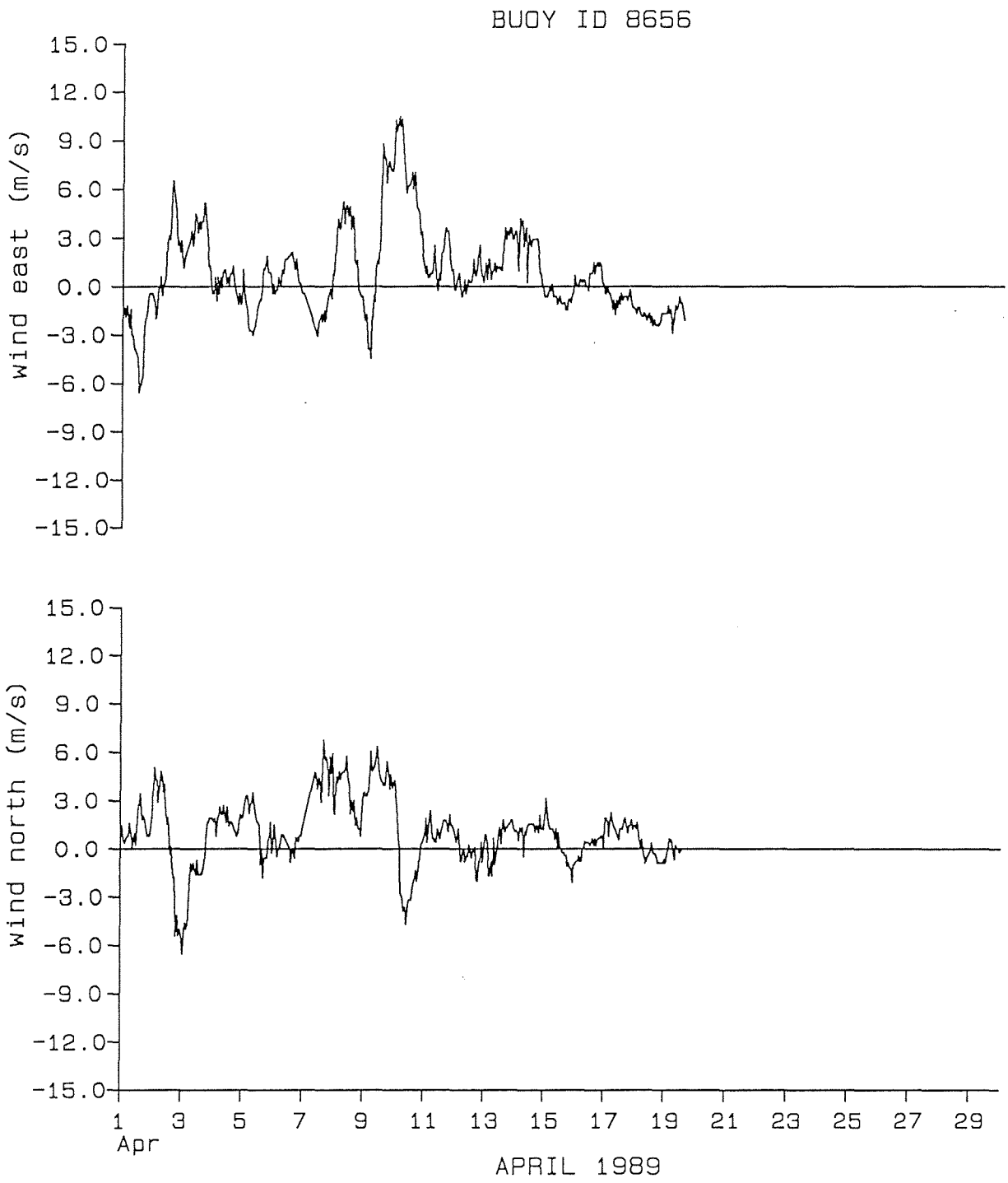

BUOY ID 4459
wind east (m/s)
15.0
12.0
9.0
6.0
3.0
0.0
-3.0
-6.0
-9.0
-12.0
-15.0
wind north (m/s)
15.0
12.0
9.0
6.0
3.0
0.0
-3.0
-6.0
-9.0
-12.0
-15.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1989

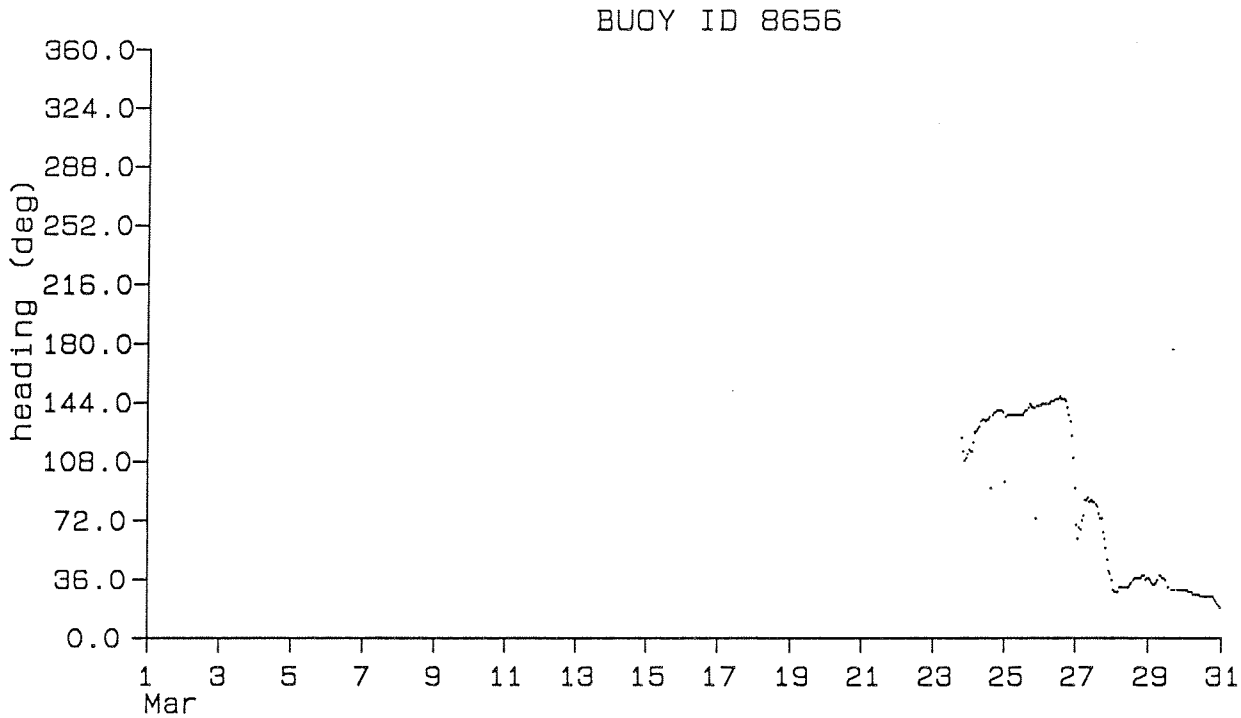

BUOY ID 4459
heading (deg)
360.0
324.0
288.0
252.0
216.0
180.0
144.0
108.0
72.0
36.0
0.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1989
heading (deg)
360.0
324.0
288.0
252.0
216.0
180.0
144.0
108.0
72.0
36.0
0.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1989

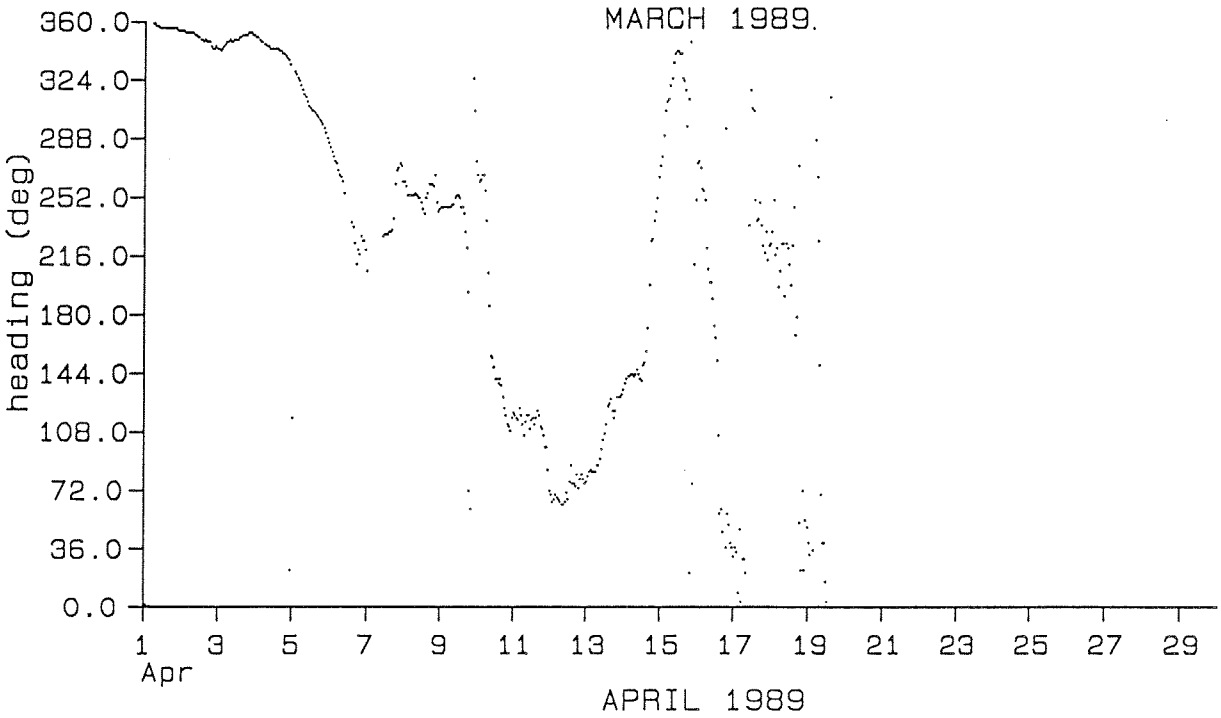

Buoy ID 8656
N
M/S
20
15
10
5
0
-5
-10
-15
-20
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1989


M/S
20
15
10
5
0
-5
-10
-15
-20
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1989

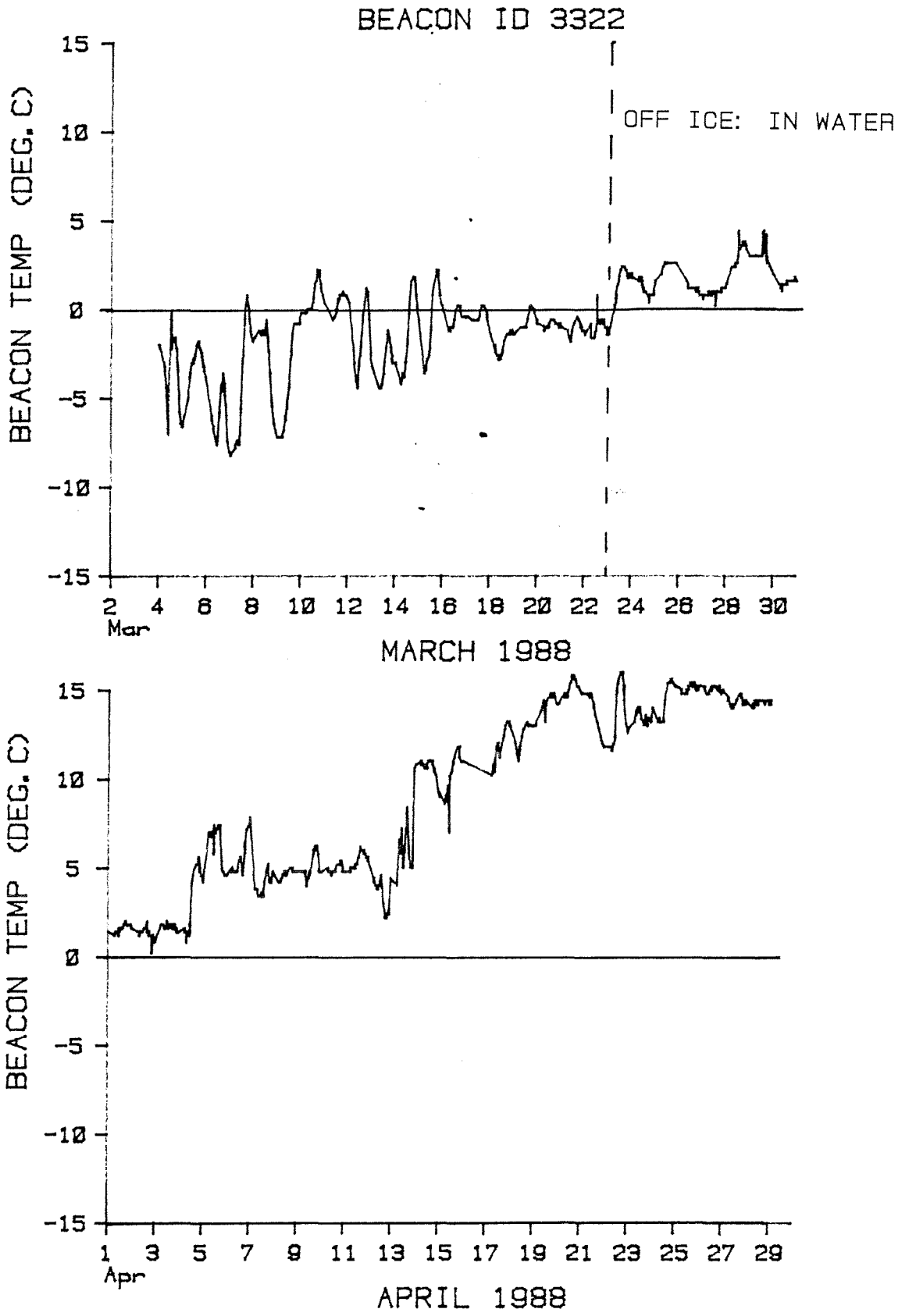

BUOY ID 8656
wind east (m/s)
15.0
12.0
9.0
6.0
3.0
0.0
-3.0
-6.0
-9.0
-12.0
-15.0
wind north (m/s)
15.0
12.0
9.0
6.0
3.0
0.0
-3.0
-6.0
-9.0
-12.0
-15.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1989

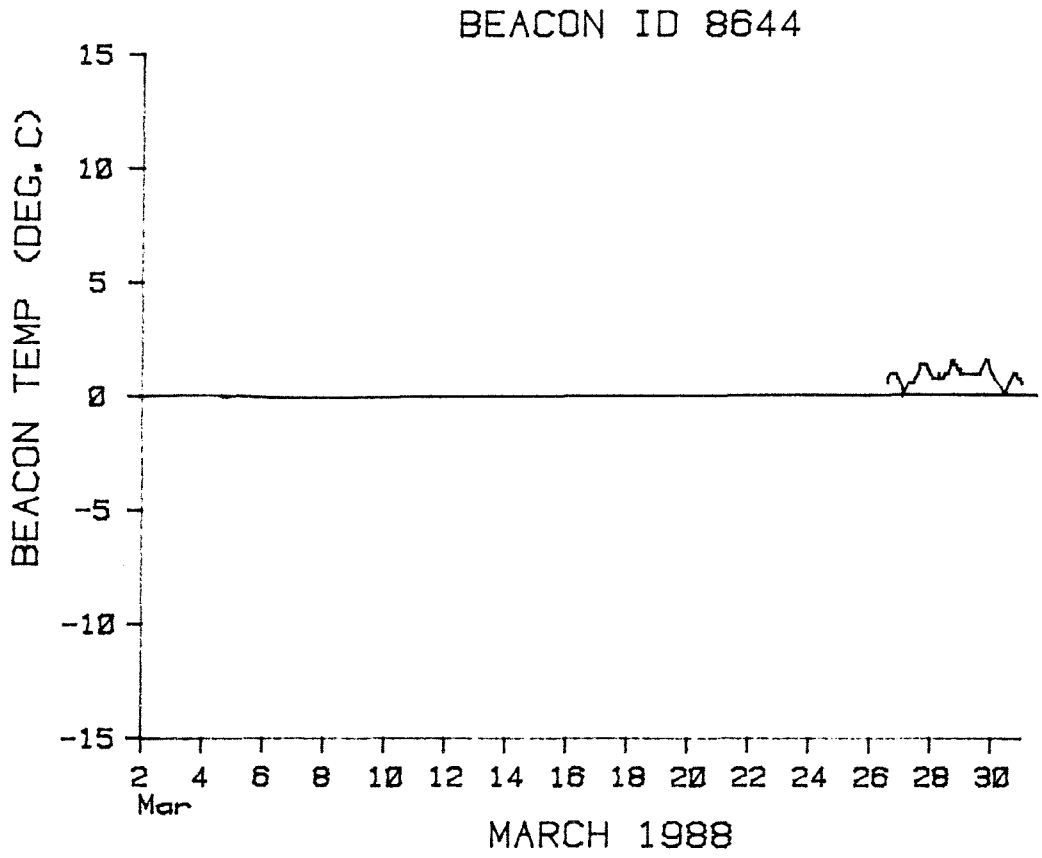

BUOY ID 8656
wind east (m/s)
15.0
12.0
9.0
6.0
3.0
0.0
-3.0
-6.0
-9.0
-12.0
-15.0
wind north (m/s)
15.0
12.0
9.0
6.0
3.0
0.0
-3.0
-6.0
-9.0
-12.0
-15.0
1
Apr
3
5
7
9
11
13
15
17
19
21
23
25
27
29
APRIL 1989

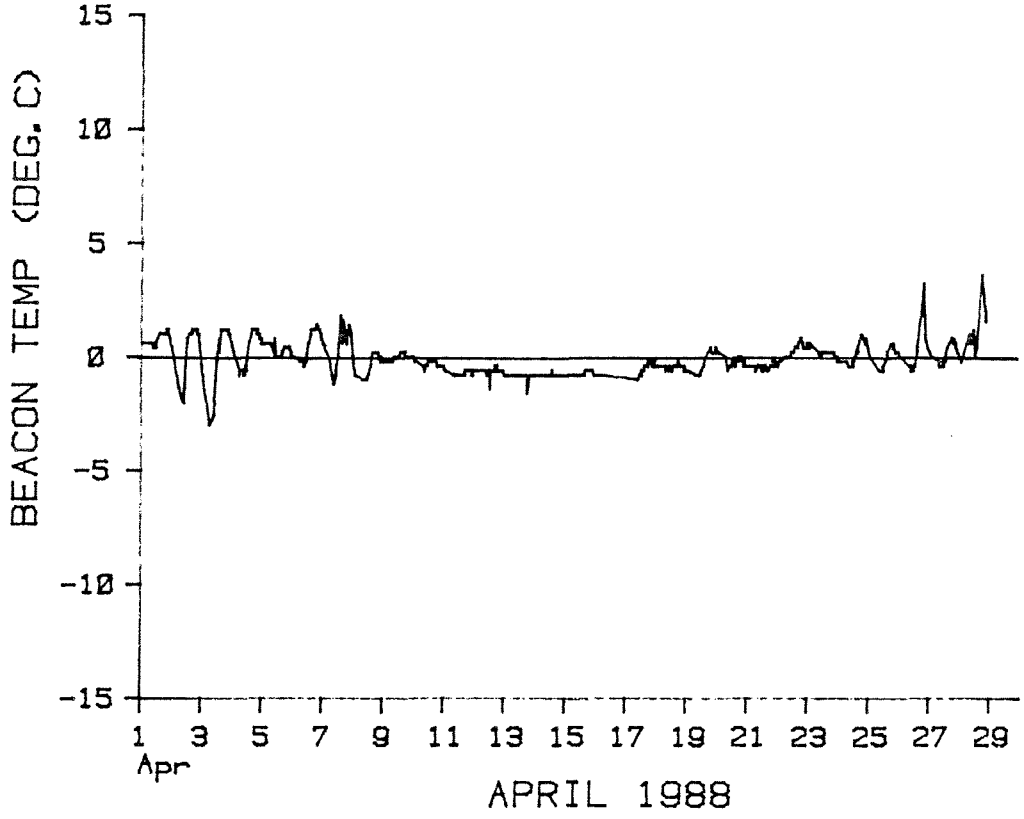

BUOY ID 8656
heading (deg)
360.0
324.0
288.0
252.0
216.0
180.0
144.0
108.0
72.0
36.0
0.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar

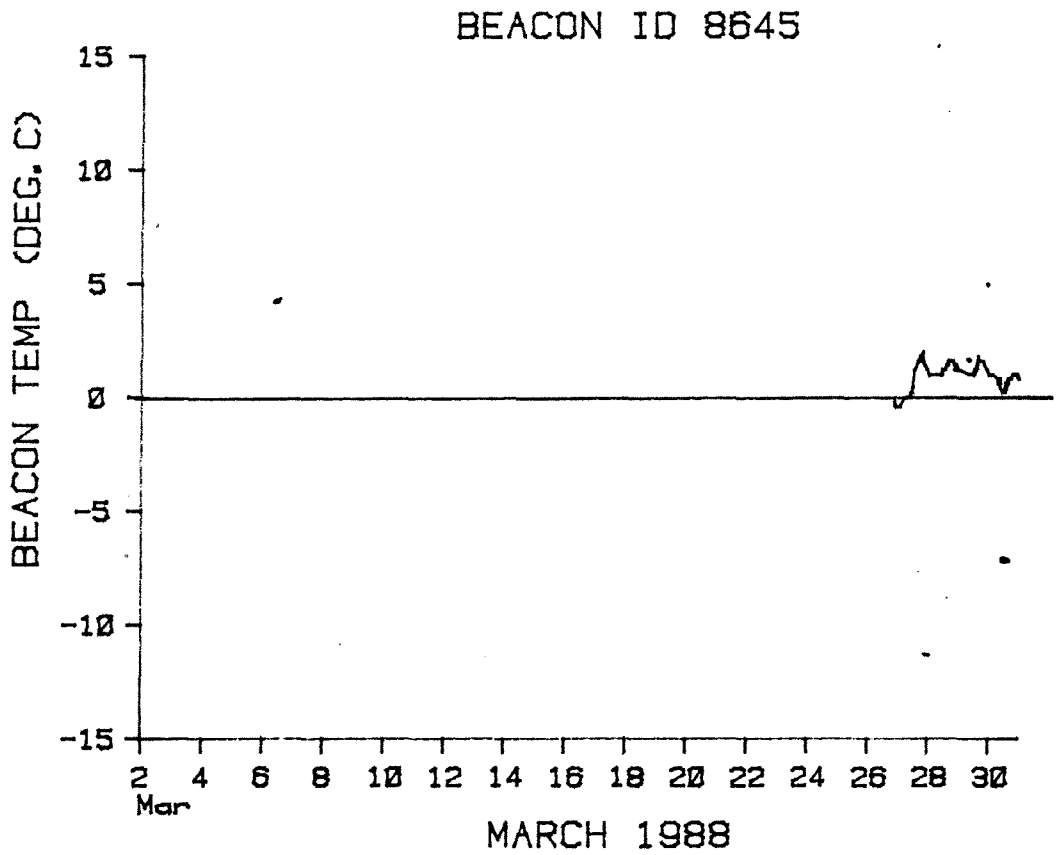

MARCH 1989.
heading (deg)
360.0
324.0
288.0
252.0
216.0
180.0
144.0
108.0
72.0
36.0
0.0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1989

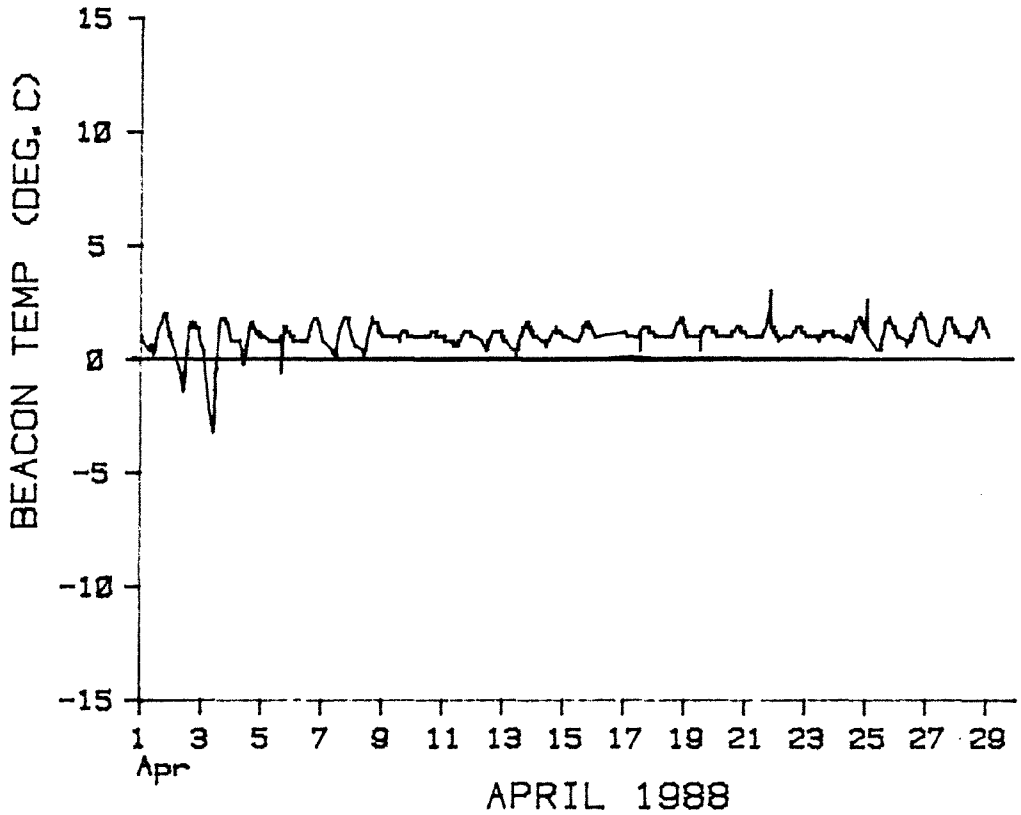
APPENDIX C

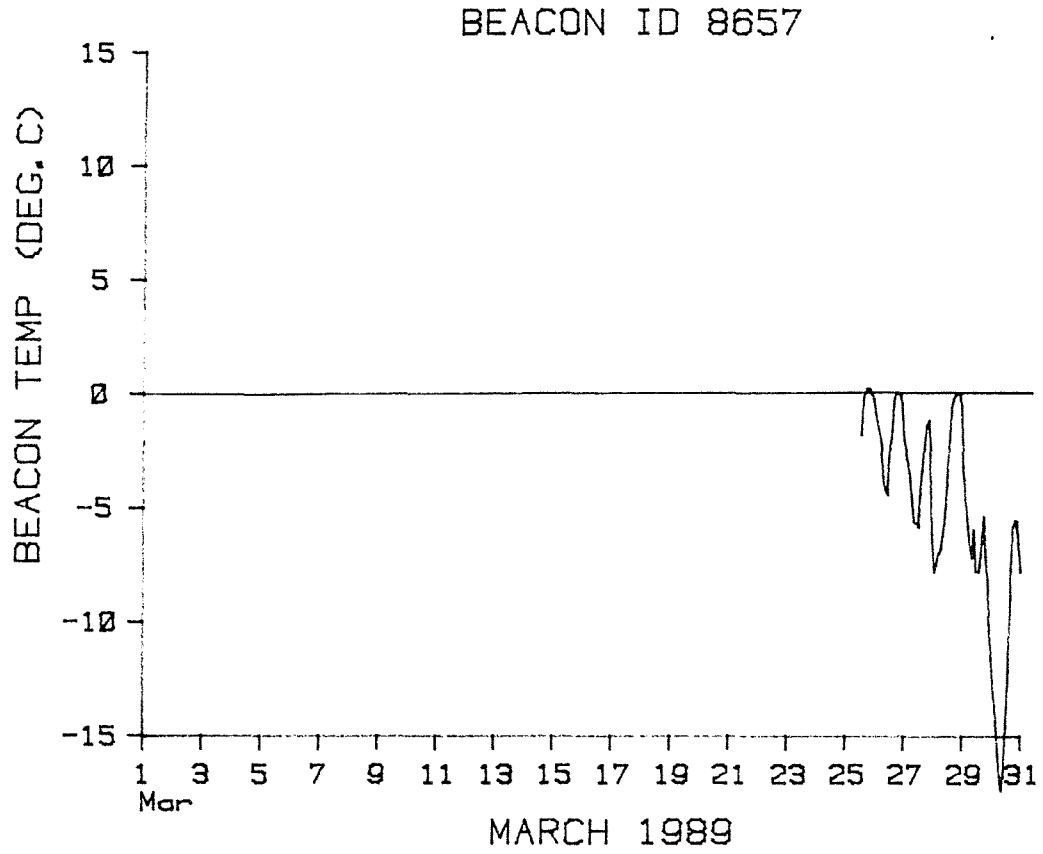

BEACON ID 3322
OFF ICE: IN WATER
BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Mar
MARCH 1988
BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1988

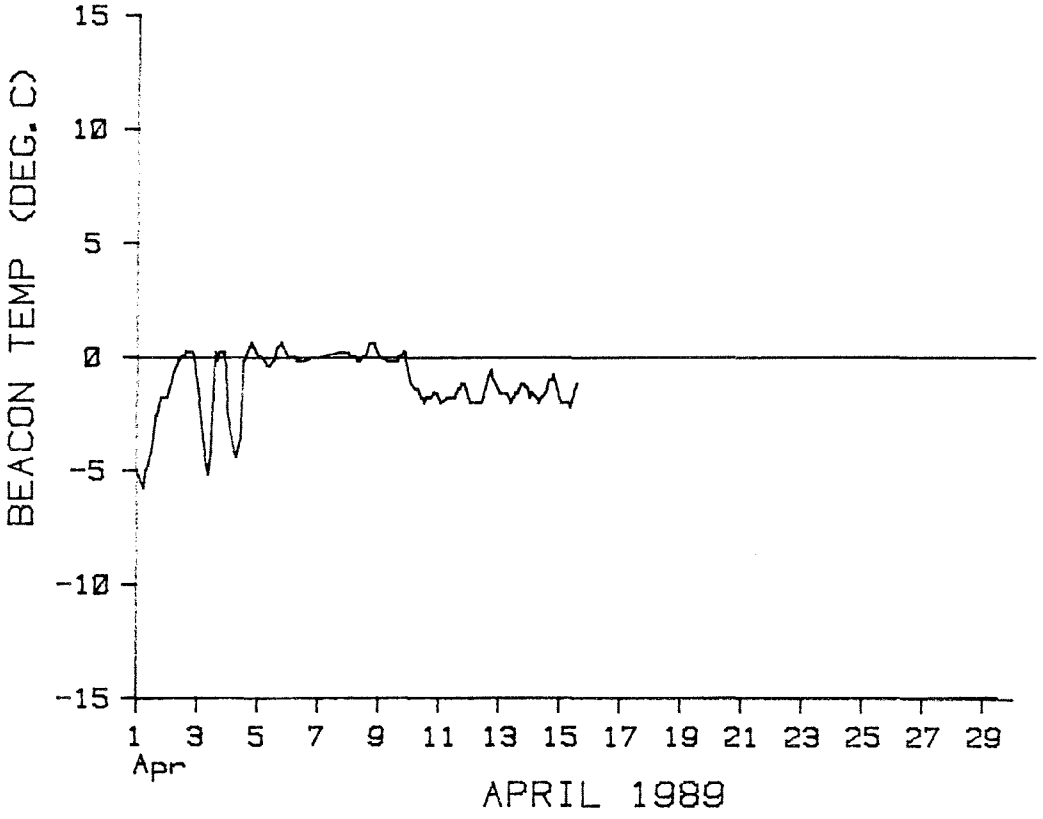

BEACON ID 8644
BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Mar
MARCH 1988

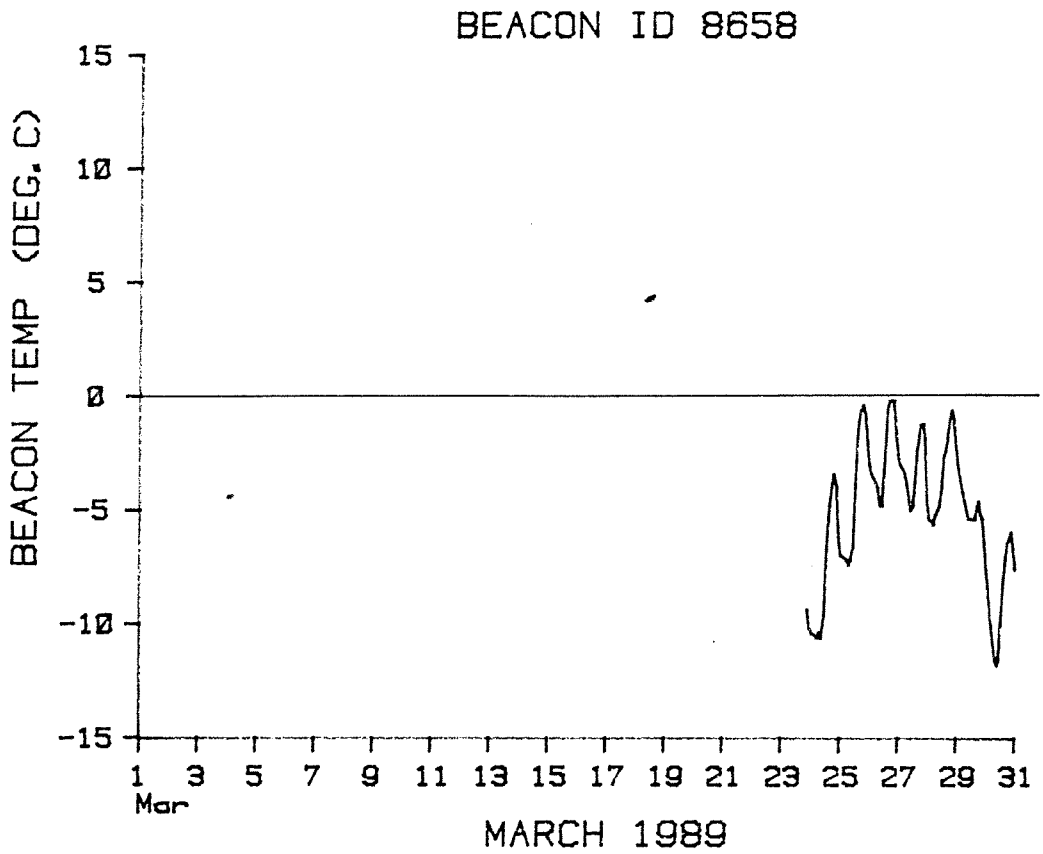

BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1988

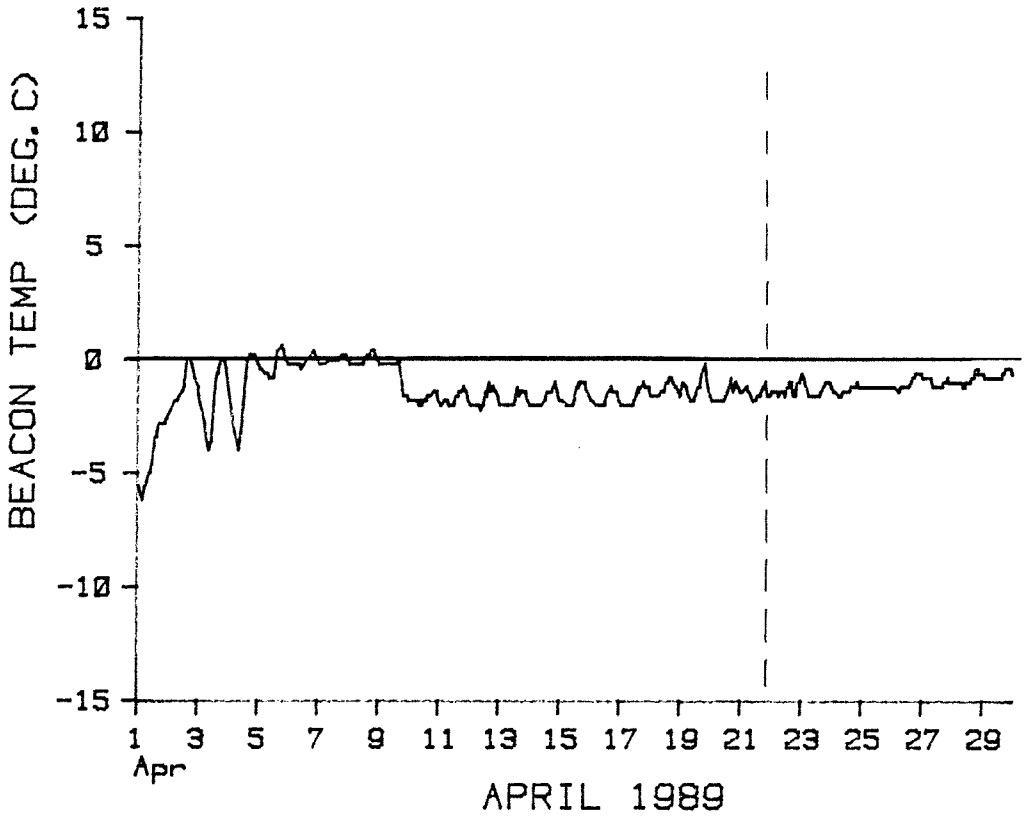

BEACON ID 8645
BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Mar
MARCH 1988

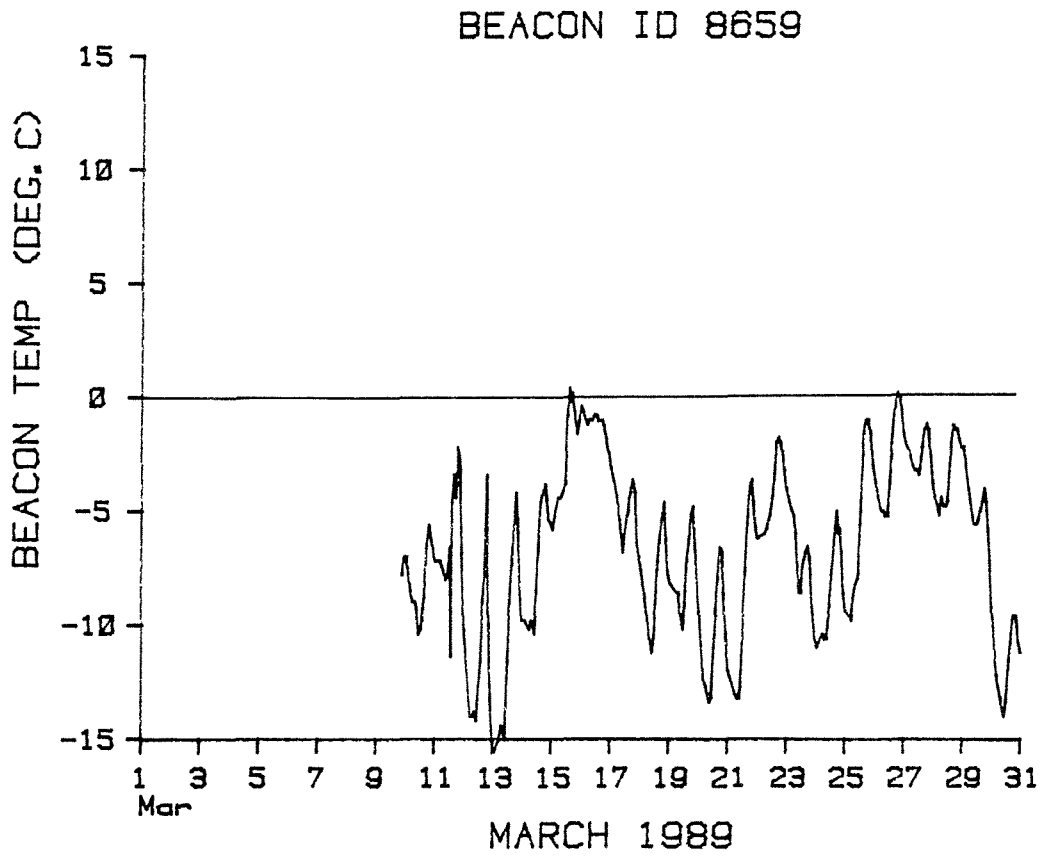

BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1988

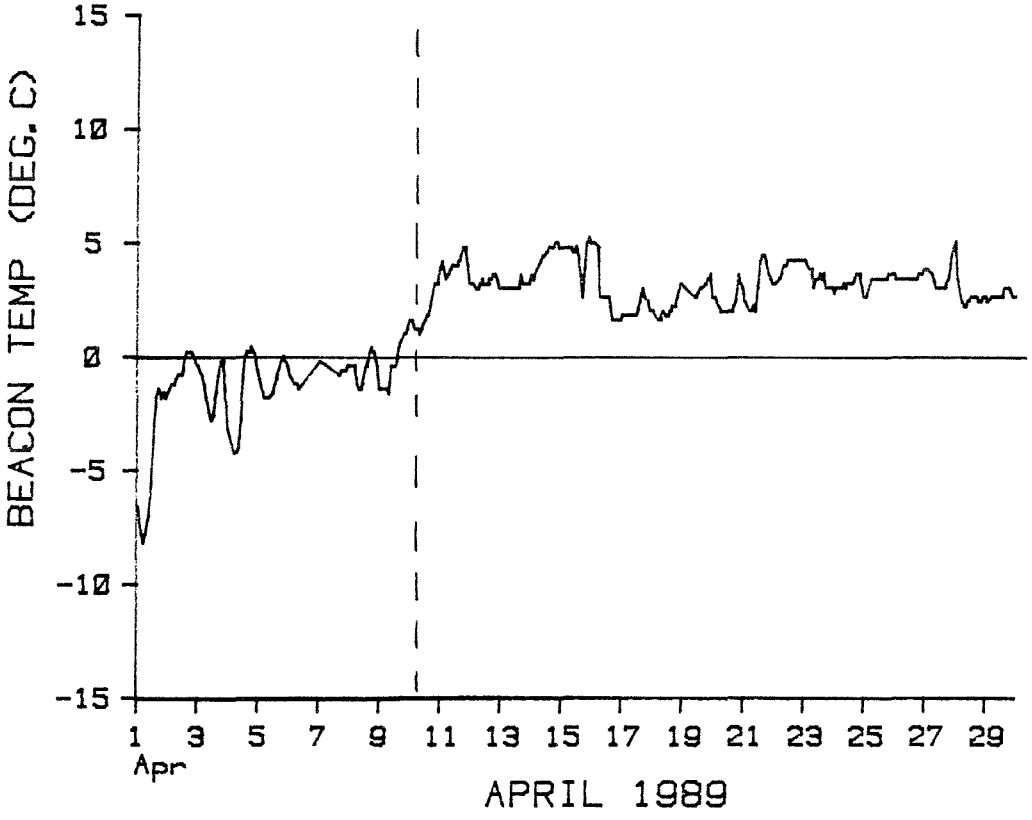

BEACON ID 8657
BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1989

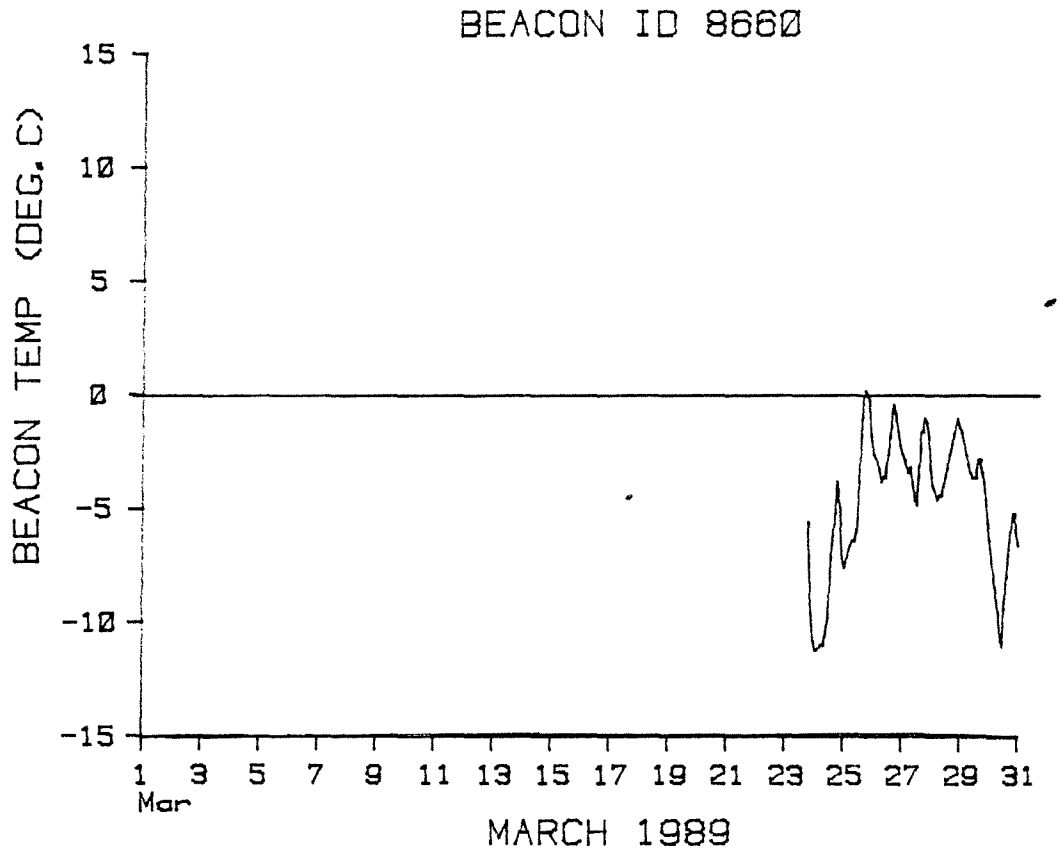

BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1989

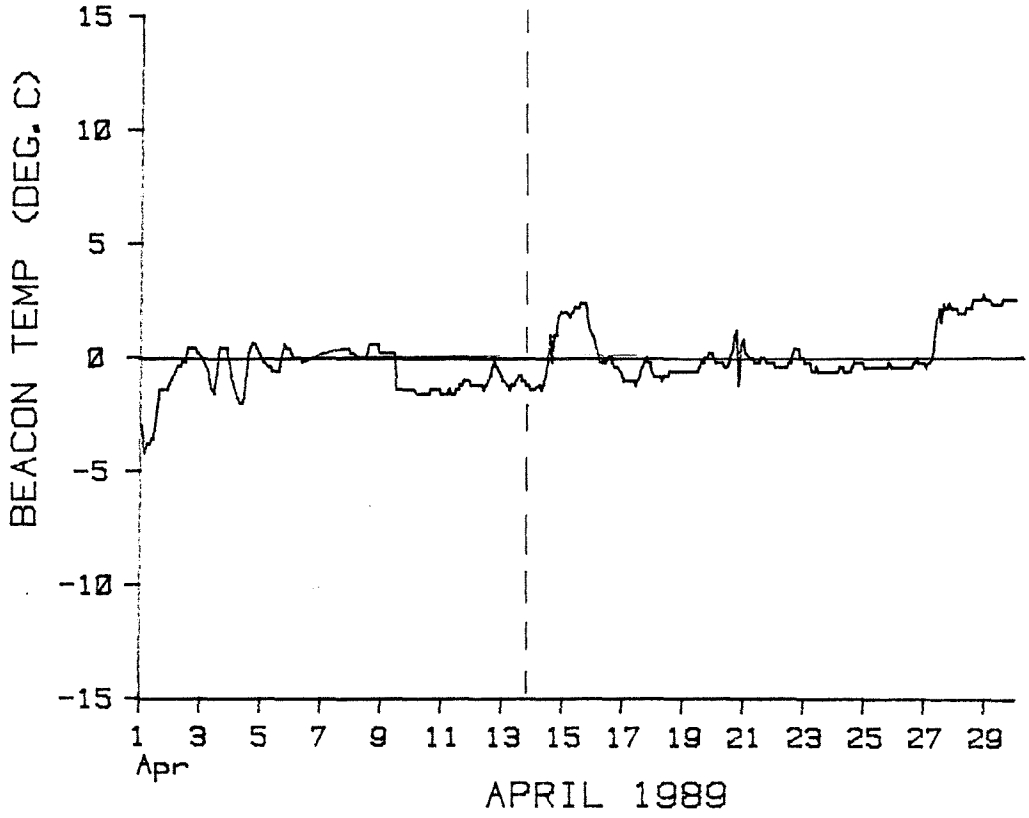

BEACON ID 8658
BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1989


BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1989

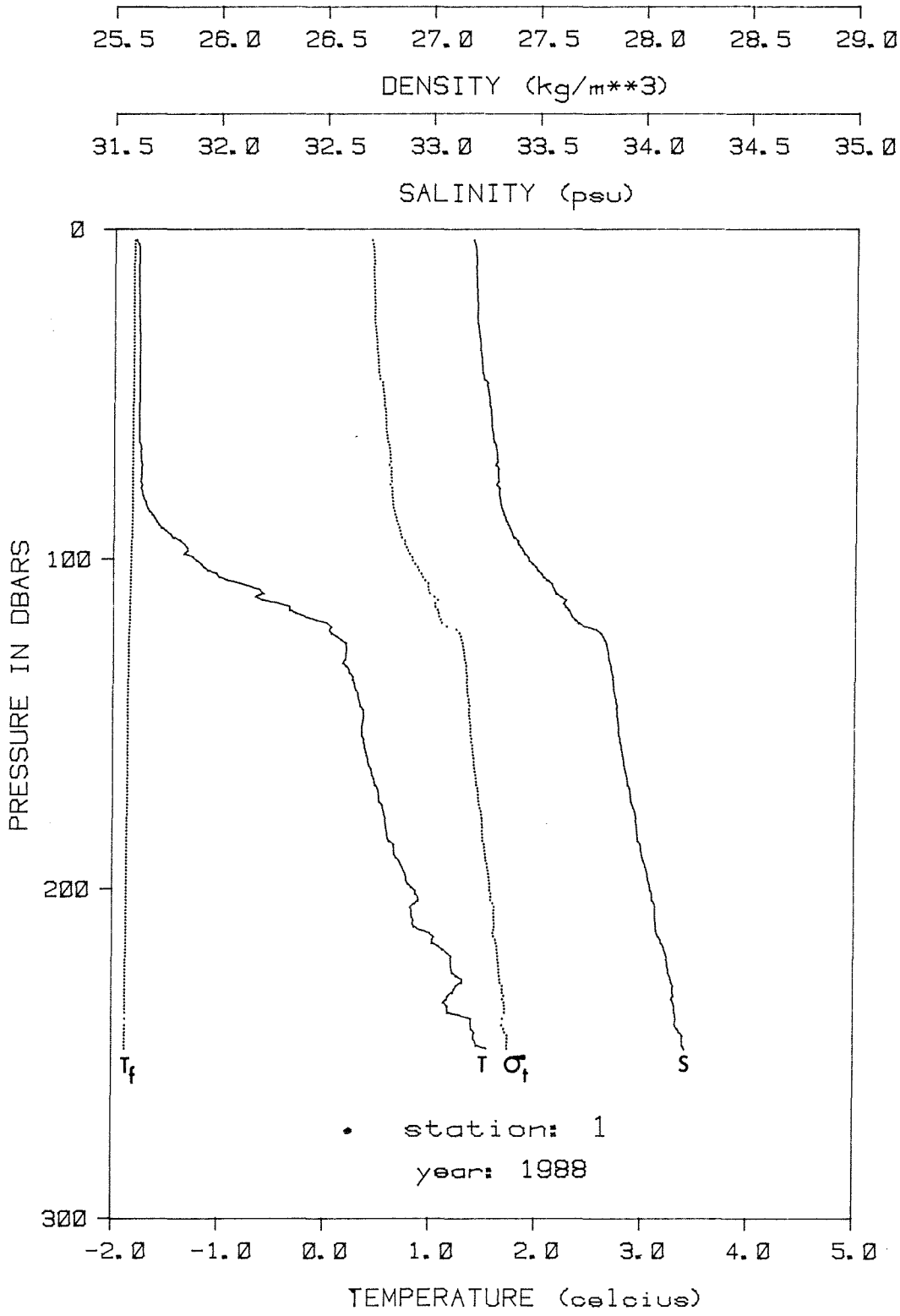

BEACON ID 8659
BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1989


BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1989


BEACON ID 8660
BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Mar
MARCH 1989

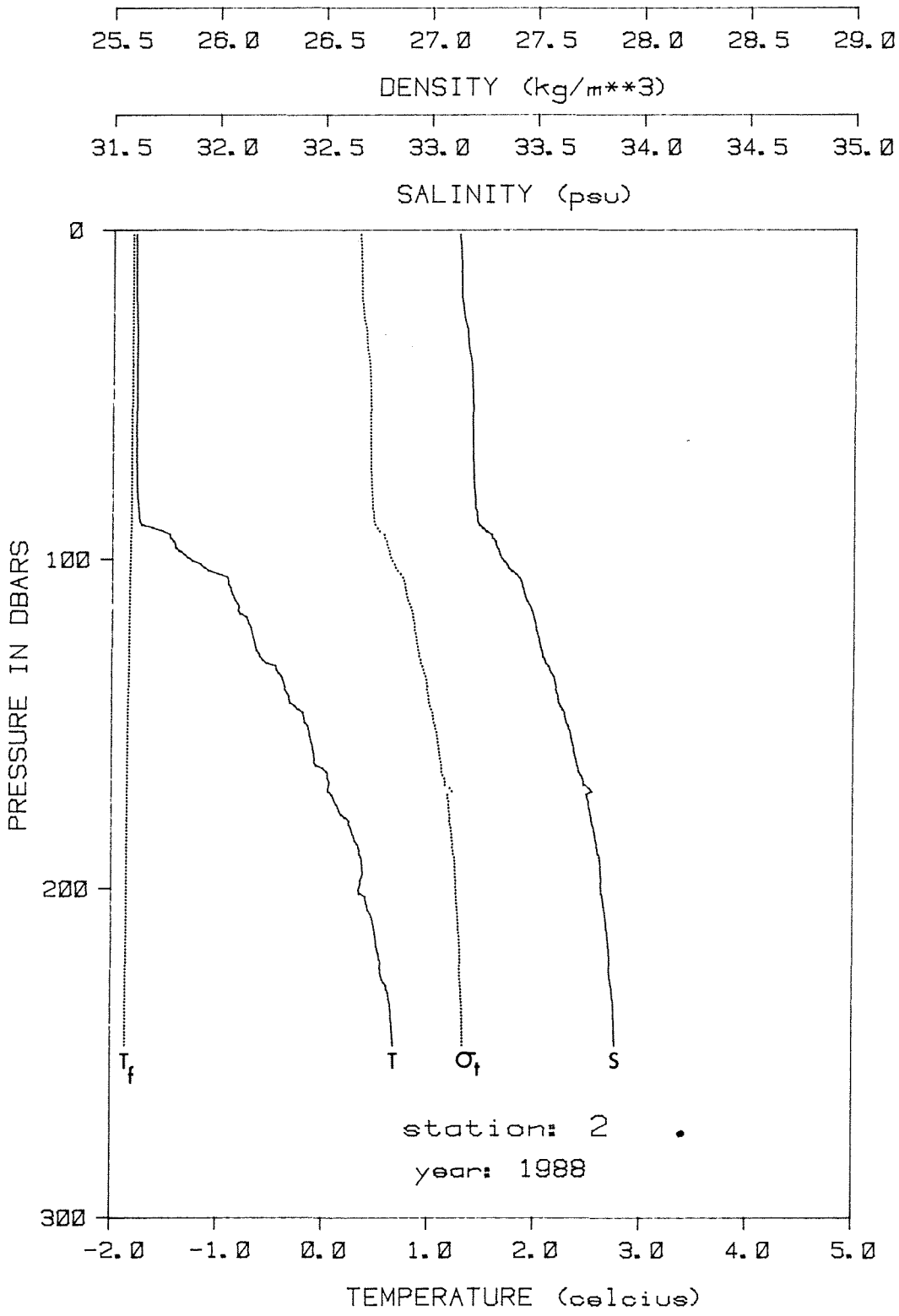

BEACON TEMP (DEG. C)
15
10
5
0
-5
-10
-15
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Apr
APRIL 1989

APPENDIX D


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f
T
σ_t
S
• station: 1
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

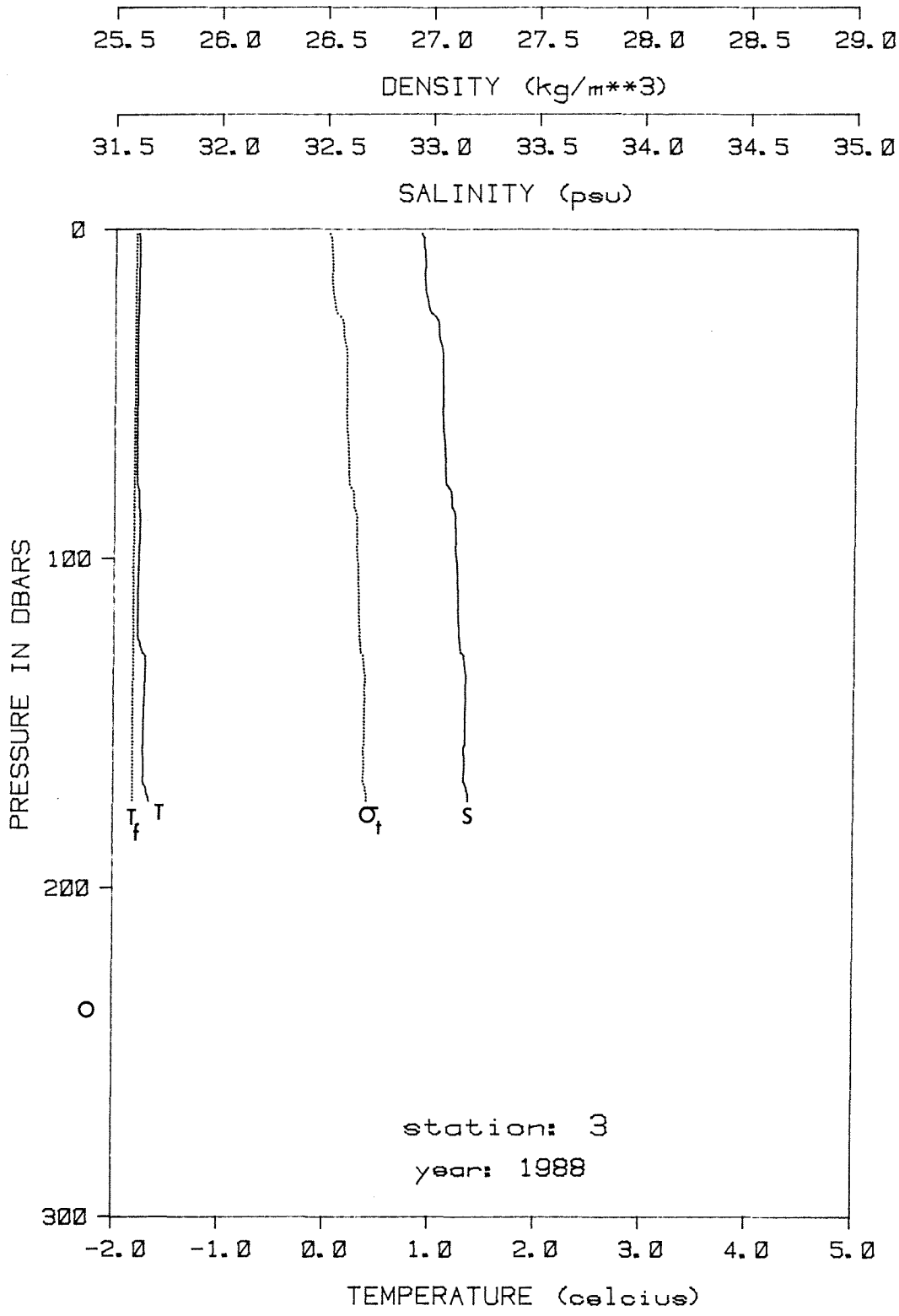
SITE: 1 LAT.N: 51 19.5 LON.W: 53 35.6 DATE: MAR. 4/88
TIME(Z): 1345

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
3.5	-1.804	0.611	33.187	-1.819	26.707
4.5	-1.782	0.611	33.194	-1.819	26.712
5.5	-1.774	0.611	33.198	-1.819	26.715
6.5	-1.773	0.611	33.200	-1.819	26.716
7.5	-1.772	0.611	33.200	-1.819	26.717
8.5	-1.773	0.611	33.201	-1.819	26.718
9.5	-1.773	0.612	33.202	-1.819	26.719
10.5	-1.773	0.612	33.203	-1.819	26.719
15.5	-1.771	0.612	33.206	-1.820	26.722
20.5	-1.769	0.612	33.208	-1.820	26.723
25.5	-1.768	0.612	33.209	-1.820	26.724
30.5	-1.763	0.612	33.216	-1.820	26.729
35.5	-1.762	0.612	33.223	-1.821	26.735
40.5	-1.763	0.612	33.231	-1.821	26.741
45.5	-1.763	0.613	33.240	-1.822	26.749
50.5	-1.764	0.613	33.264	-1.823	26.769
55.5	-1.764	0.613	33.277	-1.824	26.779
60.5	-1.764	0.614	33.280	-1.824	26.782
65.5	-1.751	0.614	33.297	-1.825	26.795
70.5	-1.744	0.614	33.308	-1.825	26.804
75.5	-1.744	0.615	33.312	-1.826	26.807
80.5	-1.730	0.615	33.316	-1.826	26.810
85.5	-1.668	0.616	33.332	-1.827	26.822
90.5	-1.554	0.619	33.364	-1.829	26.844
95.5	-1.333	0.624	33.408	-1.831	26.874
100.5	-1.218	0.627	33.458	-1.834	26.911
105.5	-1.005	0.633	33.526	-1.838	26.959
110.5	-0.587	0.642	33.586	-1.841	26.991
120.5	0.051	0.656	33.722	-1.849	27.072
130.5	0.187	0.661	33.837	-1.856	27.157
140.5	0.309	0.664	33.865	-1.857	27.174
150.5	0.349	0.665	33.886	-1.858	27.188
160.5	0.404	0.667	33.909	-1.860	27.204
170.5	0.506	0.670	33.941	-1.862	27.224
180.5	0.581	0.672	33.973	-1.863	27.246
190.5	0.675	0.674	34.001	-1.865	27.263
200.5	0.859	0.679	34.040	-1.867	27.283
210.5	0.836	0.679	34.066	-1.869	27.305
220.5	1.198	0.687	34.117	-1.872	27.322
230.5	1.236	0.689	34.149	-1.874	27.345


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f
T
σ_t
S
station: 2
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

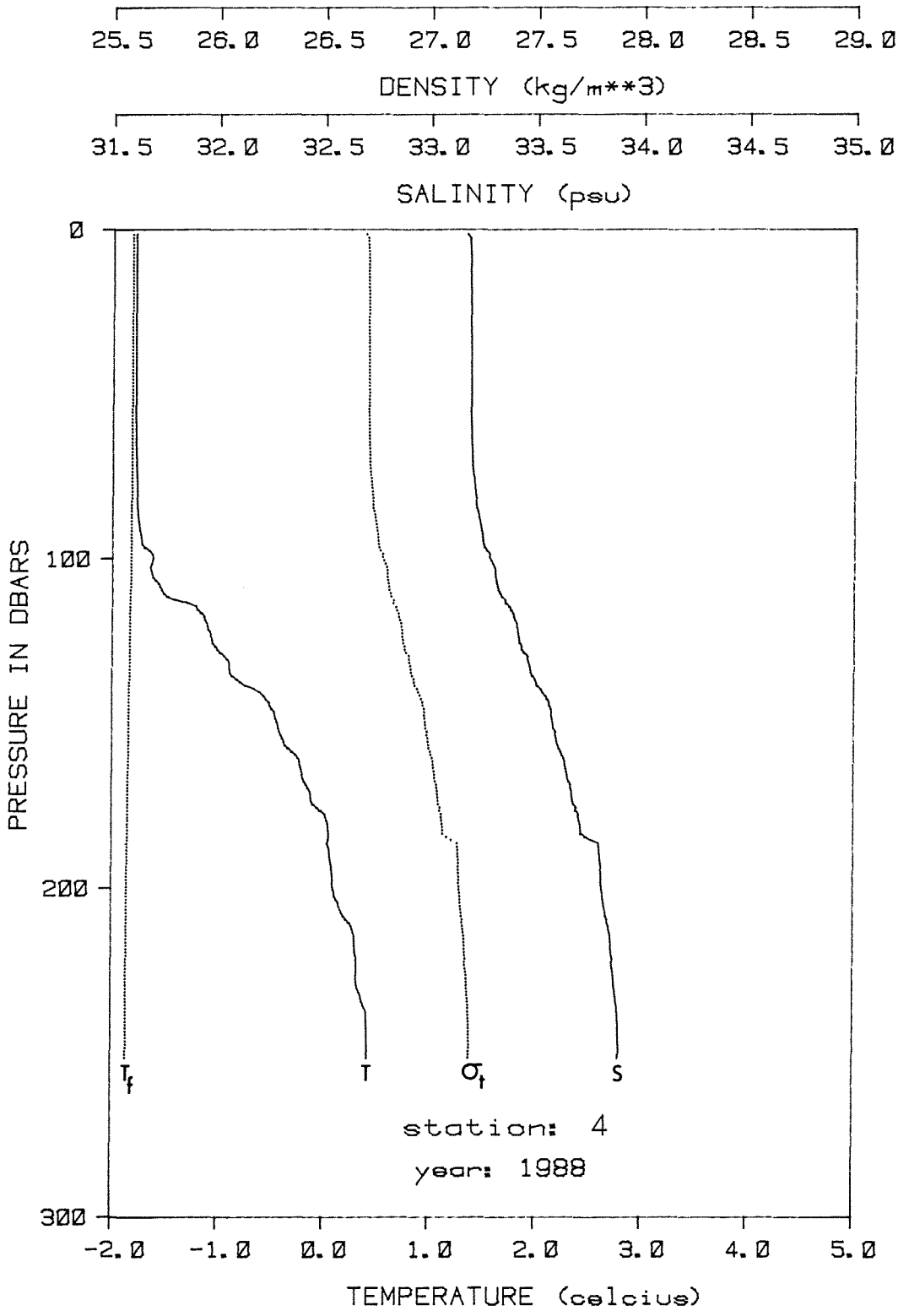
SITE: 2 LAT.N: 51 19.2 LON.W: 54 16.2 DATE: MAR. 4/88
TIME(Z): 1556

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.790	0.610	33.134	-1.816	26.664
2.5	-1.791	0.610	33.134	-1.816	26.664
3.5	-1.786	0.610	33.137	-1.816	26.666
4.5	-1.787	0.610	33.139	-1.816	26.667
5.5	-1.786	0.610	33.139	-1.816	26.668
6.5	-1.786	0.610	33.140	-1.816	26.668
7.5	-1.786	0.610	33.141	-1.816	26.669
8.5	-1.786	0.610	33.140	-1.816	26.669
9.5	-1.786	0.610	33.144	-1.816	26.671
10.5	-1.786	0.610	33.143	-1.816	26.671
15.5	-1.787	0.610	33.144	-1.816	26.671
20.5	-1.786	0.610	33.145	-1.816	26.672
25.5	-1.778	0.611	33.155	-1.817	26.680
30.5	-1.776	0.611	33.173	-1.818	26.695
35.5	-1.776	0.611	33.177	-1.818	26.699
40.5	-1.777	0.612	33.192	-1.819	26.711
45.5	-1.778	0.612	33.196	-1.819	26.713
50.5	-1.778	0.612	33.199	-1.819	26.716
55.5	-1.778	0.612	33.201	-1.819	26.718
60.5	-1.777	0.612	33.202	-1.819	26.719
65.5	-1.776	0.612	33.203	-1.819	26.719
70.5	-1.775	0.612	33.204	-1.820	26.720
75.5	-1.772	0.612	33.207	-1.820	26.722
80.5	-1.765	0.613	33.212	-1.820	26.726
85.5	-1.753	0.613	33.221	-1.821	26.733
90.5	-1.628	0.616	33.247	-1.822	26.752
95.5	-1.409	0.621	33.312	-1.826	26.798
100.5	-1.247	0.625	33.348	-1.828	26.823
105.5	-0.914	0.632	33.422	-1.832	26.871
110.5	-0.869	0.634	33.448	-1.833	26.891
115.5	-0.813	0.636	33.482	-1.835	26.916
120.5	-0.695	0.638	33.503	-1.837	26.928
130.5	-0.585	0.641	33.543	-1.839	26.957
140.5	-0.348	0.647	33.602	-1.842	26.994
150.5	-0.153	0.652	33.656	-1.845	27.029
160.5	-0.083	0.654	33.692	-1.847	27.054
170.5	0.047	0.658	33.768	-1.852	27.109
180.5	0.244	0.662	33.771	-1.852	27.101
190.5	0.359	0.665	33.805	-1.854	27.123
200.5	0.339	0.665	33.814	-1.854	27.131
210.5	0.476	0.668	33.837	-1.856	27.142
220.5	0.532	0.669	33.852	-1.857	27.151
240.5	0.657	0.672	33.878	-1.858	27.164


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f T
σ_t
S
station: 3
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

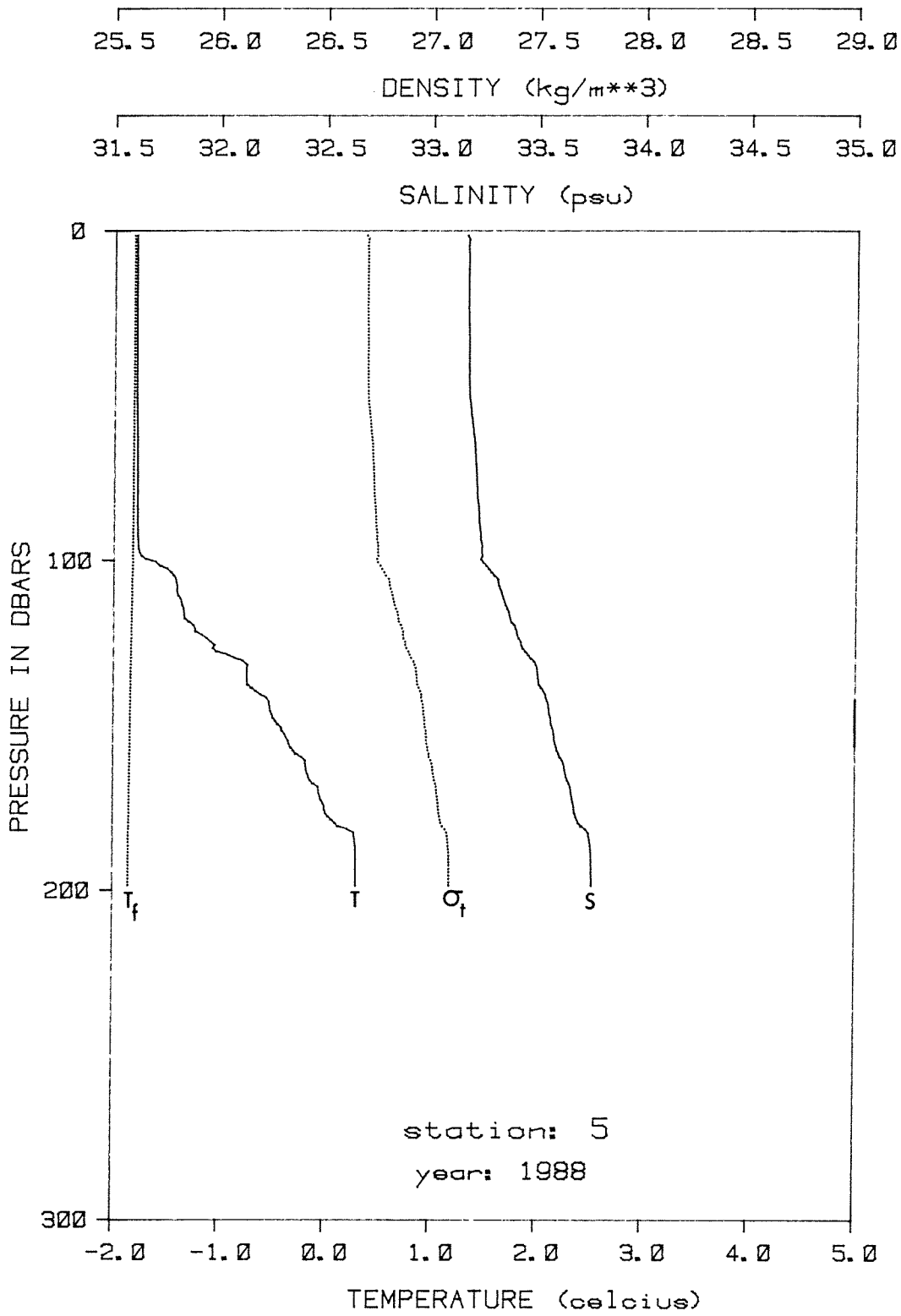
SITE: 3 LAT.N: 51 20.8 LON.W: 55 4.7 DATE: MAR. 4/88
TIME(Z): 1800

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.781	0.607	32.943	-1.805	26.508
2.5	-1.779	0.607	32.953	-1.805	26.516
3.5	-1.777	0.607	32.955	-1.805	26.518
4.5	-1.777	0.607	32.956	-1.805	26.518
5.5	-1.777	0.607	32.956	-1.805	26.518
6.5	-1.777	0.607	32.959	-1.806	26.521
7.5	-1.777	0.607	32.960	-1.806	26.522
8.5	-1.777	0.607	32.961	-1.806	26.523
9.5	-1.777	0.607	32.962	-1.806	26.523
10.5	-1.777	0.607	32.963	-1.806	26.524
15.5	-1.777	0.607	32.963	-1.806	26.524
20.5	-1.780	0.608	32.972	-1.806	26.532
25.5	-1.782	0.608	32.992	-1.807	26.548
30.5	-1.787	0.609	33.029	-1.810	26.578
35.5	-1.789	0.609	33.042	-1.810	26.589
40.5	-1.789	0.609	33.048	-1.811	26.594
45.5	-1.789	0.609	33.049	-1.811	26.594
50.5	-1.788	0.609	33.049	-1.811	26.594
55.5	-1.788	0.609	33.051	-1.811	26.596
60.5	-1.789	0.609	33.054	-1.811	26.598
65.5	-1.788	0.609	33.062	-1.811	26.605
70.5	-1.788	0.610	33.065	-1.812	26.607
75.5	-1.787	0.610	33.066	-1.812	26.609
80.5	-1.768	0.611	33.093	-1.813	26.630
85.5	-1.761	0.611	33.105	-1.814	26.639
90.5	-1.761	0.611	33.113	-1.814	26.645
95.5	-1.764	0.611	33.115	-1.814	26.648
100.5	-1.765	0.611	33.121	-1.815	26.652
105.5	-1.770	0.611	33.125	-1.815	26.656
110.5	-1.776	0.611	33.128	-1.815	26.658
115.5	-1.775	0.611	33.128	-1.815	26.658
120.5	-1.776	0.611	33.131	-1.815	26.661
130.5	-1.704	0.613	33.156	-1.817	26.679
140.5	-1.707	0.614	33.166	-1.817	26.688
150.5	-1.718	0.613	33.165	-1.817	26.687
160.5	-1.719	0.613	33.162	-1.817	26.685
170.5	-1.689	0.614	33.173	-1.818	26.693
173.5	-1.667	0.615	33.179	-1.818	26.697


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f
T
σ_t
S
station: 4
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

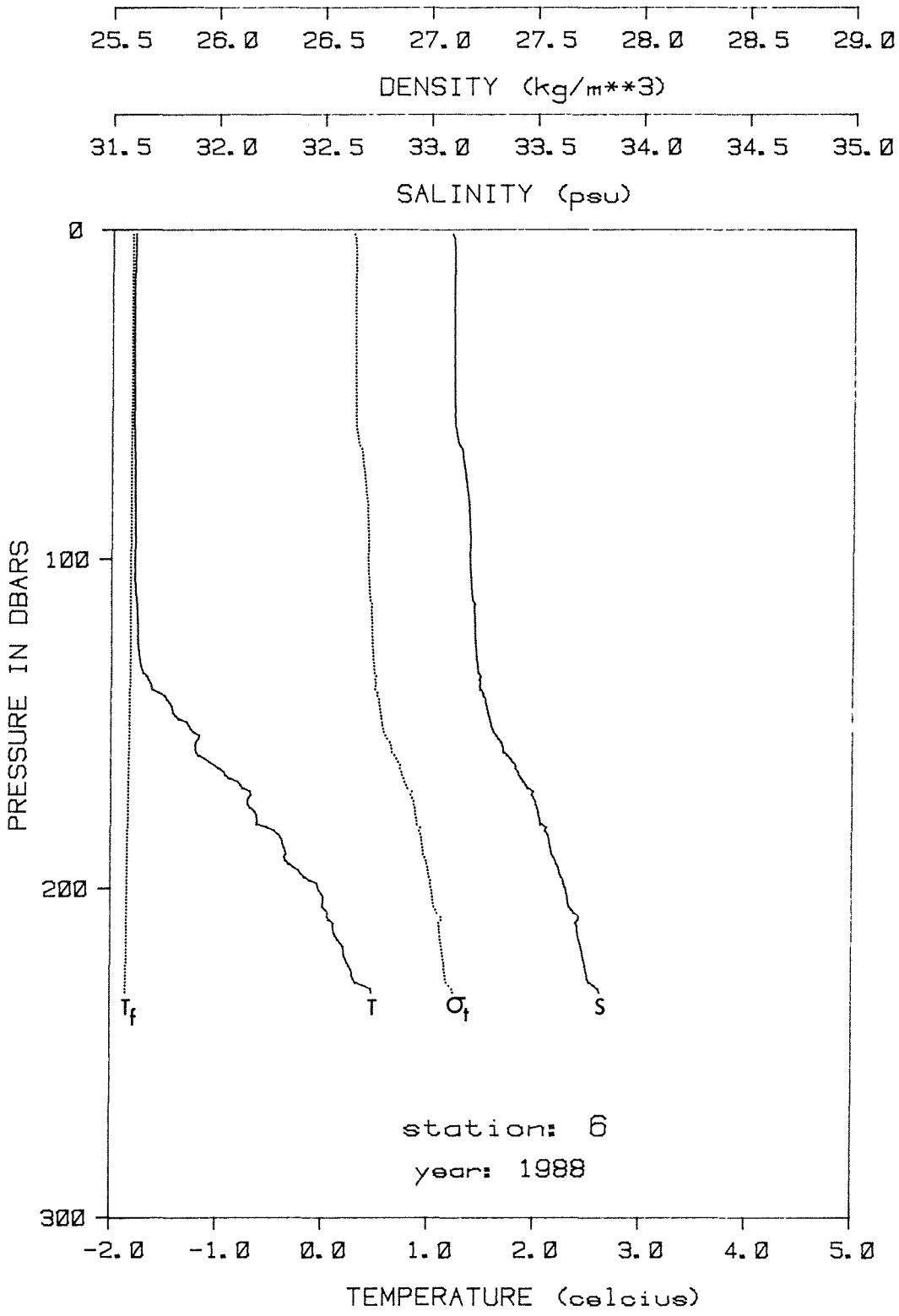
SITE: 4 LAT.N: 51 21.8 LON.W: 54 16.7 DATE: MAR. 7/88
TIME(Z): 1242

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.787	0.611	33.170	-1.818	26.693
2.5	-1.788	0.611	33.181	-1.818	26.702
3.5	-1.786	0.611	33.183	-1.818	26.703
4.5	-1.786	0.611	33.184	-1.818	26.704
5.5	-1.787	0.611	33.184	-1.818	26.704
6.5	-1.787	0.611	33.185	-1.818	26.705
7.5	-1.787	0.611	33.186	-1.819	26.706
8.5	-1.787	0.611	33.186	-1.819	26.706
9.5	-1.788	0.611	33.187	-1.819	26.706
10.5	-1.788	0.611	33.186	-1.819	26.706
15.5	-1.788	0.611	33.185	-1.818	26.705
20.5	-1.788	0.611	33.186	-1.819	26.706
25.5	-1.788	0.611	33.187	-1.819	26.707
30.5	-1.787	0.611	33.188	-1.819	26.707
35.5	-1.787	0.611	33.189	-1.819	26.708
40.5	-1.786	0.611	33.189	-1.819	26.708
45.5	-1.786	0.611	33.189	-1.819	26.708
50.5	-1.786	0.611	33.190	-1.819	26.709
55.5	-1.785	0.612	33.190	-1.819	26.709
60.5	-1.783	0.612	33.193	-1.819	26.711
65.5	-1.781	0.612	33.194	-1.819	26.712
70.5	-1.779	0.612	33.196	-1.819	26.714
75.5	-1.774	0.612	33.205	-1.820	26.721
80.5	-1.769	0.612	33.212	-1.820	26.727
85.5	-1.762	0.613	33.224	-1.821	26.736
90.5	-1.745	0.614	33.240	-1.822	26.749
95.5	-1.722	0.614	33.251	-1.822	26.757
100.5	-1.619	0.617	33.286	-1.824	26.783
105.5	-1.620	0.617	33.308	-1.825	26.801
110.5	-1.514	0.620	33.330	-1.827	26.816
115.5	-1.195	0.627	33.381	-1.830	26.848
120.5	-1.099	0.629	33.411	-1.831	26.869
130.5	-0.917	0.633	33.461	-1.834	26.903
140.5	-0.609	0.641	33.532	-1.838	26.949
150.5	-0.434	0.645	33.582	-1.841	26.981
160.5	-0.245	0.650	33.631	-1.844	27.013
170.5	-0.128	0.653	33.671	-1.846	27.039
180.5	0.043	0.657	33.710	-1.848	27.063
190.5	0.062	0.659	33.805	-1.854	27.138
200.5	0.099	0.660	33.816	-1.854	27.146
210.5	0.244	0.663	33.841	-1.856	27.158
220.5	0.309	0.665	33.862	-1.857	27.172
230.5	0.331	0.666	33.877	-1.858	27.182
240.5	0.418	0.668	33.894	-1.859	27.191
250.5	0.426	0.668	33.898	-1.859	27.194


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f
T
σ_t
S
station: 5
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

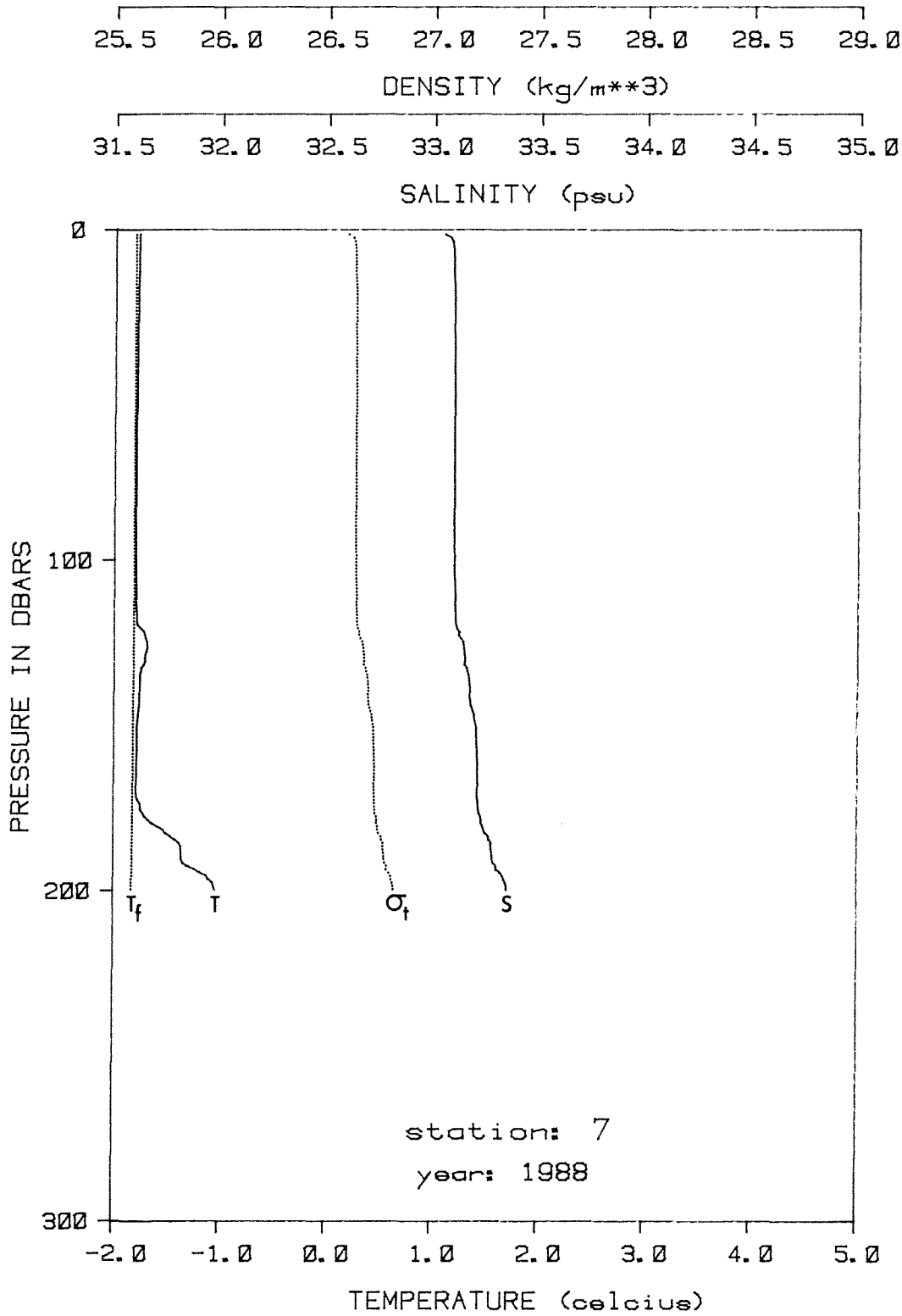
SITE: 5 LAT.N: 51 30.4 LON.W: 54 23.5 DATE: MAR. 7/88
TIME(Z): 1422

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.797	0.610	33.160	-1.817	26.685
2.5	-1.797	0.610	33.169	-1.818	26.692
3.5	-1.797	0.610	33.167	-1.817	26.691
4.5	-1.796	0.610	33.166	-1.817	26.690
5.5	-1.796	0.610	33.166	-1.817	26.690
6.5	-1.797	0.610	33.167	-1.817	26.690
7.5	-1.797	0.610	33.168	-1.817	26.691
8.5	-1.796	0.610	33.167	-1.817	26.691
9.5	-1.797	0.610	33.168	-1.817	26.691
10.5	-1.796	0.610	33.167	-1.817	26.691
15.5	-1.796	0.611	33.167	-1.817	26.690
20.5	-1.796	0.611	33.167	-1.817	26.691
25.5	-1.795	0.611	33.168	-1.817	26.691
30.5	-1.795	0.611	33.170	-1.818	26.693
35.5	-1.793	0.611	33.171	-1.818	26.694
40.5	-1.793	0.611	33.171	-1.818	26.693
45.5	-1.793	0.611	33.171	-1.818	26.694
50.5	-1.791	0.611	33.174	-1.818	26.696
55.5	-1.788	0.611	33.183	-1.818	26.704
60.5	-1.785	0.612	33.193	-1.819	26.712
65.5	-1.783	0.612	33.202	-1.819	26.718
70.5	-1.782	0.612	33.206	-1.820	26.722
75.5	-1.780	0.612	33.210	-1.820	26.725
80.5	-1.780	0.612	33.214	-1.820	26.728
85.5	-1.779	0.613	33.222	-1.821	26.735
90.5	-1.776	0.613	33.228	-1.821	26.739
95.5	-1.770	0.613	33.236	-1.821	26.746
100.5	-1.605	0.616	33.241	-1.822	26.746
105.5	-1.414	0.621	33.311	-1.826	26.798
110.5	-1.392	0.622	33.334	-1.827	26.815
115.5	-1.335	0.624	33.365	-1.829	26.839
120.5	-1.230	0.626	33.396	-1.831	26.861
130.5	-0.774	0.637	33.484	-1.836	26.917
140.5	-0.615	0.641	33.539	-1.839	26.955
150.5	-0.416	0.645	33.573	-1.841	26.973
160.5	-0.188	0.650	33.619	-1.843	27.000
180.5	0.122	0.658	33.709	-1.848	27.058
190.5	0.299	0.663	33.761	-1.851	27.090
198.5	0.301	0.663	33.763	-1.851	27.092


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f
T
σ_f
S
station: 6
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

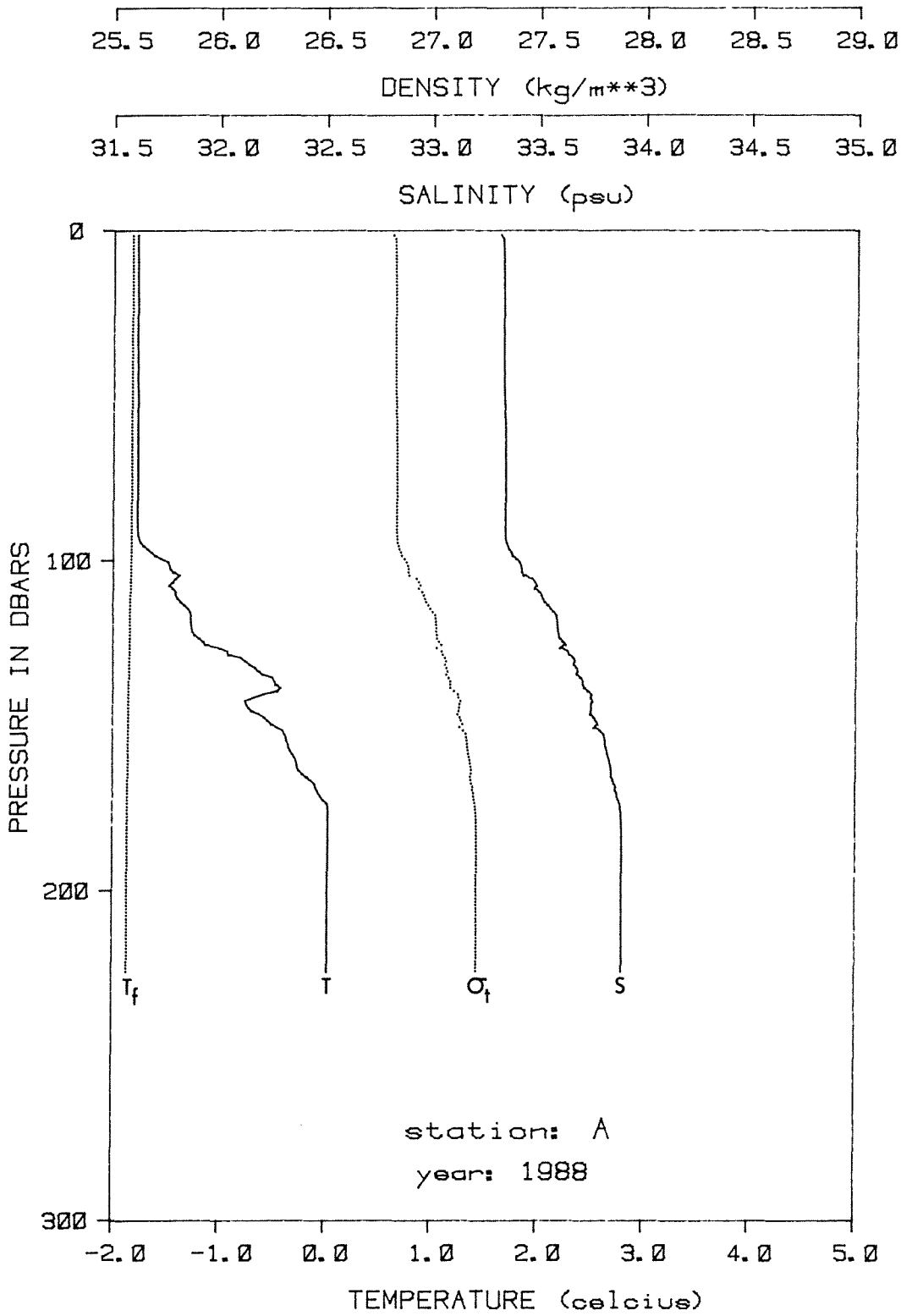
SITE: 6 LAT.N: 51 41.0 LON.W: 54 37.0 DATE: MAR. 7/88
TIME(Z): 1605

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.787	0.609	33.100	-1.814	26.636
2.5	-1.786	0.610	33.107	-1.814	26.641
3.5	-1.787	0.610	33.108	-1.814	26.642
4.5	-1.787	0.610	33.109	-1.814	26.643
5.5	-1.787	0.610	33.111	-1.814	26.645
6.5	-1.788	0.610	33.111	-1.814	26.645
7.5	-1.788	0.610	33.111	-1.814	26.645
8.5	-1.790	0.610	33.111	-1.814	26.644
9.5	-1.792	0.610	33.111	-1.814	26.645
10.5	-1.792	0.610	33.110	-1.814	26.644
15.5	-1.794	0.610	33.112	-1.814	26.645
20.5	-1.795	0.610	33.111	-1.814	26.645
25.5	-1.794	0.610	33.111	-1.814	26.645
30.5	-1.795	0.610	33.112	-1.814	26.646
35.5	-1.796	0.610	33.112	-1.814	26.646
40.5	-1.795	0.610	33.112	-1.814	26.646
45.5	-1.795	0.610	33.113	-1.814	26.647
50.5	-1.794	0.610	33.114	-1.814	26.647
55.5	-1.792	0.610	33.116	-1.815	26.649
60.5	-1.790	0.610	33.122	-1.815	26.654
65.5	-1.786	0.611	33.138	-1.816	26.667
70.5	-1.783	0.611	33.159	-1.817	26.684
75.5	-1.782	0.611	33.170	-1.818	26.693
80.5	-1.781	0.612	33.180	-1.818	26.700
85.5	-1.780	0.612	33.186	-1.818	26.705
90.5	-1.779	0.612	33.189	-1.819	26.708
95.5	-1.778	0.612	33.192	-1.819	26.710
100.5	-1.778	0.612	33.193	-1.819	26.711
105.5	-1.780	0.612	33.197	-1.819	26.715
110.5	-1.771	0.613	33.201	-1.819	26.718
115.5	-1.758	0.613	33.213	-1.820	26.727
120.5	-1.752	0.613	33.216	-1.820	26.729
130.5	-1.732	0.614	33.224	-1.821	26.735
140.5	-1.554	0.618	33.256	-1.823	26.757
160.5	-1.117	0.629	33.382	-1.830	26.846
180.5	-0.625	0.641	33.527	-1.838	26.945
200.5	-0.030	0.654	33.650	-1.845	27.018
210.5	0.102	0.658	33.698	-1.848	27.050
220.5	0.208	0.661	33.729	-1.850	27.070
230.5	0.465	0.667	33.803	-1.854	27.115


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f
T
σ_t
S
station: 7
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

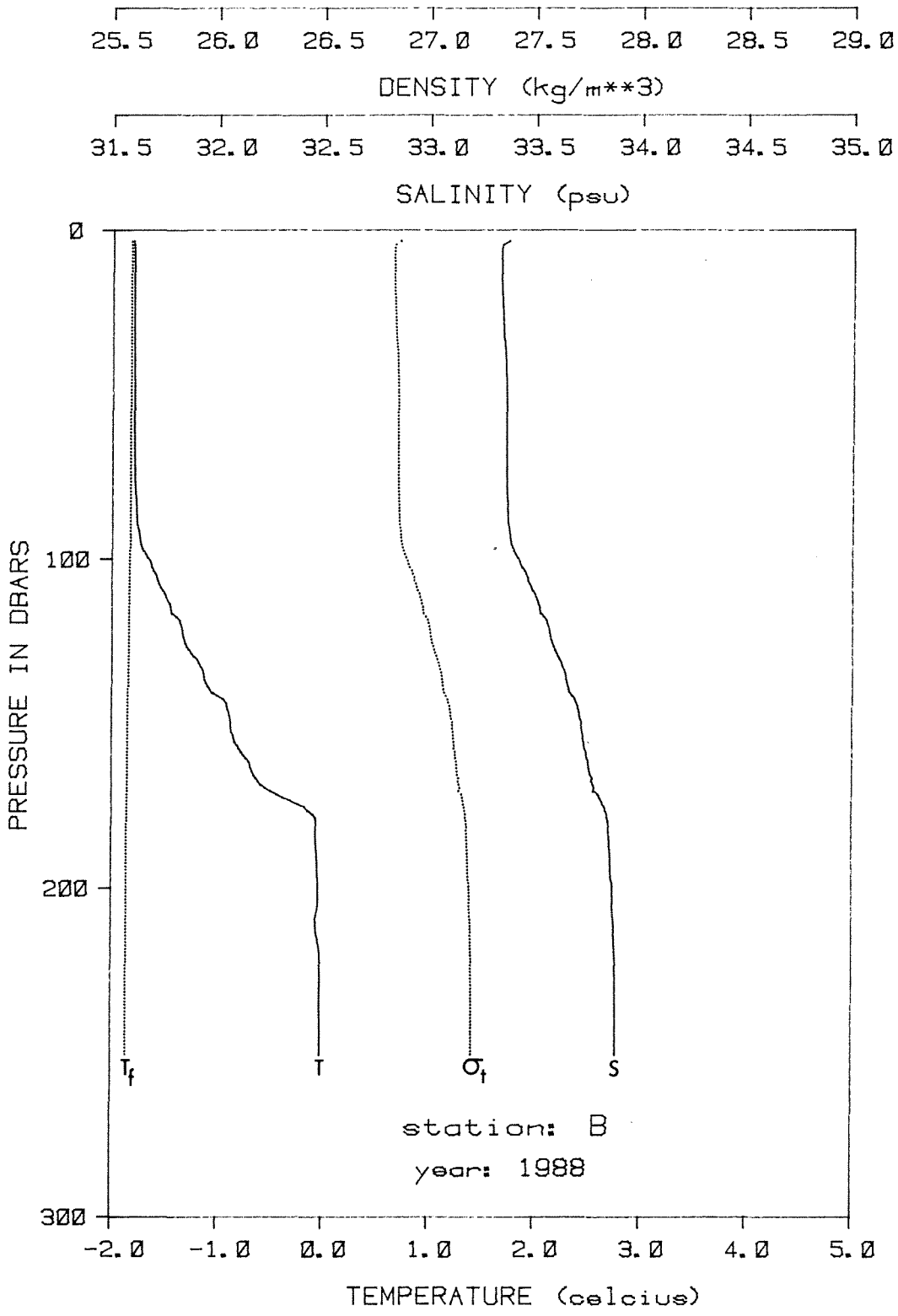
SITE: 7 LAT.N: 51 58.2 LON.W: 54 47.1 DATE: MAR. 7/88
TIME(Z): 1738

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.778	0.609	33.048	-1.811	26.593
2.5	-1.780	0.609	33.077	-1.812	26.617
3.5	-1.780	0.609	33.085	-1.813	26.623
4.5	-1.779	0.609	33.087	-1.813	26.625
5.5	-1.779	0.609	33.090	-1.813	26.627
6.5	-1.781	0.609	33.090	-1.813	26.628
7.5	-1.783	0.609	33.090	-1.813	26.628
8.5	-1.783	0.609	33.091	-1.813	26.628
9.5	-1.783	0.609	33.092	-1.813	26.629
10.5	-1.783	0.609	33.092	-1.813	26.629
15.5	-1.787	0.609	33.093	-1.813	26.630
20.5	-1.790	0.610	33.096	-1.813	26.632
25.5	-1.790	0.610	33.095	-1.813	26.632
30.5	-1.791	0.610	33.096	-1.813	26.633
35.5	-1.793	0.610	33.098	-1.814	26.635
40.5	-1.793	0.610	33.097	-1.813	26.634
45.5	-1.795	0.610	33.098	-1.814	26.635
50.5	-1.796	0.610	33.099	-1.814	26.635
55.5	-1.799	0.610	33.099	-1.814	26.635
60.5	-1.800	0.610	33.099	-1.814	26.635
65.5	-1.800	0.610	33.099	-1.814	26.635
70.5	-1.800	0.610	33.099	-1.814	26.635
75.5	-1.801	0.610	33.099	-1.814	26.635
80.5	-1.801	0.610	33.099	-1.814	26.635
85.5	-1.801	0.610	33.099	-1.814	26.636
90.5	-1.801	0.610	33.099	-1.814	26.636
95.5	-1.800	0.610	33.100	-1.814	26.636
100.5	-1.799	0.610	33.101	-1.814	26.637
105.5	-1.796	0.610	33.102	-1.814	26.637
110.5	-1.795	0.611	33.105	-1.814	26.640
115.5	-1.788	0.611	33.108	-1.814	26.642
120.5	-1.755	0.612	33.116	-1.815	26.648
130.5	-1.708	0.613	33.154	-1.817	26.678
140.5	-1.761	0.613	33.177	-1.818	26.698
160.5	-1.786	0.613	33.213	-1.820	26.728
170.5	-1.788	0.613	33.215	-1.820	26.729
180.5	-1.592	0.617	33.240	-1.822	26.745
190.5	-1.358	0.623	33.285	-1.824	26.775
199.5	-1.043	0.630	33.356	-1.828	26.822


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f
T
σ_t
S
station: A
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

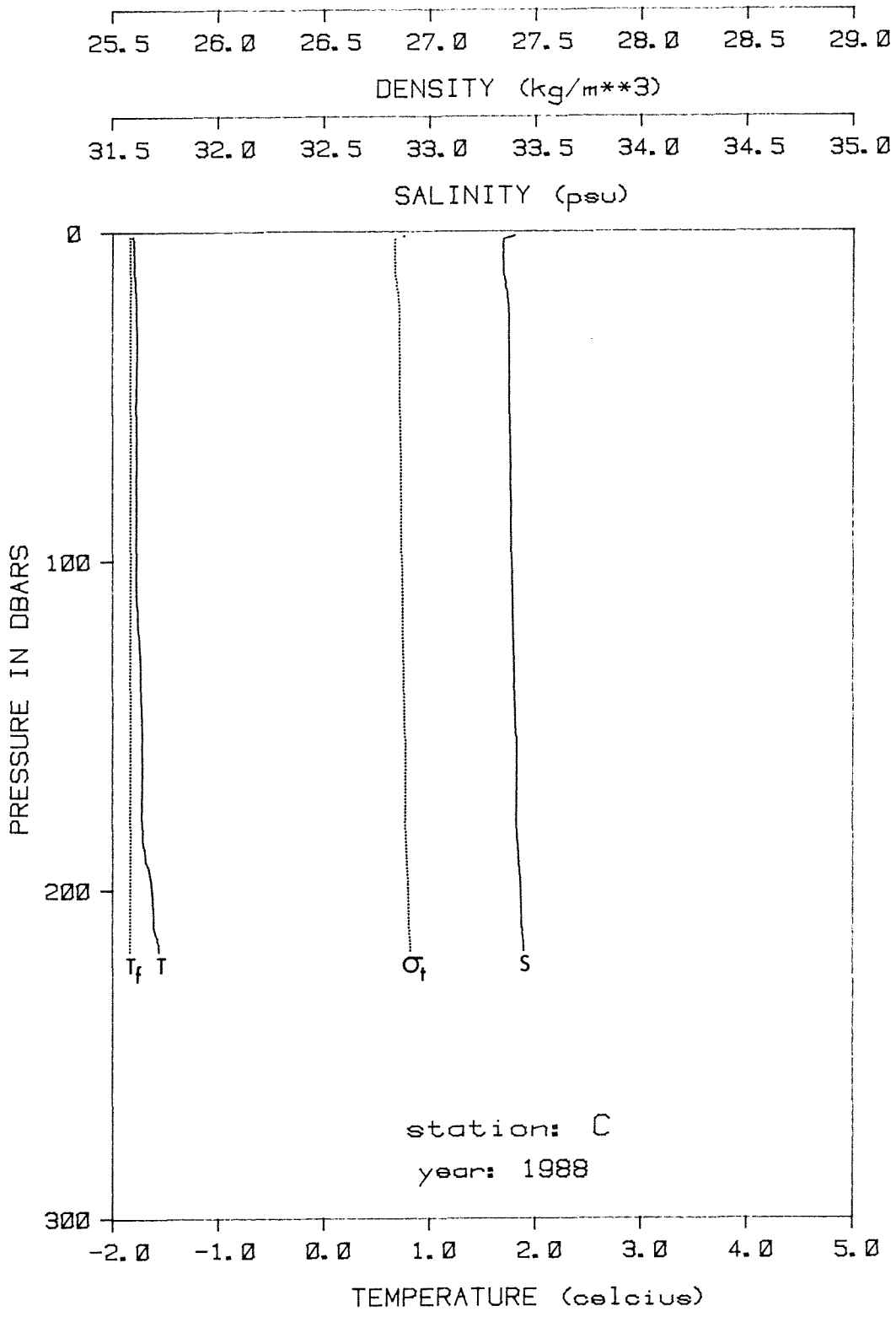
SITE: A LAT.N: 51 21.3 LON.W: 54 04.1 DATE: MAR. 26/88
TIME(Z): 1338

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.779	0.613	33.317	-1.826	26.812
2.5	-1.779	0.613	33.328	-1.827	26.821
3.5	-1.779	0.613	33.330	-1.827	26.823
4.5	-1.779	0.613	33.330	-1.827	26.823
5.5	-1.779	0.614	33.331	-1.827	26.824
6.5	-1.779	0.614	33.331	-1.827	26.824
7.5	-1.778	0.614	33.332	-1.827	26.824
8.5	-1.778	0.614	33.332	-1.827	26.824
9.5	-1.778	0.614	33.333	-1.827	26.825
10.5	-1.777	0.614	33.332	-1.827	26.824
15.5	-1.778	0.614	33.333	-1.827	26.825
20.5	-1.775	0.614	33.334	-1.827	26.825
25.5	-1.776	0.614	33.335	-1.827	26.826
30.5	-1.776	0.614	33.335	-1.827	26.826
35.5	-1.777	0.614	33.335	-1.827	26.826
40.5	-1.775	0.614	33.335	-1.827	26.826
45.5	-1.777	0.614	33.335	-1.827	26.827
50.5	-1.771	0.614	33.337	-1.827	26.828
55.5	-1.771	0.614	33.341	-1.827	26.831
60.5	-1.771	0.614	33.344	-1.828	26.834
65.5	-1.771	0.614	33.344	-1.828	26.834
70.5	-1.772	0.615	33.344	-1.828	26.834
75.5	-1.772	0.615	33.344	-1.828	26.834
80.5	-1.772	0.615	33.345	-1.828	26.834
85.5	-1.772	0.615	33.345	-1.828	26.835
90.5	-1.770	0.615	33.345	-1.828	26.835
95.5	-1.720	0.616	33.356	-1.828	26.842
100.5	-1.485	0.621	33.411	-1.831	26.881
105.5	-1.411	0.624	33.470	-1.835	26.927
110.5	-1.409	0.625	33.516	-1.837	26.964
115.5	-1.275	0.628	33.572	-1.841	27.005
120.5	-1.259	0.629	33.594	-1.842	27.023
130.5	-0.756	0.640	33.673	-1.846	27.069
140.5	-0.582	0.645	33.754	-1.851	27.127
150.5	-0.462	0.648	33.769	-1.852	27.134
160.5	-0.280	0.652	33.838	-1.856	27.182
170.5	-0.062	0.657	33.875	-1.858	27.201
190.5	0.028	0.660	33.900	-1.859	27.217
210.5	0.024	0.660	33.901	-1.859	27.217


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f
T
σ_t
S
station: B
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

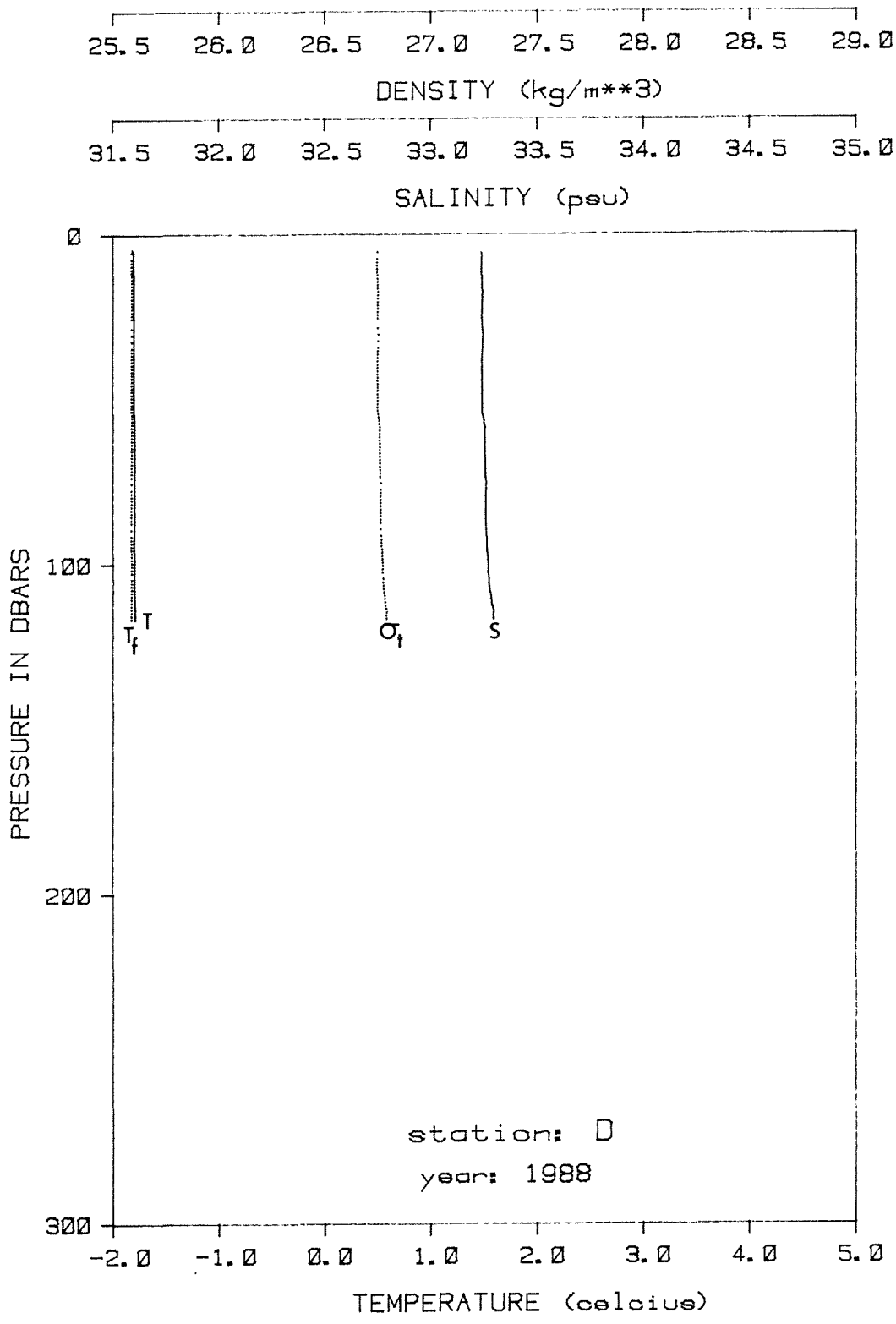
SITE: B LAT.N: 51 21.8 LON.W: 54 24.1 DATE: MAR. 26/88
TIME(Z): 1520

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
3.5	-1.811	0.614	33.371	-1.829	26.856
4.5	-1.804	0.613	33.341	-1.827	26.832
5.5	-1.802	0.613	33.337	-1.827	26.829
6.5	-1.802	0.613	33.336	-1.827	26.828
7.5	-1.802	0.613	33.335	-1.827	26.827
8.5	-1.801	0.613	33.335	-1.827	26.827
9.5	-1.801	0.613	33.336	-1.827	26.828
10.5	-1.801	0.613	33.336	-1.827	26.828
15.5	-1.799	0.613	33.339	-1.827	26.830
20.5	-1.798	0.613	33.342	-1.827	26.833
25.5	-1.799	0.614	33.345	-1.828	26.835
30.5	-1.798	0.614	33.348	-1.828	26.838
35.5	-1.798	0.614	33.354	-1.828	26.842
40.5	-1.797	0.614	33.358	-1.828	26.846
45.5	-1.796	0.614	33.361	-1.828	26.848
46.5	-1.796	0.614	33.362	-1.829	26.849
47.5	-1.796	0.614	33.362	-1.829	26.849
48.5	-1.795	0.614	33.362	-1.829	26.849
49.5	-1.795	0.614	33.362	-1.829	26.849
50.5	-1.795	0.614	33.363	-1.829	26.850
55.5	-1.794	0.614	33.364	-1.829	26.850
60.5	-1.794	0.614	33.364	-1.829	26.850
65.5	-1.792	0.614	33.364	-1.829	26.850
70.5	-1.789	0.615	33.365	-1.829	26.851
75.5	-1.788	0.615	33.365	-1.829	26.851
80.5	-1.780	0.615	33.367	-1.829	26.853
85.5	-1.771	0.615	33.370	-1.829	26.855
90.5	-1.757	0.616	33.377	-1.829	26.860
95.5	-1.732	0.616	33.387	-1.830	26.868
100.5	-1.641	0.619	33.427	-1.832	26.898
105.5	-1.577	0.621	33.466	-1.835	26.928
110.5	-1.503	0.623	33.500	-1.836	26.954
115.5	-1.441	0.624	33.525	-1.838	26.972
120.5	-1.344	0.627	33.564	-1.840	27.001
130.5	-1.196	0.631	33.617	-1.843	27.039
140.5	-1.051	0.634	33.666	-1.846	27.074
150.5	-0.873	0.639	33.721	-1.849	27.112
175.5	-0.175	0.655	33.829	-1.855	27.169
200.5	-0.039	0.658	33.869	-1.858	27.195
225.5	-0.018	0.659	33.883	-1.858	27.206
250.5	-0.018	0.659	33.885	-1.858	27.207


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f T
σ_t
S
station: C
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

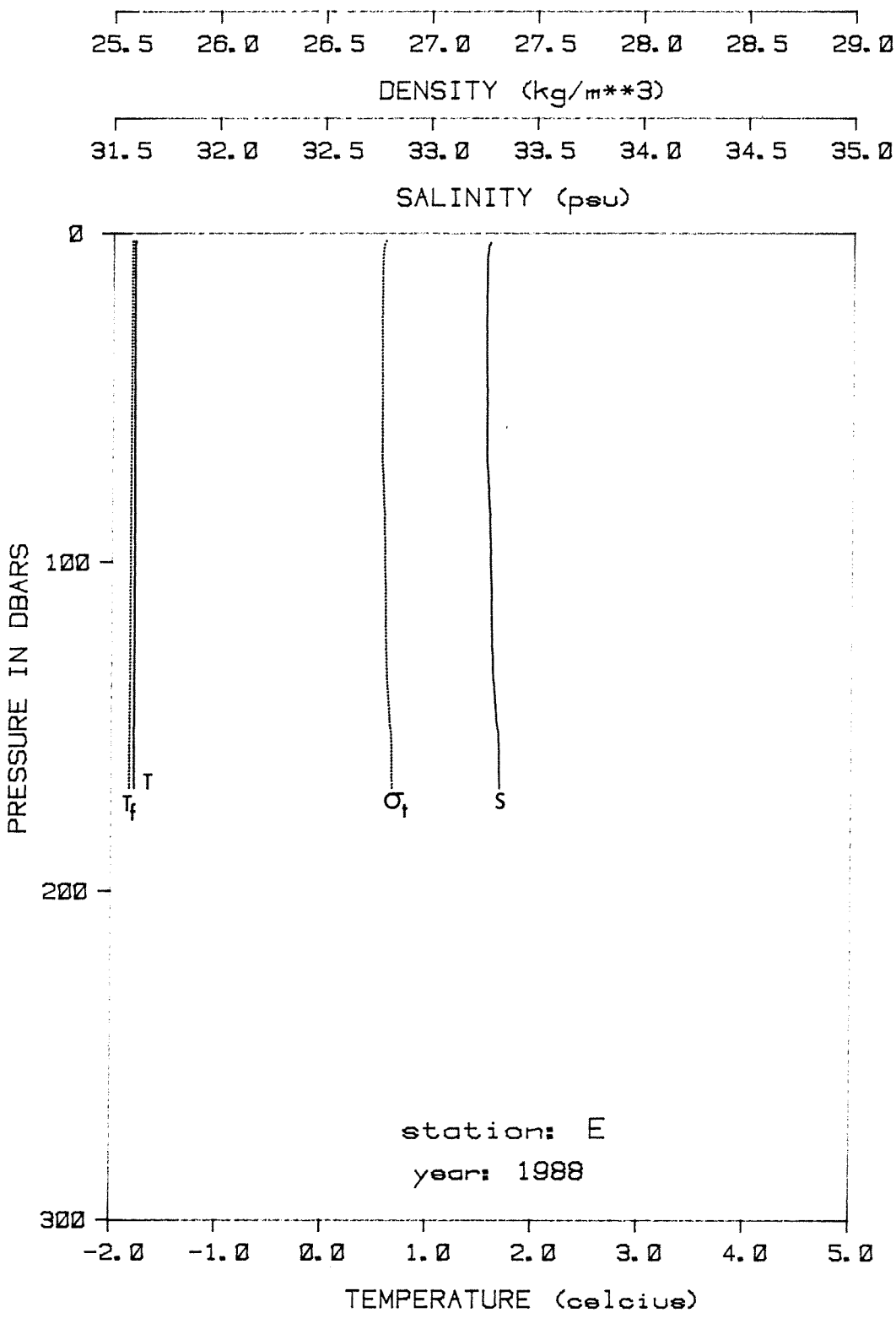
SITE: C LAT.N: 51 22.2 LON.W: 54 42.7 DATE: MAR. 26/88
TIME(Z): 1655

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.807	0.614	33.397	-1.831	26.878
2.5	-1.795	0.613	33.347	-1.828	26.837
3.5	-1.795	0.613	33.345	-1.828	26.835
4.5	-1.794	0.613	33.345	-1.828	26.835
5.5	-1.794	0.613	33.346	-1.828	26.836
6.5	-1.794	0.613	33.346	-1.828	26.836
7.5	-1.792	0.614	33.345	-1.828	26.835
8.5	-1.791	0.614	33.345	-1.828	26.835
9.5	-1.790	0.614	33.347	-1.828	26.837
10.5	-1.789	0.614	33.347	-1.828	26.837
15.5	-1.784	0.614	33.355	-1.828	26.843
20.5	-1.778	0.614	33.366	-1.829	26.852
25.5	-1.774	0.614	33.372	-1.829	26.856
30.5	-1.768	0.615	33.371	-1.829	26.856
35.5	-1.767	0.615	33.373	-1.829	26.857
40.5	-1.770	0.615	33.374	-1.829	26.858
45.5	-1.769	0.615	33.374	-1.829	26.859
50.5	-1.774	0.615	33.374	-1.829	26.859
55.5	-1.778	0.615	33.375	-1.829	26.859
60.5	-1.778	0.615	33.376	-1.829	26.860
65.5	-1.775	0.615	33.378	-1.829	26.862
70.5	-1.773	0.615	33.380	-1.830	26.863
75.5	-1.776	0.615	33.380	-1.830	26.863
80.5	-1.774	0.615	33.382	-1.830	26.865
85.5	-1.774	0.615	33.383	-1.830	26.866
90.5	-1.774	0.615	33.383	-1.830	26.866
95.5	-1.776	0.615	33.384	-1.830	26.867
100.5	-1.778	0.615	33.386	-1.830	26.868
105.5	-1.779	0.616	33.387	-1.830	26.869
110.5	-1.775	0.616	33.390	-1.830	26.871
115.5	-1.762	0.616	33.391	-1.830	26.872
120.5	-1.759	0.616	33.392	-1.830	26.873
130.5	-1.735	0.617	33.397	-1.831	26.876
140.5	-1.733	0.617	33.399	-1.831	26.878
150.5	-1.722	0.617	33.403	-1.831	26.881
175.5	-1.721	0.618	33.411	-1.831	26.887
200.5	-1.627	0.620	33.430	-1.832	26.900


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T
T_f
σ_t
S
station: D
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

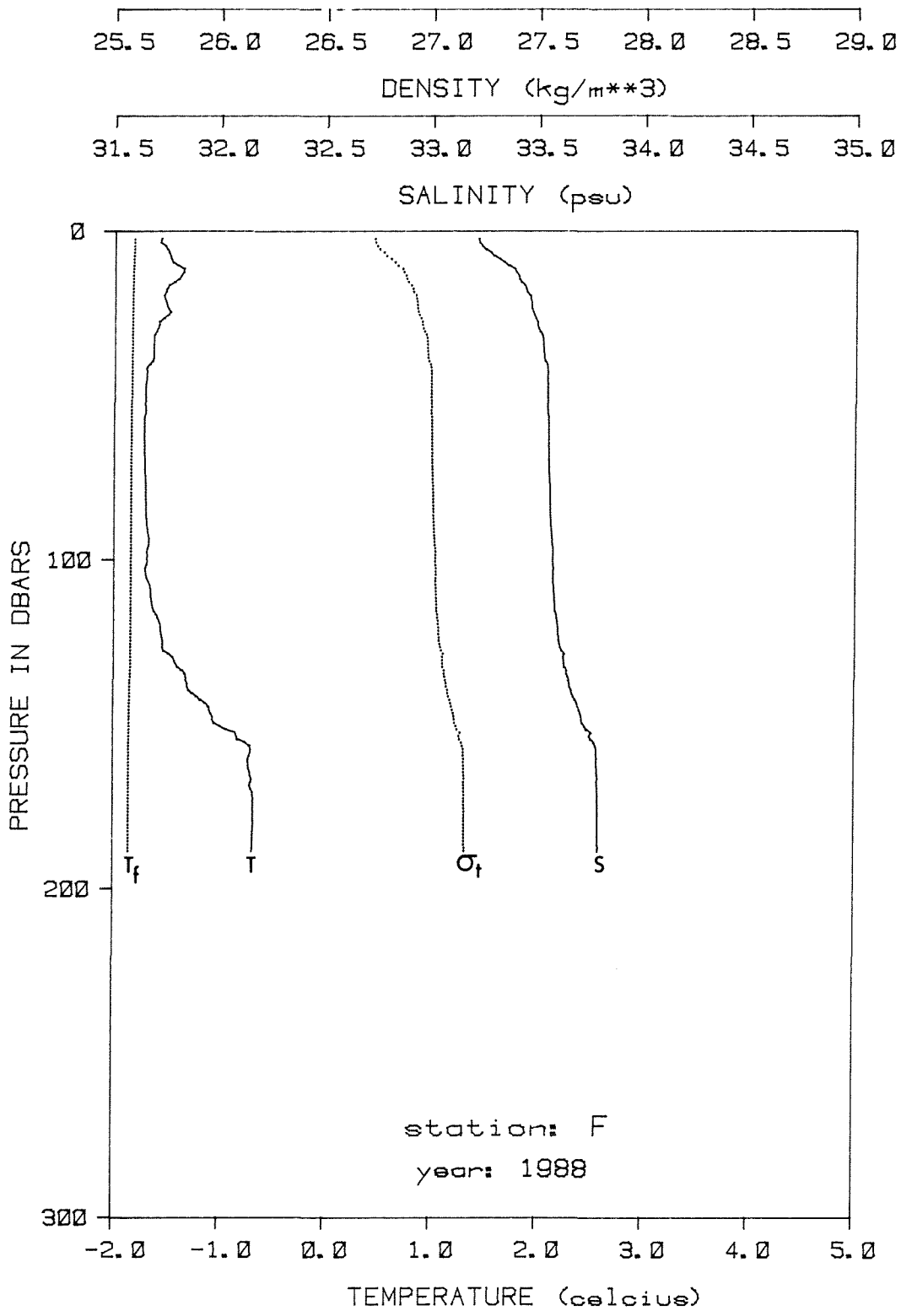
SITE: D LAT.N: 51 22.4 LON.W: 54 03.2 DATE: MAR. 26/88
TIME(Z): 1828

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
2.5	-1.843	0.613	33.377	-1.829	26.862
3.5	-1.827	0.614	33.393	-1.830	26.875
5.5	-1.803	0.612	33.240	-1.822	26.750
7.5	-1.803	0.612	33.239	-1.822	26.749
8.5	-1.803	0.612	33.238	-1.821	26.749
9.5	-1.803	0.612	33.238	-1.821	26.748
10.5	-1.803	0.612	33.238	-1.822	26.749
15.5	-1.803	0.612	33.238	-1.821	26.749
20.5	-1.803	0.612	33.239	-1.822	26.750
25.5	-1.802	0.612	33.238	-1.822	26.749
30.5	-1.803	0.612	33.245	-1.822	26.754
35.5	-1.802	0.612	33.241	-1.822	26.751
40.5	-1.802	0.612	33.239	-1.822	26.749
45.5	-1.802	0.612	33.240	-1.822	26.750
50.5	-1.800	0.612	33.242	-1.822	26.751
55.5	-1.801	0.612	33.243	-1.822	26.753
60.5	-1.797	0.612	33.252	-1.822	26.760
65.5	-1.796	0.613	33.253	-1.822	26.760
70.5	-1.796	0.613	33.254	-1.822	26.761
75.5	-1.795	0.613	33.260	-1.823	26.766
80.5	-1.795	0.613	33.258	-1.823	26.764
85.5	-1.794	0.613	33.258	-1.823	26.765
89.5	-1.795	0.613	33.260	-1.823	26.766
95.5	-1.798	0.613	33.265	-1.823	26.770
100.5	-1.799	0.613	33.269	-1.823	26.773
105.5	-1.798	0.613	33.272	-1.823	26.776
110.5	-1.795	0.613	33.282	-1.824	26.784
115.5	-1.790	0.614	33.292	-1.825	26.792


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T
T_f
σ_t
S
station: E
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

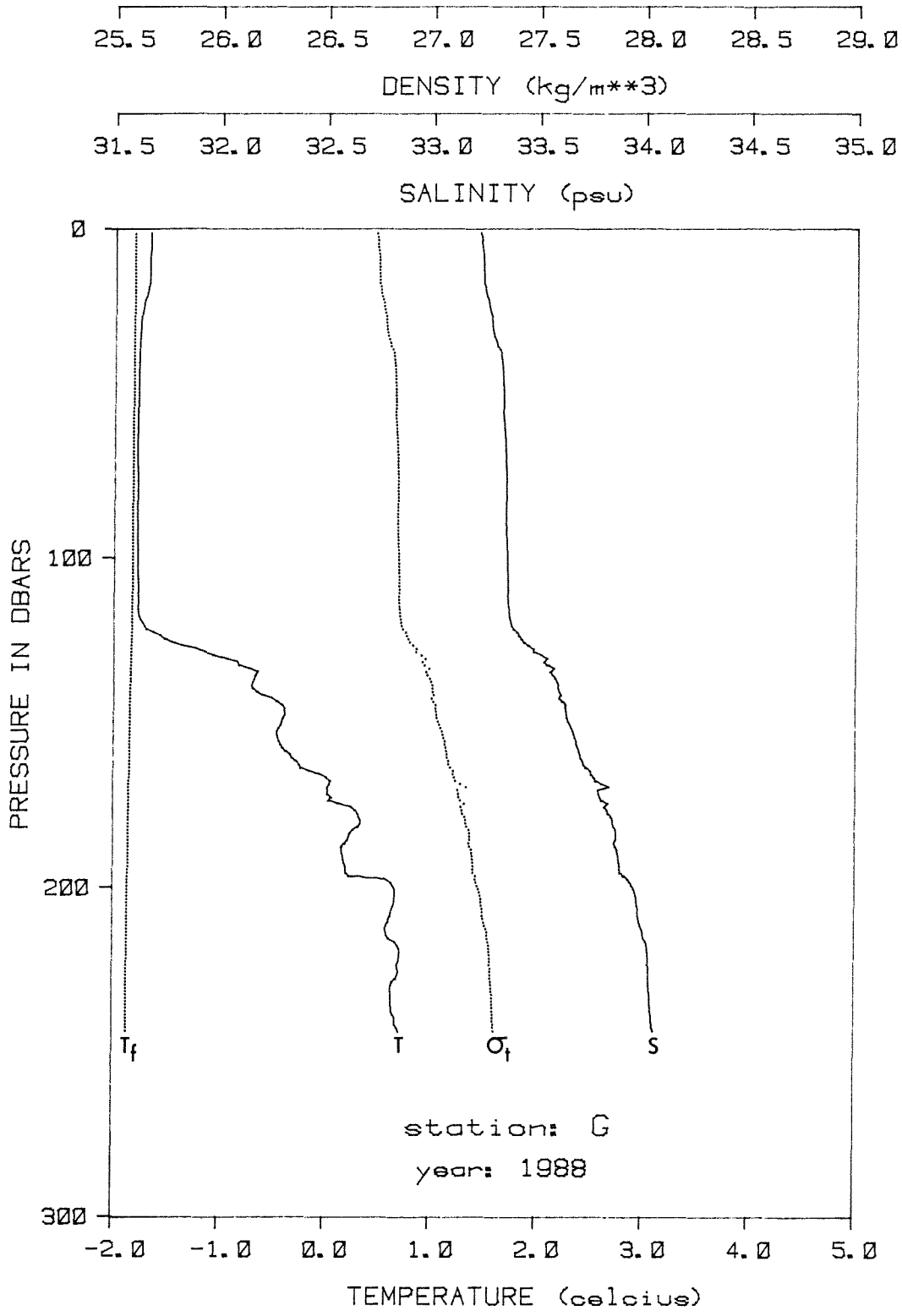
SITE: E LAT.N: 51 22.9 LON.W: 54 15.3 DATE: MAR. 26/88
TIME(Z): 1955

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.834	0.616	33.519	-1.838	26.978
2.5	-1.798	0.612	33.285	-1.824	26.787
3.5	-1.797	0.612	33.276	-1.824	26.779
4.5	-1.797	0.612	33.271	-1.823	26.775
5.5	-1.797	0.612	33.269	-1.823	26.774
6.5	-1.797	0.612	33.268	-1.823	26.772
7.5	-1.796	0.612	33.266	-1.823	26.771
8.5	-1.796	0.612	33.266	-1.823	26.771
9.5	-1.797	0.612	33.266	-1.823	26.771
10.5	-1.797	0.612	33.266	-1.823	26.771
15.5	-1.796	0.612	33.265	-1.823	26.771
16.5	-1.796	0.612	33.265	-1.823	26.771
17.5	-1.796	0.612	33.265	-1.823	26.770
18.5	-1.796	0.612	33.265	-1.823	26.770
19.5	-1.796	0.612	33.265	-1.823	26.770
20.5	-1.796	0.612	33.264	-1.823	26.770
25.5	-1.796	0.612	33.264	-1.823	26.770
30.5	-1.795	0.612	33.265	-1.823	26.770
35.5	-1.795	0.612	33.266	-1.823	26.771
40.5	-1.794	0.613	33.267	-1.823	26.772
45.5	-1.793	0.613	33.268	-1.823	26.772
50.5	-1.792	0.613	33.269	-1.823	26.773
55.5	-1.792	0.613	33.269	-1.823	26.774
60.5	-1.792	0.613	33.270	-1.823	26.774
65.5	-1.791	0.613	33.270	-1.823	26.774
70.5	-1.790	0.613	33.272	-1.823	26.776
75.5	-1.787	0.613	33.277	-1.824	26.779
80.5	-1.786	0.613	33.281	-1.824	26.783
85.5	-1.786	0.613	33.287	-1.824	26.788
90.5	-1.786	0.614	33.287	-1.824	26.788
95.5	-1.785	0.614	33.290	-1.824	26.791
100.5	-1.784	0.614	33.291	-1.824	26.791
105.5	-1.784	0.614	33.294	-1.825	26.794
110.5	-1.785	0.614	33.296	-1.825	26.795
115.5	-1.784	0.614	33.297	-1.825	26.796
120.5	-1.783	0.614	33.299	-1.825	26.797
130.5	-1.783	0.614	33.304	-1.825	26.802
140.5	-1.782	0.615	33.315	-1.826	26.810
150.5	-1.785	0.615	33.329	-1.827	26.822
160.5	-1.781	0.615	33.338	-1.827	26.829


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f
T
σ_t
S
station: F
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

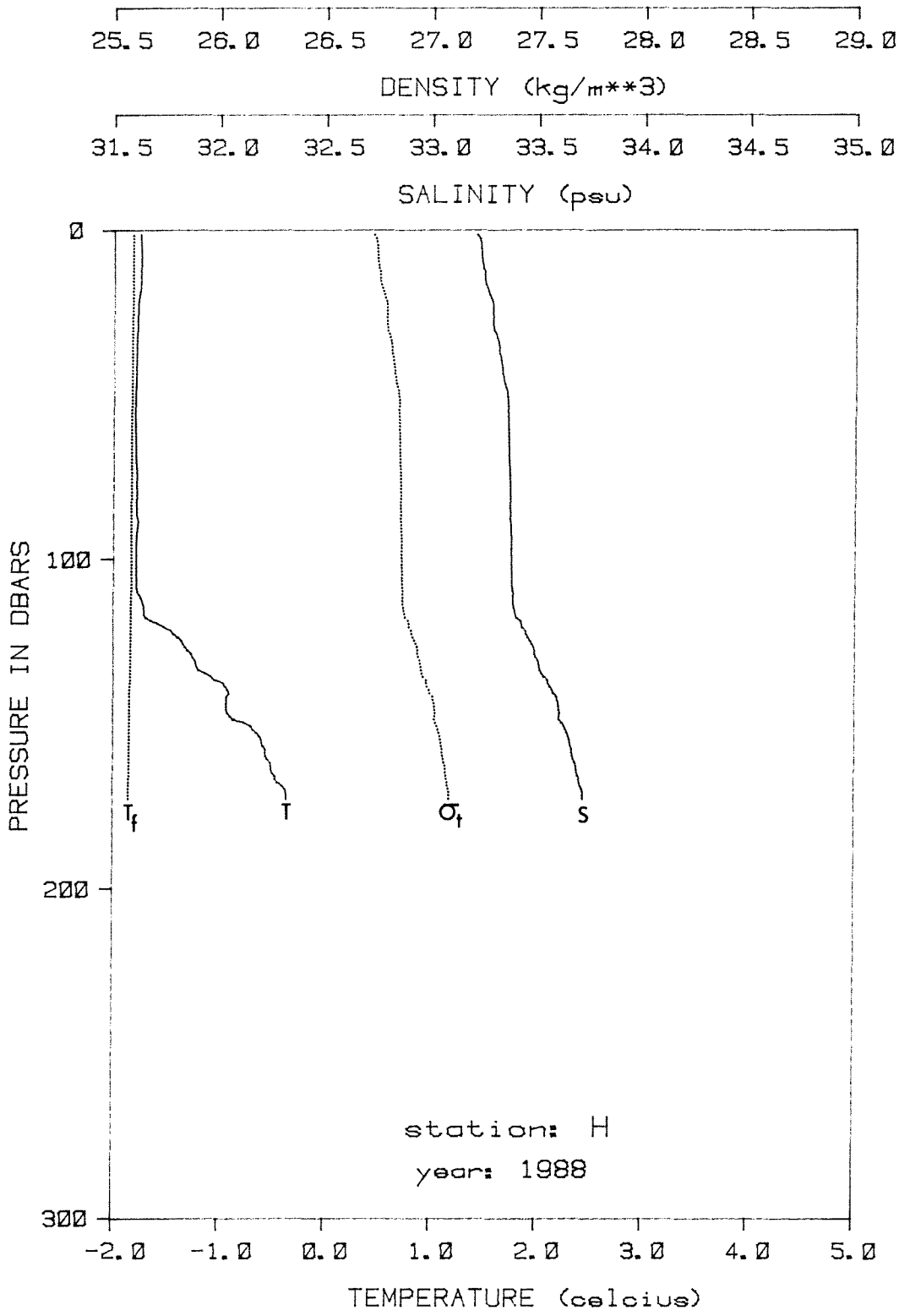
SITE: F LAT.N: 50 04.7 LON.W: 53 50.3 DATE: APR. 2/88
TIME(Z): 1453

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3
2.5	-1.564	0.616	33.214	-1.820	26.723
3.5	-1.571	0.615	33.217	-1.820	26.726
4.5	-1.530	0.616	33.229	-1.821	26.734
5.5	-1.510	0.617	33.244	-1.822	26.746
6.5	-1.494	0.618	33.270	-1.823	26.767
7.5	-1.480	0.618	33.285	-1.824	26.778
8.5	-1.471	0.619	33.312	-1.826	26.800
9.5	-1.459	0.620	33.334	-1.827	26.818
10.5	-1.408	0.621	33.354	-1.828	26.833
15.5	-1.434	0.622	33.414	-1.832	26.882
20.5	-1.532	0.620	33.459	-1.834	26.921
25.5	-1.494	0.622	33.476	-1.835	26.934
30.5	-1.605	0.620	33.504	-1.837	26.960
35.5	-1.635	0.620	33.521	-1.838	26.974
40.5	-1.669	0.619	33.537	-1.839	26.988
45.5	-1.702	0.619	33.541	-1.839	26.992
50.5	-1.709	0.619	33.542	-1.839	26.993
55.5	-1.704	0.619	33.545	-1.839	26.996
60.5	-1.716	0.619	33.549	-1.839	26.999
65.5	-1.714	0.619	33.549	-1.839	26.999
70.5	-1.712	0.619	33.550	-1.839	27.000
75.5	-1.705	0.619	33.553	-1.839	27.002
80.5	-1.701	0.620	33.557	-1.840	27.005
85.5	-1.698	0.620	33.558	-1.840	27.006
90.5	-1.684	0.620	33.563	-1.840	27.009
95.5	-1.672	0.620	33.569	-1.840	27.014
100.5	-1.685	0.620	33.570	-1.840	27.016
105.5	-1.691	0.620	33.572	-1.841	27.017
110.5	-1.651	0.621	33.578	-1.841	27.021
115.5	-1.622	0.622	33.582	-1.841	27.023
120.5	-1.558	0.623	33.596	-1.842	27.033
130.5	-1.430	0.626	33.624	-1.844	27.052
140.5	-1.255	0.630	33.664	-1.846	27.079
150.5	-0.994	0.637	33.724	-1.849	27.119
175.5	-0.674	0.644	33.789	-1.853	27.159


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f
T
σ_t
S
station: G
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

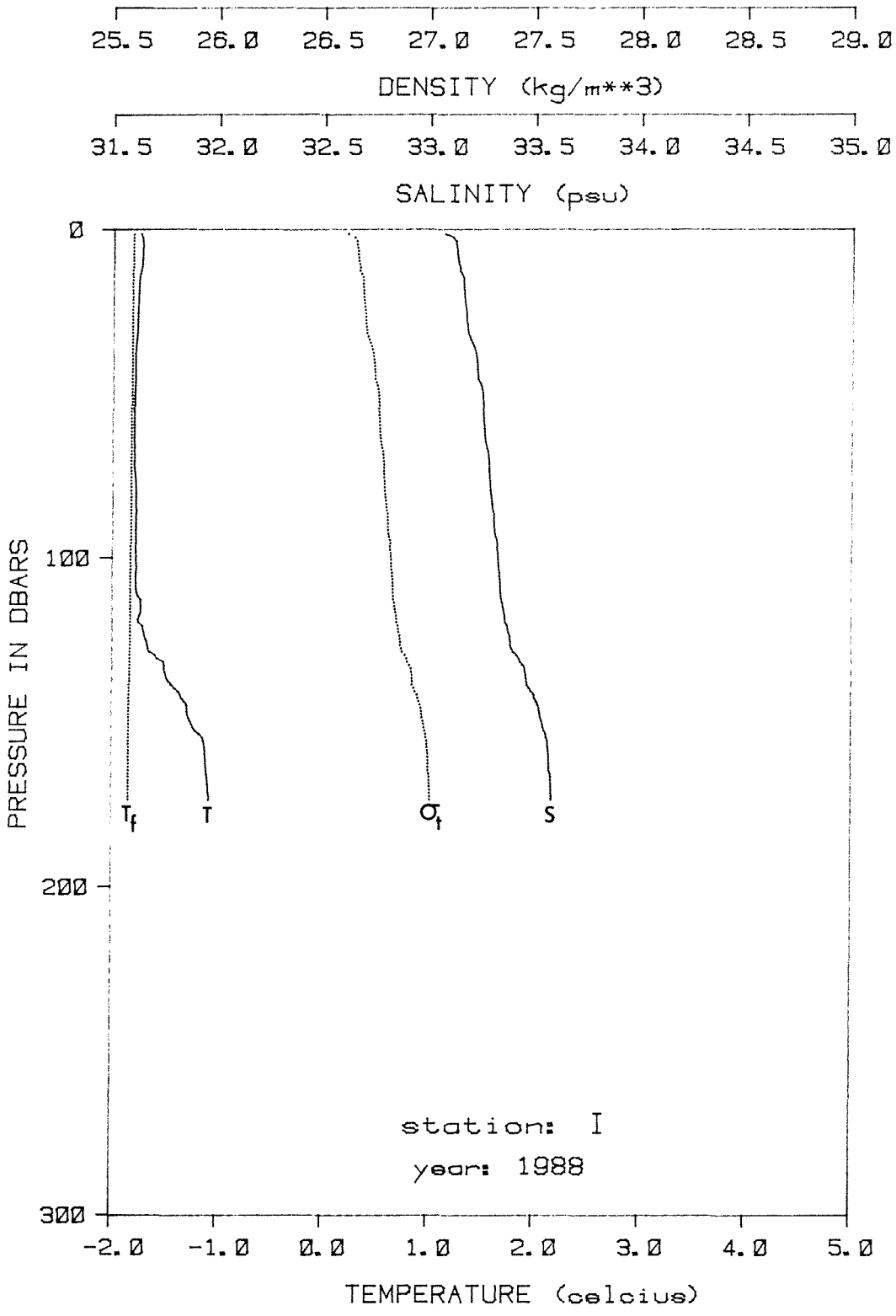
SITE: G LAT.N: 50 23.3 LON.W: 54 05.2 DATE: APR. 2/88
TIME(Z): 1636

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.669	0.614	33.220	-1.820	26.730
2.5	-1.669	0.614	33.226	-1.821	26.735
3.5	-1.669	0.614	33.227	-1.821	26.736
4.5	-1.668	0.614	33.227	-1.821	26.736
5.5	-1.669	0.614	33.228	-1.821	26.737
6.5	-1.671	0.614	33.231	-1.821	26.739
7.5	-1.674	0.614	33.233	-1.821	26.742
8.5	-1.679	0.614	33.235	-1.821	26.743
9.5	-1.679	0.614	33.235	-1.821	26.743
10.5	-1.680	0.614	33.236	-1.821	26.744
15.5	-1.681	0.614	33.237	-1.821	26.745
20.5	-1.711	0.614	33.250	-1.822	26.756
25.5	-1.747	0.613	33.269	-1.823	26.772
30.5	-1.762	0.613	33.281	-1.824	26.782
35.5	-1.770	0.614	33.302	-1.825	26.800
40.5	-1.777	0.614	33.326	-1.826	26.819
45.5	-1.779	0.614	33.330	-1.827	26.823
50.5	-1.781	0.614	33.333	-1.827	26.825
55.5	-1.781	0.614	33.334	-1.827	26.826
60.5	-1.783	0.614	33.339	-1.827	26.830
65.5	-1.786	0.614	33.344	-1.828	26.834
70.5	-1.787	0.614	33.346	-1.828	26.836
75.5	-1.782	0.614	33.349	-1.828	26.838
80.5	-1.782	0.615	33.349	-1.828	26.838
85.5	-1.782	0.615	33.349	-1.828	26.838
90.5	-1.781	0.615	33.351	-1.828	26.839
95.5	-1.780	0.615	33.353	-1.828	26.841
100.5	-1.779	0.615	33.356	-1.828	26.843
105.5	-1.776	0.615	33.358	-1.828	26.845
110.5	-1.769	0.615	33.358	-1.828	26.845
115.5	-1.769	0.615	33.365	-1.829	26.851
120.5	-1.712	0.617	33.378	-1.829	26.860
130.5	-0.942	0.634	33.545	-1.839	26.972
140.5	-0.649	0.641	33.605	-1.842	27.009
150.5	-0.418	0.646	33.654	-1.845	27.039
175.5	0.247	0.663	33.822	-1.855	27.143
200.5	0.668	0.674	33.960	-1.863	27.230
225.5	0.708	0.676	34.032	-1.867	27.285


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f
T
σ_t
S
station: H
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

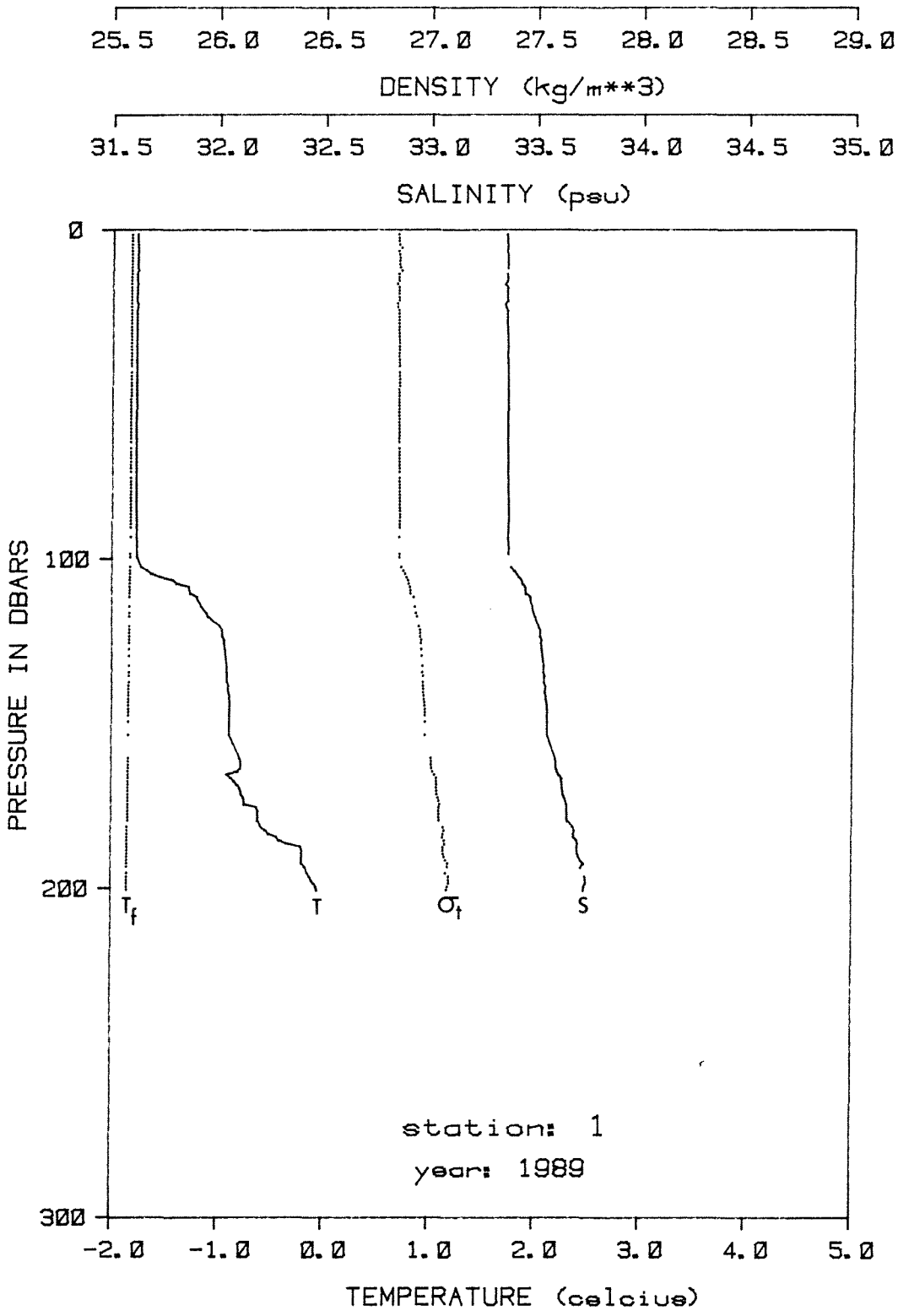
SITE: H LAT.N: 50 42.0 LON.W: 54 19.8 DATE: APR. 2/88
TIME(Z): 1826

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.750	0.612	33.210	-1.820	26.724
2.5	-1.748	0.612	33.222	-1.821	26.734
3.5	-1.747	0.612	33.226	-1.821	26.737
4.5	-1.745	0.612	33.228	-1.821	26.739
5.5	-1.744	0.612	33.228	-1.821	26.739
6.5	-1.743	0.613	33.230	-1.821	26.741
7.5	-1.742	0.613	33.231	-1.821	26.742
8.5	-1.742	0.613	33.232	-1.821	26.742
9.5	-1.742	0.613	33.233	-1.821	26.743
10.5	-1.742	0.613	33.236	-1.821	26.746
15.5	-1.747	0.613	33.247	-1.822	26.755
20.5	-1.766	0.613	33.274	-1.824	26.777
25.5	-1.774	0.613	33.285	-1.824	26.786
30.5	-1.777	0.613	33.292	-1.825	26.791
35.5	-1.783	0.613	33.316	-1.826	26.811
40.5	-1.787	0.614	33.327	-1.827	26.820
45.5	-1.789	0.614	33.338	-1.827	26.829
50.5	-1.796	0.614	33.356	-1.828	26.844
55.5	-1.794	0.614	33.361	-1.828	26.848
60.5	-1.792	0.614	33.363	-1.829	26.849
65.5	-1.788	0.615	33.364	-1.829	26.850
70.5	-1.786	0.615	33.366	-1.829	26.852
75.5	-1.780	0.615	33.368	-1.829	26.854
80.5	-1.781	0.615	33.371	-1.829	26.856
85.5	-1.777	0.615	33.373	-1.829	26.857
90.5	-1.771	0.615	33.375	-1.829	26.859
95.5	-1.783	0.615	33.377	-1.829	26.861
100.5	-1.784	0.615	33.377	-1.829	26.861
105.5	-1.782	0.615	33.378	-1.829	26.862
110.5	-1.756	0.616	33.385	-1.830	26.867
115.5	-1.707	0.617	33.393	-1.830	26.872
116.5	-1.706	0.617	33.397	-1.831	26.875
120.5	-1.517	0.621	33.430	-1.832	26.897
130.5	-1.229	0.628	33.501	-1.837	26.946
140.5	-0.903	0.636	33.577	-1.841	26.997
150.5	-0.700	0.641	33.627	-1.844	27.029
160.5	-0.545	0.644	33.672	-1.846	27.059
170.5	-0.365	0.649	33.718	-1.849	27.089


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f
T
σ_t
S
station: I
year: 1988
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

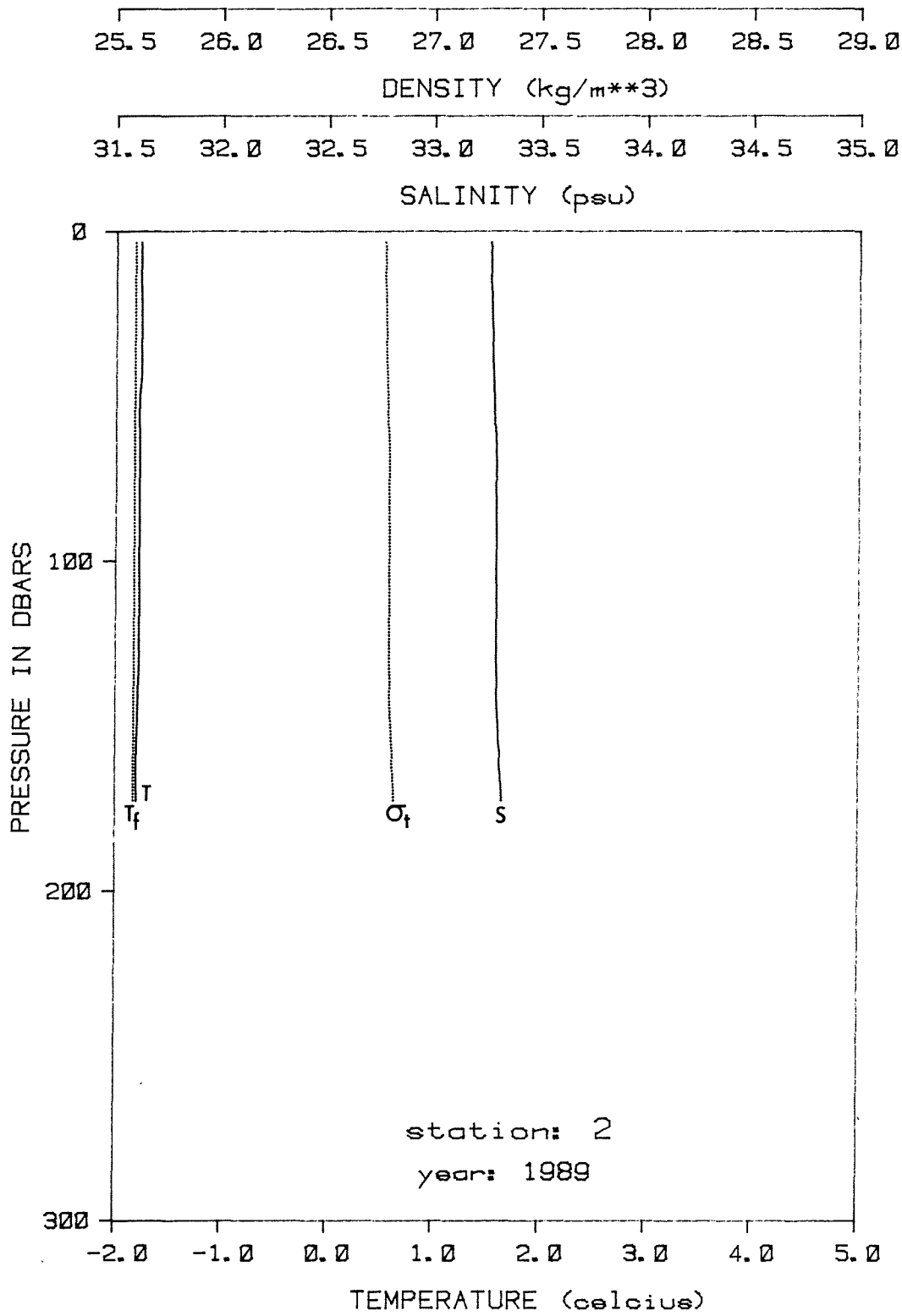
SITE: I LAT.N: 51 00.5 LON.W: 54 35.9 DATE: APR. 2/88
TIME(Z): 1942

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3
1.5	-1.742	0.610	33.069	-1.812	26.610
2.5	-1.730	0.611	33.107	-1.814	26.640
3.5	-1.726	0.611	33.120	-1.815	26.650
4.5	-1.724	0.611	33.122	-1.815	26.652
5.5	-1.725	0.611	33.125	-1.815	26.655
6.5	-1.728	0.611	33.128	-1.815	26.657
7.5	-1.728	0.611	33.128	-1.815	26.657
8.5	-1.729	0.611	33.130	-1.815	26.659
9.5	-1.731	0.611	33.133	-1.815	26.661
10.5	-1.732	0.611	33.135	-1.816	26.663
15.5	-1.755	0.611	33.159	-1.817	26.683
20.5	-1.761	0.611	33.164	-1.817	26.687
25.5	-1.768	0.611	33.173	-1.818	26.695
30.5	-1.772	0.611	33.180	-1.818	26.701
35.5	-1.785	0.612	33.208	-1.820	26.724
40.5	-1.789	0.612	33.224	-1.821	26.737
45.5	-1.790	0.612	33.229	-1.821	26.741
50.5	-1.795	0.612	33.251	-1.822	26.759
55.5	-1.796	0.612	33.255	-1.822	26.762
60.5	-1.796	0.613	33.261	-1.823	26.767
65.5	-1.795	0.613	33.269	-1.823	26.774
70.5	-1.795	0.613	33.283	-1.824	26.785
75.5	-1.783	0.613	33.286	-1.824	26.787
80.5	-1.777	0.614	33.292	-1.825	26.792
85.5	-1.773	0.614	33.302	-1.825	26.800
90.5	-1.778	0.614	33.306	-1.825	26.803
95.5	-1.779	0.614	33.322	-1.826	26.816
100.5	-1.775	0.615	33.329	-1.827	26.822
105.5	-1.777	0.615	33.336	-1.827	26.827
110.5	-1.768	0.615	33.341	-1.827	26.831
115.5	-1.729	0.616	33.354	-1.828	26.841
120.5	-1.716	0.617	33.371	-1.829	26.854
130.5	-1.577	0.620	33.427	-1.832	26.896
140.5	-1.371	0.625	33.485	-1.836	26.938
150.5	-1.243	0.629	33.540	-1.839	26.978
160.5	-1.110	0.632	33.572	-1.841	26.999
170.5	-1.084	0.633	33.582	-1.841	27.007


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T_f
T
σ_t
S
station: 1
year: 1989
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

SITE: 1 LAT.N: 50 48.8' LON.W 54 10.7' DATE: MAR. 23/89
TIME(Z): 1620

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.776	0.614	33.354	-1.828	26.842
2.5	-1.776	0.614	33.356	-1.828	26.842
3.5	-1.775	0.614	33.354	-1.828	26.842
4.5	-1.773	0.614	33.357	-1.828	26.844
5.5	-1.773	0.614	33.356	-1.829	26.857
6.5	-1.769	0.614	33.354	-1.828	26.842
7.5	-1.774	0.614	33.358	-1.828	26.845
8.5	-1.774	0.614	33.358	-1.829	26.849
9.5	-1.775	0.614	33.358	-1.828	26.846
10.5	-1.775	0.614	33.358	-1.828	26.845
15.5	-1.776	0.614	33.359	-1.828	26.846
20.5	-1.777	0.614	33.358	-1.828	26.845
24.5	-1.778	0.614	33.359	-1.828	26.846
30.5	-1.778	0.614	33.359	-1.828	26.846
35.5	-1.779	0.614	33.362	-1.829	26.849
40.5	-1.778	0.614	33.363	-1.829	26.849
45.5	-1.779	0.614	33.364	-1.829	26.850
50.5	-1.778	0.615	33.364	-1.829	26.850
55.5	-1.778	0.615	33.364	-1.829	26.850
60.5	-1.778	0.615	33.365	-1.829	26.851
66.5	-1.777	0.615	33.365	-1.829	26.851
70.5	-1.777	0.615	33.366	-1.829	26.852
75.5	-1.777	0.615	33.366	-1.829	26.852
80.5	-1.777	0.615	33.368	-1.829	26.853
85.5	-1.776	0.615	33.369	-1.829	26.854
90.5	-1.774	0.615	33.368	-1.829	26.853
99.5	-1.764	0.615		-1.829	26.854
105.5	-1.555	0.620	33.420	-1.832	26.890
110.5	-1.265	0.626	33.452	-1.834	26.908
114.5	-1.16	0.629	33.483	-1.835	26.929
120.5	-0.983	0.633	33.515	-1.837	26.949
129.5	-0.928	0.634	33.534	-1.838	26.962
140.5	-0.896	0.635	33.547	-1.839	26.972
149.5	-0.887	0.636	33.559	-1.84	26.981
160.5	-0.789	0.638	33.597	-1.842	27.009
170.5	-0.781	0.639	33.632	-1.844	27.037
179.5	-0.619	0.643	33.655	-1.845	27.049
190.5	-0.196	0.652	33.711	-1.848	27.075
200.5	-0.053	0.655	33.734	-1.85	27.087


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
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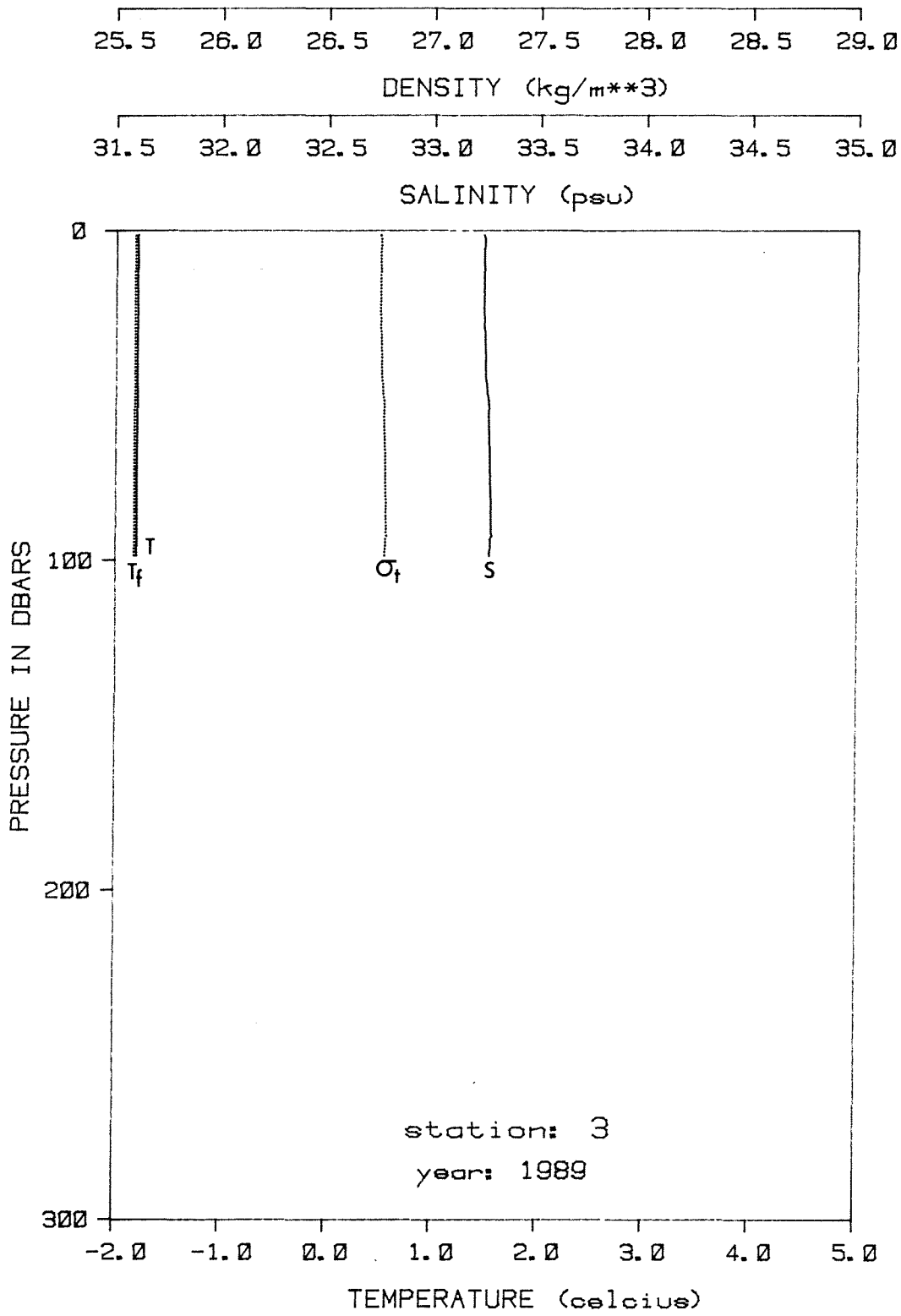
station: 2
year: 1989
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

SITE: 2 LAT.N: 51 1.8' LON.W 55 5.8' DATE: MAR. 23/89
TIME(Z):1900

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3
3.5	-1.769	0.613	33.262	-1.823	26.767
4.5	-1.766	0.613	33.266	-1.823	26.77
5.5	-1.768	0.613	33.267	-1.823	26.771
6.5	-1.769	0.613	33.264	-1.823	26.769
7.5	-1.768	0.613	33.265	-1.823	26.77
8.5	-1.767	0.613	33.266	-1.823	26.77
9.5	-1.768	0.613	33.266	-1.823	26.77
10.5	-1.767	0.613	33.265	-1.823	26.769
15.5	-1.766	0.613	33.267	-1.823	26.771
20.5	-1.762	0.613	33.269	-1.823	26.773
25.5	-1.762	0.613	33.271	-1.823	26.775
30.5	-1.762	0.613	33.274	-1.824	26.777
31.5	-1.762	0.613	33.274	-1.824	26.776
35.5	-1.76	0.613	33.275	-1.824	26.777
40.5	-1.761	0.613	33.277	-1.824	26.779
45.5	-1.766	0.613	33.28	-1.824	26.781
50.5	-1.78	0.613	33.282	-1.824	26.784
55.5	-1.78	0.613	33.285	-1.824	26.786
60.5	-1.777	0.613	33.29	-1.824	26.79
65.5	-1.777	0.614	33.293	-1.825	26.792
70.5	-1.777	0.614	33.293	-1.825	26.793
75.5	-1.776	0.614	33.293	-1.825	26.792
80.5	-1.776	0.614	33.294	-1.825	26.793
85.5	-1.776	0.614	33.294	-1.825	26.793
90.5	-1.776	0.614	33.294	-1.825	26.793
95.5	-1.777	0.614	33.294	-1.825	26.794
100.5	-1.777	0.614	33.295	-1.825	26.794
105.5	-1.776	0.614	33.294	-1.825	26.793
110.5	-1.776	0.614	33.295	-1.825	26.794
115.5	-1.776	0.614	33.295	-1.825	26.794
120.5	-1.776	0.614	33.296	-1.825	26.795
130.5	-1.776	0.614	33.295	-1.825	26.794
140.5	-1.784	0.614	33.298	-1.825	26.796
150.5	-1.792	0.614	33.305	-1.825	26.802
160.5	-1.799	0.614	33.313	-1.826	26.809
170.5	-1.797	0.615	33.323	-1.826	26.817
171.5	-1.797	0.615	33.324	-1.826	26.818
172.5	-1.796	0.615	33.324	-1.826	26.818


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
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PRESSURE IN DBARS
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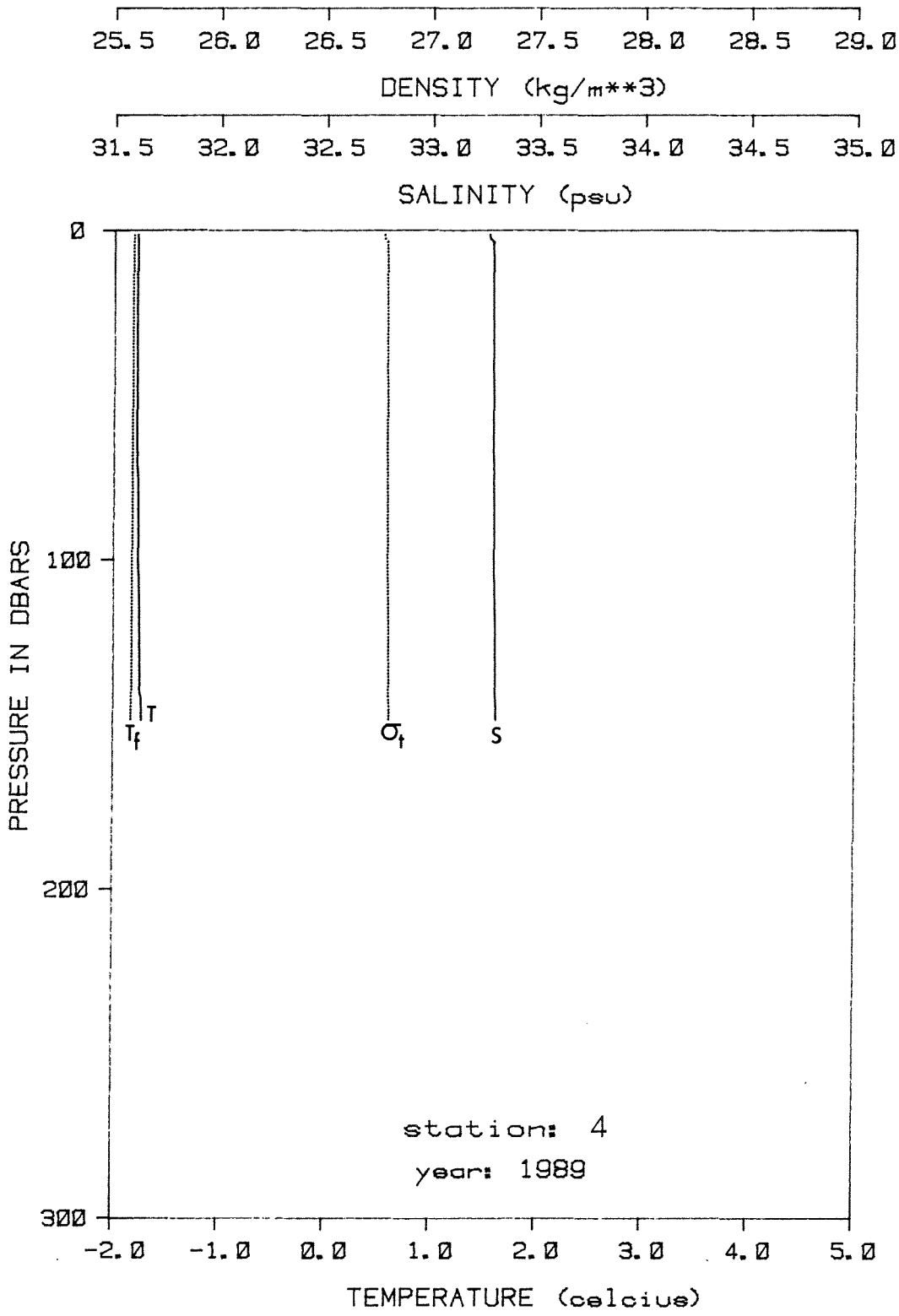
station: 3
year: 1989
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

SITE: 3 LAT.N: 51 20.3' LON.W 55 15.8' DATE: MAR. 23/89
TIME(Z): 2100

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.8	0.611	33.235	-1.821	26.745
2.5	-1.8	0.612	33.239	-1.822	26.749
3.5	-1.8	0.612	33.239	-1.822	26.749
4.5	-1.799	0.612	33.239	-1.822	26.749
5.5	-1.798	0.612	33.236	-1.821	26.747
6.5	-1.798	0.612	33.235	-1.821	26.746
7.5	-1.798	0.612	33.235	-1.821	26.746
8.5	-1.797	0.612	33.235	-1.821	26.746
9.5	-1.797	0.612	33.235	-1.821	26.746
10.5	-1.797	0.612	33.236	-1.821	26.747
15.5	-1.797	0.612	33.238	-1.821	26.748
20.5	-1.795	0.612	33.237	-1.821	26.747
25.5	-1.794	0.612	33.237	-1.821	26.747
30.5	-1.798	0.612	33.241	-1.822	26.751
35.5	-1.799	0.612	33.243	-1.822	26.752
40.5	-1.799	0.612	33.244	-1.822	26.753
45.5	-1.8	0.612	33.246	-1.822	26.755
50.5	-1.797	0.612	33.256	-1.823	26.763
55.5	-1.796	0.613	33.261	-1.823	26.767
60.5	-1.795	0.613	33.263	-1.823	26.768
65.5	-1.798	0.613	33.266	-1.823	26.771
70.5	-1.8	0.613	33.267	-1.823	26.772
75.5	-1.8	0.613	33.268	-1.823	26.773
80.5	-1.801	0.613	33.27	-1.823	26.774
85.5	-1.8	0.613	33.271	-1.823	26.775
90.5	-1.8	0.613	33.272	-1.823	26.776
95.5	-1.799	0.613	33.268	-1.823	26.772
98.5	-1.8	0.613	33.267	-1.823	26.772


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
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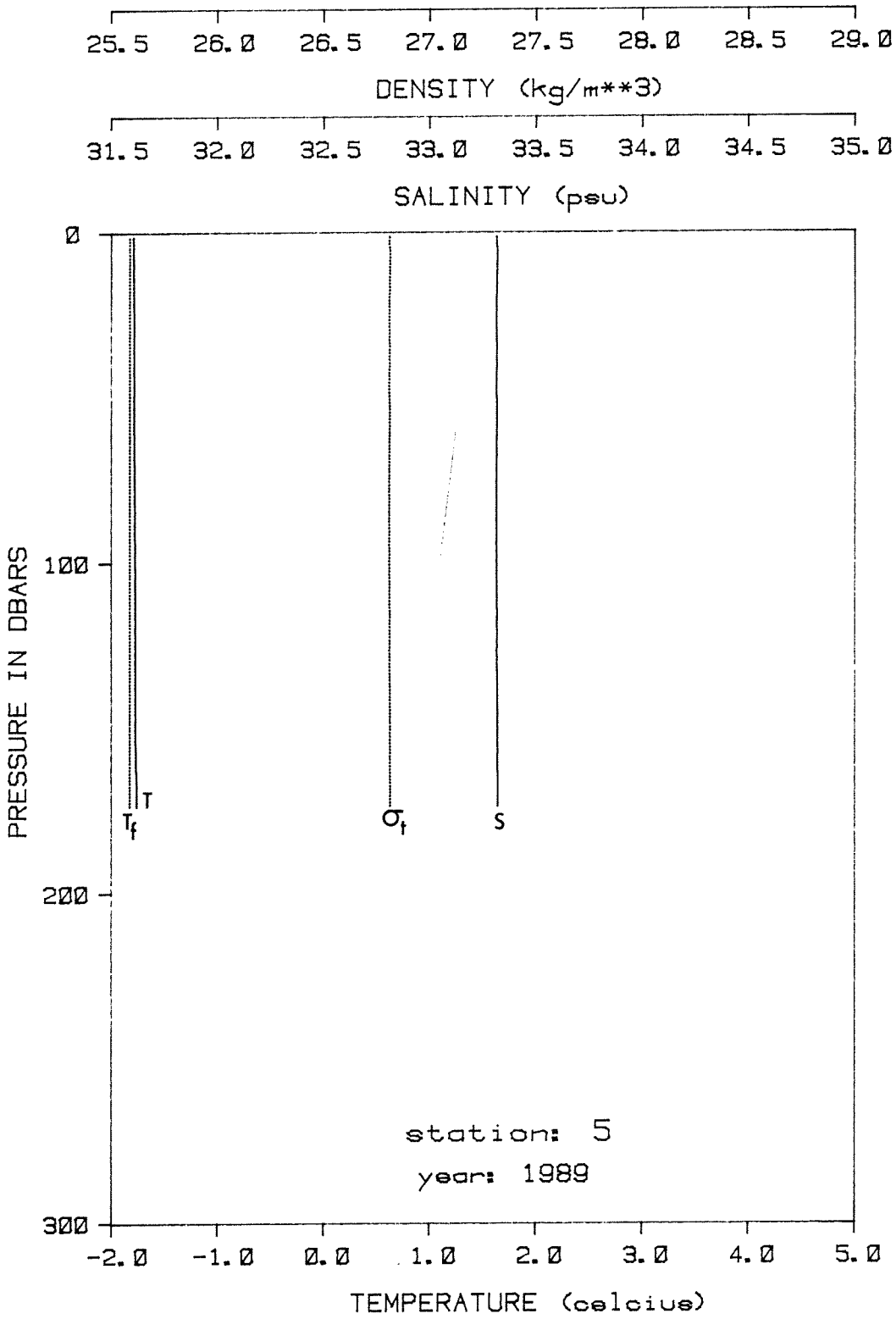
station: 4
year: 1989
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

SITE: 4 LAT.N: 51 27.7' LON.W 54 39.6' DATE: MAR. 24/89
TIME(Z): 1530

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.786	0.612	33.266	-1.823	26.771
2.5	-1.785	0.612	33.269	-1.823	26.773
3.5	-1.785	0.613	33.283	-1.824	26.785
4.5	-1.785	0.613	33.284	-1.824	26.786
5.5	-1.785	0.613	33.284	-1.824	26.786
6.5	-1.785	0.613	33.285	-1.824	26.786
7.5	-1.785	0.613	33.286	-1.824	26.787
8.5	-1.784	0.613	33.286	-1.824	26.787
9.5	-1.784	0.613	33.286	-1.824	26.787
10.5	-1.784	0.613	33.286	-1.824	26.787
15.5	-1.785	0.613	33.287	-1.824	26.788
20.5	-1.785	0.613	33.288	-1.824	26.789
25.5	-1.786	0.613	33.288	-1.824	26.789
30.5	-1.786	0.613	33.289	-1.824	26.789
35.5	-1.786	0.613	33.289	-1.824	26.789
40.5	-1.784	0.613	33.288	-1.824	26.788
45.5	-1.785	0.613	33.29	-1.824	26.791
50.5	-1.784	0.613	33.291	-1.824	26.791
55.5	-1.784	0.613	33.291	-1.825	26.791
60.5	-1.782	0.613	33.291	-1.825	26.791
65.5	-1.782	0.613	33.291	-1.825	26.791
70.5	-1.781	0.614	33.293	-1.825	26.793
75.5	-1.771	0.614	33.293	-1.825	26.792
80.5	-1.769	0.614	33.294	-1.825	26.793
85.5	-1.769	0.614	33.295	-1.825	26.794
90.5	-1.767	0.614	33.295	-1.825	26.794
95.5	-1.768	0.614	33.295	-1.825	26.794
100.5	-1.764	0.614	33.296	-1.825	26.795
105.5	-1.759	0.614	33.297	-1.825	26.796
110.5	-1.757	0.614	33.299	-1.825	26.797
115.5	-1.753	0.615	33.301	-1.825	26.799
120.5	-1.752	0.615	33.303	-1.825	26.8
130.5	-1.749	0.615	33.303	-1.825	26.8
140.5	-1.742	0.615	33.306	-1.825	26.802
148.5	-1.727	0.616	33.308	-1.825	26.804


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
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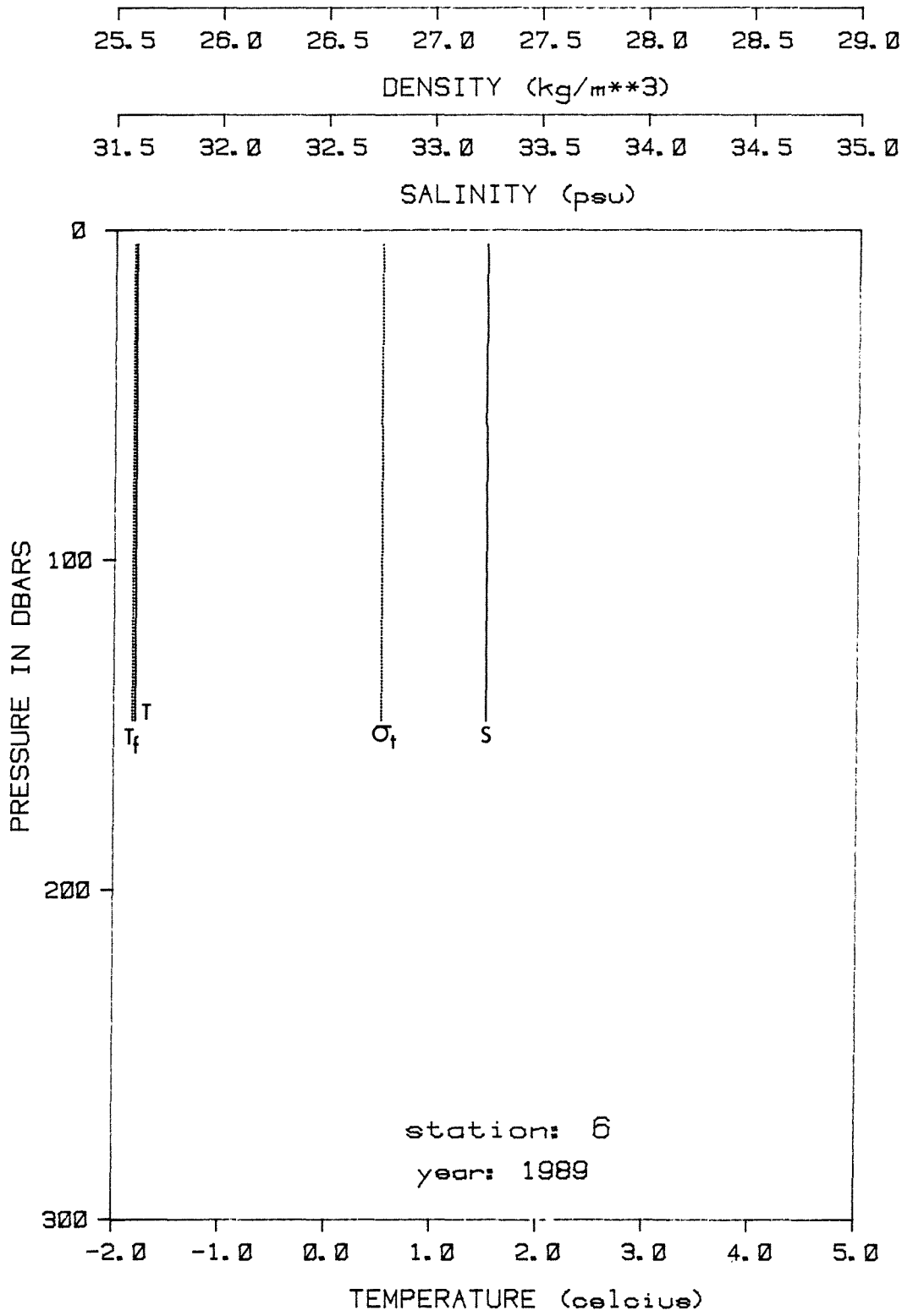
S
station: 5
year: 1989
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

SITE: 5 LAT.N: 51 22.6' LON.W 54 45.7' DATE: MAR. 24/89
TIME(Z): 1655

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.791	0.613	33.314	-1.826	26.81
2.5	-1.79	0.613	33.315	-1.826	26.81
3.5	-1.789	0.613	33.315	-1.826	26.81
4.5	-1.789	0.613	33.317	-1.826	26.812
5.5	-1.79	0.613	33.318	-1.826	26.813
6.5	-1.789	0.613	33.318	-1.826	26.813
7.5	-1.789	0.613	33.319	-1.826	26.813
8.5	-1.787	0.613	33.318	-1.826	26.813
9.5	-1.787	0.613	33.317	-1.826	26.812
10.5	-1.786	0.613	33.317	-1.826	26.812
15.5	-1.786	0.613	33.316	-1.826	26.811
20.5	-1.785	0.613	33.314	-1.826	26.809
25.5	-1.782	0.613	33.314	-1.826	26.809
30.5	-1.782	0.613	33.315	-1.826	26.81
35.5	-1.784	0.613	33.316	-1.826	26.811
40.5	-1.783	0.614	33.315	-1.826	26.811
45.5	-1.781	0.614	33.313	-1.826	26.809
50.5	-1.784	0.614	33.315	-1.826	26.811
55.5	-1.784	0.614	33.316	-1.826	26.812
60.5	-1.783	0.614	33.316	-1.826	26.811
65.5	-1.782	0.614	33.315	-1.826	26.81
70.5	-1.778	0.614	33.314	-1.826	26.809
75.5	-1.779	0.614	33.313	-1.826	26.809
80.5	-1.779	0.614	33.315	-1.826	26.81
85.5	-1.777	0.614	33.314	-1.826	26.809
90.5	-1.778	0.614	33.315	-1.826	26.81
95.5	-1.774	0.614	33.314	-1.826	26.81
100.5	-1.775	0.614	33.315	-1.826	26.811
105.5	-1.774	0.614	33.315	-1.826	26.811
110.5	-1.773	0.614	33.316	-1.826	26.811
115.5	-1.773	0.615	33.318	-1.826	26.812
120.5	-1.773	0.615	33.317	-1.826	26.812
130.5	-1.772	0.615	33.316	-1.826	26.811
140.5	-1.771	0.615	33.319	-1.826	26.813
150.5	-1.771	0.615	33.32	-1.826	26.814
160.5	-1.765	0.615	33.32	-1.826	26.814
170.5	-1.758	0.615	33.322	-1.826	26.815
173.5	-1.758	0.616	33.322	-1.826	26.816


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
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300
PRESSURE IN DBARS
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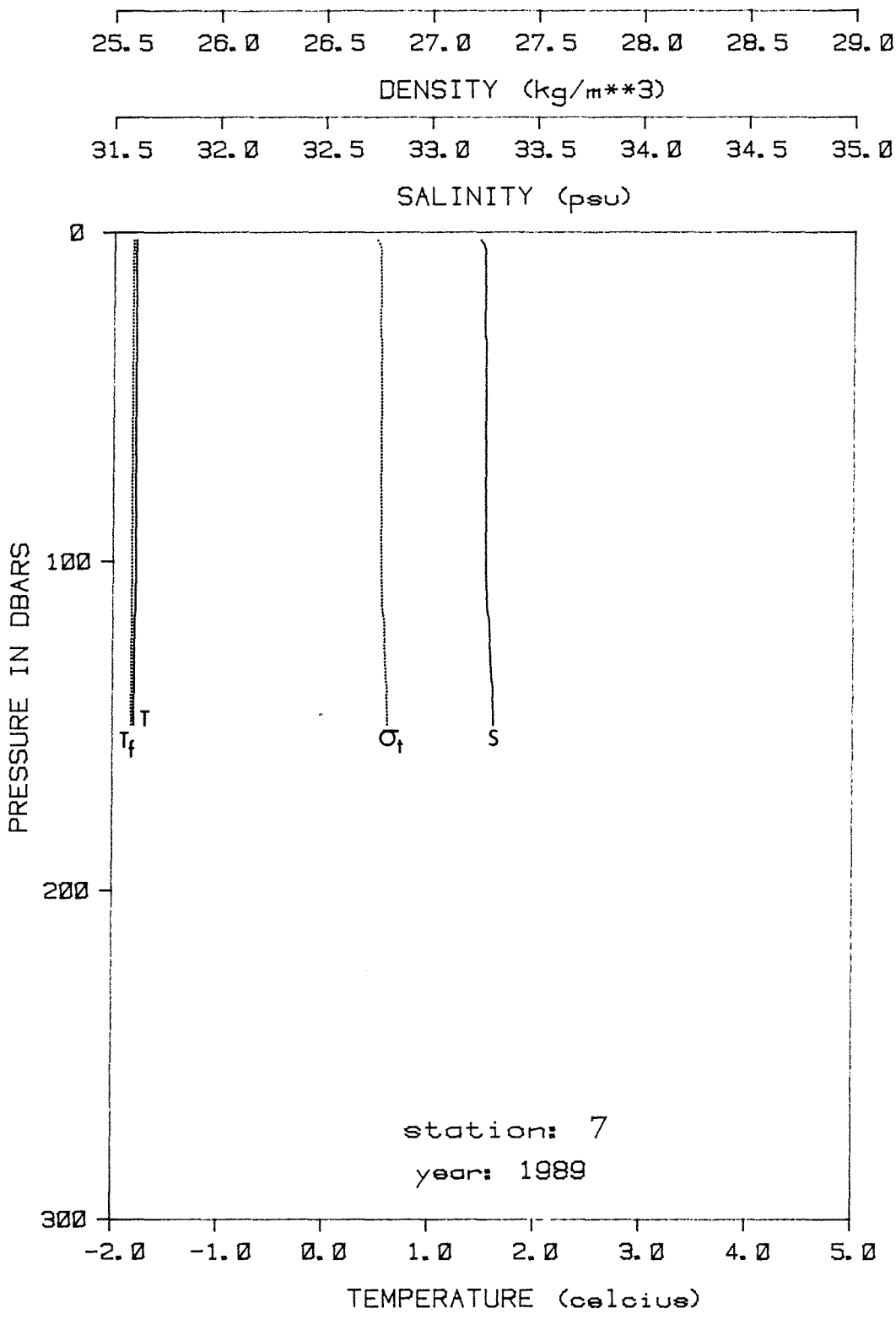
station: 6
year: 1989
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

SITE: 6 LAT.N: 51 16.6' LON.W 54 54.0' DATE: MAR. 24/89
TIME(Z): 1835

PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
4.5	-1.802	0.612	33.246	-1.822	26.755
5.5	-1.802	0.612	33.248	-1.822	26.756
6.5	-1.802	0.612	33.249	-1.822	26.757
7.5	-1.802	0.612	33.249	-1.822	26.757
8.5	-1.802	0.612	33.249	-1.822	26.758
9.5	-1.802	0.612	33.25	-1.822	26.758
10.5	-1.802	0.612	33.25	-1.822	26.758
15.5	-1.802	0.612	33.248	-1.822	26.756
20.5	-1.803	0.612	33.25	-1.822	26.758
25.5	-1.802	0.612	33.25	-1.822	26.758
30.5	-1.802	0.612	33.251	-1.822	26.759
35.5	-1.8	0.612	33.248	-1.822	26.757
40.5	-1.8	0.612	33.248	-1.822	26.757
45.5	-1.799	0.612	33.247	-1.822	26.756
50.5	-1.798	0.612	33.247	-1.822	26.755
55.5	-1.798	0.612	33.246	-1.822	26.755
60.5	-1.797	0.612	33.252	-1.822	26.759
65.5	-1.797	0.612	33.251	-1.822	26.759
70.5	-1.798	0.613	33.253	-1.822	26.76
75.5	-1.797	0.613	33.252	-1.822	26.759
80.5	-1.797	0.613	33.252	-1.822	26.76
85.5	-1.797	0.613	33.251	-1.822	26.759
90.5	-1.797	0.613	33.253	-1.822	26.76
95.5	-1.797	0.613	33.253	-1.822	26.76
100.5	-1.797	0.613	33.252	-1.822	26.76
105.5	-1.796	0.613	33.253	-1.822	26.761
110.5	-1.796	0.613	33.252	-1.822	26.76
115.5	-1.796	0.613	33.253	-1.822	26.76
120.5	-1.797	0.613	33.254	-1.822	26.761
125.5	-1.796	0.613	33.253	-1.822	26.761
130.5	-1.796	0.613	33.253	-1.822	26.761
140.5	-1.796	0.613	33.254	-1.822	26.761
148.5	-1.796	0.613	33.254	-1.822	26.761


25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
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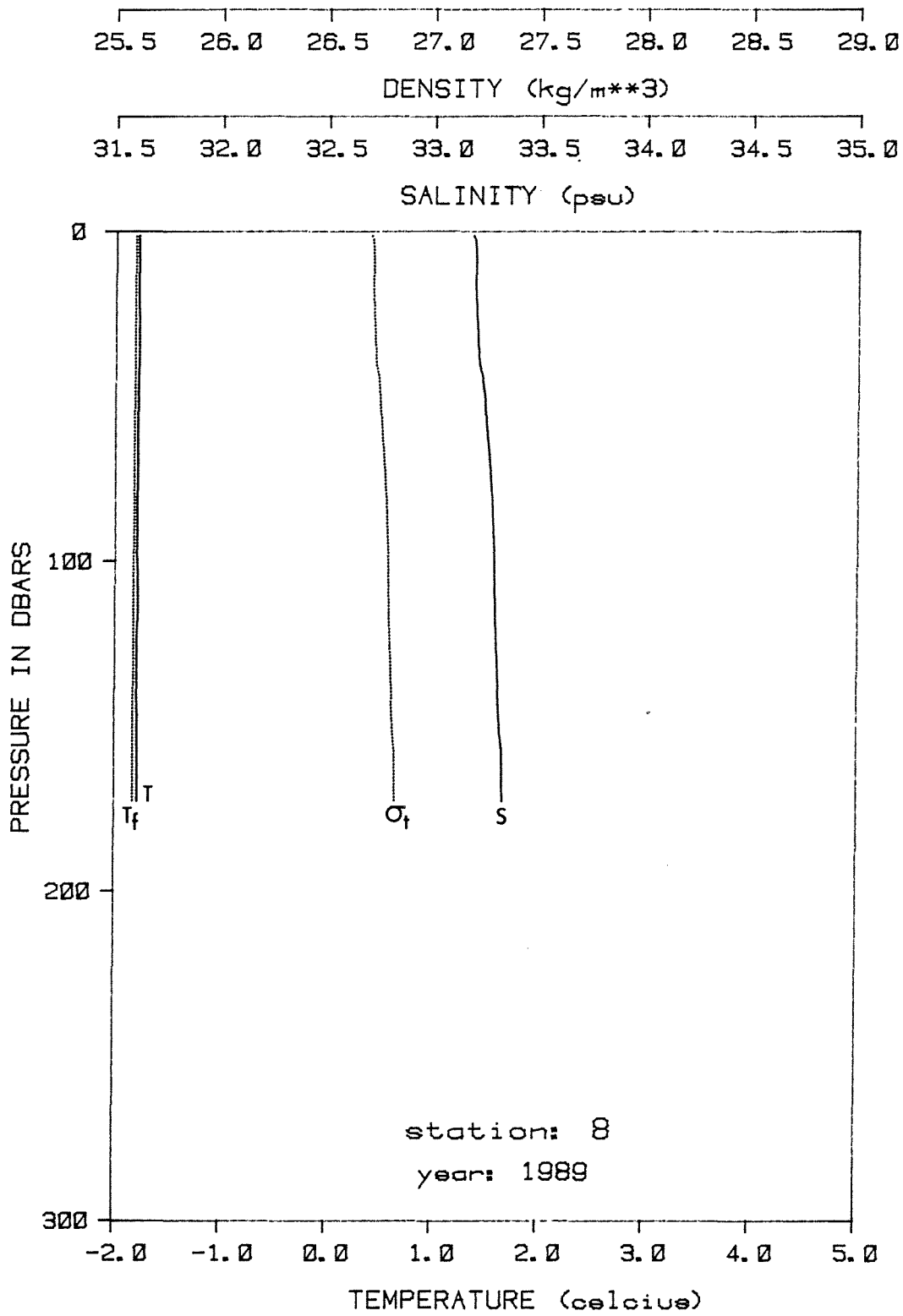
station: 7
year: 1989
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

SITE: 7 LAT.N: 51 10.4' LON.W 55 1.4' DATE: MAR. 24/89
TIME(Z): 1955

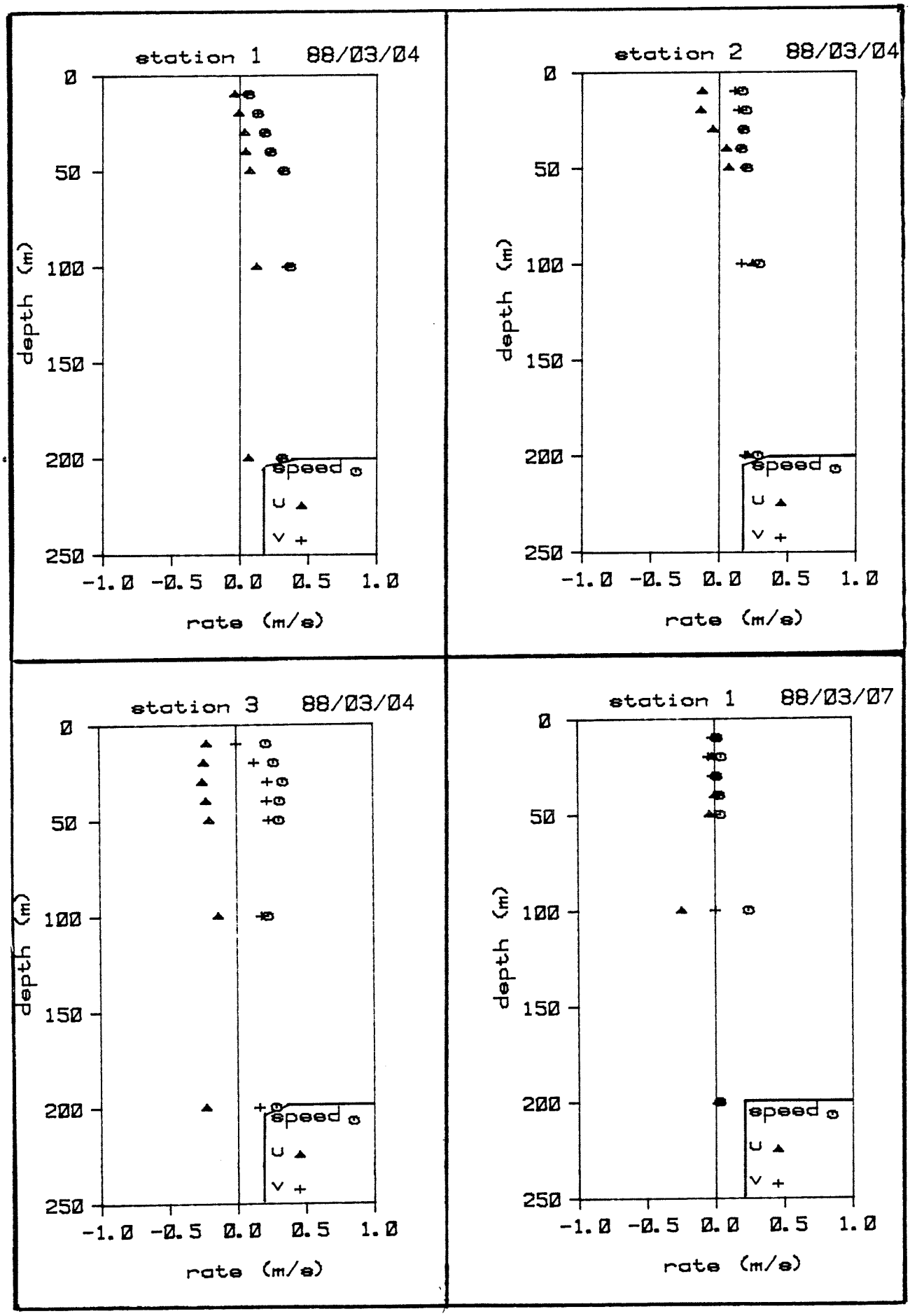
PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
2.5	-1.795	0.612	33.231	-1.821	26.742
3.5	-1.794	0.612	33.242	-1.822	26.752
4.5	-1.794	0.612	33.249	-1.822	26.757
5.5	-1.794	0.612	33.253	-1.822	26.76
6.5	-1.794	0.612	33.254	-1.822	26.761
7.5	-1.794	0.612	33.254	-1.822	26.761
8.5	-1.793	0.612	33.254	-1.822	26.761
9.5	-1.794	0.612	33.254	-1.822	26.762
10.5	-1.794	0.612	33.256	-1.823	26.763
15.5	-1.792	0.612	33.254	-1.822	26.761
20.5	-1.792	0.612	33.255	-1.822	26.762
25.5	-1.79	0.612	33.254	-1.822	26.761
30.5	-1.79	0.612	33.254	-1.822	26.761
35.5	-1.789	0.612	33.26	-1.823	26.766
40.5	-1.791	0.612	33.26	-1.823	26.766
45.5	-1.791	0.613	33.261	-1.823	26.767
50.5	-1.791	0.613	33.261	-1.823	26.766
55.5	-1.79	0.613	33.26	-1.823	26.766
60.5	-1.79	0.613	33.26	-1.823	26.766
65.5	-1.791	0.613	33.261	-1.823	26.767
70.5	-1.791	0.613	33.26	-1.823	26.766
75.5	-1.79	0.613	33.261	-1.823	26.766
80.5	-1.788	0.613	33.262	-1.823	26.767
85.5	-1.787	0.613	33.263	-1.823	26.768
90.5	-1.786	0.613	33.263	-1.823	26.768
95.5	-1.786	0.613	33.263	-1.823	26.769
100.5	-1.784	0.613	33.263	-1.823	26.769
105.5	-1.784	0.613	33.264	-1.823	26.769
110.5	-1.786	0.613	33.269	-1.823	26.773
115.5	-1.79	0.613	33.273	-1.823	26.776
120.5	-1.798	0.614	33.282	-1.824	26.784
130.5	-1.797	0.614	33.287	-1.824	26.788
140.5	-1.801	0.614	33.299	-1.825	26.798
149.5	-1.802	0.614	33.302	-1.825	26.801

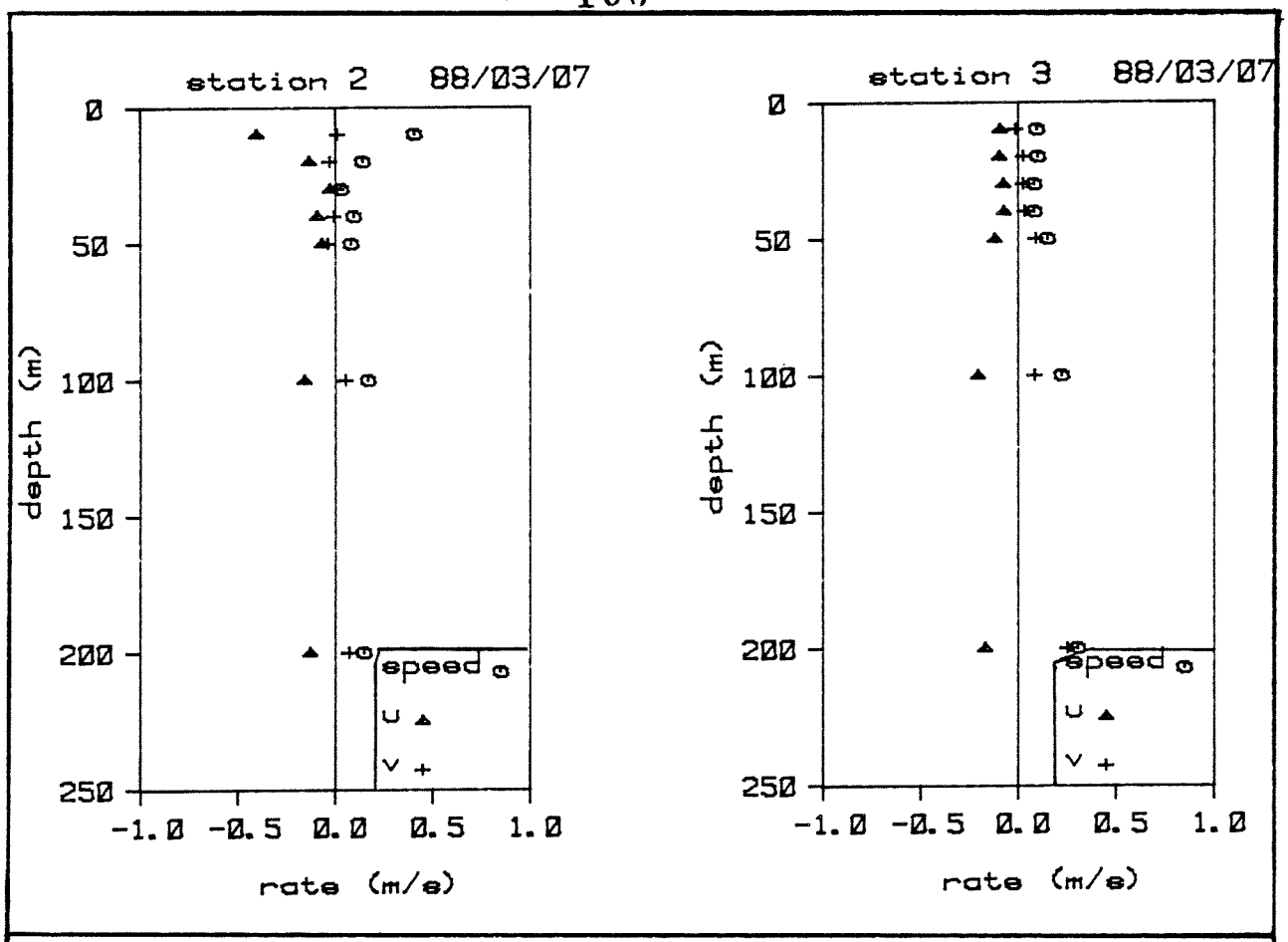

25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0
DENSITY (kg/m**3)
31.5 32.0 32.5 33.0 33.5 34.0 34.5 35.0
SALINITY (psu)
0
100
200
300
PRESSURE IN DBARS
T
Tf
σt
S
station: 8
year: 1989
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0
TEMPERATURE (celcius)

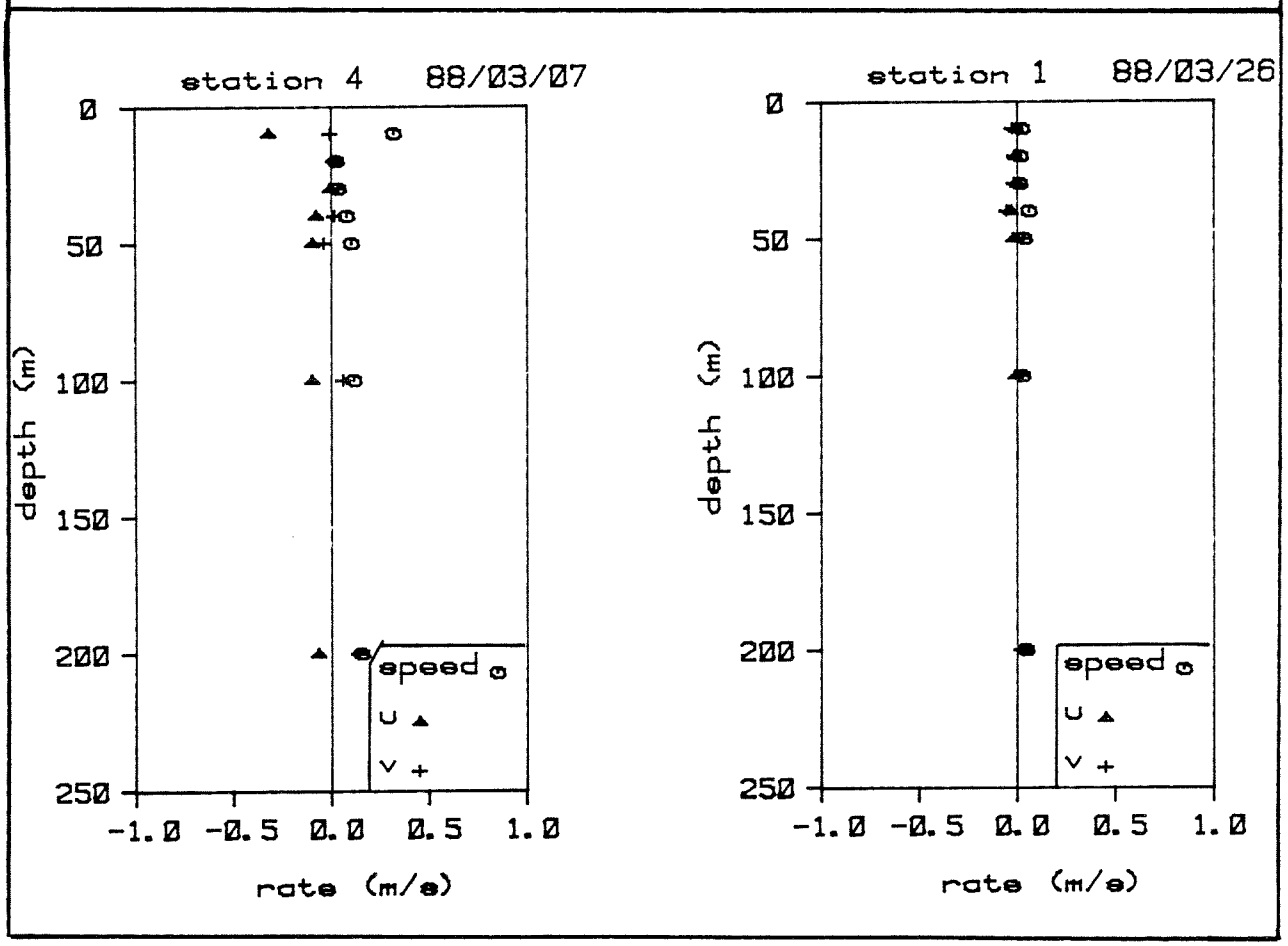
SITE: 8 LAT.N: 51 3.4' LON.W 55 13.5' DATE: MAR. 24/89
TIME(Z): 2120

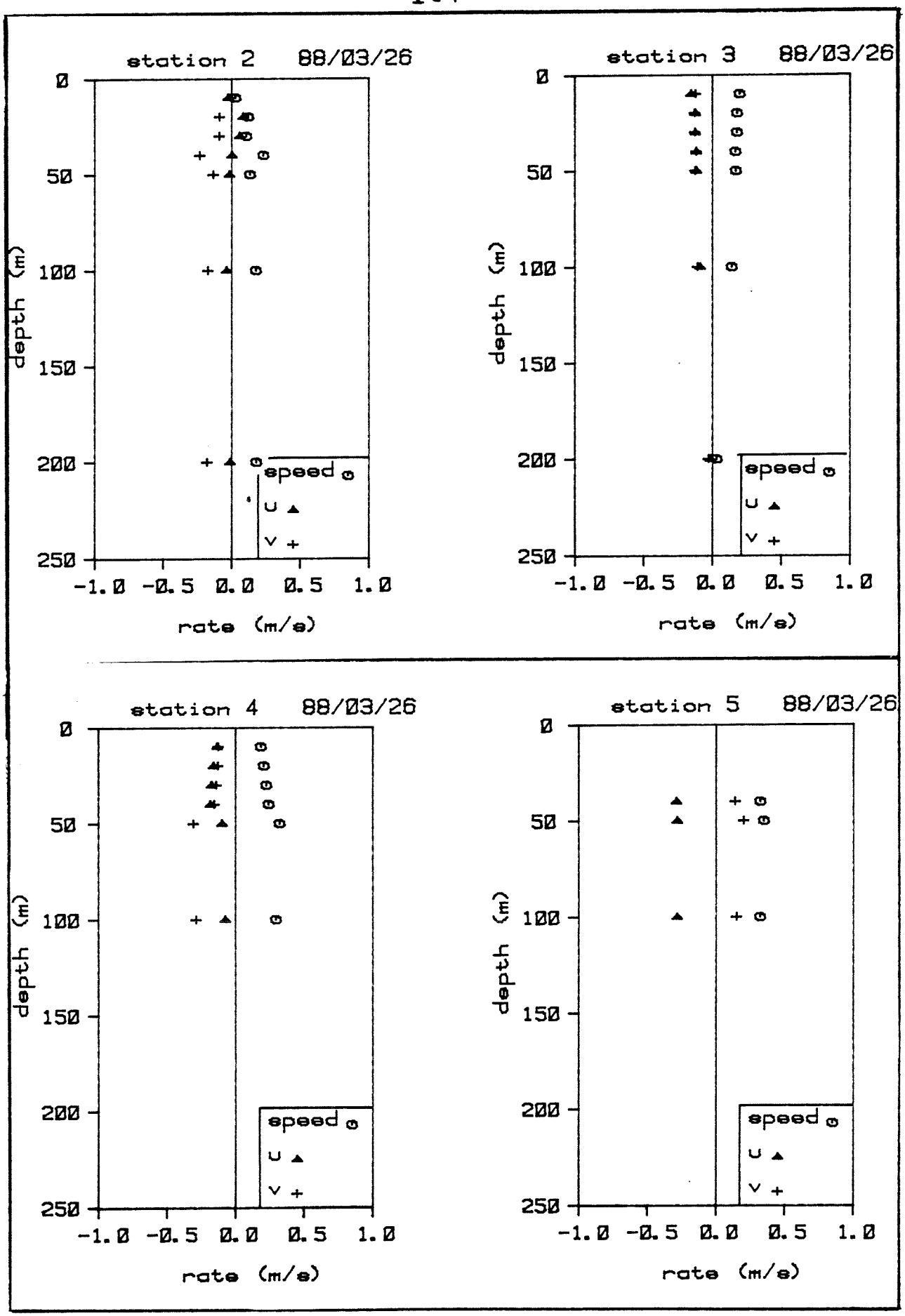
PRESS. (DBAR)	TEMP. (DEG.C)	COND.R	SAL.	FREEZE-T (DEG.C)	SIGMA-T (KG/M**3)
1.5	-1.791	0.611	33.18	-1.818	26.701
2.5	-1.791	0.611	33.188	-1.819	26.707
3.5	-1.791	0.611	33.19	-1.819	26.709
4.5	-1.791	0.611	33.191	-1.819	26.71
5.5	-1.79	0.611	33.192	-1.819	26.711
6.5	-1.789	0.611	33.192	-1.819	26.711
7.5	-1.789	0.611	33.193	-1.819	26.711
8.5	-1.789	0.611	33.194	-1.819	26.712
9.5	-1.789	0.611	33.194	-1.819	26.712
10.5	-1.788	0.611	33.193	-1.819	26.712
15.5	-1.788	0.611	33.193	-1.819	26.712
20.5	-1.786	0.611	33.194	-1.819	26.712
25.5	-1.782	0.611	33.199	-1.819	26.716
30.5	-1.782	0.612	33.204	-1.82	26.72
35.5	-1.782	0.612	33.208	-1.82	26.723
40.5	-1.783	0.612	33.212	-1.82	26.727
45.5	-1.79	0.612	33.228	-1.821	26.74
50.5	-1.79	0.612	33.237	-1.821	26.747
55.5	-1.79	0.612	33.243	-1.822	26.752
60.5	-1.789	0.613	33.25	-1.822	26.758
65.5	-1.789	0.613	33.258	-1.823	26.764
70.5	-1.788	0.613	33.263	-1.823	26.768
75.5	-1.79	0.613	33.268	-1.823	26.773
80.5	-1.795	0.613	33.275	-1.824	26.778
85.5	-1.794	0.613	33.277	-1.824	26.78
90.5	-1.795	0.613	33.281	-1.824	26.783
95.5	-1.796	0.613	33.284	-1.824	26.786
100.5	-1.788	0.614	33.288	-1.824	26.789
105.5	-1.784	0.614	33.289	-1.824	26.79
110.5	-1.782	0.614	33.29	-1.824	26.79
115.5	-1.783	0.614	33.292	-1.825	26.792
120.5	-1.793	0.614	33.295	-1.825	26.795
130.5	-1.794	0.614	33.302	-1.825	26.8
140.5	-1.791	0.614	33.308	-1.825	26.805
150.5	-1.785	0.615	33.315	-1.826	26.811
160.5	-1.783	0.615	33.327	-1.827	26.82
170.5	-1.783	0.615	33.329	-1.827	26.822
172.5	-1.783	0.615	33.33	-1.827	26.823

APPENDIX E


station 1 88/03/04
station 2 88/03/04
station 3 88/03/04
station 1 88/03/07
depth (m)
0
50
100
150
200
250
-1.0 -0.5 0.0 0.5 1.0
rate (m/s)
speed
u
v


station 2 88/03/07
station 3 88/03/07
depth (m)
0
50
100
150
200
250
-1.0 -0.5 0.0 0.5 1.0
rate (m/s)
speed
u
v


station 4 88/03/07
station 1 88/03/26
depth (m)
0
50
100
150
200
250
-1.0 -0.5 0.0 0.5 1.0
rate (m/s)
speed
u
v


station 2 88/03/26
station 3 88/03/26
station 4 88/03/26
station 5 88/03/26
depth (m)
0
50
100
150
200
250
-1.0 -0.5 0.0 0.5 1.0
rate (m/s)
speed
u
v

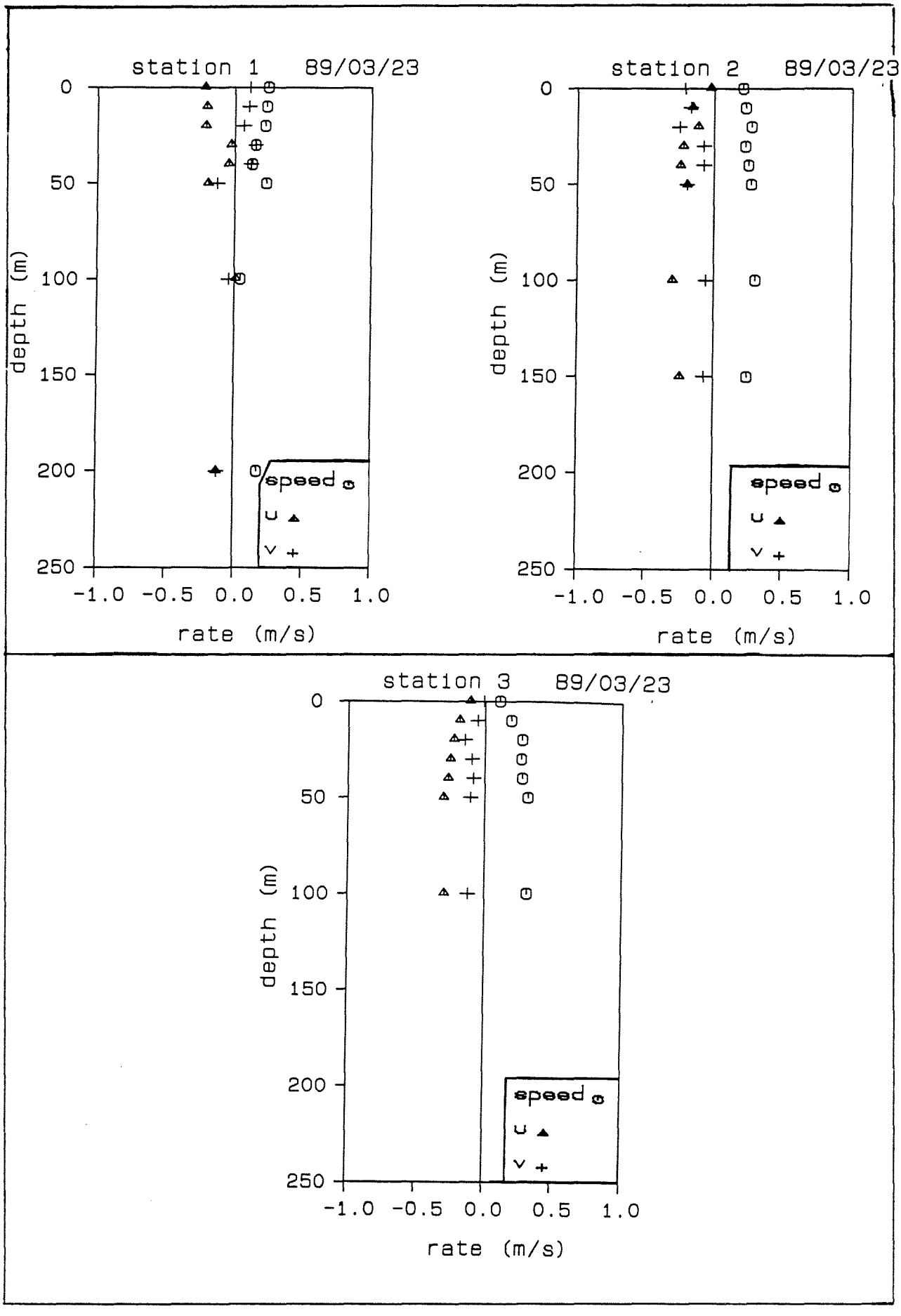
DATE	STATION	DEPTH/m	QUANTITY	UNITS	MEAN	STD.DEV
mar4	1	10	ns_velocity	m/s	0.05291	0.0100675
mar4	1	10	ew_velocity	m/s	-0.04	0.0101265
mar4	1	10	temperature	degreesC	-1.78	0
mar4	1	20	ns_velocity	m/s	0.1322	0.00729109
mar4	1	20	ew_velocity	m/s	-0.008	0.00769415
mar4	1	20	temperature	degreesC	-1.772	0.004
mar4	1	30	ns_velocity	m/s	0.18139	0.00867834
mar4	1	30	ew_velocity	m/s	0.03262	0.0097471
mar4	1	30	temperature	degreesC	-1.7708	0.00266469
mar4	1	40	ns_velocity	m/s	0.22244	0.0227406
mar4	1	40	ew_velocity	m/s	0.04067	0.0062538
mar4	1	40	temperature	degreesC	-1.7733	0.00471404
mar4	1	50	ns_velocity	m/s	0.315	0.036169
mar4	1	50	ew_velocity	m/s	0.0718	0.0146547
mar4	1	50	temperature	degreesC	-1.759	0.0137477
mar4	1	100	ns_velocity	m/s	0.34770	0.0218082
mar4	1	100	ew_velocity	m/s	0.12108	0.00861539
mar4	1	100	temperature	degreesC	-0.9315	0.180292
mar4	1	200	ns_velocity	m/s	0.306	0.00603022
mar4	1	200	ew_velocity	m/s	0.06236	0.0048104
mar4	1	200	temperature	degreesC	0.96364	0.00771391
mar4	2	10	ns_velocity	m/s	0.11449	0.0152397
mar4	2	10	ew_velocity	m/s	-0.12588	0.0098834
mar4	2	10	temperature	degreesC	-1.79	0
mar4	2	20	ns_velocity	m/s	0.1435	0.00487339
mar4	2	20	ew_velocity	m/s	-0.13575	0.00976921
mar4	2	20	temperature	degreesC	-1.78875	0.00330719
mar4	2	30	ns_velocity	m/s	0.173143	0.00833972
mar4	2	30	ew_velocity	m/s	-0.048	0.00507093
mar4	2	30	temperature	degreesC	-1.785	0.005
mar4	2	40	ns_velocity	m/s	0.155833	0.00888663
mar4	2	40	ew_velocity	m/s	0.0515	0.00497494
mar4	2	40	temperature	degreesC	-1.79	0
mar4	2	50	ns_velocity	m/s	0.192333	0.0205724
mar4	2	50	ew_velocity	m/s	0.0685	0.0128873
mar4	2	50	temperature	degreesC	-1.76583	0.0189113
mar4	2	100	ns_velocity	m/s	0.164615	0.0111047
mar4	2	100	ew_velocity	m/s	0.243385	0.0176876
mar4	2	100	temperature	degreesC	-0.91154	0.0633484
mar4	2	200	ns_velocity	m/s	0.1915	0.0204145
mar4	2	200	ew_velocity	m/s	0.208125	0.0194996
mar4	2	200	temperature	degreesC	0.40063	0.04145
mar4	3	10	ns_velocity	m/s	0.001714	0.011876
mar4	3	10	ew_velocity	m/s	-0.21771	0.0154708
mar4	3	10	temperature	degreesC	-1.78714	0.00451754
mar4	3	20	ns_velocity	m/s	0.131077	0.0420082
mar4	3	20	ew_velocity	m/s	-0.23939	0.0243359
mar4	3	20	temperature	degreesC	-1.79	0
mar4	3	30	ns_velocity	m/s	0.229231	0.0211011
mar4	3	30	ew_velocity	m/s	-0.25062	0.0216032
mar4	3	30	temperature	degreesC	-1.79	0
mar4	3	40	ns_velocity	m/s	0.224167	0.0184474
mar4	3	40	ew_velocity	m/s	-0.22533	0.0062893
mar4	3	40	temperature	degreesC	-1.79	0

DATE	STATION	DEPTH/m	QUANTITY	UNITS	MEAN	STD.DEV
mar4	3	50	ns_velocity	m/s	0.236833	0.0120957
mar4	3	50	ew_velocity	m/s	-0.2025	0.00583809
mar4	3	50	temperature	degreesC	-1.79	0
mar4	3	100	ns_velocity	m/s	0.181455	0.0153999
mar4	3	100	ew_velocity	m/s	-0.13855	0.0062720
mar4	3	100	temperature	degreesC	-1.77455	0.00497929
mar4	3	200	ns_velocity	m/s	0.1616	0.0127164
mar4	3	200	ew_velocity	m/s	-0.23067	0.0154172
mar4	3	200	temperature	degreesC	-1.648	0.0164114
mar7	1	10	ns_velocity	m/s	-0.0155	0.004252
mar7	1	10	ew_velocity	m/s	0.008	0.006481
mar7	1	10	temperature	degreesC	-1.79	0.002764
mar7	1	20	ns_velocity	m/s	-0.04383	0.004580
mar7	1	20	ew_velocity	m/s	-0.01917	0.005444
mar7	1	20	temperature	degreesC	-1.79	0
mar7	1	30	ns_velocity	m/s	-0.012	0.005204
mar7	1	30	ew_velocity	m/s	0.00831	0.00701
mar7	1	30	temperature	degreesC	-1.794	0.00487
mar7	1	40	ns_velocity	m/s	0.03389	0.00670
mar7	1	40	ew_velocity	m/s	-0.001263	0.004689
mar7	1	40	temperature	degreesC	-1.791	0.00223
mar7	1	50	ns_velocity	m/s	0.001882	0.00837
mar7	1	50	ew_velocity	m/s	-0.040824	0.006546
mar7	1	50	temperature	m/s	-1.786	0.005882
mar7	1	100	ns_velocity	m/s	0.00371	0.02092
mar7	1	100	ew_velocity	m/s	-0.24543	0.035524
mar7	1	100	temperature	degreesC	-1.4929	0.096912
mar7	1	200	ns_velocity	m/s	0.02967	0.007564
mar7	1	200	ew_velocity	m/s	0.013167	0.003210
mar7	1	200	temperature	degreesC	0.244167	0.04591
mar7	2	10	ns_velocity	m/s	0.01	0.01635
mar7	2	10	ew_velocity	m/s	-0.40617	0.033956
mar7	2	10	temperature	degreesC	-1.6792	0.0027639
mar7	2	20	ns_velocity	m/s	-0.030462	0.02278
mar7	2	20	ew_velocity	m/s	-0.13569	0.15841
mar7	2	20	temperature	degreesC	-1.75231	0.049327
mar7	2	30	ns_velocity	m/s	0.007846	0.02359
mar7	2	30	ew_velocity	m/s	-0.028615	0.049149
mar7	2	30	temperature	degreesC	-1.8	0
mar7	2	40	ns_velocity	m/s	-0.0075	0.007309
mar7	2	40	ew_velocity	m/s	-0.094833	0.008143
mar7	2	40	temperature	degreesC	-1.8	0
mar7	2	50	ns_velocity	m/s	-0.03867	0.013499
mar7	2	50	ew_velocity	m/s	-0.070167	0.016030
mar7	2	50	temperature	degreesC	-1.7892	0.004930
mar7	2	100	ns_velocity	m/s	0.054	0.007688
mar7	2	100	ew_velocity	m/s	-0.15989	0.02596
mar7	2	100	temperature	degreesC	-1.485	0.11833
mar7	2	200	ns_velocity	m/s	0.0725	0.011948
mar7	2	200	ew_velocity	m/s	-0.1293	0.0191
mar7	2	200	temperature	degreesC	0.2415	0.05507

DATE	STATION	DEPTH/m	QUANTITY	UNITS	MEAN	STD.DEV
mar7	3	10	ns_velocity	m/s	-0.01267	0.0108
mar7	3	10	ew_velocity	m/s	-0.09383	0.01182
mar7	3	10	temperature	degreesC	-1.7942	0.004930
mar7	3	20	ns_velocity	m/s	0.027	0.008226
mar7	3	20	ew_velocity	m/s	-0.097167	0.01008
mar7	3	20	temperature	degreesC	-1.8	0
mar7	3	30	ns_velocity	m/s	0.02723	0.01114
mar7	3	30	ew_velocity	m/s	-0.07769	0.006509
mar7	3	30	temperature	degreesC	-1.8	0
mar7	3	40	ns_velocity	m/s	0.035385	0.008643
mar7	3	40	ew_velocity	m/s	-0.074769	0.01364
mar7	3	40	temperature	degreesC	-1.8	0
mar7	3	50	ns_velocity	m/s	0.09088	0.011112
mar7	3	50	ew_velocity	m/s	-0.12075	0.16570
mar7	3	50	temperature	degreesC	-1.7319	0.051747
mar7	3	100	ns_velocity	m/s	0.08659	0.01921
mar7	3	100	ew_velocity	m/s	-0.20612	0.01969
mar7	3	100	temperature	degreesC	-1.7653	0.02033
mar7	3	200	ns_velocity	m/s	0.25467	0.014407
mar7	3	200	ew_velocity	m/s	-0.17011	0.006911
mar7	3	200	temperature	degreesC	0.00889	0.05878
mar7	4	10	ns_velocity	m/s	-0.00625	0.00392906
mar7	4	10	ew_velocity	m/s	-0.32025	0.0119347
mar7	4	10	temperature	degreesC	-1.67	0
mar7	4	20	ns_velocity	m/s	0.012444	0.0186137
mar7	4	20	ew_velocity	m/s	0.024444	0.121281
mar7	4	20	temperature	degreesC	-1.74889	0.0417517
mar7	4	30	ns_velocity	m/s	0.0375	0.0154191
mar7	4	30	ew_velocity	m/s	-0.00625	0.0253464
mar7	4	30	temperature	degreesC	-1.8	0
mar7	4	40	ns_velocity	m/s	0.01711	0.0056655
mar7	4	40	ew_velocity	m/s	-0.07844	0.012535
mar7	4	40	temperature	degreesC	-1.79889	0.00314269
mar7	4	50	ns_velocity	m/s	-0.03925	0.0109516
mar7	4	50	ew_velocity	m/s	-0.0965	0.0128744
mar7	4	50	temperature	degreesC	-1.8	0
mar7	4	100	ns_velocity	m/s	0.062	0.0129228
mar7	4	100	ew_velocity	m/s	-0.099	0.0153297
mar7	4	100	temperature	degreesC	-1.78875	0.00927024
mar7	4	200	ns_velocity	m/s	0.139333	0.01335
mar7	4	200	ew_velocity	m/s	-0.067667	0.006262
mar7	4	200	temperature	degreesC	-1.225	0.107355

DATE	STATION	DEPTH/m	QUANTITY	UNITS	MEAN	STD.DEV
mar26	1	10	ns_velocity	m/s	-0.02475	0.00830286
mar26	1	10	ew_velocity	m/s	-0.0065	0.012114
mar26	1	10	temperature	degreesC	-1.79	0
mar26	1	20	ns_velocity	m/s	-0.0136	0.0276955
mar26	1	20	ew_velocity	m/s	-0.0102	0.0239908
mar26	1	20	temperature	degreesC	-1.79	0
mar26	1	30	ns_velocity	m/s	-0.015556	0.021965
mar26	1	30	ew_velocity	m/s	0.000444	0.02194
mar26	1	30	temperature	degreesC	-1.79	0
mar26	1	40	ns_velocity	m/s	-0.052182	0.017382
mar26	1	40	ew_velocity	m/s	-0.032182	0.012074
mar26	1	40	temperature	degreesC	-1.78	0.00426401
mar26	1	50	ns_velocity	m/s	0.031819	0.0406891
mar26	1	50	ew_velocity	m/s	-0.02	0.0313456
mar26	1	50	temperature	degreesC	-1.77818	0.00385694
mar26	1	100	ns_velocity	m/s	0.0278	0.0247378
mar26	1	100	ew_velocity	m/s	-0.0106	0.0221007
mar26	1	100	temperature	degreesC	-1.4605	0.0946295
mar26	1	200	ns_velocity	m/s	0.021833	0.0077656
mar26	1	200	ew_velocity	m/s	0.043167	0.0133031
mar26	1	200	temperature	degreesC	0	0
mar26	2	10	ns_velocity	m/s	-0.004545	0.01467
mar26	2	10	ew_velocity	m/s	-0.026182	0.011519
mar26	2	10	temperature	degreesC	-1.83182	0.00385694
mar26	2	20	ns_velocity	m/s	-0.087636	0.069097
mar26	2	20	ew_velocity	m/s	0.083091	0.0158255
mar26	2	20	temperature	degreesC	-1.81636	0.00481051
mar26	2	30	ns_velocity	m/s	-0.09	0.0962289
mar26	2	30	ew_velocity	m/s	0.058	0.0409959
mar26	2	30	temperature	degreesC	-1.81667	0.0047141
mar26	2	40	ns_velocity	m/s	-0.23183	0.0082647
mar26	2	40	ew_velocity	m/s	0.000167	0.01178
mar26	2	40	temperature	degreesC	-1.81667	0.0047141
mar26	2	50	ns_velocity	m/s	-0.13323	0.0987601
mar26	2	50	ew_velocity	m/s	-0.01769	0.060712
mar26	2	50	temperature	degreesC	-1.81231	0.00799412
mar26	2	100	ns_velocity	m/s	-0.173	0.0493254
mar26	2	100	ew_velocity	m/s	-0.0375	0.0323123
mar26	2	100	temperature	degreesC	-1.55	0.0747217
mar26	2	200	ns_velocity	m/s	-0.179	0.005
mar26	2	200	ew_velocity	m/s	-0.01233	0.004459
mar26	2	200	temperature	degreesC	-0.07333	0.004714
mar26	3	10	ns_velocity	m/s	-0.123	0.020025
mar26	3	10	ew_velocity	m/s	-0.15583	0.019226
mar26	3	10	temperature	degreesC	-1.79	0
mar26	3	20	ns_velocity	m/s	-0.1283	0.0073861
mar26	3	20	ew_velocity	m/s	-0.1258	0.0055050
mar26	3	20	temperature	degreesC	-1.78417	0.00493006
mar26	3	30	ns_velocity	m/s	-0.12667	0.0054160
mar26	3	30	ew_velocity	m/s	-0.12556	0.0049690
mar26	3	30	temperature	degreesC	-1.78	0
mar26	3	40	ns_velocity	m/s	-0.1184	0.0192693
mar26	3	40	ew_velocity	m/s	-0.11893	0.0159978

DATE	STATION	DEPTH/m	QUANTITY	UNITS	MEAN	STD.DEV
mar26	3	40	temperature	degreesC	-1.78	0
mar26	3	50	ns_velocity	m/s	-0.12419	0.00802151
mar26	3	50	ew_velocity	m/s	-0.11791	0.0092679
mar26	3	50	temperature	degreesC	-1.7819	0.00392676
mar26	3	100	ns_velocity	m/s	-0.10824	0.0259672
mar26	3	100	ew_velocity	m/s	-0.09047	0.024700
mar26	3	100	temperature	degreesC	-1.78118	0.0123108
mar26	3	200	ns_velocity	m/s	-0.02678	0.025137
mar26	3	200	ew_velocity	m/s	-0.01522	0.031384
mar26	3	200	temperature	degreesC	-1.60609	0.0143676
mar26	4	10	ns_velocity	m/s	-0.1265	0.0102347
mar26	4	10	ew_velocity	m/s	-0.1342	0.0125289
mar26	4	10	temperature	degreesC	-1.81	0
mar26	4	20	ns_velocity	m/s	-0.12817	0.0089984
mar26	4	20	ew_velocity	m/s	-0.16167	0.0102578
mar26	4	20	temperature	degreesC	-1.81	0
mar26	4	30	ns_velocity	m/s	-0.1405	0.00934969
mar26	4	30	ew_velocity	m/s	-0.1755	0.0104602
mar26	4	30	temperature	degreesC	-1.81	0
mar26	4	40	ns_velocity	m/s	-0.156	0.0102956
mar26	4	40	ew_velocity	m/s	-0.18483	0.0075920
mar26	4	40	temperature	degreesC	-1.81	0
mar26	4	50	ns_velocity	m/s	-0.3063	0.0682634
mar26	4	50	ew_velocity	m/s	-0.0995	0.047047
mar26	4	50	temperature	degreesC	-1.81667	0.00623614
mar26	4	100	ns_velocity	m/s	-0.2864	0.0131514
mar26	4	100	ew_velocity	m/s	-0.07546	0.001499
mar26	4	100	temperature	degreesC	-1.81	0
mar26	5	40	ns_velocity	m/s	0.14	0.012
mar26	5	40	ew_velocity	m/s	-0.29	0.018
mar26	5	40	temperature	degreesC	-1.8	0
mar26	5	50	ns_velocity	m/s	0.20267	0.0313829
mar26	5	50	ew_velocity	m/s	-0.2844	0.0531562
mar26	5	50	temperature	degreesC	-1.79	0
mar26	5	100	ns_velocity	m/s	0.1515	0.0270324
mar26	5	100	ew_velocity	m/s	-0.28425	0.0375691
mar26	5	100	temperature	degreesC	-1.79	0


station 1 89/03/23
station 2 89/03/23
station 3 89/03/23
depth (m)
rate (m/s)
0
50
100
150
200
250
-1.0 -0.5 0.0 0.5 1.0
speed
u
v

DATE	STATION	DEPTH/m	QUANTITY	UNITS	MEAN	STD.DEV
mar23	1	0	ns_velocity	m/s	0.110	0.058
mar23	1	0	ew_velocity	m/s	-0.218	0.042
mar23	1	0	temperature	degreesC	-2.03	0
mar23	1	10	ns_velocity	m/s	0.100	0.052
mar23	1	10	ew_velocity	m/s	-0.207	0.041
mar23	1	10	temperature	degreesC	-2.03	0
mar23	1	20	ns_velocity	m/s	0.064	0.051
mar23	1	20	ew_velocity	m/s	-0.212	0.029
mar23	1	20	temperature	degreesC	-1.94	0
mar23	1	30	ns_velocity	m/s	0.151	0.016
mar23	1	30	ew_velocity	m/s	-0.026	0.085
mar23	1	30	temperature	degreesC	-2.03	0
mar23	1	40	ns_velocity	m/s	0.117	0.008
mar23	1	40	ew_velocity	m/s	-0.046	0.021
mar23	1	40	temperature	degreesC	-2.03	0
mar23	1	50	ns_velocity	m/s	-0.128	0.054
mar23	1	50	ew_velocity	m/s	-0.193	0.027
mar23	1	50	temperature	degreesC	-1.94	0
mar23	1	100	ns_velocity	m/s	-0.041	0.034
mar23	1	100	ew_velocity	m/s	0.009	0.047
mar23	1	100	temperature	degreesC	-1.04	0
mar23	1	200	ns_velocity	m/s	-0.120	0.022
mar23	1	200	ew_velocity	m/s	-0.122	0.014
mar23	1	200	temperature	degreesC	-0.27	0
mar23	2	0	ns_velocity	m/s	-0.211	0.016
mar23	2	0	ew_velocity	m/s	-0.020	0.046
mar23	2	0	temperature	degreesC	-2.02	0
mar23	2	10	ns_velocity	m/s	-0.170	0.034
mar23	2	10	ew_velocity	m/s	-0.156	0.046
mar23	2	10	temperature	degreesC	-2.01	0
mar23	2	20	ns_velocity	m/s	-0.250	0.042
mar23	2	20	ew_velocity	m/s	-0.113	0.079
mar23	2	20	temperature	degreesC	-2.01	0
mar23	2	30	ns_velocity	m/s	-0.071	0.046
mar23	2	30	ew_velocity	m/s	-0.220	0.016
mar23	2	30	temperature	degreesC	-2.02	0
mar23	2	40	ns_velocity	m/s	-0.072	0.048
mar23	2	40	ew_velocity	m/s	-0.242	0.009
mar23	2	40	temperature	degreesC	-2.02	0
mar23	2	50	ns_velocity	m/s	-0.194	0.036
mar23	2	50	ew_velocity	m/s	-0.192	0.045
mar23	2	50	temperature	degreesC	-2.03	0
mar23	2	100	ns_velocity	m/s	-0.056	0.068
mar23	2	100	ew_velocity	m/s	-0.298	0.020
mar23	2	100	temperature	degreesC	-2.03	0
mar23	2	150	ns_velocity	m/s	-0.065	0.061
mar23	2	150	ew_velocity	m/s	-0.239	0.015
mar23	2	150	temperature	degreesC	-2.05	0
mar23	3	0	ns_velocity	m/s	-0.009	0.021
mar23	3	0	ew_velocity	m/s	-0.109	0.015
mar23	3	0	temperature	degreesC	-2.07	0
mar23	3	10	ns_velocity	m/s	-0.052	0.048
mar23	3	10	ew_velocity	m/s	-0.186	0.017

DATE	STATION	DEPTH/m	QUANTITY	UNITS	MEAN	STD.DEV
mar23	3	10	temperature	degreesC	-2.07	0
mar23	3	20	ns_velocity	m/s	-0.148	0.061
mar23	3	20	ew_velocity	m/s	-0.229	0.035
mar23	3	20	temperature	degreesC	-2.07	0
mar23	3	30	ns_velocity	m/s	-0.094	0.075
mar23	3	30	ew_velocity	m/s	-0.252	0.021
mar23	3	30	temperature	degreesC	-2.07	0
mar23	3	40	ns_velocity	m/s	-0.081	0.066
mar23	3	40	ew_velocity	m/s	-0.267	0.023
mar23	3	40	temperature	degreesC	-2.07	0
mar23	3	50	ns_velocity	m/s	-0.104	0.076
mar23	3	50	ew_velocity	m/s	-0.301	0.020
mar23	3	50	temperature	degreesC	-2.07	0
mar23	3	100	ns_velocity	m/s	-0.119	0.085
mar23	3	100	ew_velocity	m/s	-0.291	0.023
mar23	3	100	temperature	degreesC	-2.08	0