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Hydrographic and Current Observations in the North-East Atlantic Ocean

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F.S. POSEIDON Cruise 124

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September to December 1985

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Summary

In this report two sets of data from the North-East Atlantic ocean between 15°N and 40°N and east of 27°W are presented: Hydrographic measurements stem from cruises with F.S. POLARSTERN, F.S. POSEIDON and B.O. TALIARTE in autumn 1985. Further, one year long time series of temperature and currents were obtained at eleven sites from autumn 1984 to autumn 1985. These include the continuation of the time series at mooring site N1 (33°N, 22°W) later denoted as KIEL276 which started in April 1980. Methods of data processing are also discussed.

Zusammenfassung

Dieser Bericht enthält zwei Datensätze vom Nordostatlantik aus dem Seegebiet von 15°N bis 40°N und östlich von 27°W: Hydrographische Messungen vom Herbst 1985, die mit F.S. POLARSTERN, F.S. POSEIDON und B.O. TALIARTE durchgeführt wurden, werden dargestellt. Ferner wurden Zeitreihen von Temperatur und Strömungen auf elf Positionen mit verankerten Geräten im Zeitraum vom Herbst 1984 bis Herbst 1985 gewonnen. Sie enthalten auch die Fortsetzung der Messungen auf Position N1 (33°N, 22°W), später als KIEL276 bezeichnet, die im April 1980 begannen. Außerdem werden Methoden der Datenaufbereitung diskutiert.

摘 要

本报告概述了东北大西洋15°N至40°N之间、27°W以东区域内的二组调查资料：1985年秋季分别由“普拉斯塔尔”号（F. S. POLARSTERN）、“普沙东”号（F、S. POSEIDON）和“塔利阿坦”号（B. O. TALIARTE）调查船获取的水文观测资料和1984年秋至1985年秋在11个锚系站上得到的长达一年的温度和海流资料，其中也包括了N_1锚系站（33°N，22°W）上的连续时间系列资料（该测站始于1980年4月）。文章还对资料处理方法进行了讨论。

Resumen

En este informe se presentan dos colecciones de datos del Atlántico Nororiental, al Este de los 27°W y entre los 15°N y 40° N. Las medidas hidrográficas proceden de los cruceros realizados durante el otoño de 1985 por el F.S. POLARSTERN, el F.S. POSEIDON y el B.O. TALIARTE. Se presentan además, las series temporales de temperatura y corrientes, obtenidas en once posiciones desde el otoño de 1984 al otoño de 1985, en las que se incluye la continuación de la serie temporal correspondiente a la posición N1(33° N, 22° W), iniciada en Abril de 1980 y denominada posteriormente con el nombre de Kiel 276. Se comentan tambien los métodos del proceso de datos.

Contents

1. Introduction

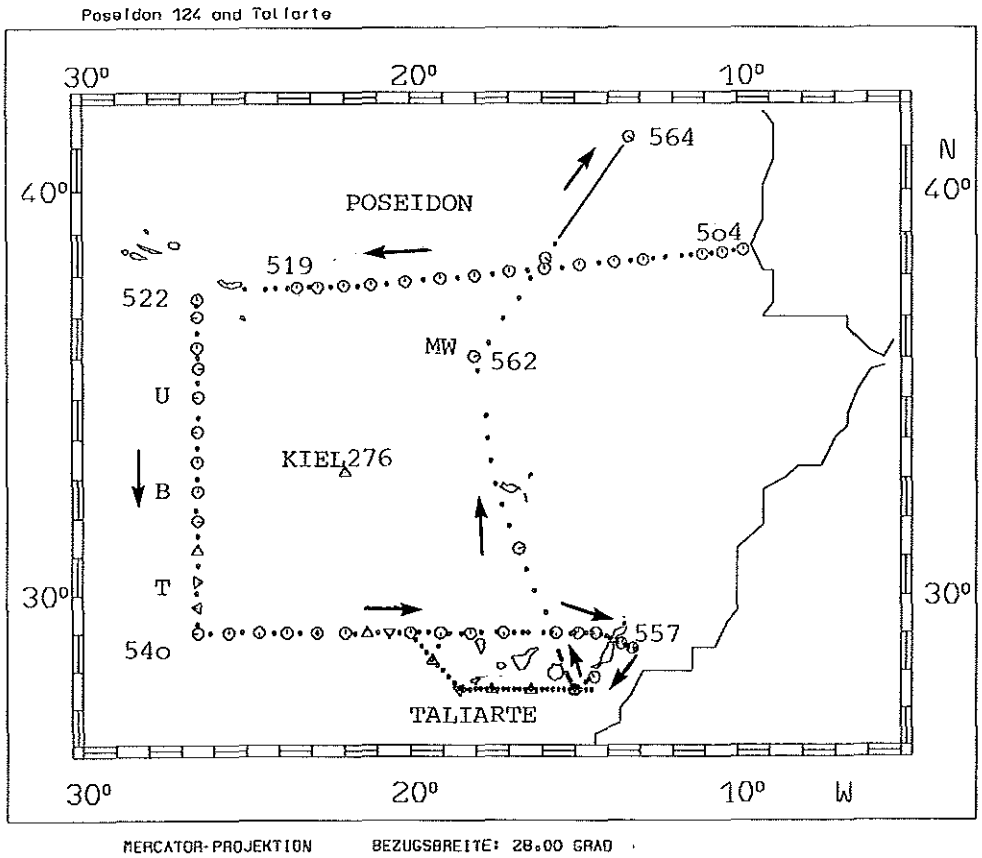
In order to investigate the recirculation regime of the North Atlantic subtropical gyre intensive hydrographic surveys and mooring work have been conducted since 1980 within the Kiel University's special research programme 'Warmwassersphäre des Nordatlantiks" (e.g. Käse and Siedler, 1982; Stramma, 1984; Siedler et al., 1985; Käse and Zenk, 1987).

In autumn 1985 two cruises were conducted in the eastern North Atlantic between 15°N and 40°N and east of 27°W (see table 1). During the first one (Siedler, 1986; fig. 1b) F.S. POLARSTERN recovered five moorings with one current meter and two 400 m long thermistor cables each in the main thermocline (Positions R, O, P, E and X in fig. 1b) and two moorings with five current meters each (positions KS1 and KS2), which were deployed in autumn 1984 (Müller et al., 1987). In order to further investigate mesoscale fluctuations in the main thermocline two positions (E and X in fig. 1a) have been prolongued and one position (Y) occupied for the first time for one year. On positions V, Q and W three current meter moorings were set to test whether differences in the mesoscale energy level on both sides of the boundary between the subtropical recirculation regime and the shadow zone (Luyten et al., 1983) can be detected. Several CTD-profiles on mooring positions and three XBT-sections have been obtained additionally.

The other cruises in autumn 1985 with F.S. F.S. POSEIDON and B.O. TALIARTE covered the northern part of the investigation area (Fig. 1a). Thermistor cable moorings U, B and T have been recovered after one year, and current meter mooring N1 replaced for one year. Note that position N1 since 1987 is denoted as KIEL276 (Siedler et al., 1987). In order to monitor the Mediterranean outflow another mooring with three current meters and two thermistor cable has been launched at position MW. Three densely spaced sections with CTD- and XBT-stations allow to determine baroclinic flow and water mass distribution. With this report we fill the 1984/85 gap in a series of reports (see Müller et al., 1987; Siedler et al., 1987). In section 2 we describe methods used for calibration and processing of hydrographic and moored instruments data. In sections 3 and 4 we then present hydrographic sections and time series from moored instruments.

ship	Cruise No.	Observation period	Port dep/arriv.	Area	Stations				
					CTD	hydrographic with nutrients	XBT deep blue	moorings	
								recov.	deploy.
F.S. POLARSTERN	ANT-IV/1b	28.9.-14.10. 1985	Las Palmas-Dakar	Canary Islands-Dakar	10	-	79	7	6
F.S. POSEIDON	124	7.11.-9.12. 1985	Lisbon-Las Palmas-Kiel	North-east Atlantic (28°N-40°N)	45	30	95	4	2
B.O. TALIARTE	XIV	19.11.-2.12. 1985	Las Palmas	Canary Islands		5	34	-	-

Table 1: Overview of autumn 1985 activities of F.S. PLARSTERN, F.S. POSEIDON and B.O. TALIARTE



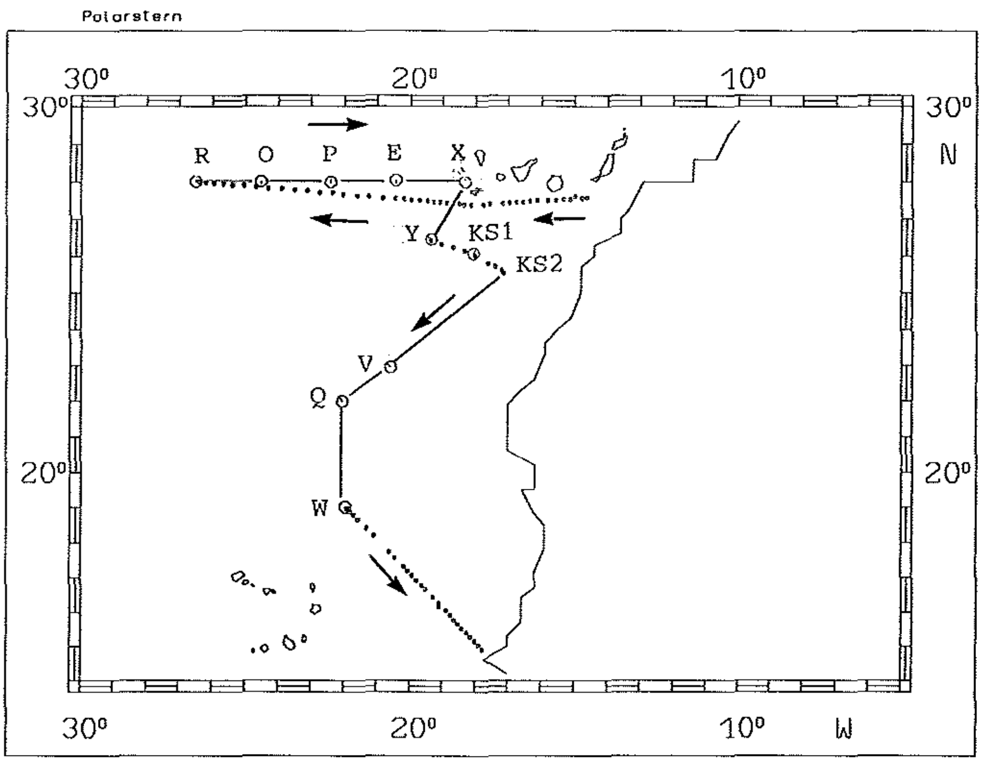


Figure 1: Cruise tracks of FS POSEIDON and BO TALIARTE (a) and FS POLARSTERN (b) in autumn 1985 with CTD-stations (circles), bottle stations (triangles), and XBT casts (points). Mooring positions are denoted with letters.

2. Instruments, calibration and data processing

In this section we deal with methods and results of the calibration and the processing of data from conductivity-temperature-pressure profilers (CTD), expandable bathythermographs (XBT) and moored instruments (Aanderaa current meters and thermistor cables).

2.1 Conductivity-temperature-pressure profiling systems (CTD's)

Three CTD machines with coefficients from laboratory calibrations were used combined with rosette samplers for in-situ calibration. On F.S. POLARSTERN a Neil Brown MARK III (NB) instrument lent from the Alfred-Wegener-Institut für Polarforschung, Bremerhaven, was available. Apart from difficulties with the recording system at the beginning this instrument worked well. On F.S. POSEIDON first a newly delivered Neil Brown system MARK III NBIS-CTD NB1 was used. Besides severe spiking due to detuned compensation circuit for the temperature response (see below in this paragraph) the conductivity cell broke during the up-profile of station 526. From then on, a CTD manufactured by Meerestechnik Elektronik (ME-CTD MS45) served as back up. Here also difficulties with the computer recording system occured which resulted in total data losts on stations 536, 538 and 539.

All three CTD's were calibrated in a laboratory, but due to a bad reference the conductivity calibration of the CTD MS45 was bad. Wherever possible the same in-situ calibration coefficients were applied for the whole data set or at least several stations. With this in mind the coefficients were determined as follows: first, temperature readings of the CTD were compared with temperature values of protected mercury reversing thermometers and corrected for the whole cruise when the differences were significantly different from zero and the laboratory calibration of the CTD older than six months. Because of the slow response of the mercury thermometers only values from the mixed surface layer and from the deep sea (>1500 m) have been chosen.

Next, the pressure sensors were calibrated using deck values and pressures from unprotected reversing thermometers in combination with corrected CTD-temperatures. In one case (MS45, POSEIDON 124) slight differences of order 1.5 dbar between down and up profiles due to hysteresis effects occurred. These differences were considered in the calibration of the conductivity sensor of this CTD.

In-situ salinities were available from pairs of rosette samplers closed at the same depth and measured with Guildline salinometer models 8400. The salinometers were free of drift over several days and showed high precision, i.e. the differences of pairs of salinity probes seldom exceed 10^{-3}. Thus all pairs exceeding $3 \cdot 10^{-3}$ were rejected. Taking salinities and calibrated temperatures and pressures (up-profile in case MS45) in-situ conductivities were calculated and compared with conductivity readings from the CTD.

Let Ψ_c be one of the parameters pressure, temperature or conductivity to be calibrated and Ψ the corresponding measured quantitiy. Then the in-situ calibration coefficients were determined from the equation

$$(1) \quad \Psi_c = \Psi + \sum_{i=o}^{2} a_i \Psi^i + R$$

where R is any polynomial in other quantities than Ψ, including time (station number) to consider a trend. In most cases R is not significantly different from zero. The index c denotes calibrated values. Equation (1) is multilinear in the unknown coefficients a_i and those of the polynomal R and thus the coefficients may be determined in the least square sense using calibration points and CTD readings.

With σ as standard deviation of differences of reference to CTD-values after correction and N as number of calibration points for each sensor we estimate the precision of the calibration as the ratio $2\sigma/\sqrt{N}$. With N_e as effective number of degrees of freedom, the maximum of $2\sigma/\sqrt{N_e}$ and the expected systematic error gives an estimate of the expected accuracy of the calibration. N_e is set to the number of reversing thermometers used in the case of pressure and temperature calibration and to the number of stations in the case of conductivity calibrations.

In tables 2.1 - 2.3 we display the results. For both Neil Brown instruments the result is sufficiently good for each sensor (tables 2.1 and 2.2). Whereas the CTD-system from POLARSTERN (table 2.1) proved to be of high quality with only minor corrections to be needed we had to apply a quadratic drift correction of order 0.02 mS cm^{-1} to the conductivity cell of the NB1 of POSEIDON to achieve similar high accuracy in the final data (table 2.2).

The back up CTD system MS45 was calibrated earlier against a bad reference conductivity standard and thus the high corrections in the leading coefficients a_i were not unexpected (table 2.3a). Because of the conductivity cell's dependence on pressure (of order 0.01 mS cm^{-1}) and because of additional drifts in its calibration in two sets of stations (order 0.02 mS cm^{-1}) the quality of derived salinity data had to be compared and corrected on some stations (table 2.3b) against the mean ΘS-relationship of the North Atlantic Central Water in the North-East Atlantic (Willenbrink, 1982) and high quality data from an earlier cruise (Müller et al., 1987). The resulting final accuracy in salinity data is sufficient for baroclinic flow calculations and water mass analysis down to 2000 m.

Table 2.1: In-situ calibration of the NBIS-CTD used on F.S. POLARSTERN cruise no. 8, ANT IV, 1b, according to equation (1) with R = 0. For estimating precision and accuracy see text. All numbers are to be used in the standard units dbar, °C, mS cm^{-1} if not stated explicitly.

	Pressure	Temperature	Conductivity
a_0	3.75	$-5.4 \cdot 10^{-3}$	0.0
a_1	0.0	0.0	0.0
a_2	0.0	0.0	0.0
precision	1.5 dbar	$\pm$6 mK	$\pm$1.5μS cm^{-1}
accuracy	<0.5 dbar near surface <5 dbar at 4000 dbar	$\pm$5 mK	$\pm$2μS cm^{-1}

Table 2.2: As table 2.2 for the NBIS-CTD NB1 used on F.S. POSEIDON cruise no. 124

with $R = \sum_{i=o}^{2} b_i S^i$ and $506 < S < 526$, $S \neq 516$ as station number.

	Pressure	Temperature	Conductivity
a_0	-3.0	$0.7 \cdot 10^{-3}$	0.0215
a_1	-10^{-3}	$1.94 \cdot 10^{-4}$	$-5.3063 \cdot 10^{-4}$
a_2	0.0	0.0	0.0
b_0	-	-	36.878
b_1	-	-	$-1.420 \cdot 10^{-1}$
b_2	-	-	$1.3658 \cdot 10^{-4}$
precision	± 1 dbar	± 5 mK	$\pm 1.0 \mu S\ cm^{-1}$
accuracy	<3 dbar at 2000 dbar	<5 mK	$\pm 1.5 \mu S\ cm^{-1}$

Table 2.3a: As table 2.1 for the ME-CTD MS45 used on F.S. POSEIDON cruise no. 124 with $R = \sum_{i=0}^{1} b_i S^i + \sum_{i=1}^{2} c_i P^i$ where S is station number and P is pressure. Additional correction to salinities after these corrections as in table 2.3b.

	Pressure (lowering)	Temperature	Conductivity	Remarks
a_0	2.28	$-3.0\cdot10^{-3}$	0.234	
a_1	$-3.61\cdot10^{-3}$	$4.0\cdot10^{-4}$	$-1.807\cdot10^{-2}$	
a_2	$2.20\cdot10^{-6}$	0.0	$1.929\cdot10^{-4}$	
b_0	-	-	1.784	Station 530
b_1	-	-	$-3.345\cdot10^{-3}$	to 541
b_0	-	-	0.830	Station 542
b_1	-	-	$-1.498\cdot10^{-3}$	to 564
c_1	-	-	$-7.9\cdot10^{-6}$	pressure effect
c_2	-	-	$2.1\cdot10^{-9}$	
precision	$\pm$2 dbar	$\pm$5 mK	$\pm$0.01mS cm^{-1}	
accuracy	<1 dbar near surface <4 dbar at 4000 dbar	<5 mK	$\pm$0.01mS cm^{-1}	

Table 2.3b: Additional corrections in salinity to fit the mean potential temperature salinity relation in the North Atlantic Central Water after in-situ calibration of the ME-CTD MS45.

Stat.No.:	531	532	542	543	544	545	550	551
Correction:	0.005	0.01	-0.005	-0.01	-0.015	-0.02	-0.015	-0.01

To avoid severe spiking in derived salinities the time constants of conductivity- and temperature-sensors have to be adjusted. In ME-CTD's this is achieved geometrically in that the flushing time of the conductivity cell is about 100 ms at a lowering rate of 1 m s^{-1} and thus corresponds to the response time of the platinium resistance to temperature changes. No severe spiking was observed with this type of CTD during POSEIDON 124.

In NBIS-CTD's the electronically high passed signal of a fast response temperature sensor is added to the high accurate but relative slow signal of the platinium resistance sensor to match the fast response of the conductivity cell for fine structure measurements. It is this electric circuit which was detuned and thus led to severe spiking in derived salinities on the NB1 during the POSEIDON cruise. In figures 2.1 to 2.6 we show how one can overcome this problem with simple methods originally proposed by P.L. Grose (UNESCO, 1988).

We start with the θS-diagramme of station 506 off the Portuguese coast which below the high salinity intrusion of Mediterranean Water shows step like structures with statically instable situations (fig. 2.1) which are physically unreasonable. A subset of these data between 5.5°C and 7.0°C (1600 dbar to 1700 dbar in pressure) is shown in figure 2.2 to 2.6 as vertical profiles of temperature, conductivity and derived salinity for different processing states. First, it is clear from figure 2.2 that the instabilities mentioned in figure 2.1 are artificial due to a mismatch in the response of temperature and conductivity, the conductivity being faster, and that they occur on large vertical scales of 5 dbar. Obviously it is not easy to eliminate such cycles by simple spike tests. In a next step we therefore applied a recursive integral filter to the conductivity data:

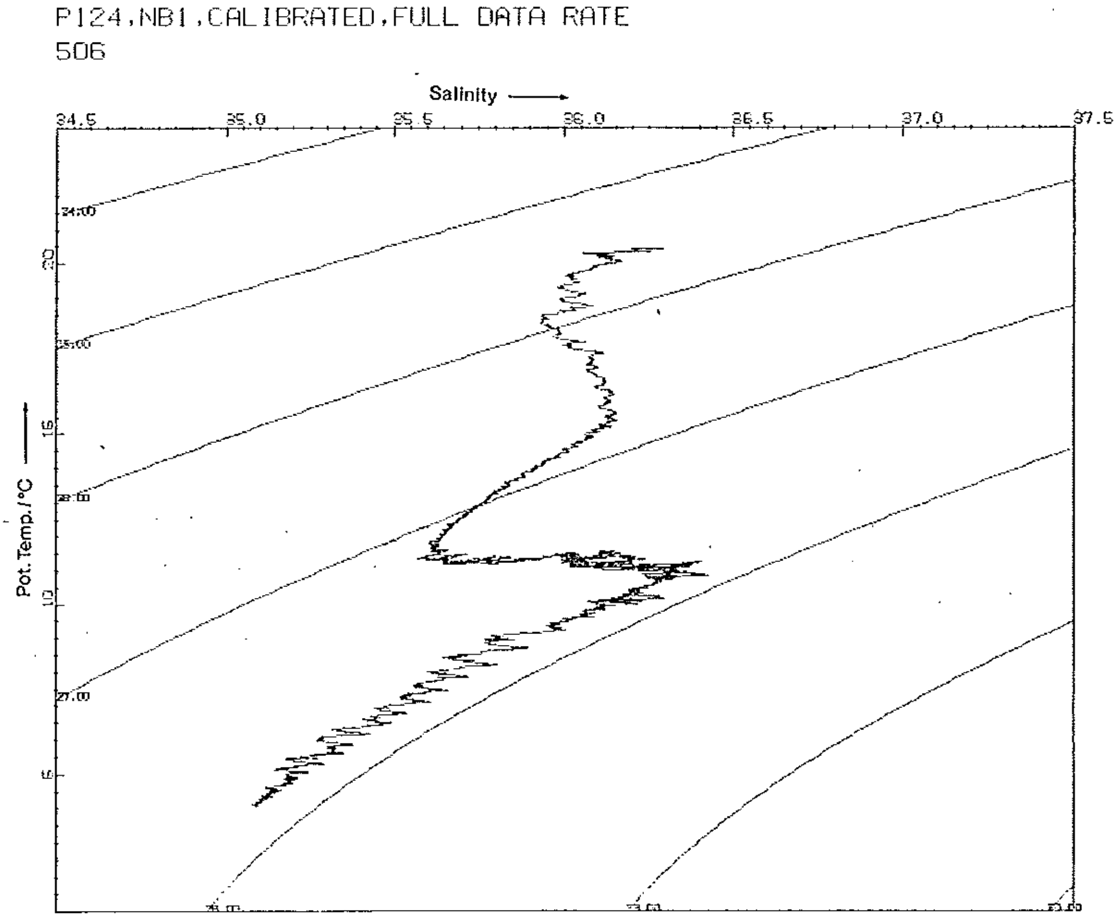


Fig. 2.1: F.S. POSEIDON, cruise 124, station 506 off Portugal, 07-Nov-85. Potential temperature - salinity relation, full data rate at 1 m s^{-1} lowering rate of CTD NB1.

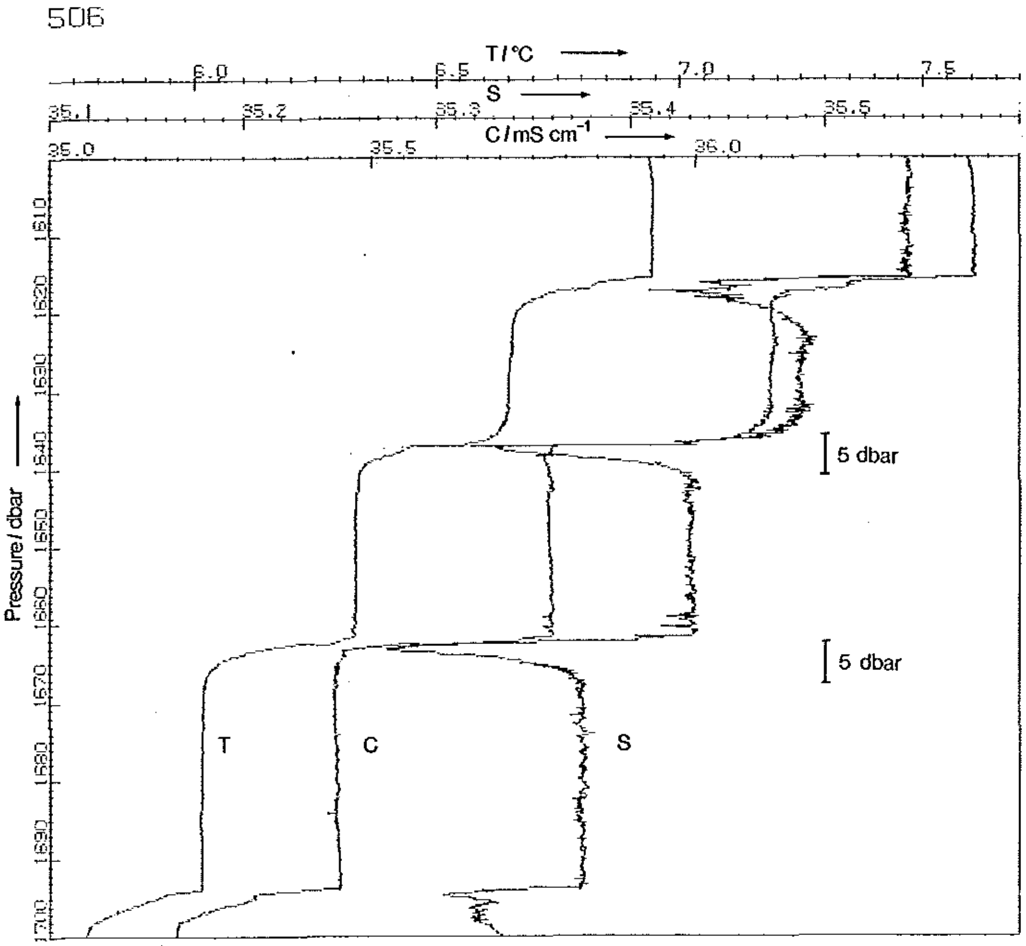


Fig. 2.2: As fig. 2.1, profiles of temperature T, conductivity C and derived salinity S between 1600 dbar and 1700 dbar.

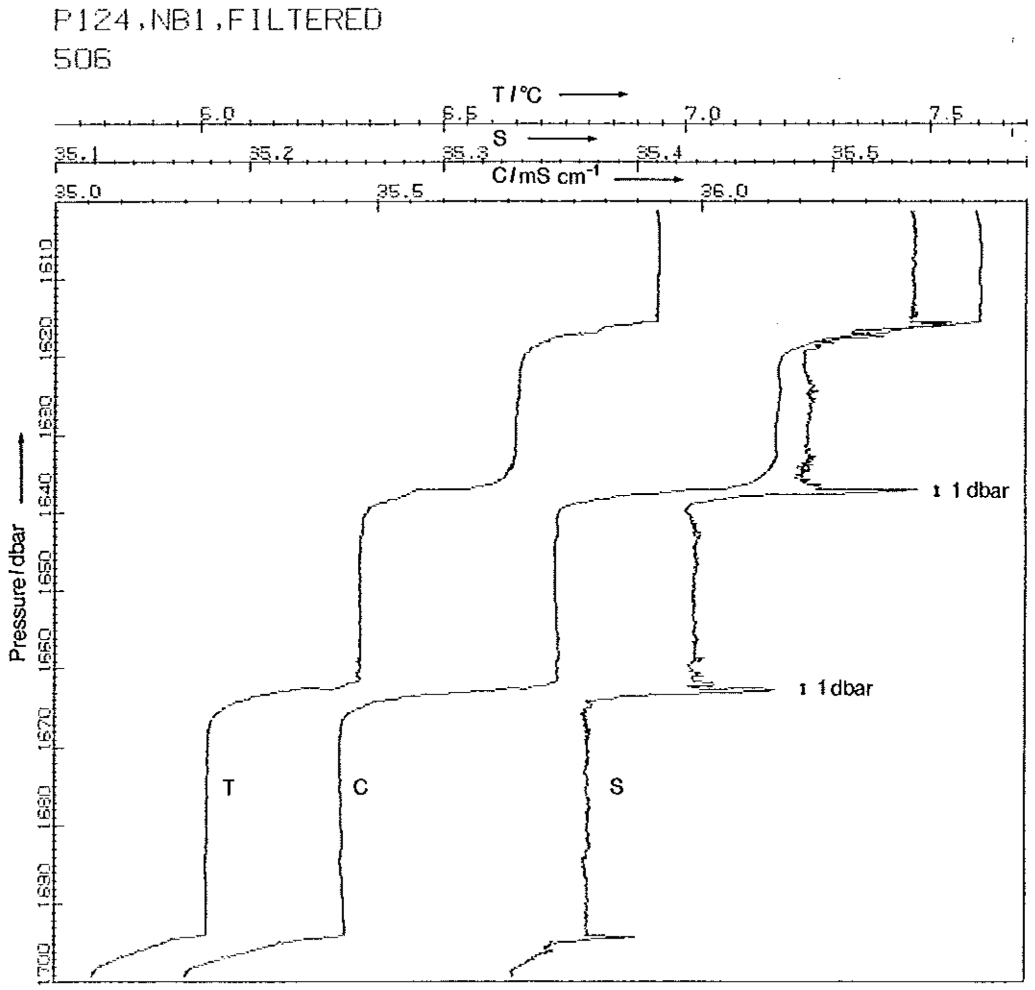


Fig. 2.3: As fig. 2.1, conductivity corrected to $C_{i,c} = C_i + (C_{i-1,c} - C_i)e^{-\Delta t/c_k}$ with $\Delta t/c_k = 1/9$ and S calculated anew.

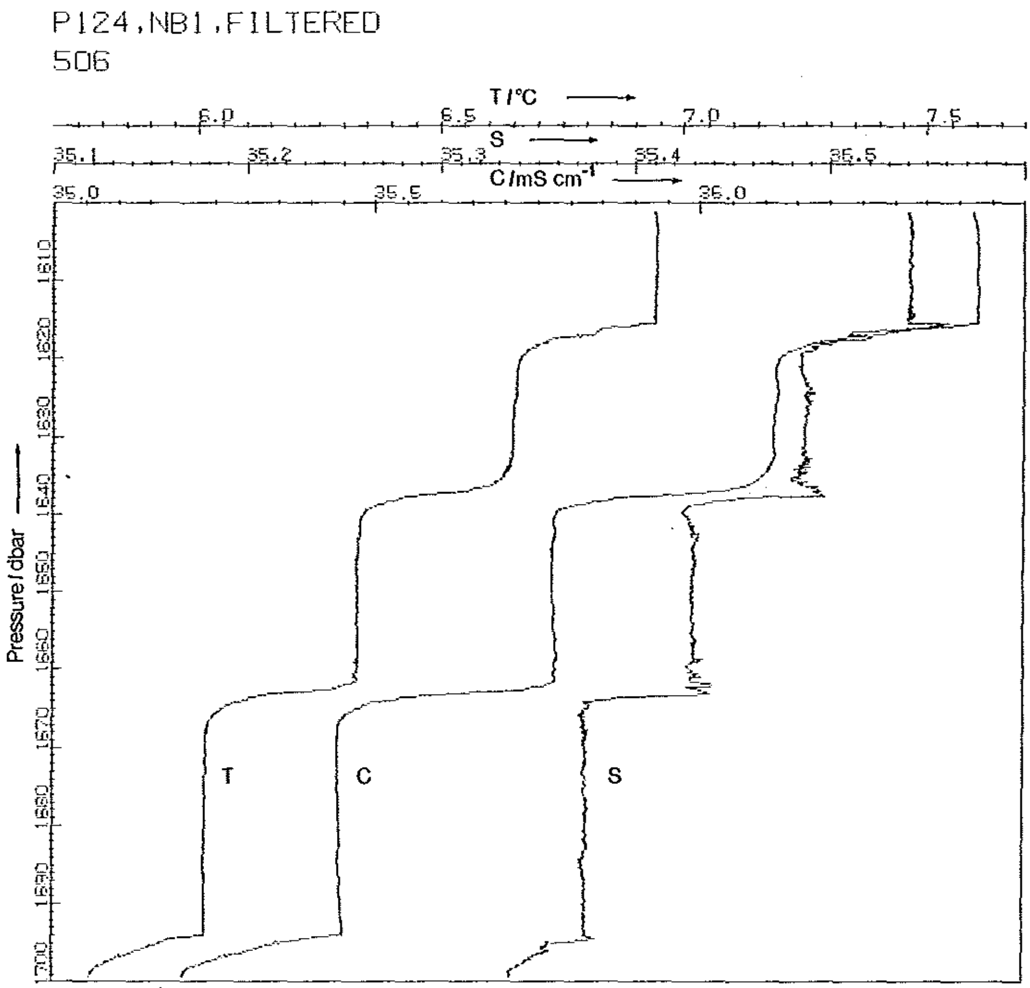
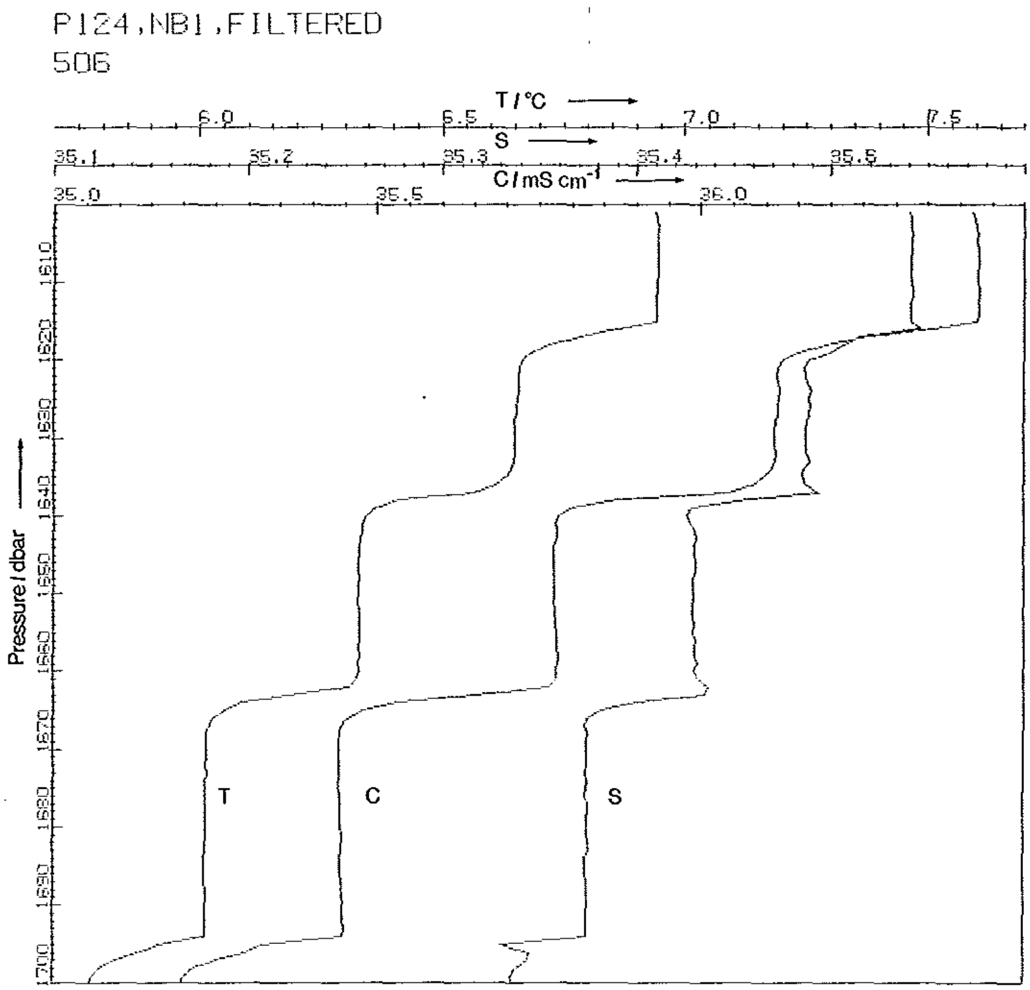


Fig. 2.4: As fig. 2.3, despiked in salinity.



<u>Fig. 2.5:</u> As fig. 2.4, 1 dbar mean, S calculated anew.

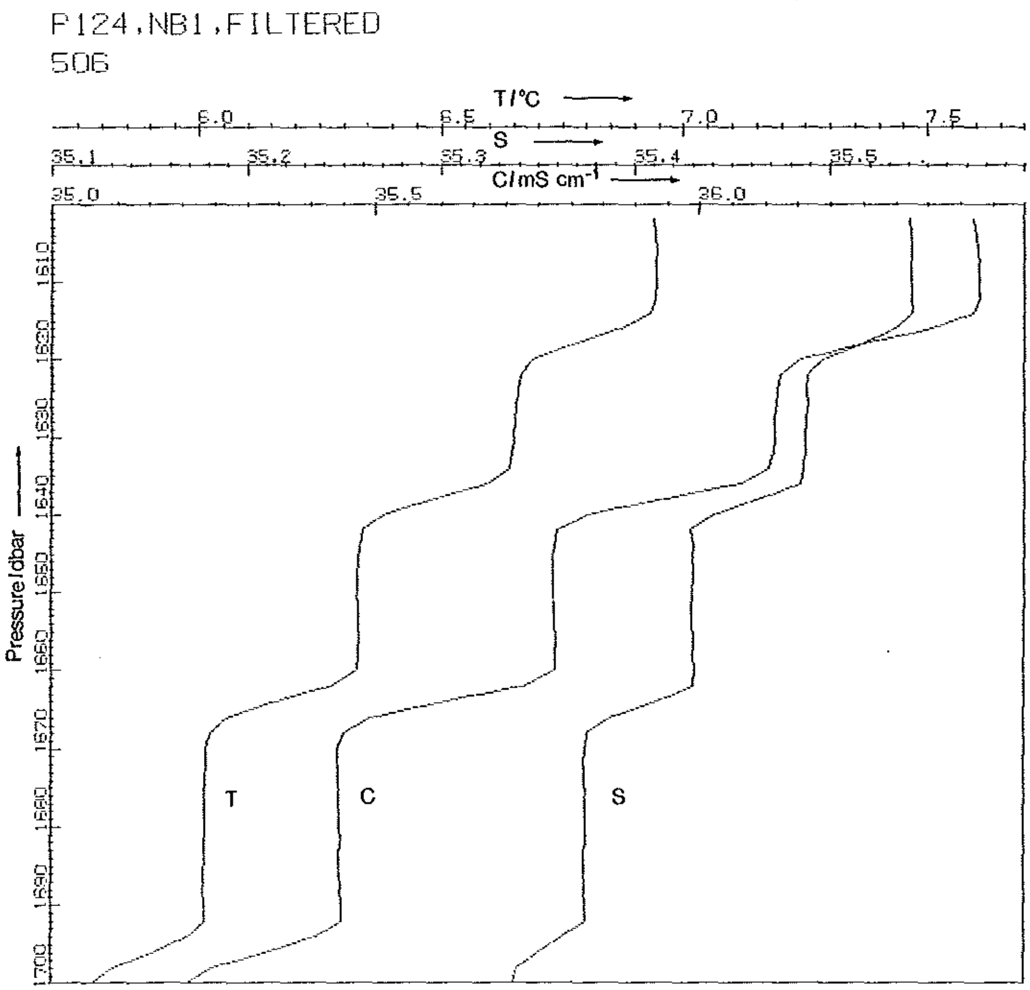


Fig. 2.6: As fig. 2.5, 5 dbar running mean, 2 dbar linear interpolation, S anew.

(2) $C_{i,c} = C_i + (C_{i-1,c} - C_i)\, e^{-\Delta t/c_K}$

Here the index i denotes the i-th cycle, the index c a corrected value, and $\Delta t/c_K$ the ratio of sampling interval to the virtuel time constant. It turned out that a ratio of 1/9 gave the best result in the sense that the left hand sided spikes in derived salinities were nearly completely removed. Instead, by overcompensating, sharp right hand sided spikes occured but on the much smaller vertical scale of 1 dbar (fig. 2.3) which easily could be eliminated by a simple spike test (fig. 2.4). Calculating 1 dbar averages smoothed the curves further (fig. 2.5) but still shows rudiments of the original spikes to both sides at steps. Up to here the processing has reduced the spikes in salinity by a factor 10 and their vertical scale by a factor 5. Additionally they are no longer distributed on one side of the curve but on both sides and are of the same order. For that reason now a running mean over 5 dbar and interpolation to 2 dbar could be applied without weighting errors to one side (fig. 2.6). Although more sophisticated methods have been proposed (Horne and Toole, 1980; Giles and McDougall, 1986) this simple method proved to be very powerful in reducing spikes which occur due to a mismatch of response times between temperature and conductivity measurements, at least if one restricts oneself to vertical scales larger than 2 dbar in the analysis.

All station data acquired with the CTD NB1 during F.S. POSEIDON cruise 124 were processed in this manner. As 10 dbar running means they are displayed together with the data from the MS45 as θS-diagramme in figure 2.7.

2.2 Expendable Bathythermograph (XBT)

Deep Blue (T7) probes were launched at a nominal spacing of 40 km and with higher resolution near the Canary Islands. All data were recorded digitally with the system described by Emery et al. (1985). Comparing XBT data from the F.S. POSEIDON cruise at XBT positions with near surface temperature of a continuously recording system calibrated against CTD's we found a linear correction for XBT-temperatures

(2) $T_C = 0.48^\circ C + 0.97 \cdot T \pm 0.15^\circ C$.

No corrections were applied to XBT's from F.S. POLARSTERN and B.O. TALIARTE cruises.

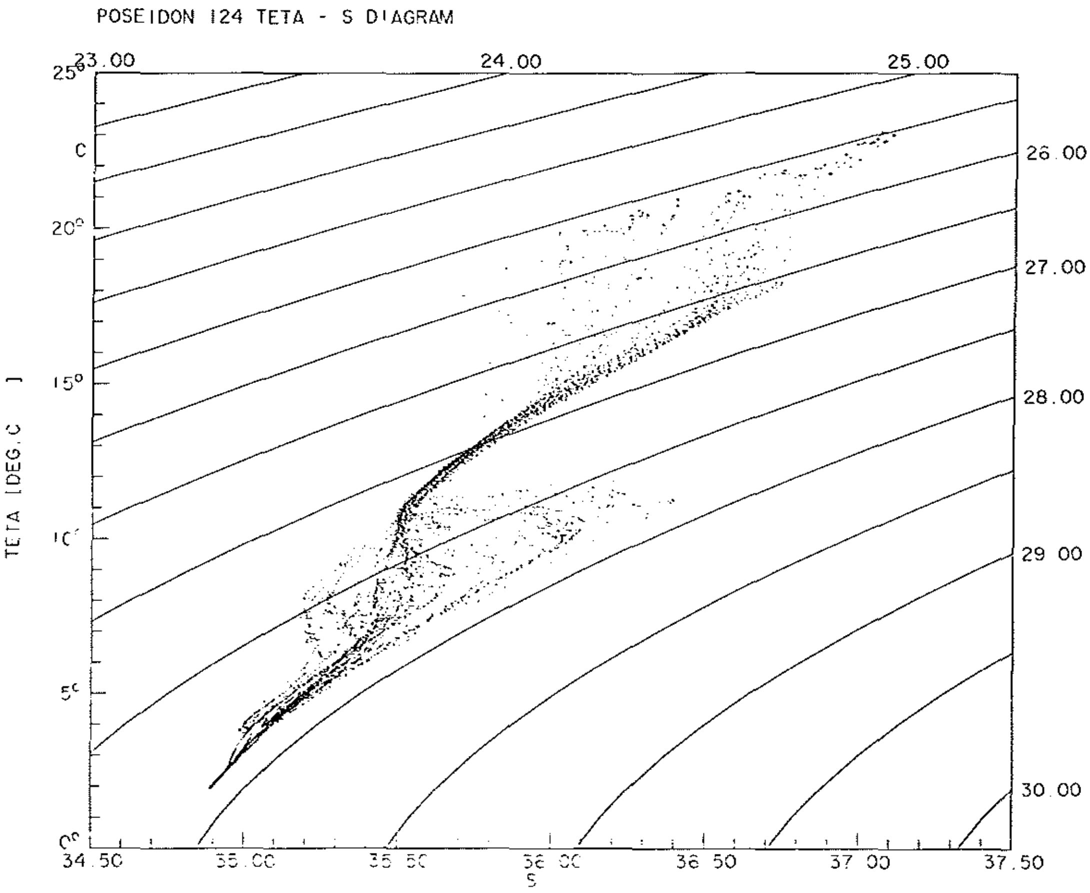


Fig. 2.7: F.S. POSEIDON, cruise 124, overall potential temperature - salinity relationship.

2.3 Nutrients

From stations 522 to 559 of POSEIDON, samples for the analysis of nutrients were taken from the rosette sampler of the CTD in the same depths and positions as the ones taken to calibrate the sensor of conductivity. On B.O. TALIARTE, samples were taken with NISKIN bottles. In both cases the unfiltered samples were conserved in polypropylene bottles at ≈ 18°C. The nutrient analysis was performed using a Technicon autoanalyzer following the technique described by Grasshoff et al. (1983).

2.4 Moored current meters and thermistor cables

All moored instruments were of Aanderaa type (Aanderaa, 1983). The sampling interval was set to 1 h (current meters, 5 sensors) or to 2 h (thermistor cables, 11 sensors) to allow for one year record length and resolution of tidal and inertial oscillations. All moorings were equipped with pressure sensors in the uppermost instrument to control the nominal depth of the instruments and to monitor mooring motion. Two-daily means of temperature and salinities at the beginning and at the end of the records together with available CTD profiles led to linear endpoint corrections in these parameters. Whereas temperatures records show no or weak linear trends, salinity and therefore density sometimes have long term nonlinear variations which are expected to be due to fouling of the inductive conductivity cells.

A low pass filter with half amplitude response at 33 h and m weights

$$(2) \quad w_i = \frac{m}{\pi(i-1)} \sin\left(\frac{\pi(i-1)}{m}\right) \quad i = 2,3,\ldots m$$

were m = 67 for hourly and m = 35 for two hourly sampled time series removed high frequency signals (fig. 2.8). Daily means from the filtered records then built the basis for statistics and time series plots in section 4.

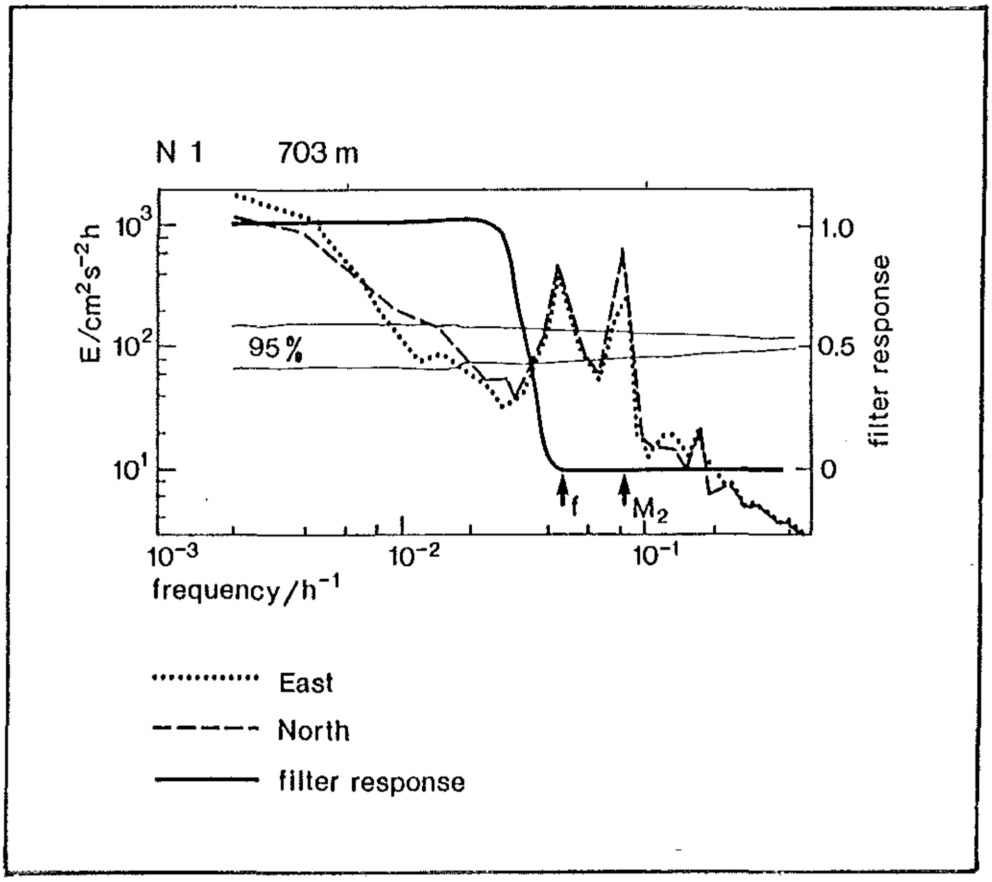


Fig. 2.8: High frequency spectra of current measurements at 703 m depth, position N1, 33°N, 22°W and low pass filter amplitude response according to equation 2. Adapted from Müller (1987).

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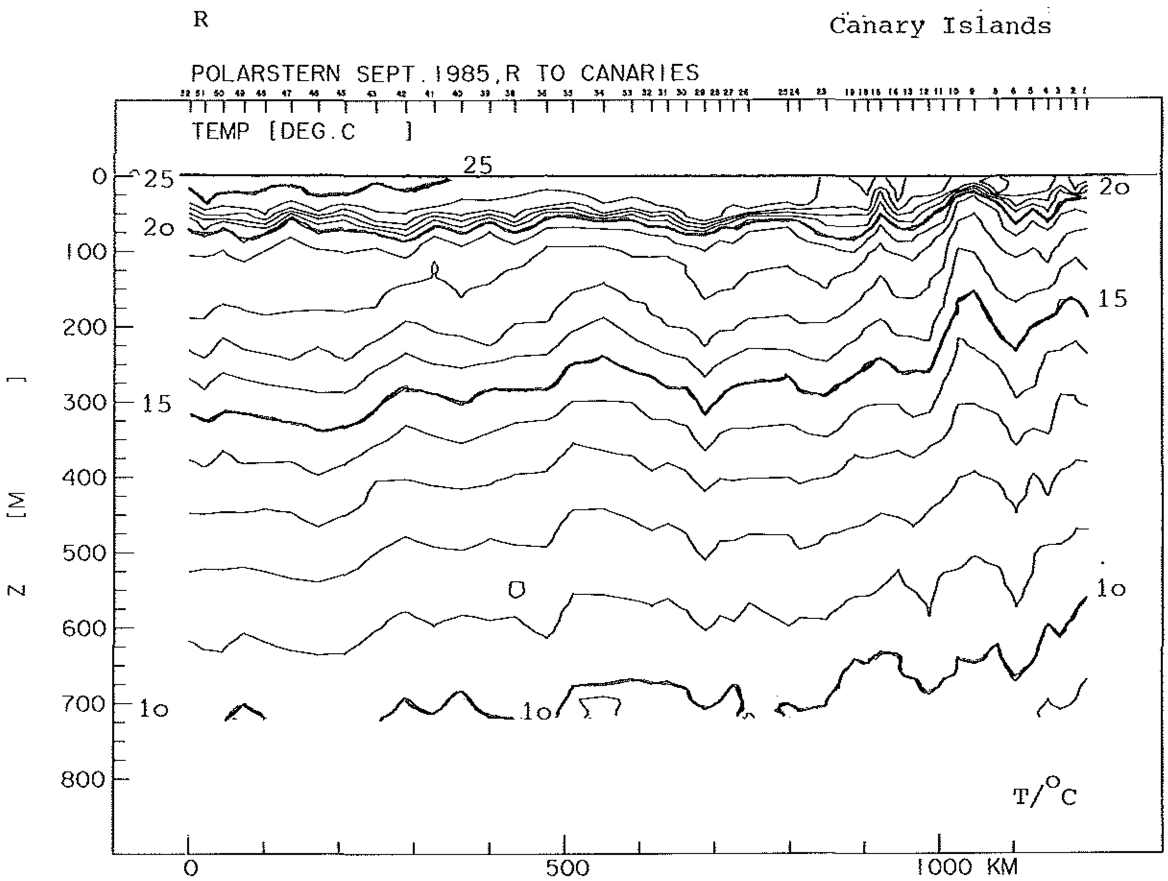
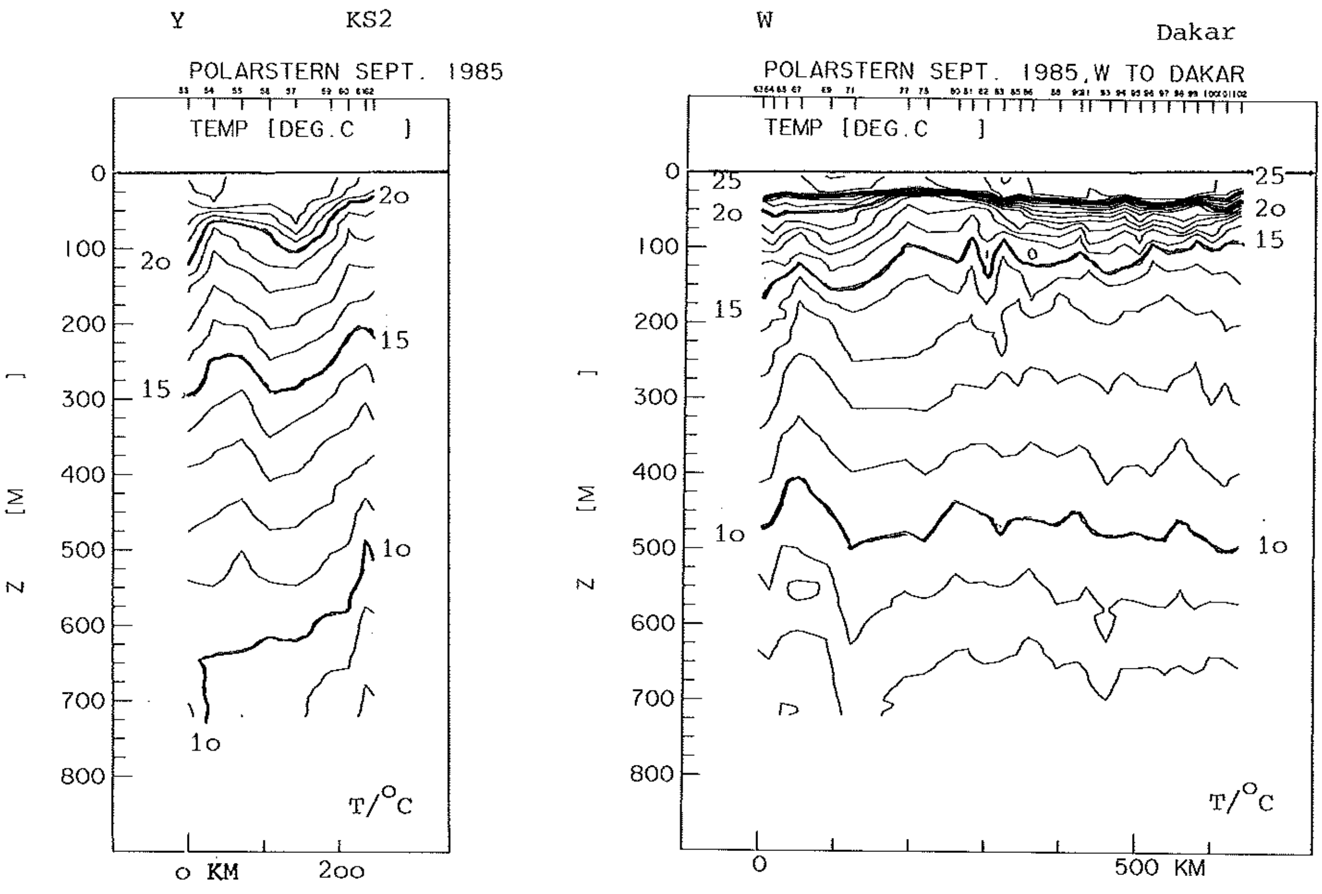
3. Hydrographic data

3.1 POLARSTERN cruise ANT IV/1b

An inventory of CTD stations and XBT casts according to Siedler (1986) is given in table 5.1. We here show the three XBT sections (c.f. fig. 1b for location).



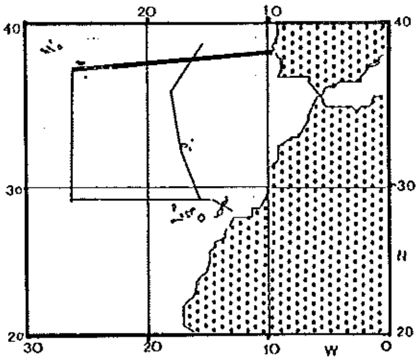
POLARSTERN cruise ANT IV/1b: XBT section from R to the Canary Islands, 29 Sept - 01 Oct 1985. Positions see figure 1b.



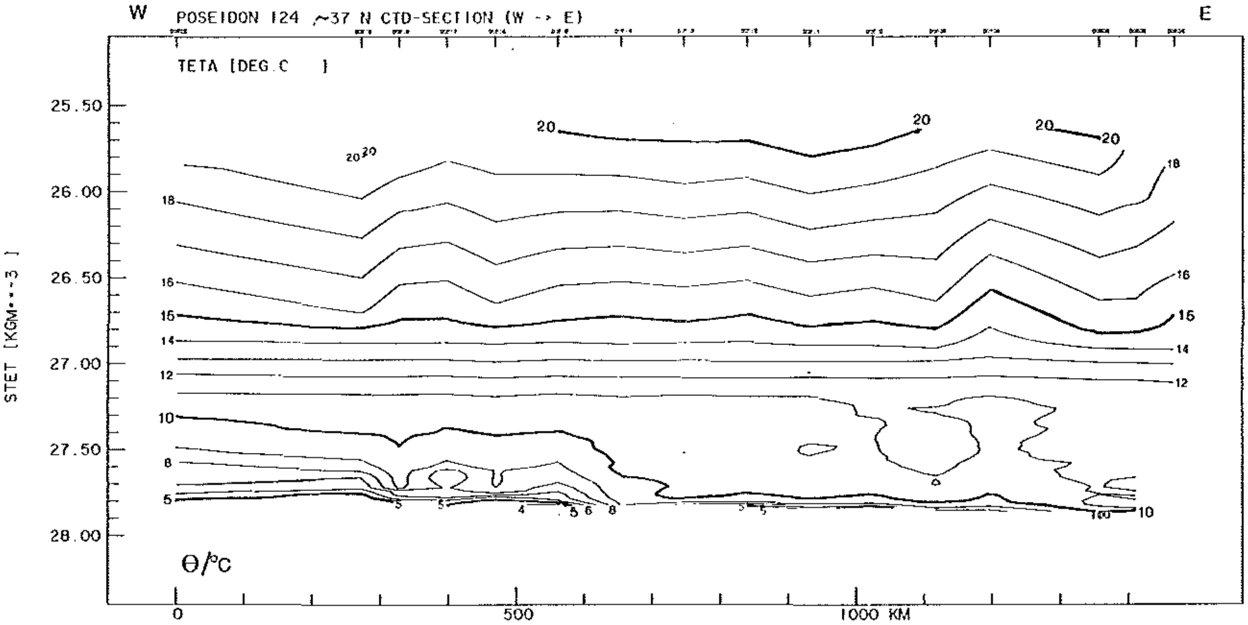
POLARSTERN cruise ANT IV/1b: XBT sections from position Y to KS2, 06-07 Oct (left) and W to Dakar, 11-13 Oct 1985 (right). See figure 1b for location of sections.

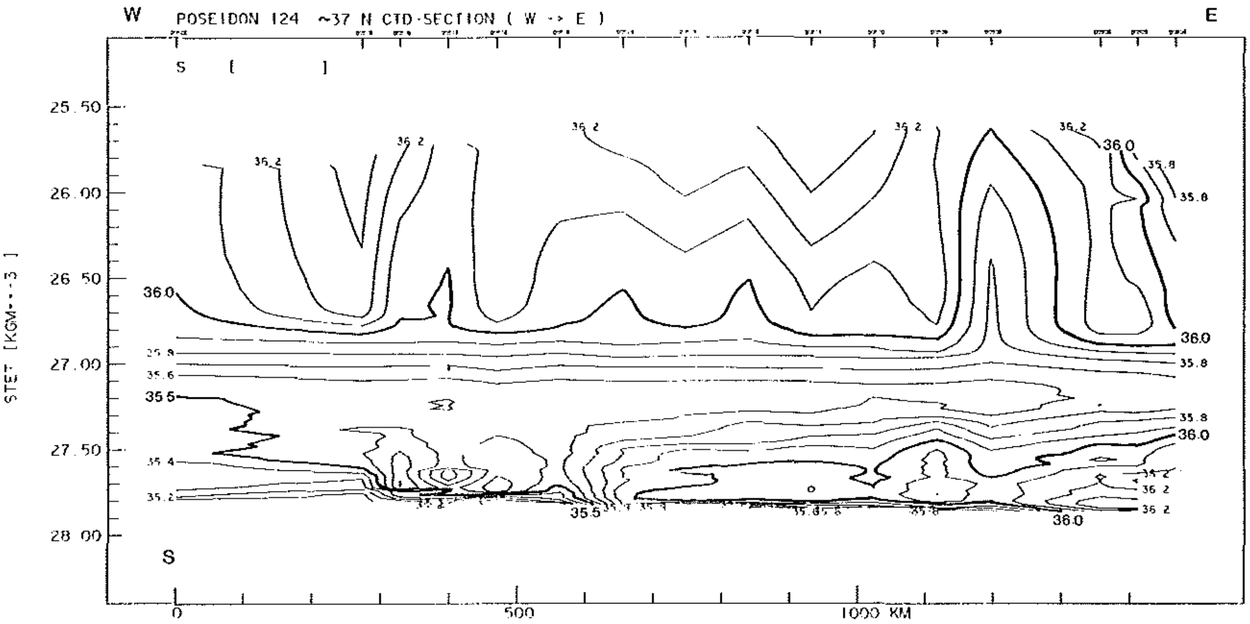
3.2 POSEIDON cruise 124

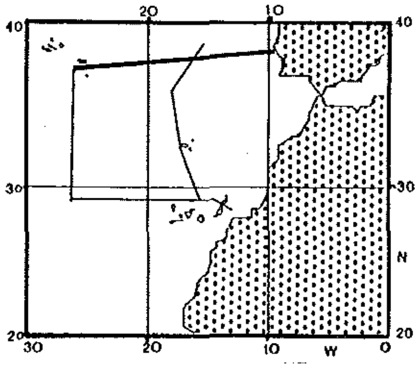
For station inventories of CTDs and XBT's see tables 5.3 and 5.4. Sections of potential temperature, salinity, pressure and the nutrients are drawn against potential density as vertical coordinate, XBT temperature against depth. Orientation is West and South on the left hand side.



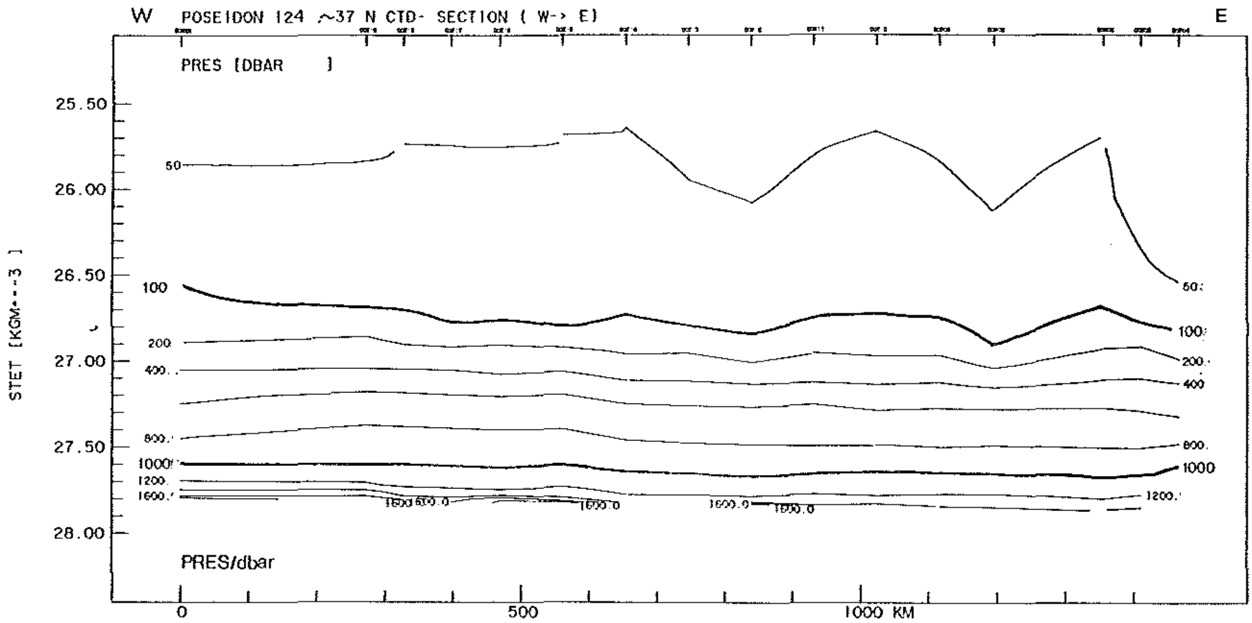
POSEIDON cruise 124: Sections of potential temperature and salinity between Portugal and the Azores, 07-11 Nov 1985. Potential density is the vertical coordinate.

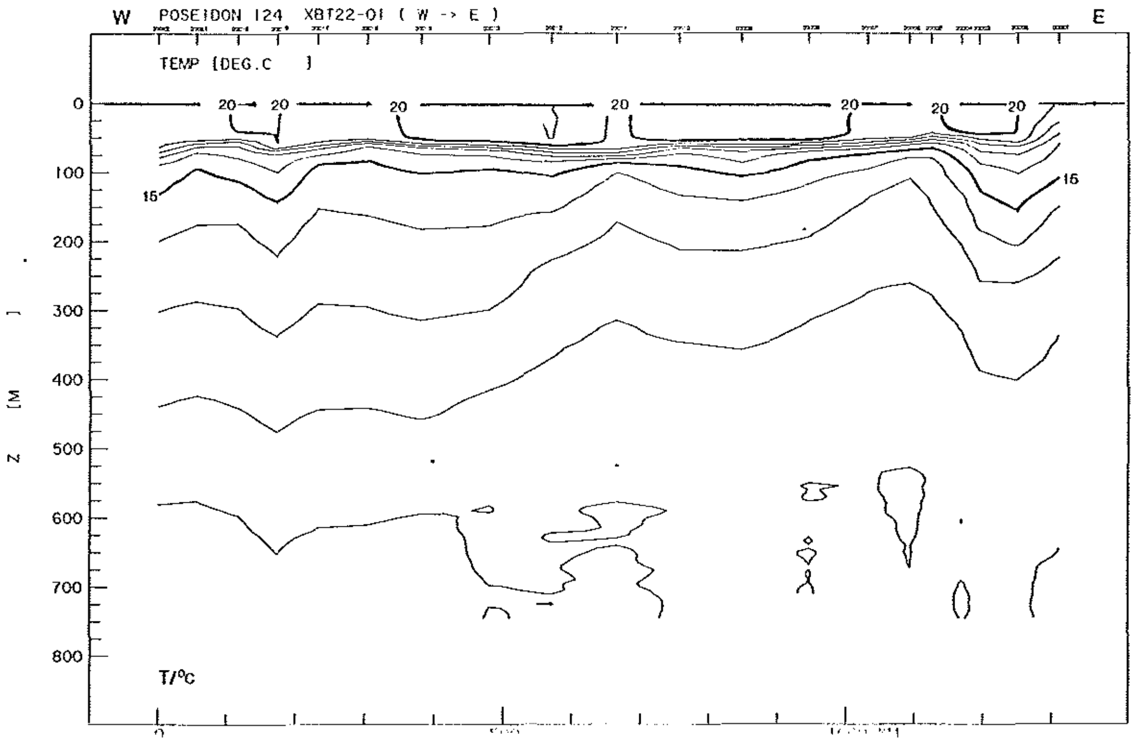


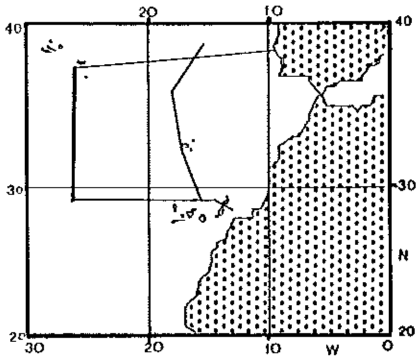




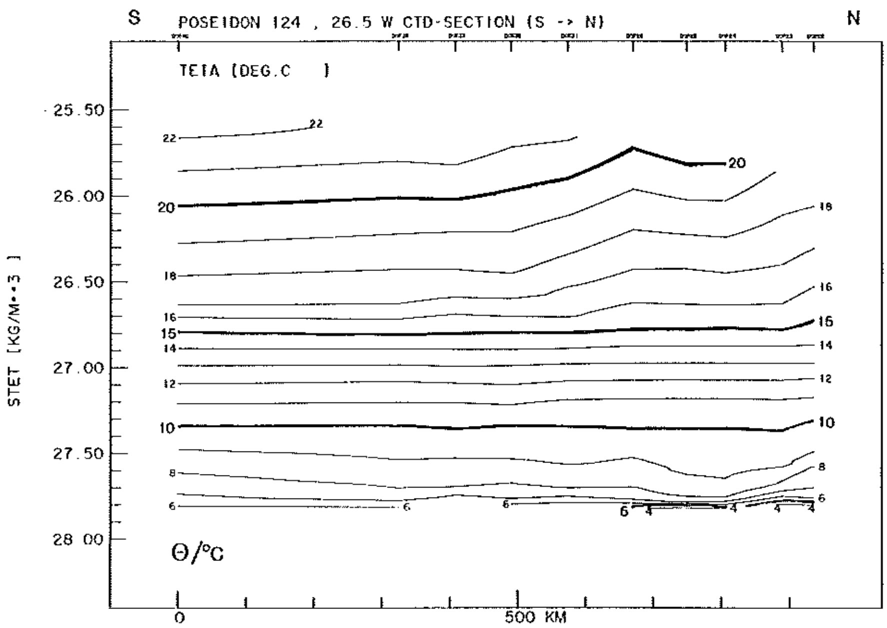
POSEIDON cruise 124: Sections of pressure and temperature from XBTs between Portugal and the Azores. Potential density and depth are the vertical coordintes, respectively 07-11 Nov 1985.

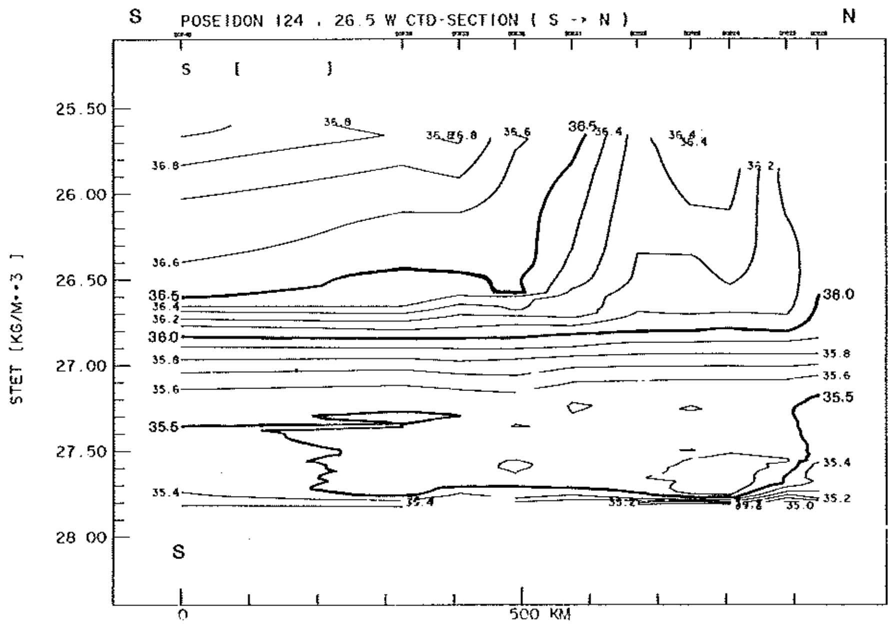


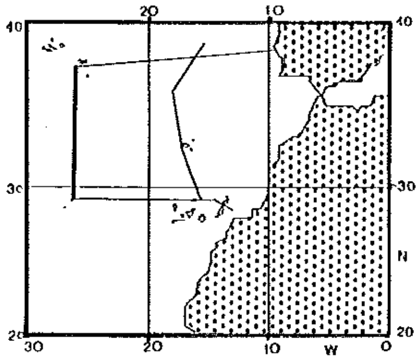




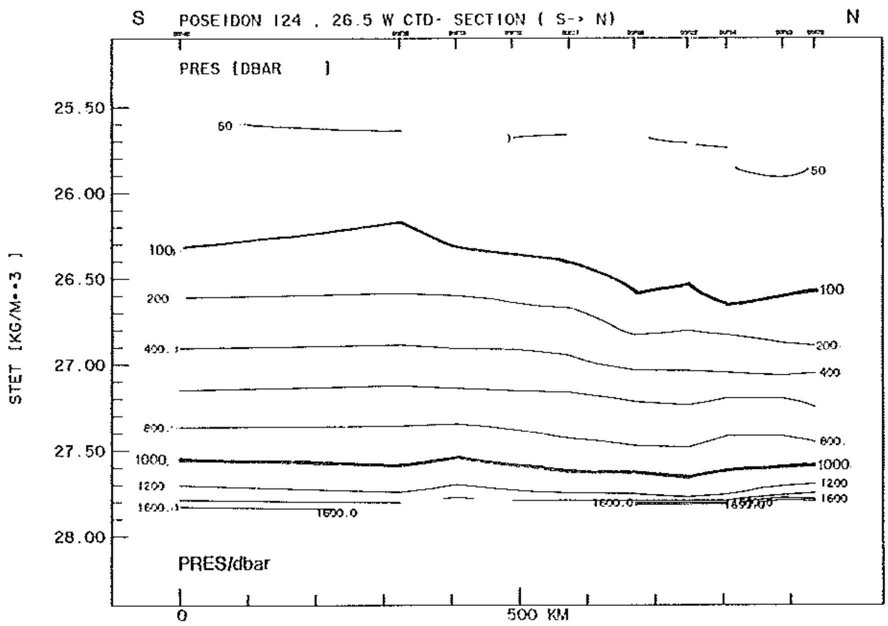
<u>POSEIDON cruise 124:</u> Sections of potential temperature and salinity between the Azores and 29°N00, 26°W30, 14-20 Nov 1985. Potential density is the vertical coordinate.

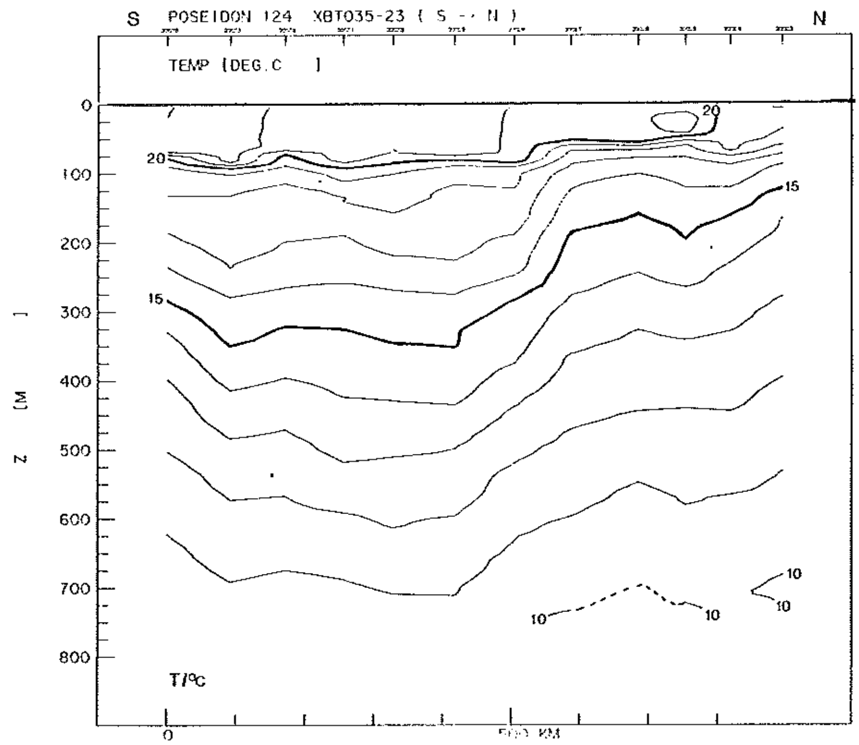


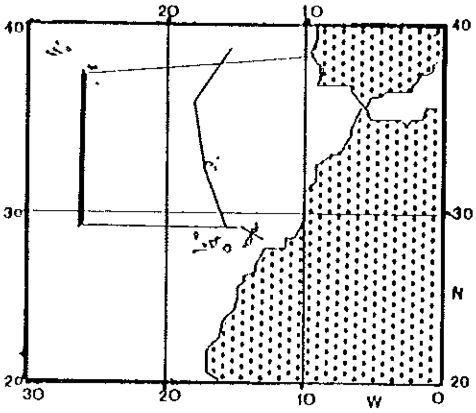




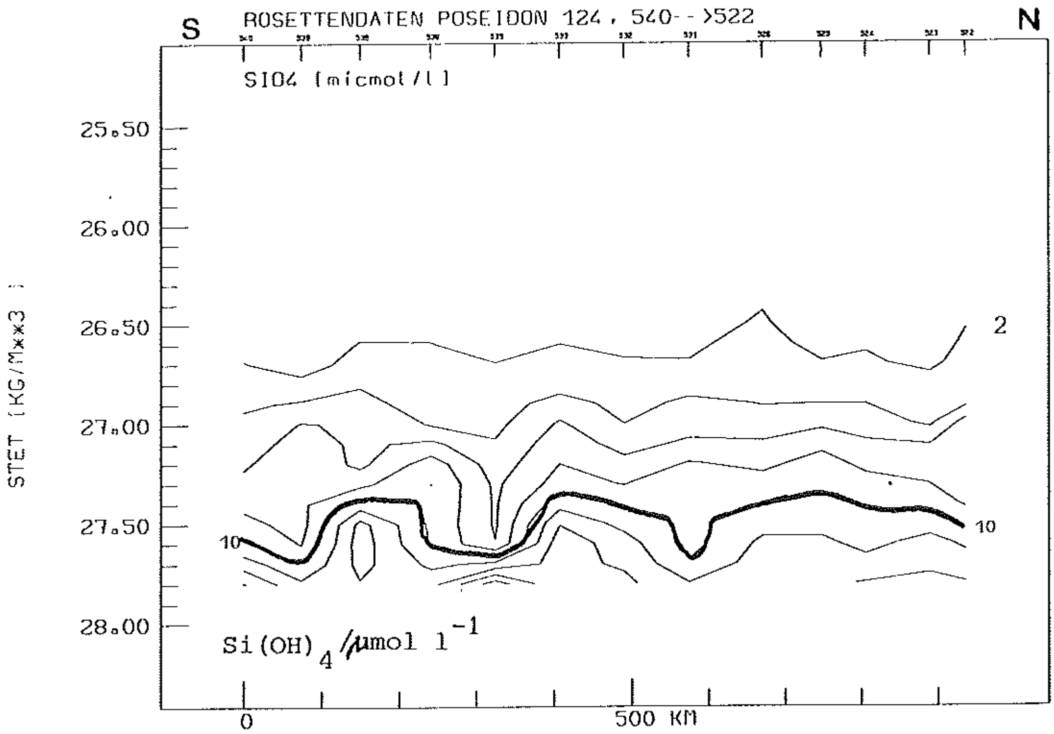
POSEIDON cruise 124: Sections of pressure and temperature from XBTs between the Azores and 29°N00, 26°W30, 14-20 Nov 1985. Potential density and depth are the vertical coordinates, respectively.

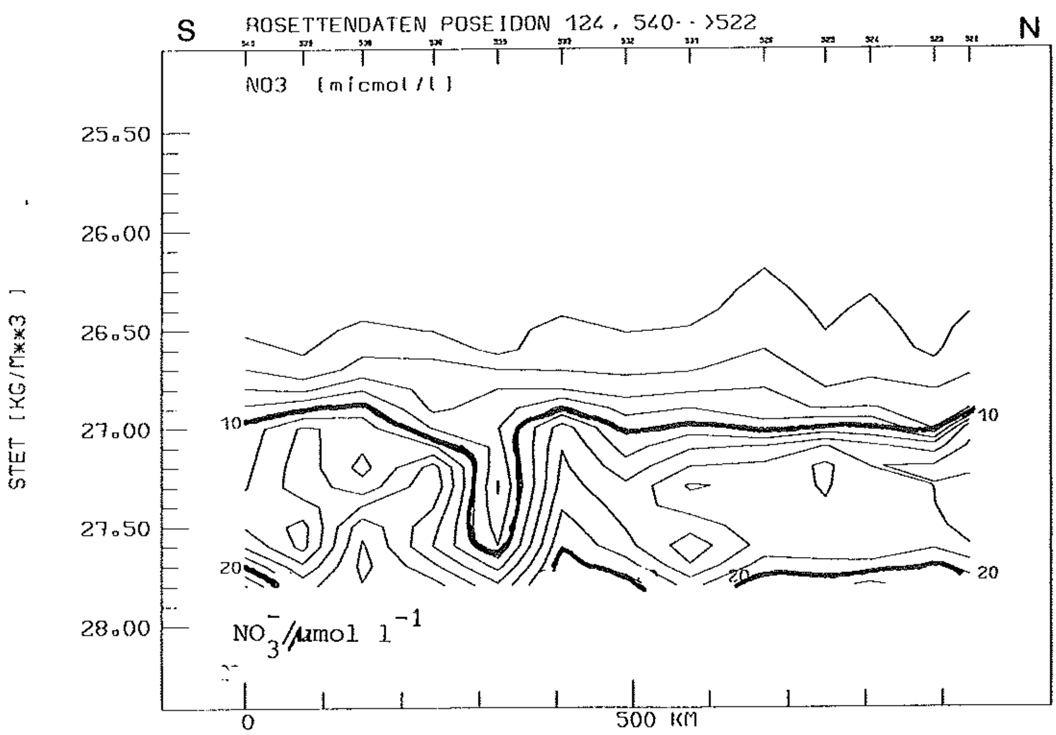


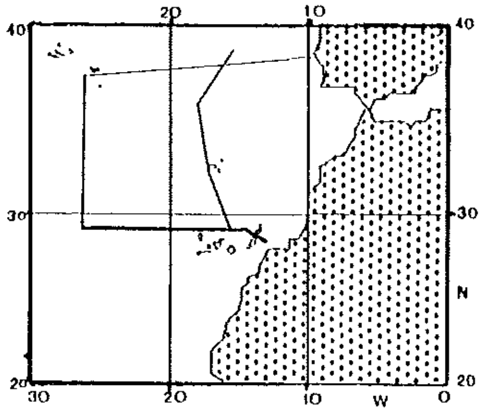




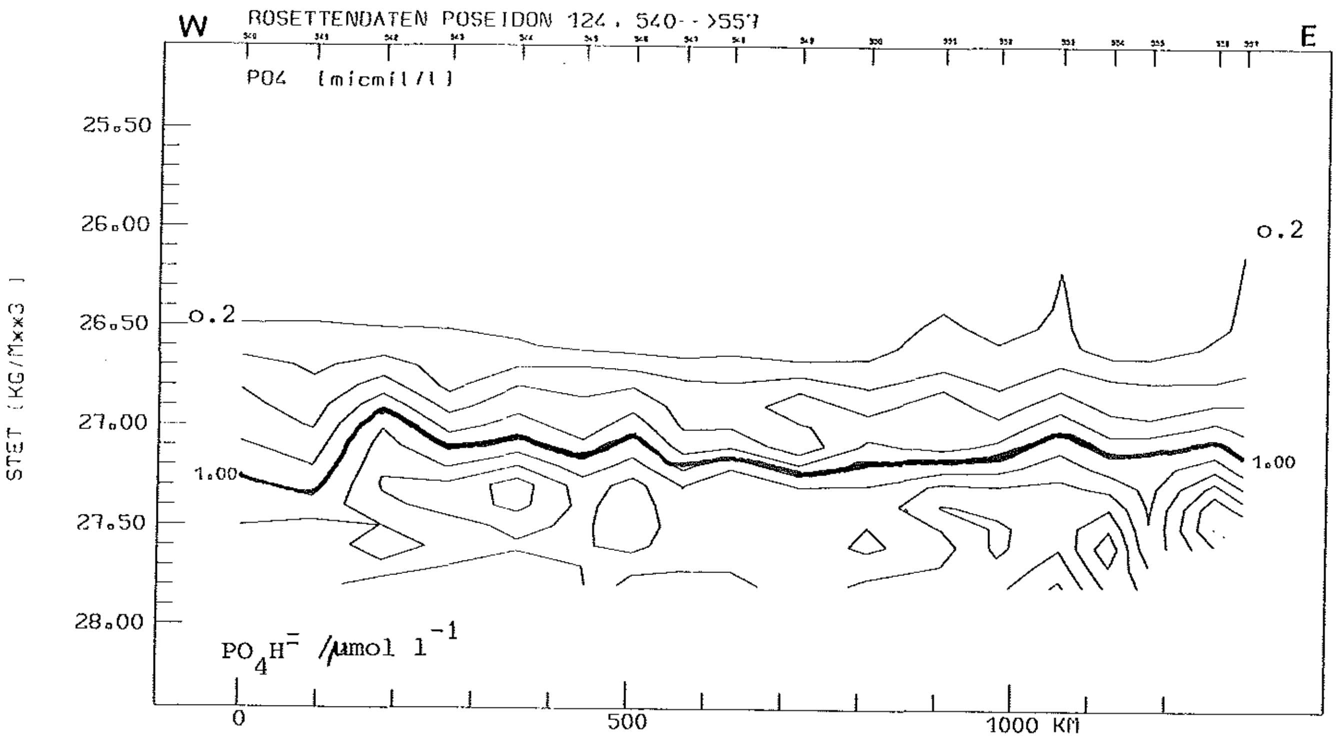
POSEIDON cruise 124: Sections of silicate and nitrate between 29°N00, 26°W30 and the Azores, 14-20 Nov 1985. Potential density is the vertical coordinate.

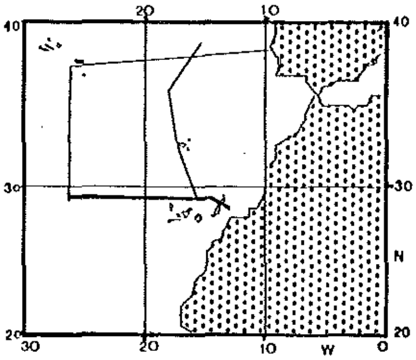




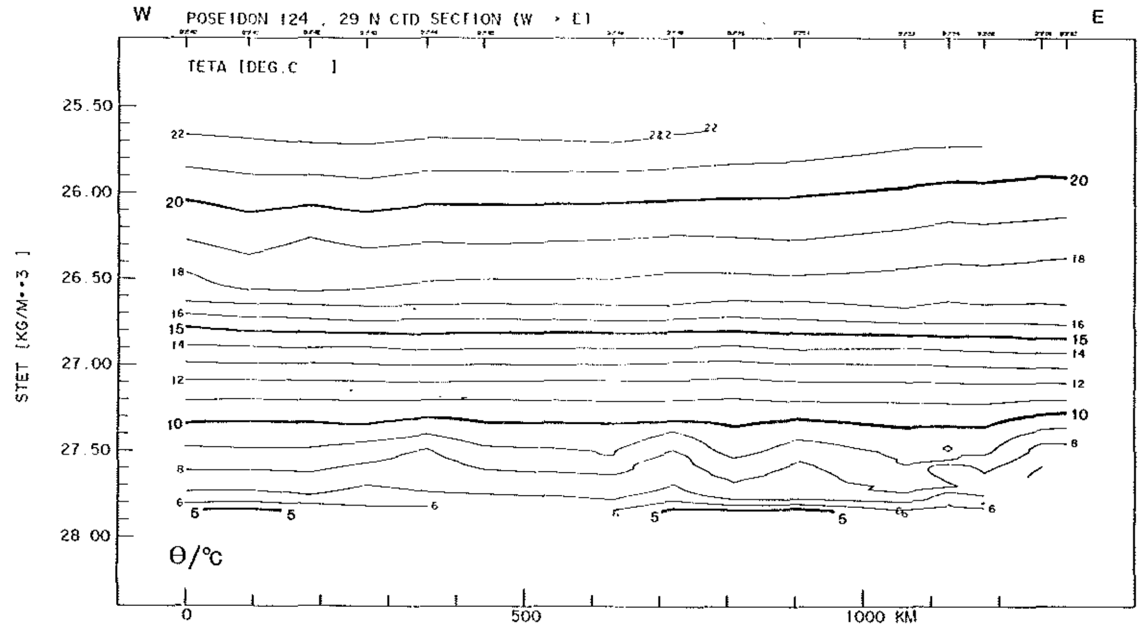


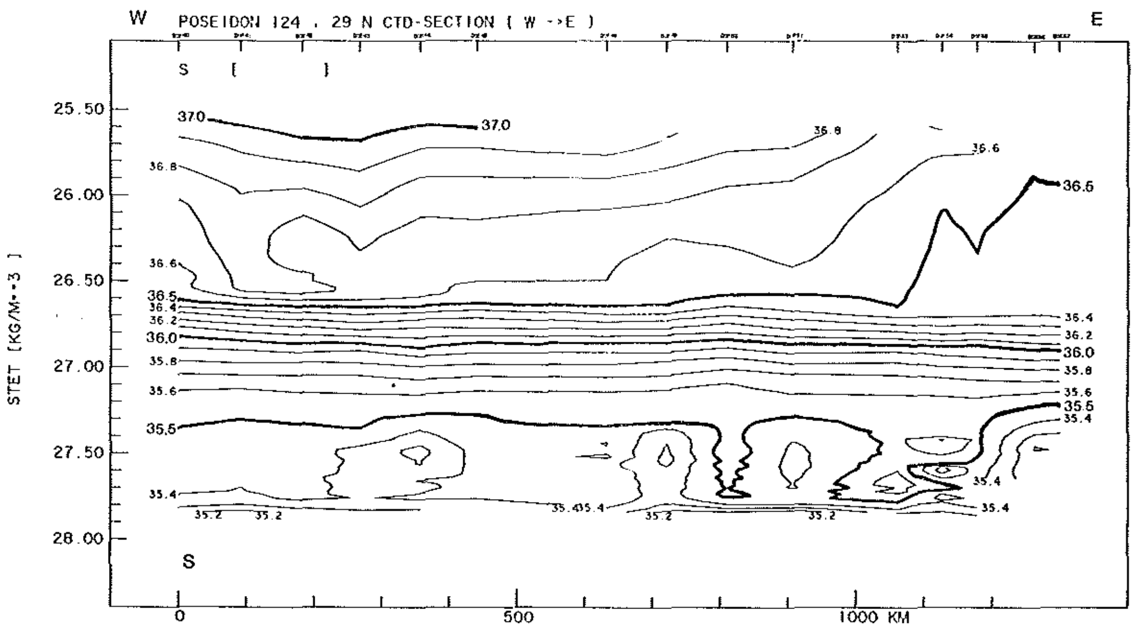
POSEIDON cruise 124: Section of phosphate between 29°N00, 26°W30 and the Azores, 14-20 Nov 1985. Potential density is the vertical coordinate.

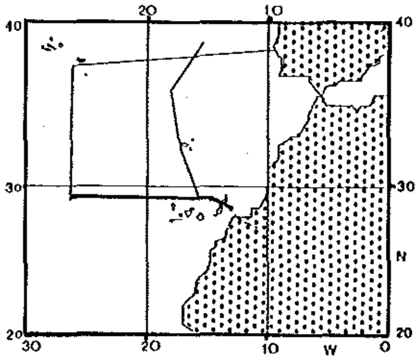




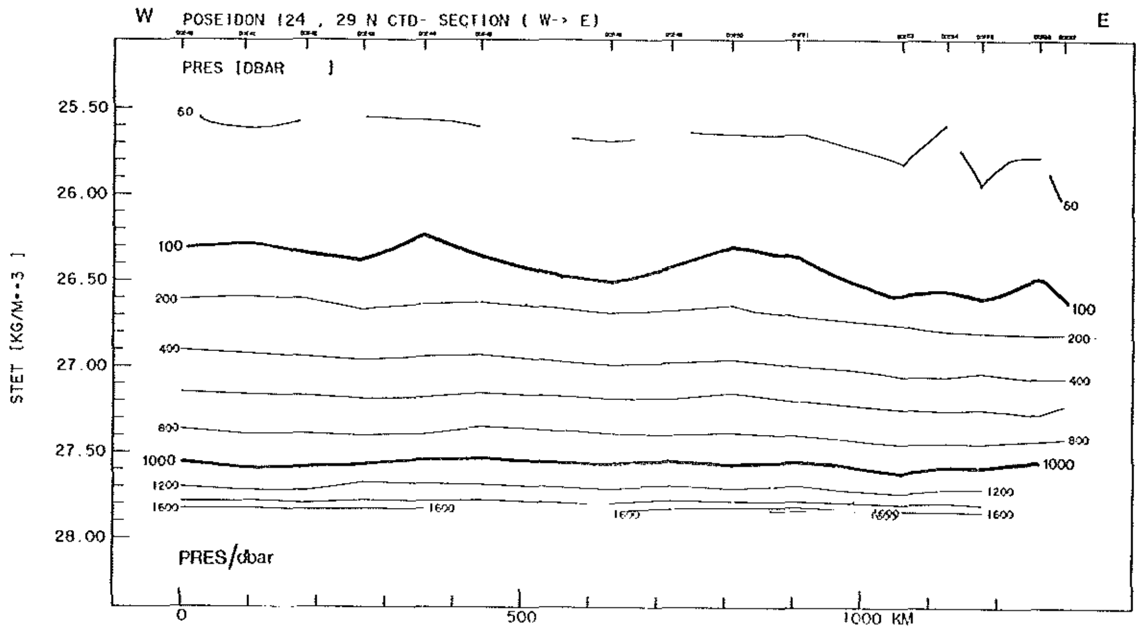
POSEIDON cruise 124: Sections of potential temperature and salinity between 29°N00, 26°W30 and the Canary Islands, 20-25 Nov 1985. Potential density is the vertical coordinate.

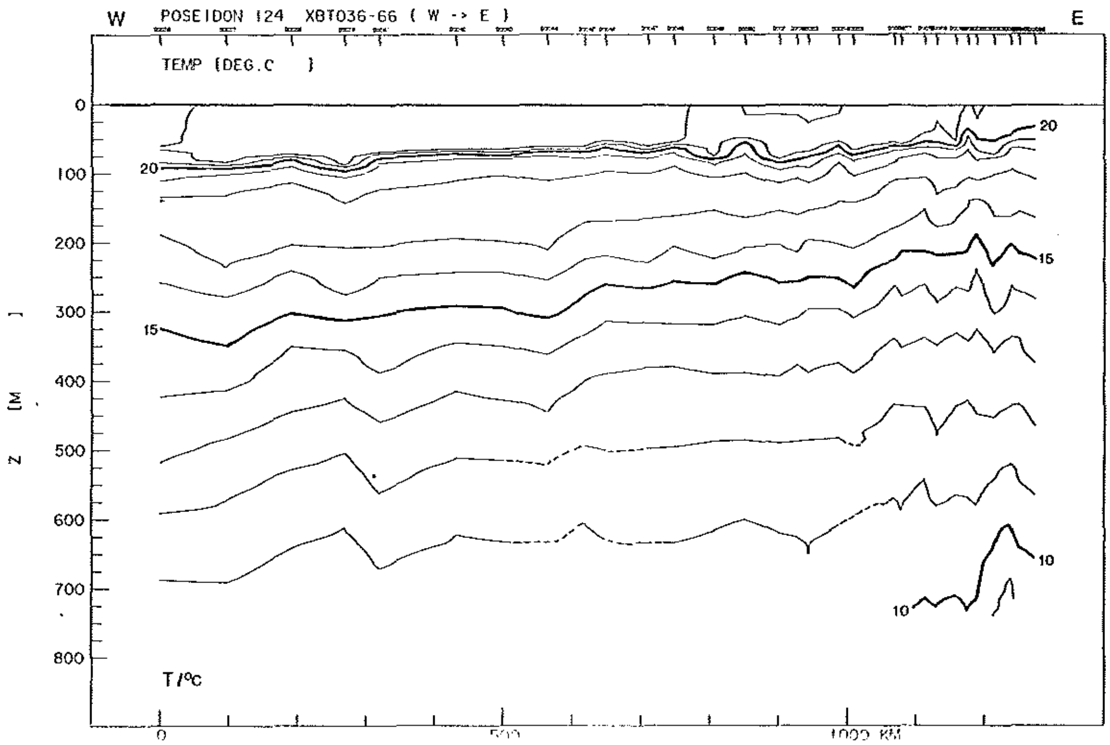


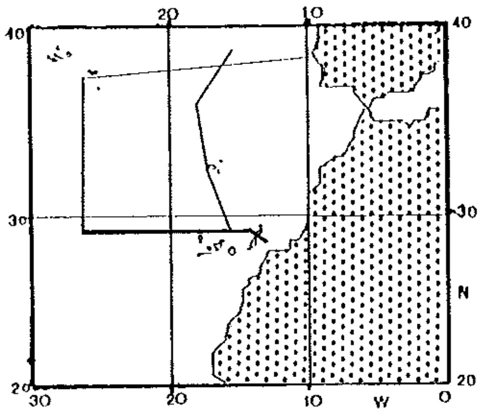




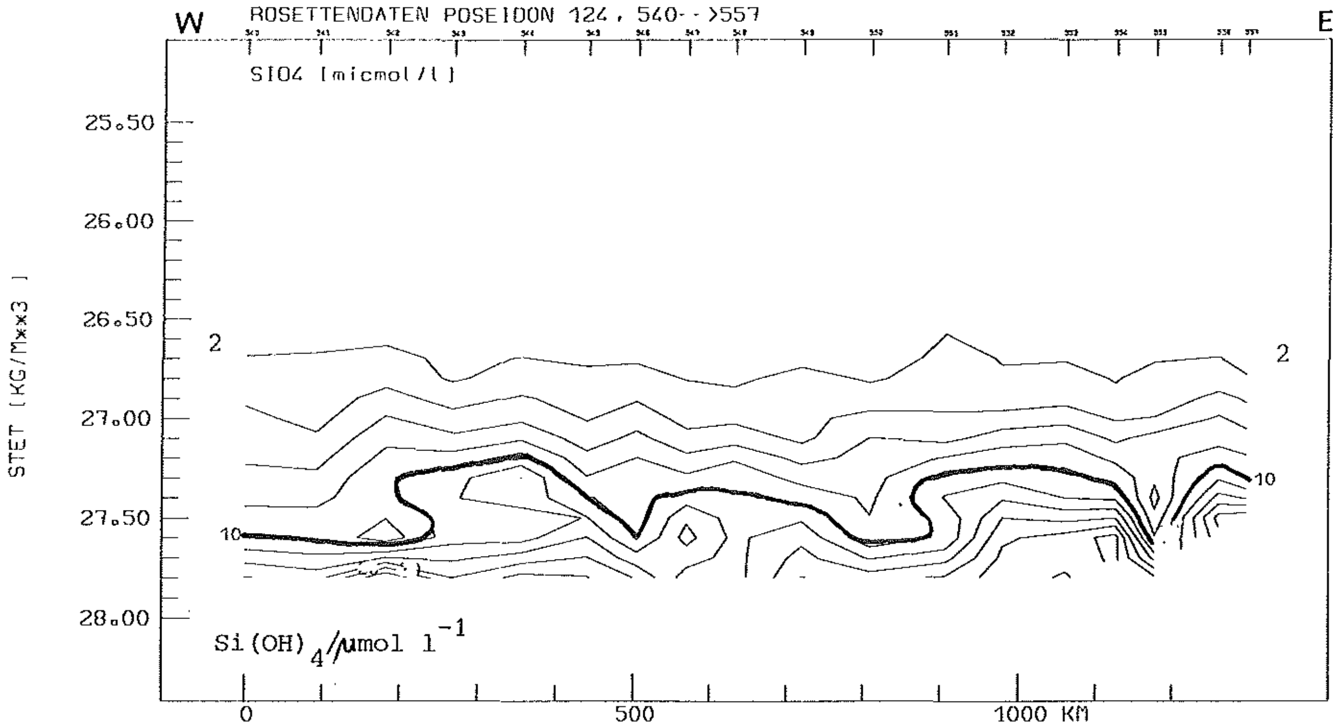
POSEIDON cruise 124: Sections of pressure and XBT temperature between 29°N00, 26°W30 and the Canary Islands, 20-25 Nov 1985. Potential density and depth are the vertical coordinates, respectively.

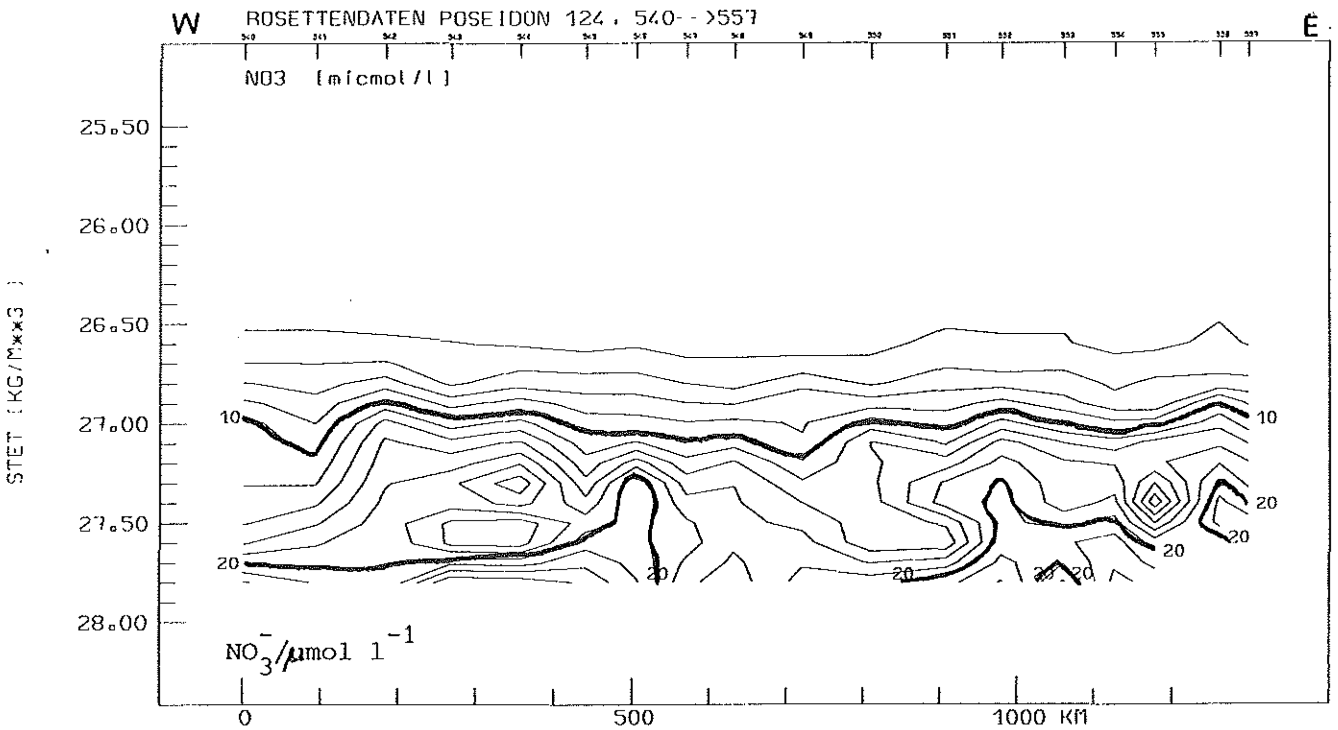


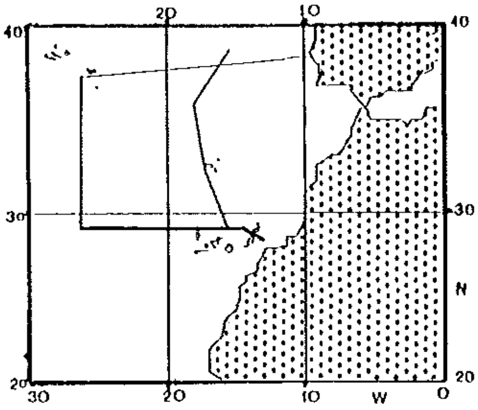




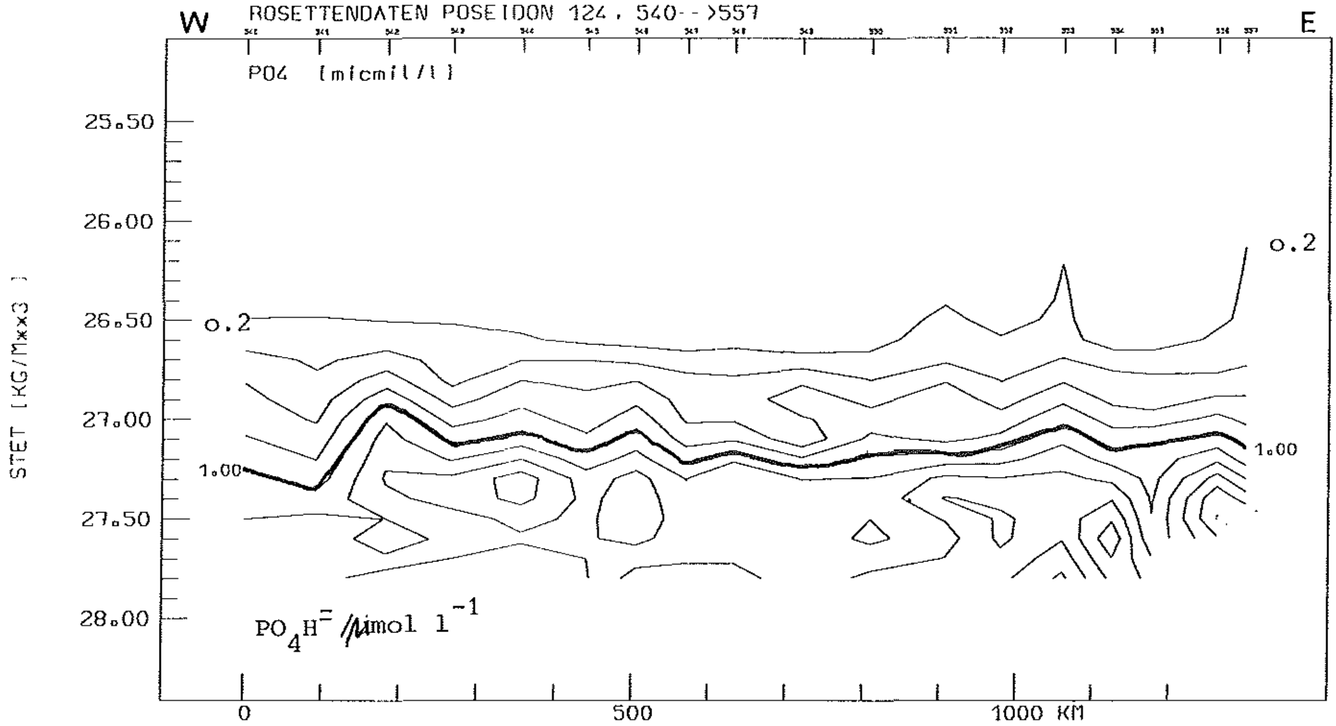
POSEIDON cruise 124: Sections of silicate and nitrate between 29°N00, 26°W30 and the Canary Islands, 20-24 Nov 1985. Potential density is the vertical coordinate.

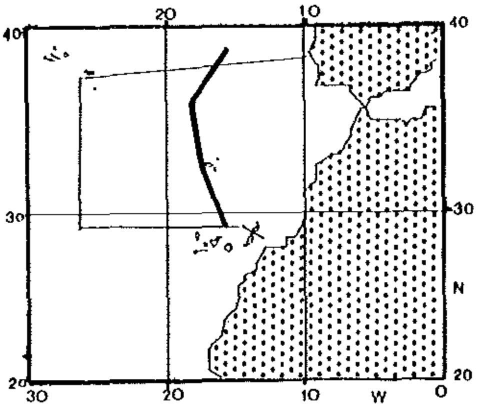




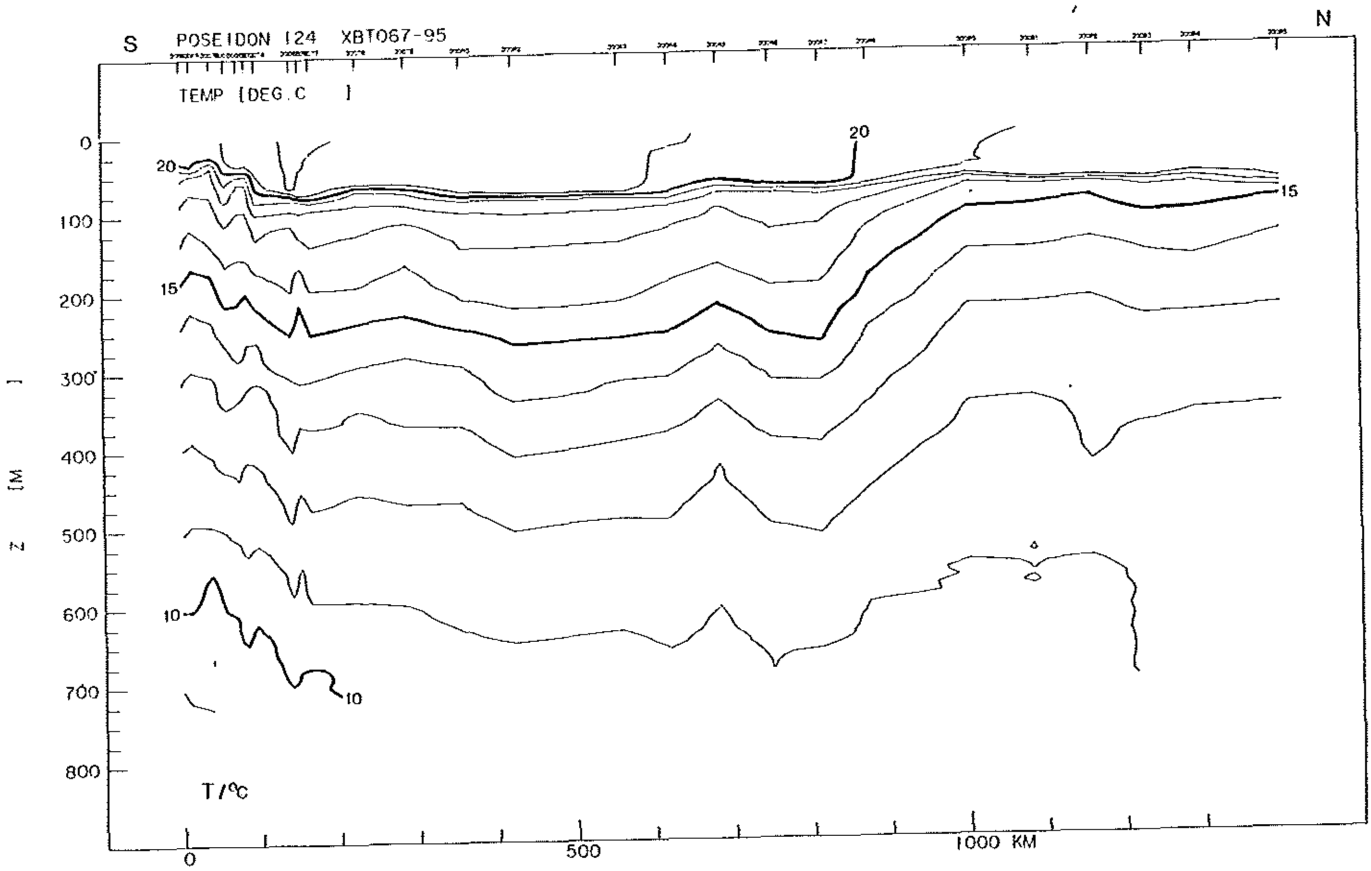


POSEIDON cruise 124: Section of phosphate between 29°N00, 26°W30 and the Canary Islands, 20-24 Nov 1985. Potential density is the vertical coordinate.



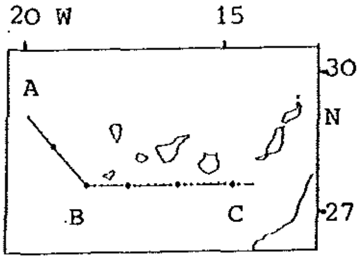


POSEIDON cruise 124: Section of XBT temperature between the Canary Islands and 41°N14, 13°W22, 01-03 Dec 1985.

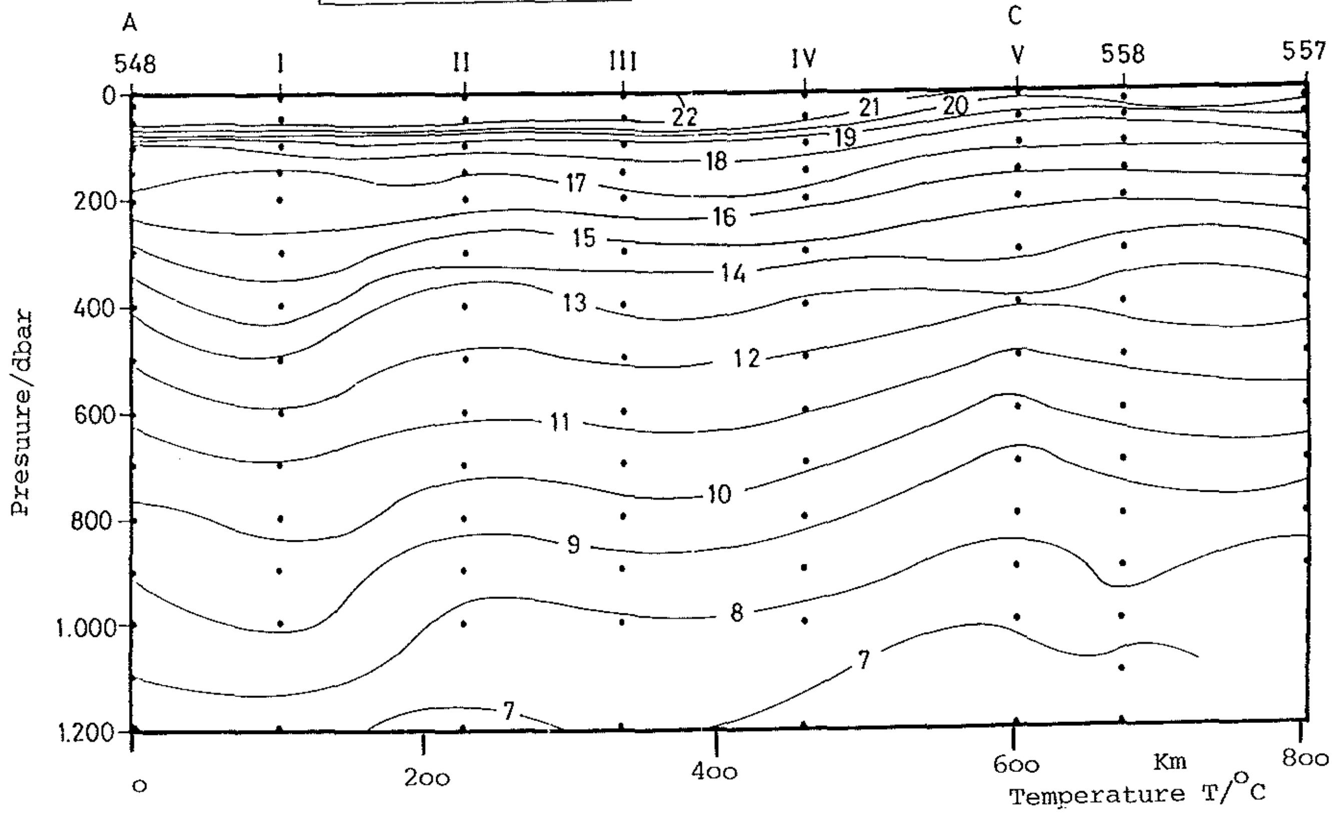


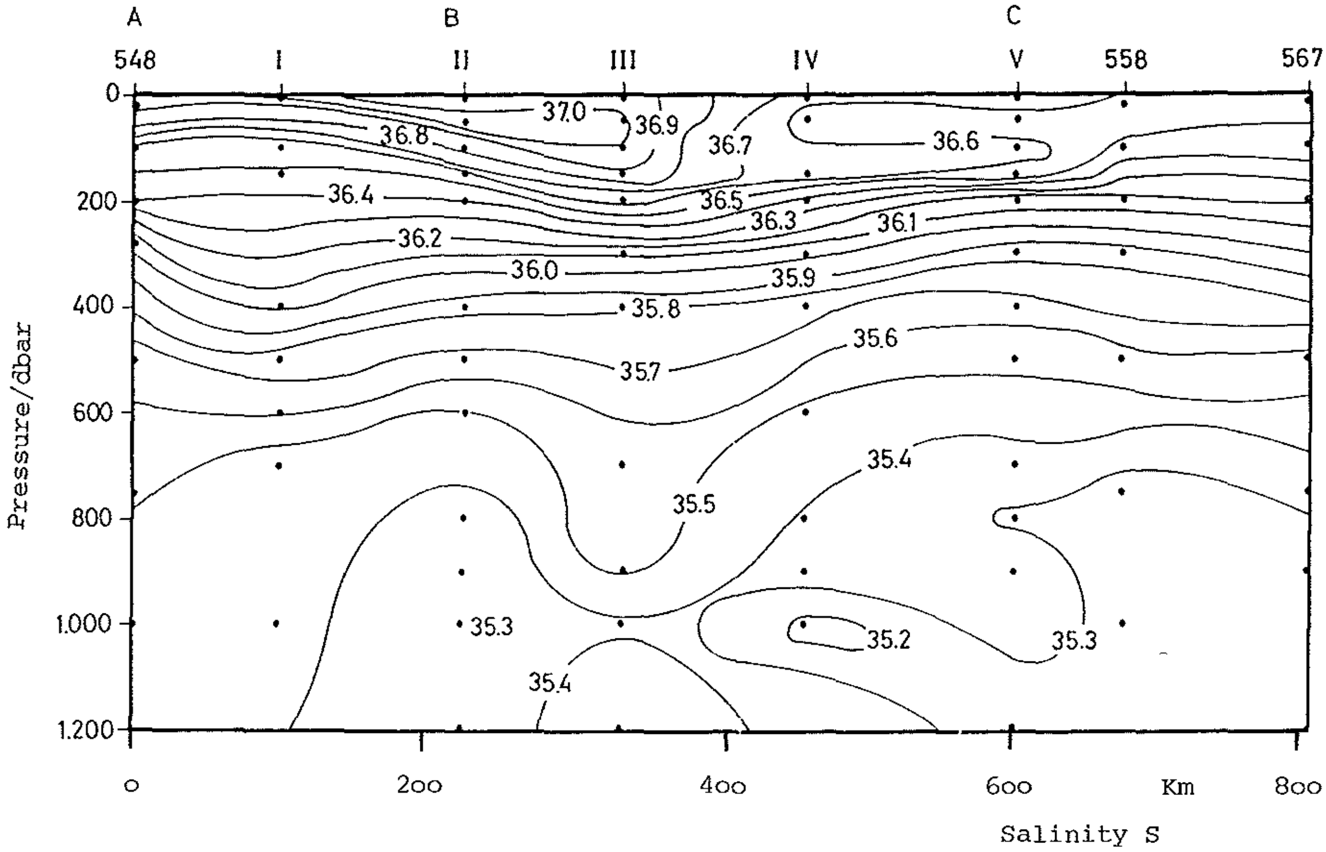
3.3 TALIARTE cruise XIV

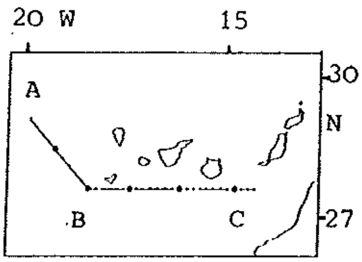
An inventory of hydrographic stations and XBT casts are given in tables 5.5 and 5.6.



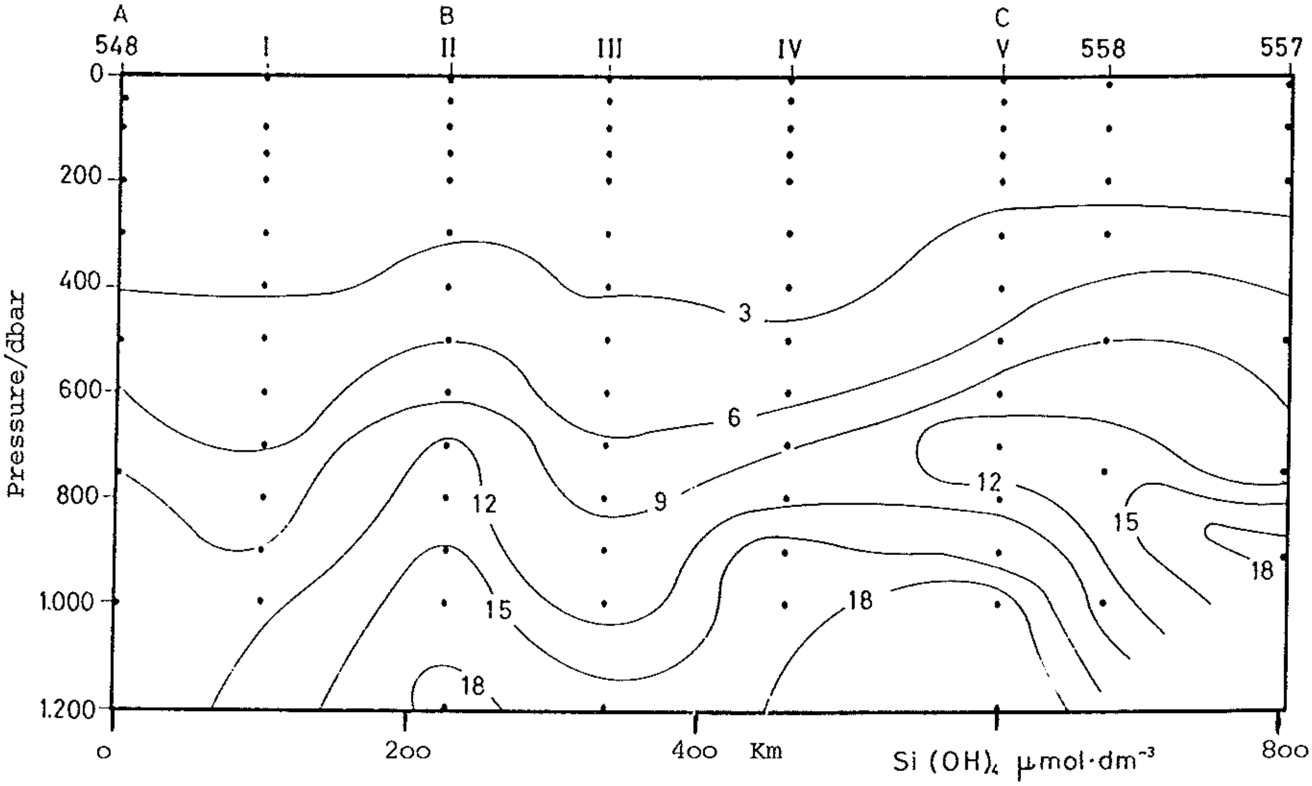
TALIARTE cruise XIV: Sections of temperature and salinity south of the Canary Islands.

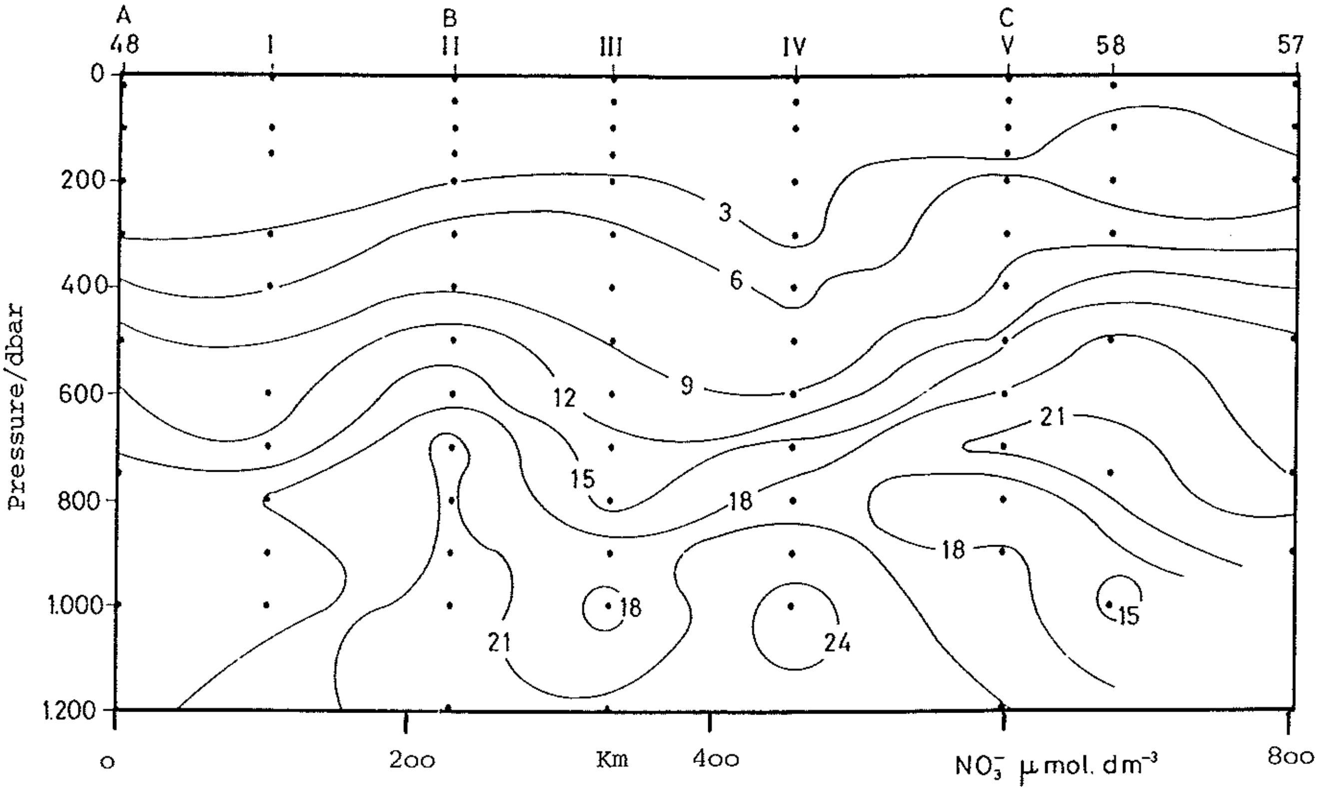


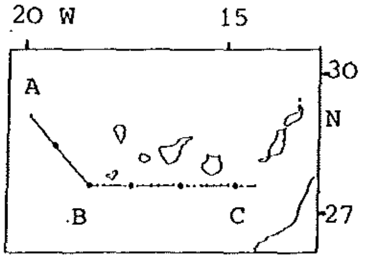




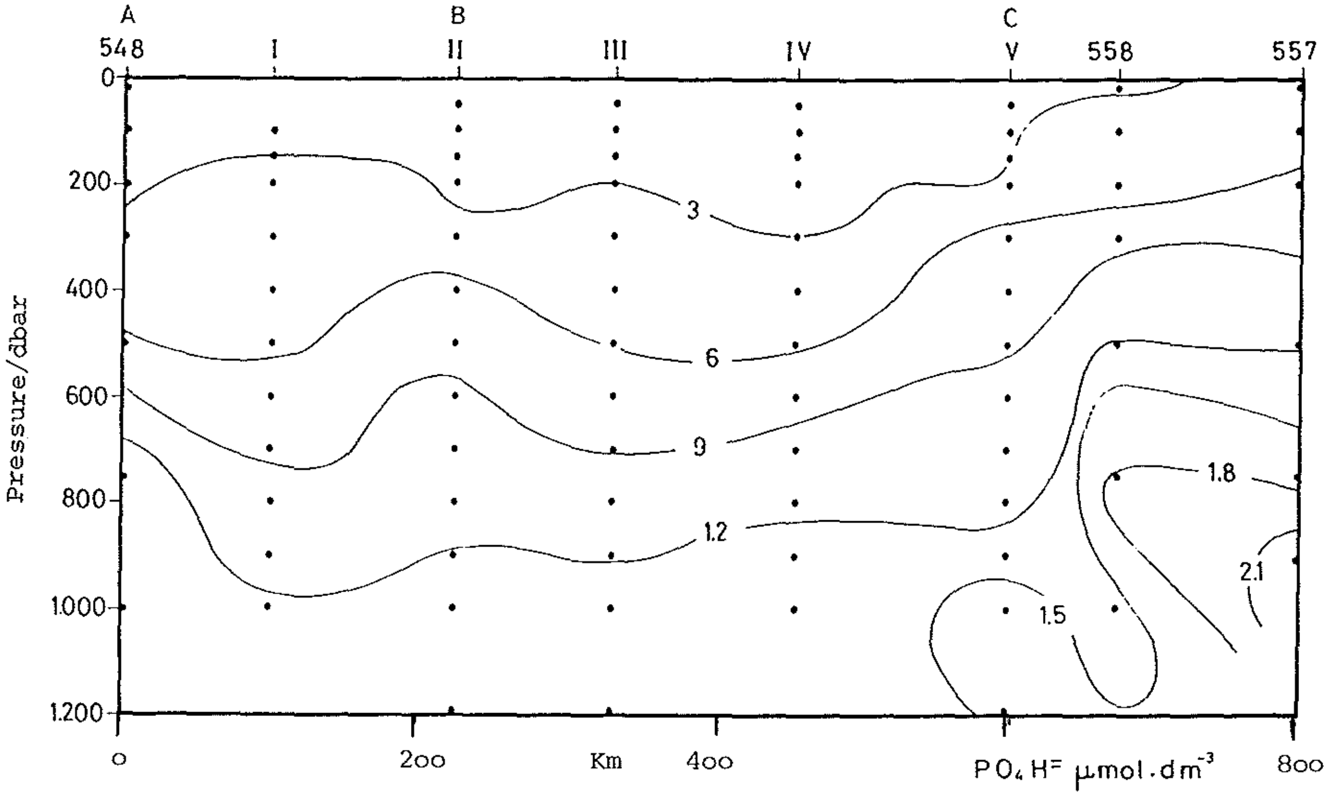
TALIARTE cruise XIV: Sections of silicate and nitrate south of the Canary Islands.

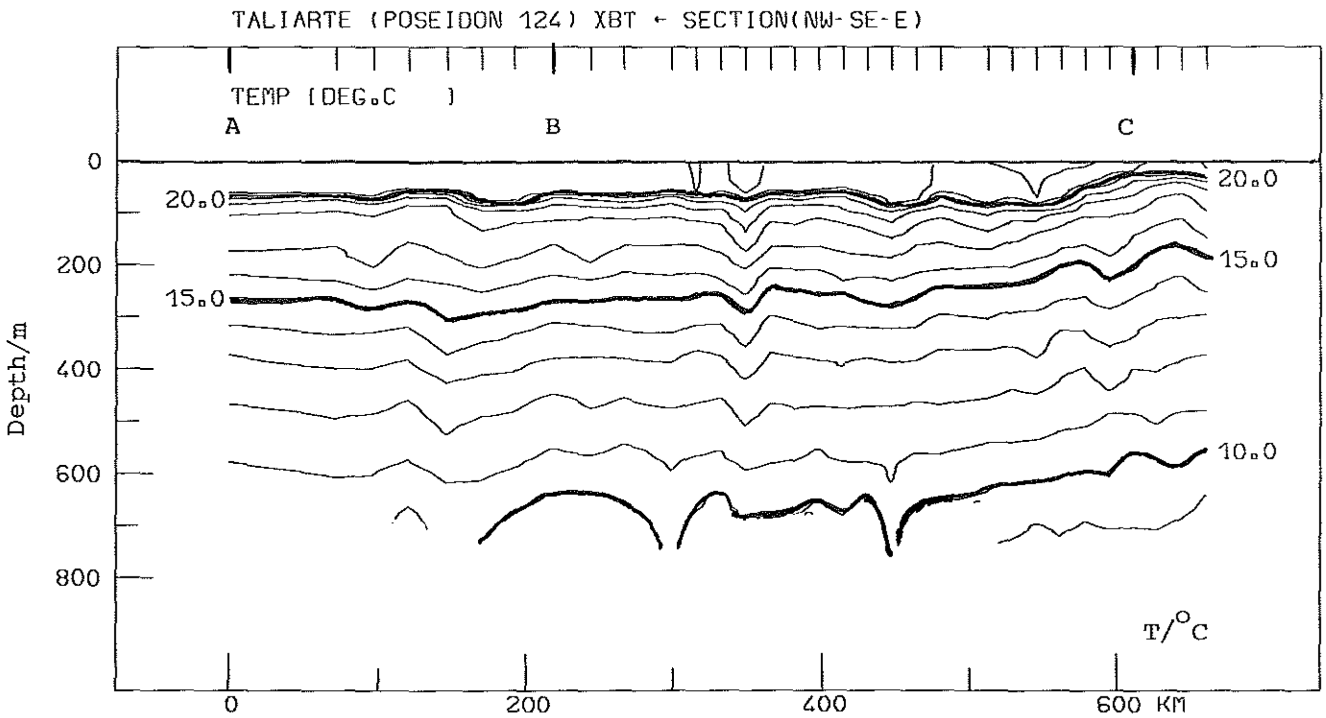






<u>TALIARTE cruise XIV</u>: Section of phosphate and XBT temperature south of the Canary Islands.





4. Time series

From each mooring, an inventory table leads the presentations. In the progressive vector diagrams up is north direction, the starting dates are indicated, and the curves are incremented by 10 days. In the vector time series also up is north.

4.1 Current meter mooring N1/276-6

IfM mooring No: 276-6 External name: N1/KIEL276

Latitude: 33°09.5'N Longitude: 21°57.3'W

Sounding: 5235 m Water depth: 5290 m

Deployed: 26-Oct-84 Recovered: 16-Nov-85

Start of record: 26-Oct-84, 15:00 Z End of record: 16-Nov-85, 11:00 Z

Remarks:

Identi-fication	instrument				Remarks
	type	No	depth (m)	sampling (min.)	
276602	A-VPT	673	330	120	rotor fouling, rotor stop 10-Feb-85
276603	A-VTC	2528	562	120	
276604	A-VTC	7330	764	120	
276605	A-T50	486/530	766-816	120	stop 07-Sep-85, channel 12 no data
276606	ACM	-	-	-	
276607	A-VTC	7343	1168	120	
276608	A-VTC	6681	1670	120	
276609	A-VT	6678	3080	120	
276610	A-VT	6160	5224	120	rotor lost during launching, stop 23-Jul-85

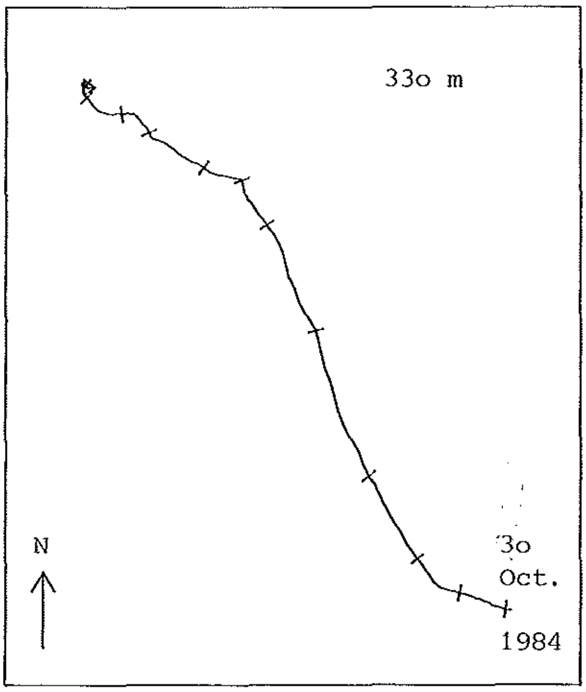
A-VT(PC) : Aanderaa current meter RCM4/5 with sensors for P and C (optional)

A-T50 : Aanderaa thermistor cable 50 m or 400 m

ACM-2 : Neil Brown acoustic vector averaging current meter

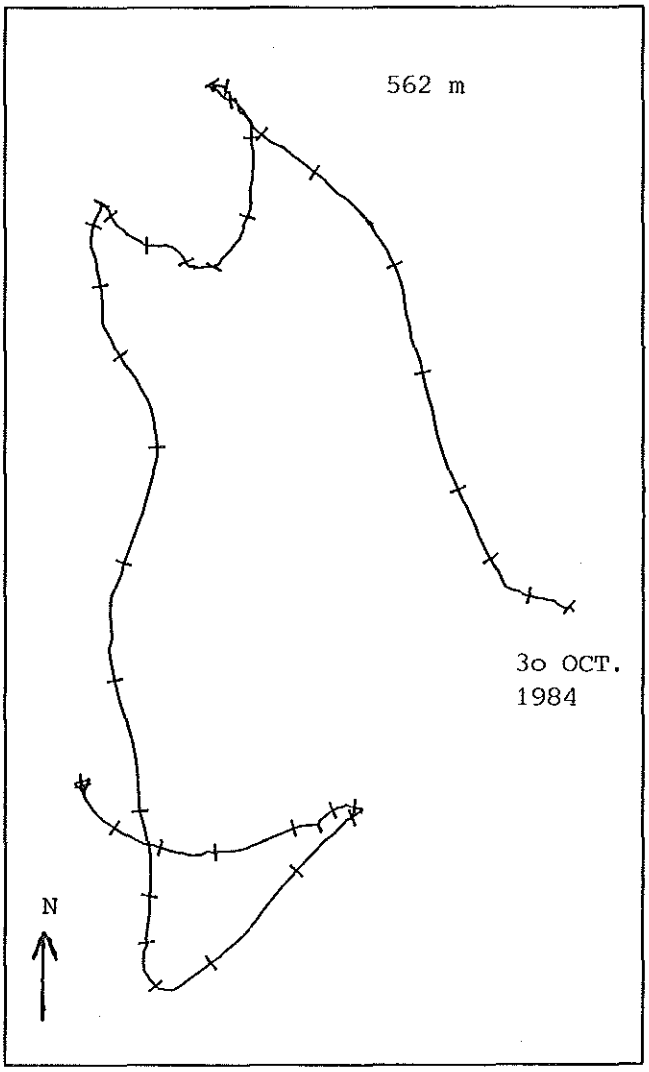
P, T, C, S : Pressure, temperature, conductivity, salinity

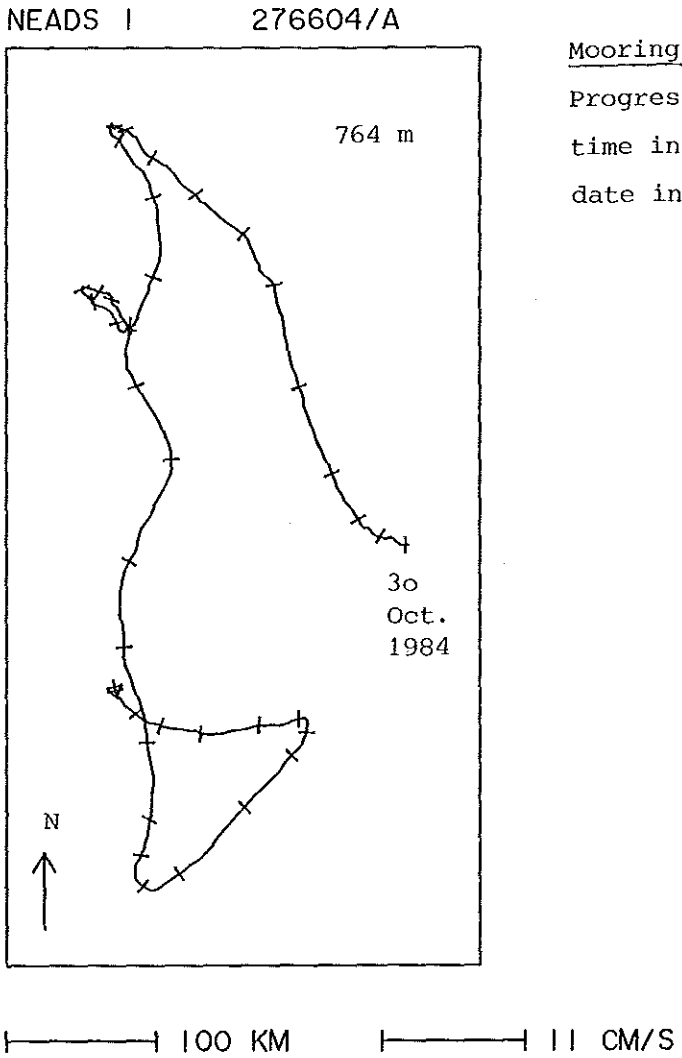
NEADS I 276602/A



Mooring N1/276-6: Progressive vector diagrams, time increments 1o days, start date indicated.

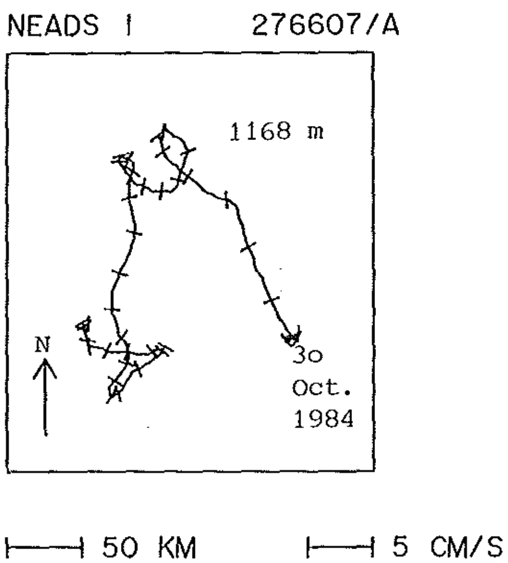
NEADS I 276603/A I2 27Z=



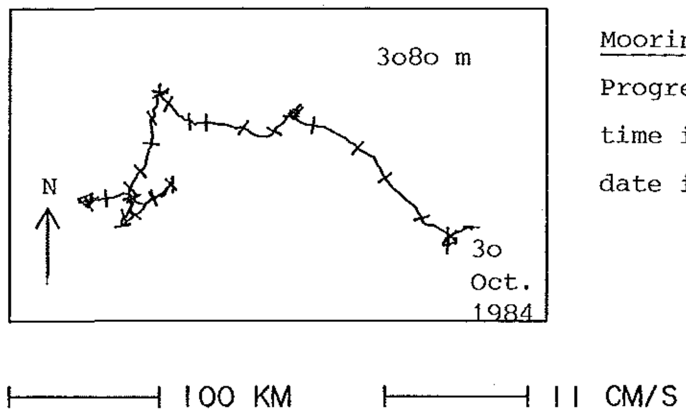


<u>Mooring N1/276-6</u>:

Progressive vector diagrams, time increments 1o days, start date indicated.



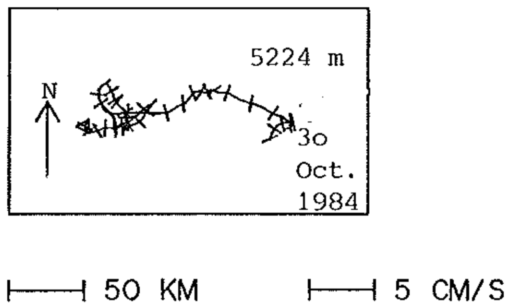
NEADS I 276608/A



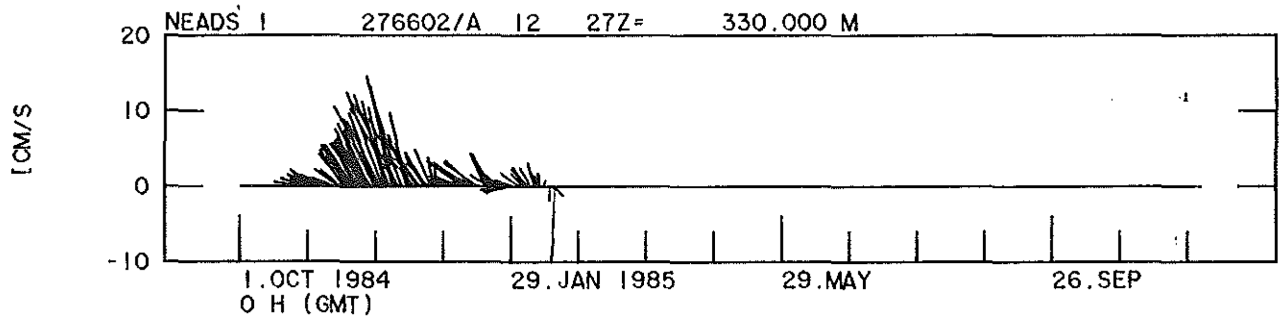
Mooring N1/276-6:

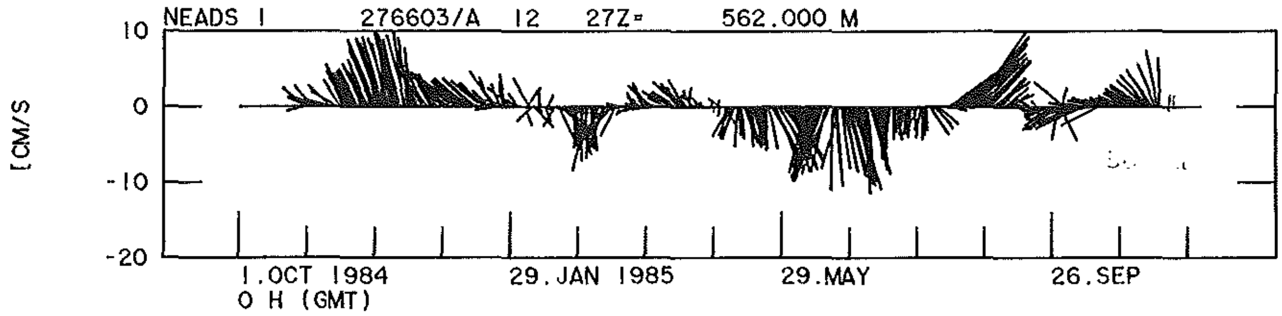
Progressive vector diagrams, time increments 1o days, start date indicated.

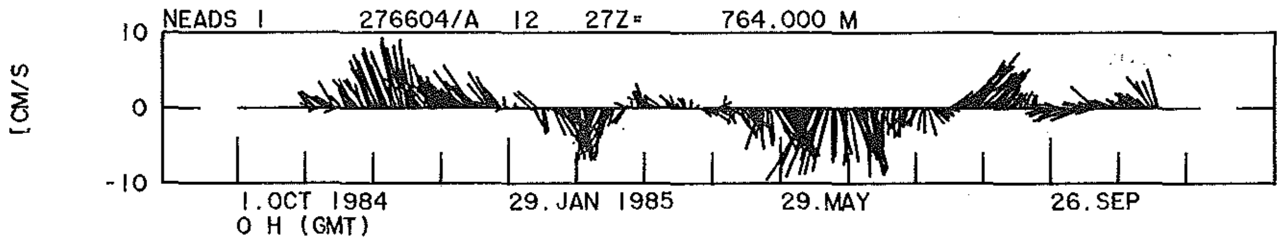
NEADS I 276609

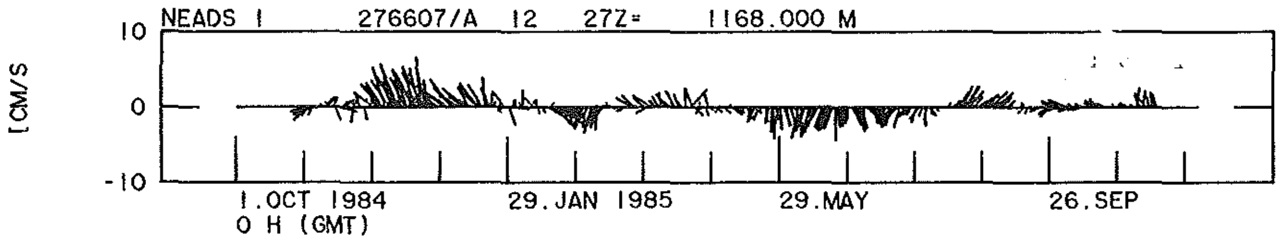


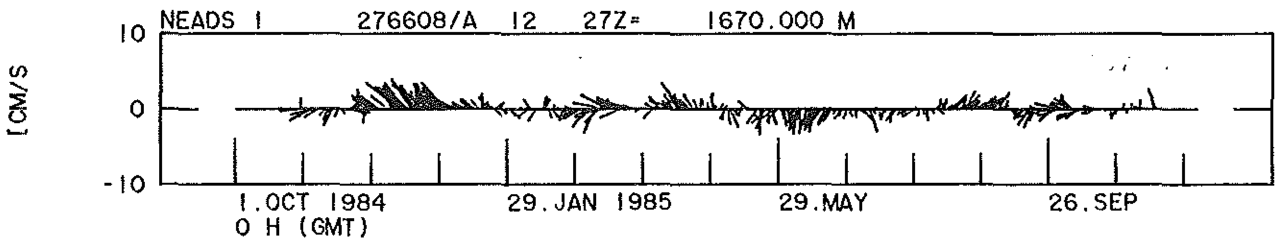
Mooring N1/276-6:Vector time series,up is north

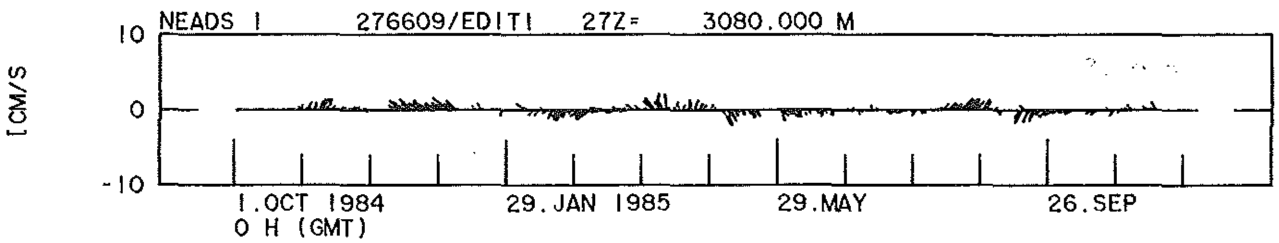




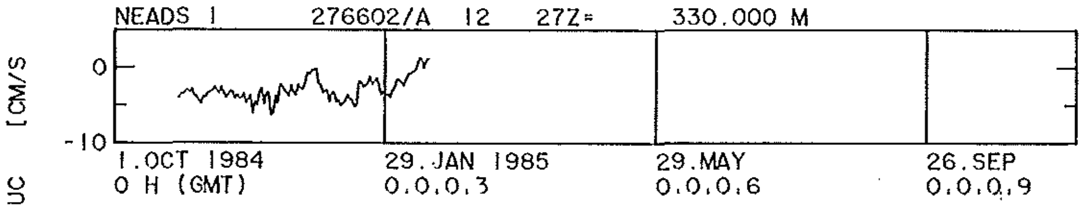


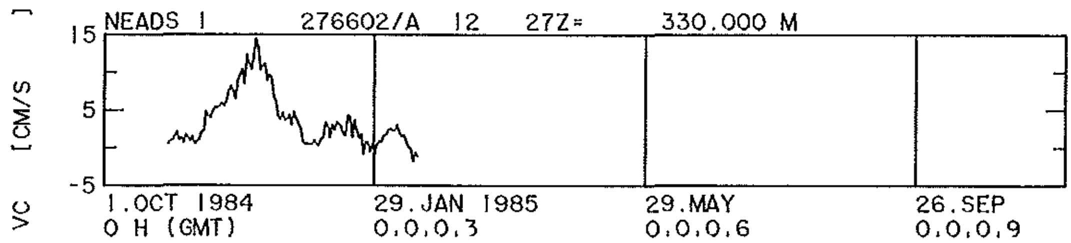


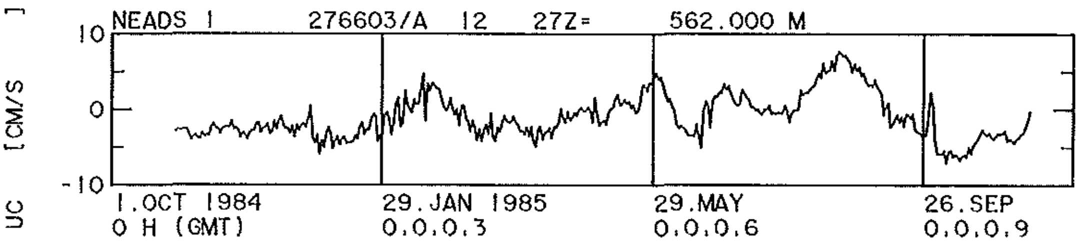


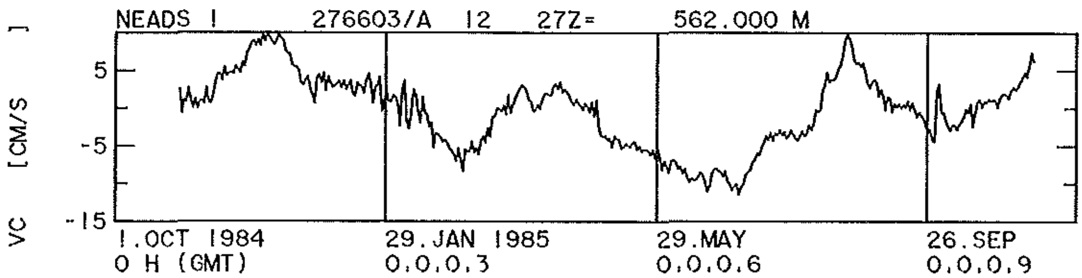


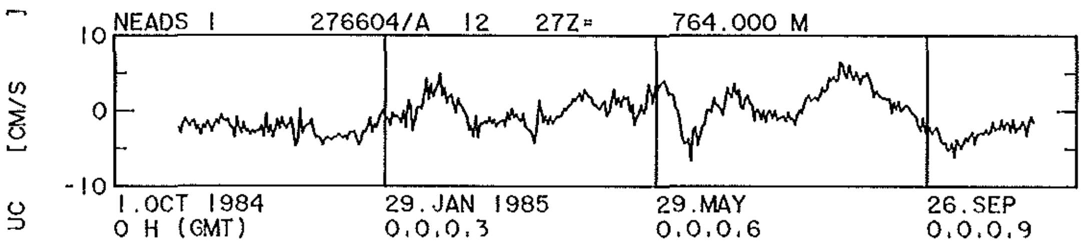
Mooring N1/276-6: Time series of east- (uc) and north (vc) current.

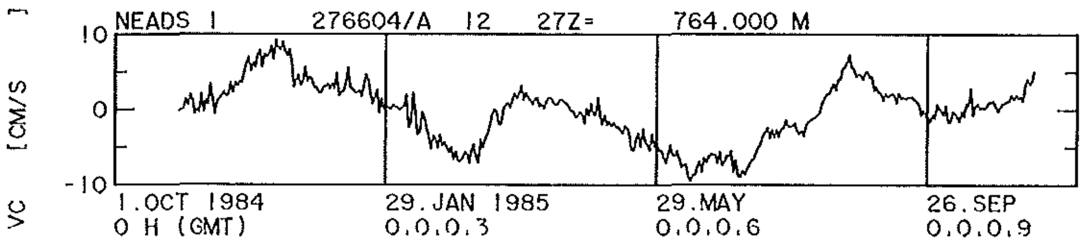




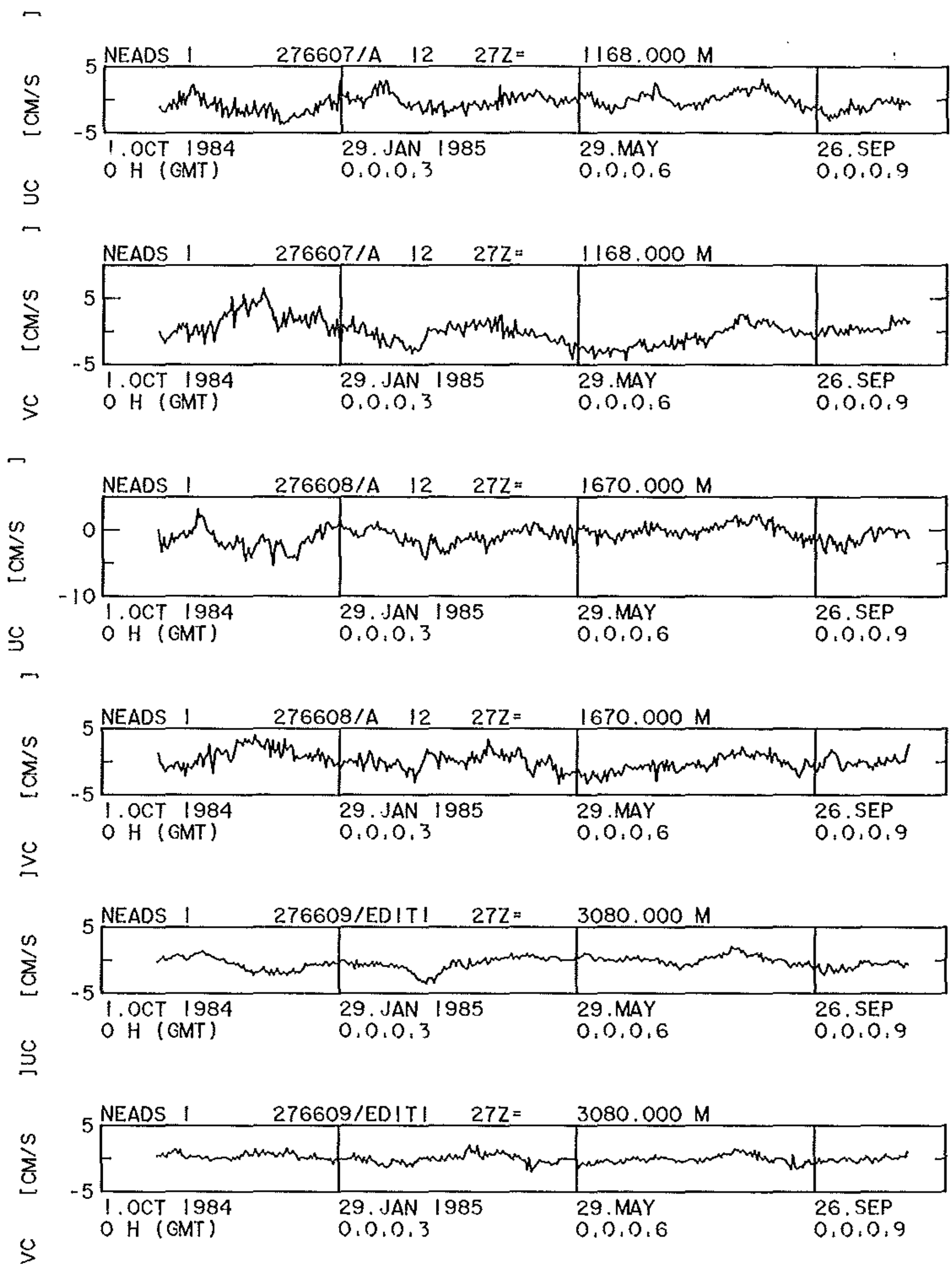




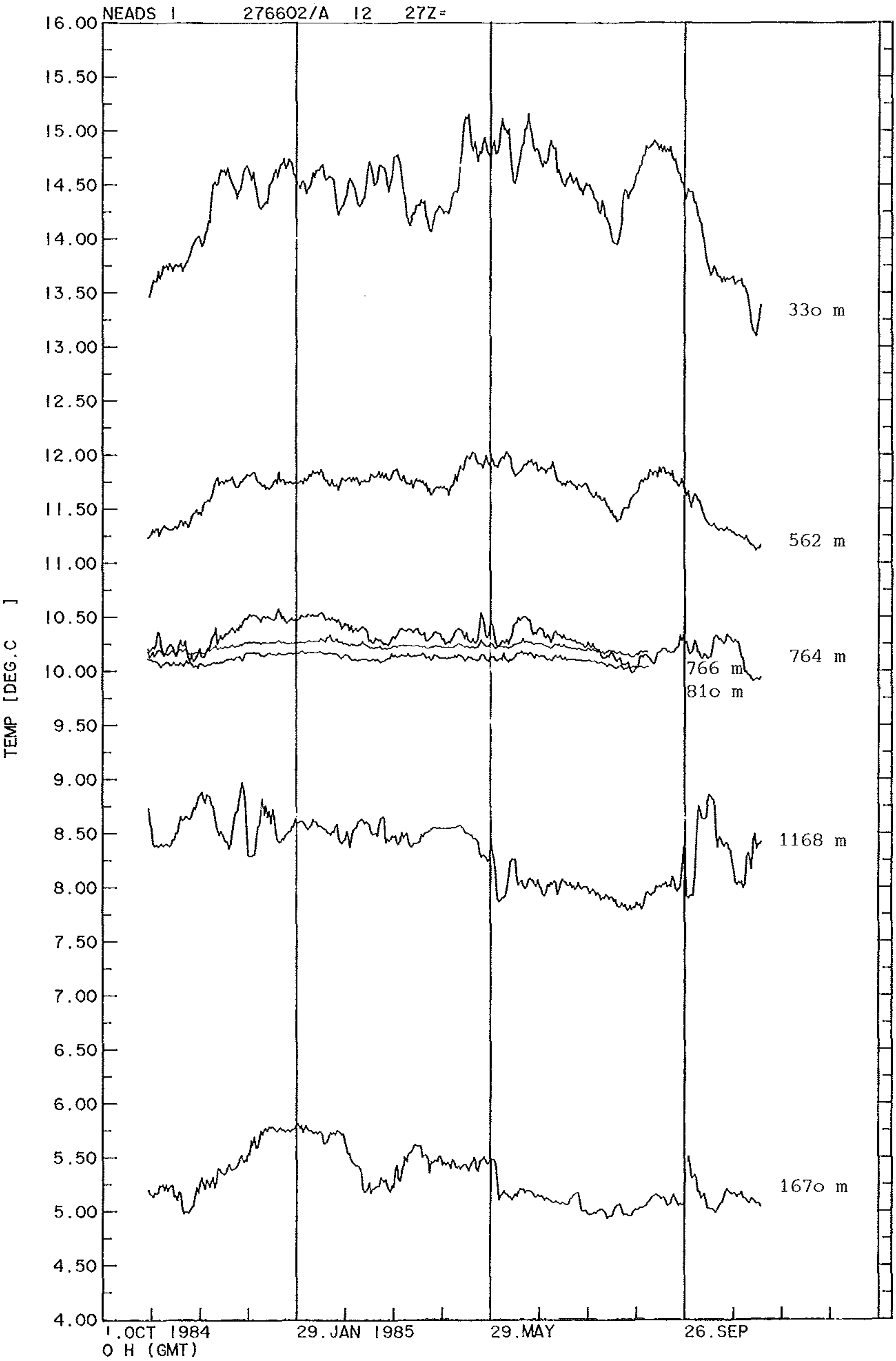




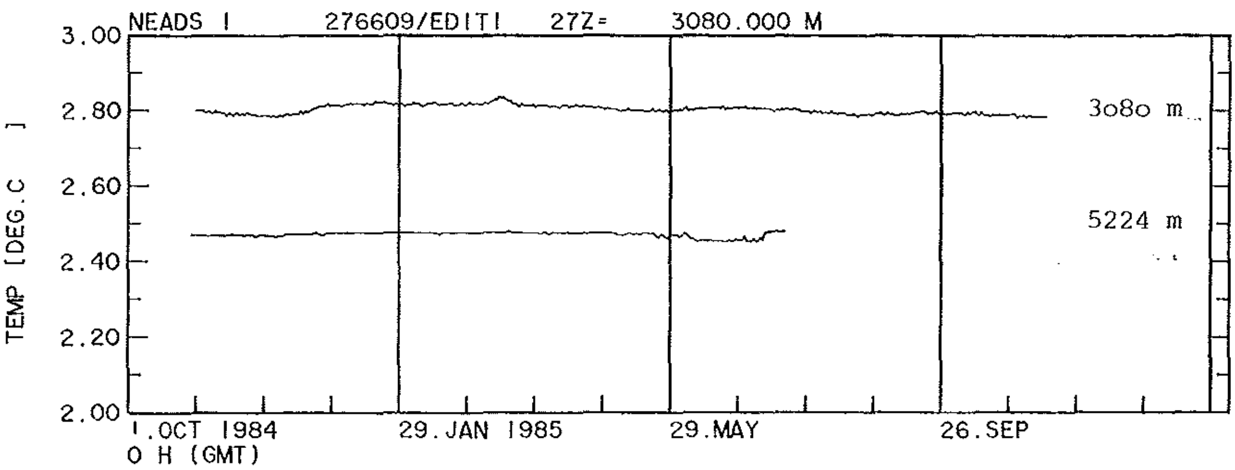
Mooring N1/276-6:Time seriès of east (uc) and north (vc) current.



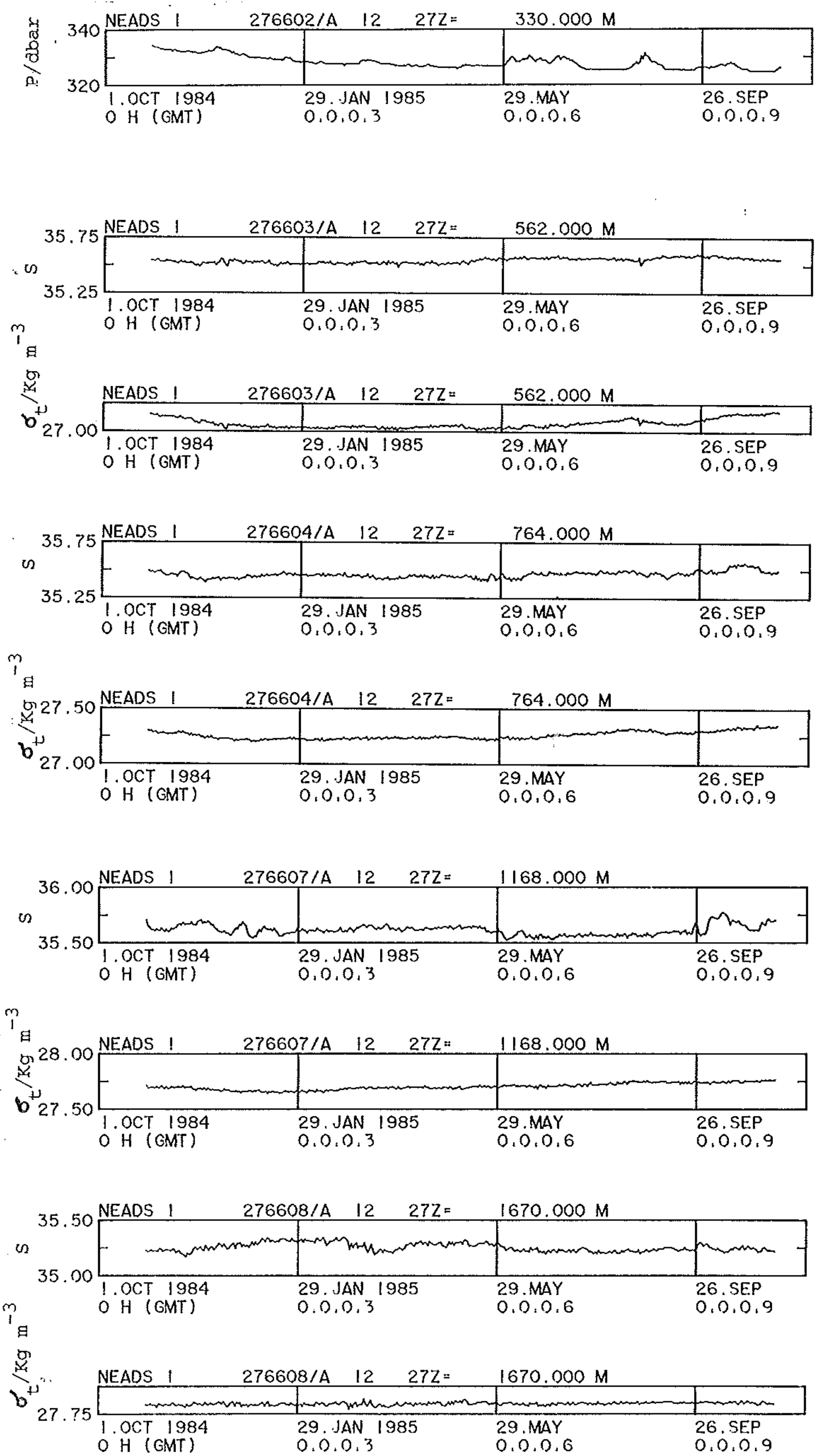
Mooring N1/276-6:Time series of temperature.



Mooring N1/276-6:Time series of temperature.



Mooring N1/276-6:Time series of pressure,salinity,density.



4.2 Thermistor cable mooring U/300-1

IfM mooring No: 300-1 External name: U

Latitude:	35°01.8'N	Longitude:	26°26.9'W
Sounding:	4160 m	Water depth:	4185 m
Deployed:	29-Oct-84	Recovered:	15-Nov-85
Start of record:	29-Oct-84, 14:00 Z	End of record:	15-Nov-85, 08:00 Z

Remarks:

Identi-fication	instrument type	No	depth (m)	sampling (min.)	Remarks
300101	A-VTP	6679	225	60	
300102	A-T400	226/ 1133	227-627	120	
300103	A-T400	441/ 1134			no data

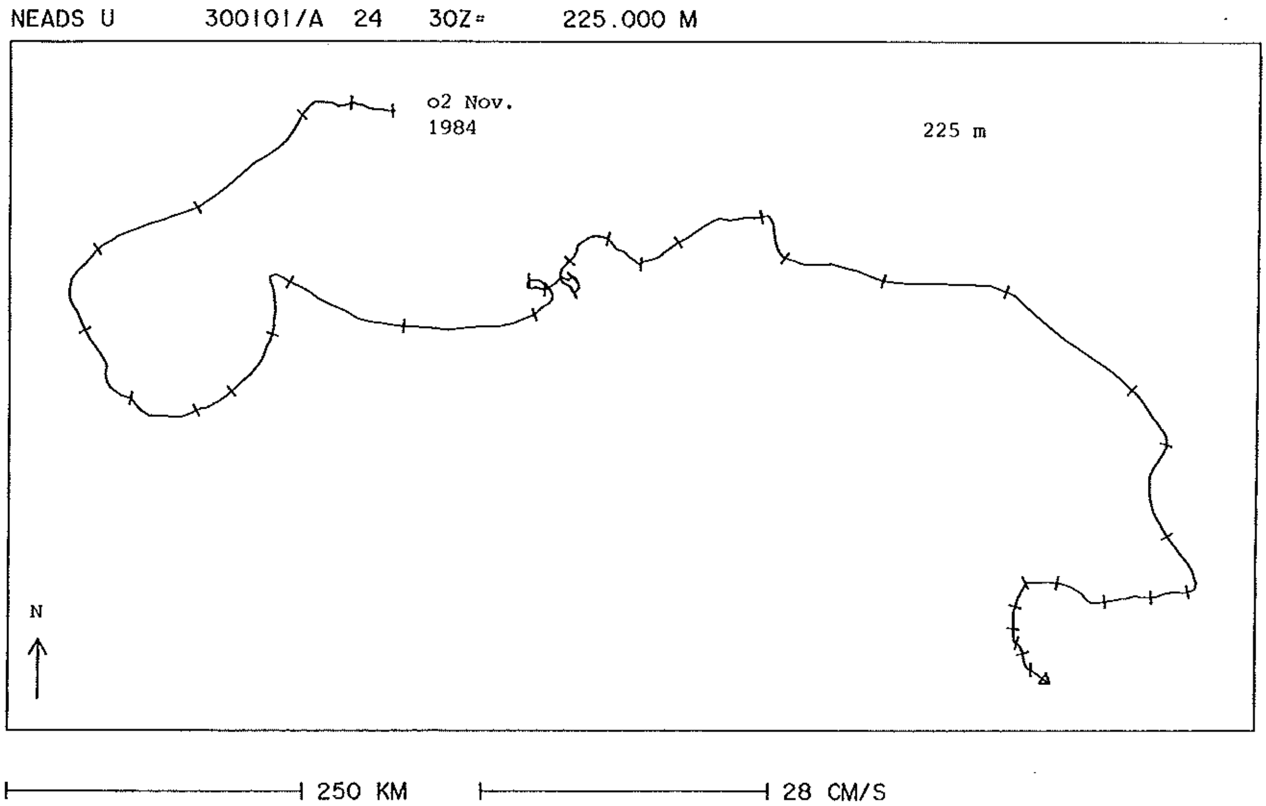
A-VT(PC) : Aanderaa current meter RCM4/5 with sensors for P and C (optional)

A-T50 : Aanderaa thermistor cable 50 m or 400 m

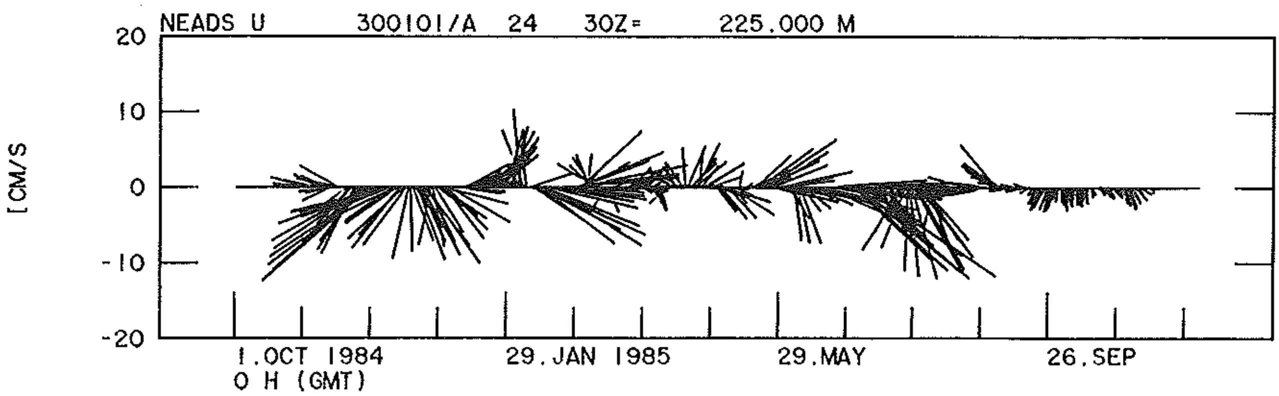
ACM-2 : Neil Brown acoustic vector averaging current meter

P, T, C, S : Pressure, temperature, conductivity, salinity

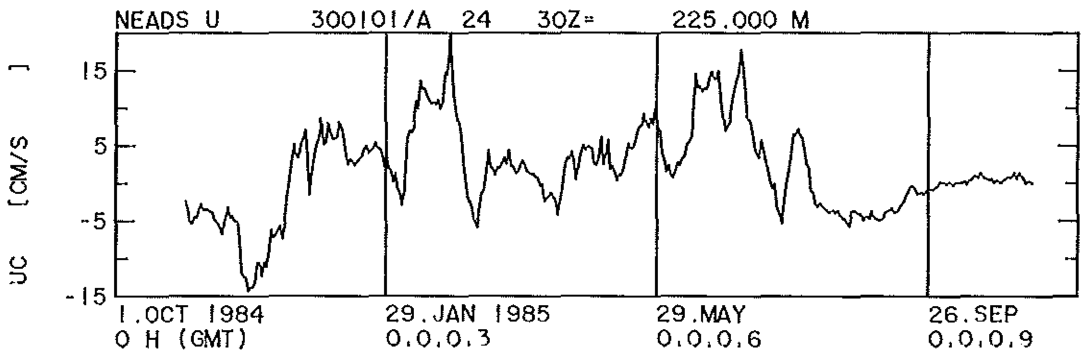
Mooring U/3oo-1:Progressive vector diagram,time increments 1o days, start day indicated.

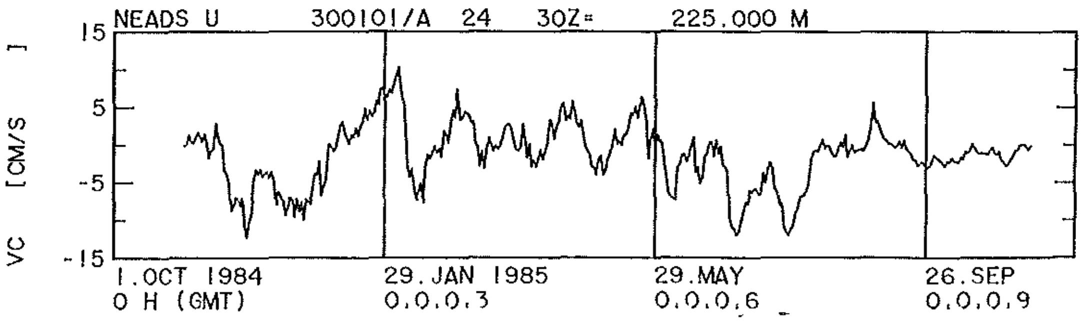


Mooring U/3oo-1:Vector time series,up is north.

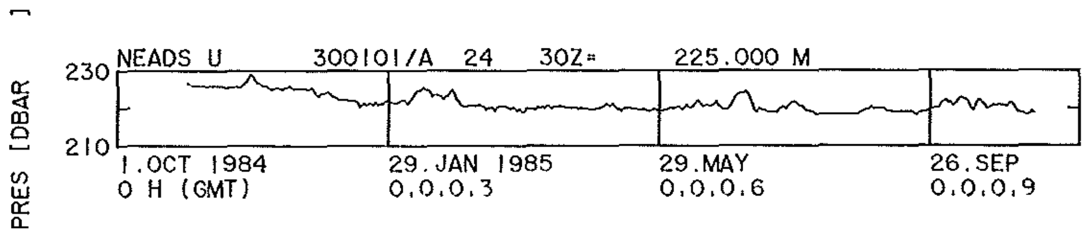


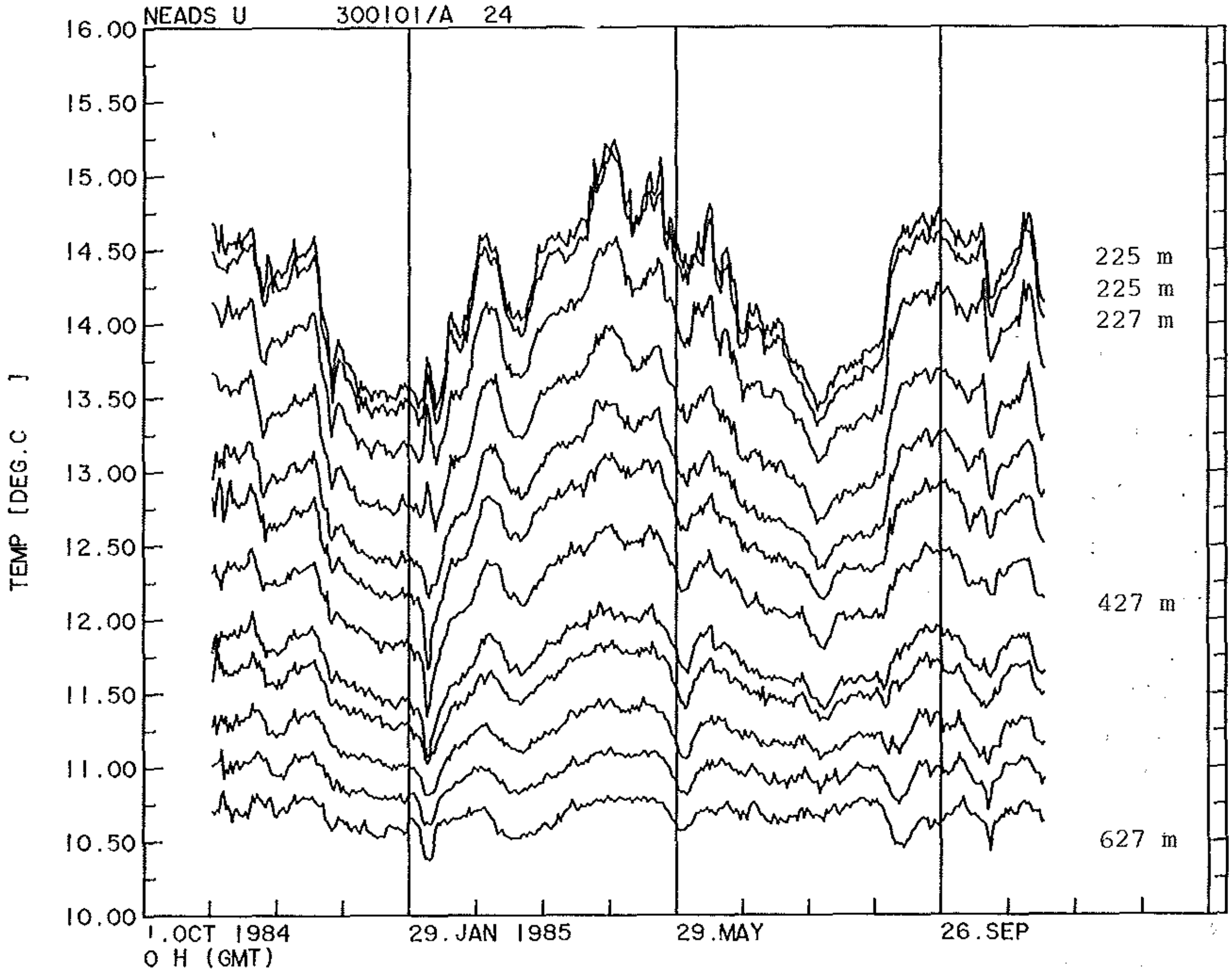
Mooring U/3oo-1:Time series of east (uc) and north (vc) current.





Mooring U/3oo-1:Time series of pressure and temperature





4.3 Thermistor cable mooring B/301-1

IfM mooring No: 301-1 External name: B

Latitude: 32°38.9'N Longitude: 26°30.5'W

Sounding: 4610 m Water depth: 4646 m

Deployed: 30-Oct-84 Recovered: 18-Nov-85

Start of record: 30-Oct-84, 13:00 Z End of record: 14-May-85

Remarks:

Identi-fication	instrument type	No	depth (m)	sampling (min.)	Remarks
301101	A-VTP	124	175	60	stop 29-Apr-85,
301102	A-T400	384/ 1135	177-577	120	stop 01-May-85
301103	A-T400	385/ 1136	580-980	120	stop 05-May-85

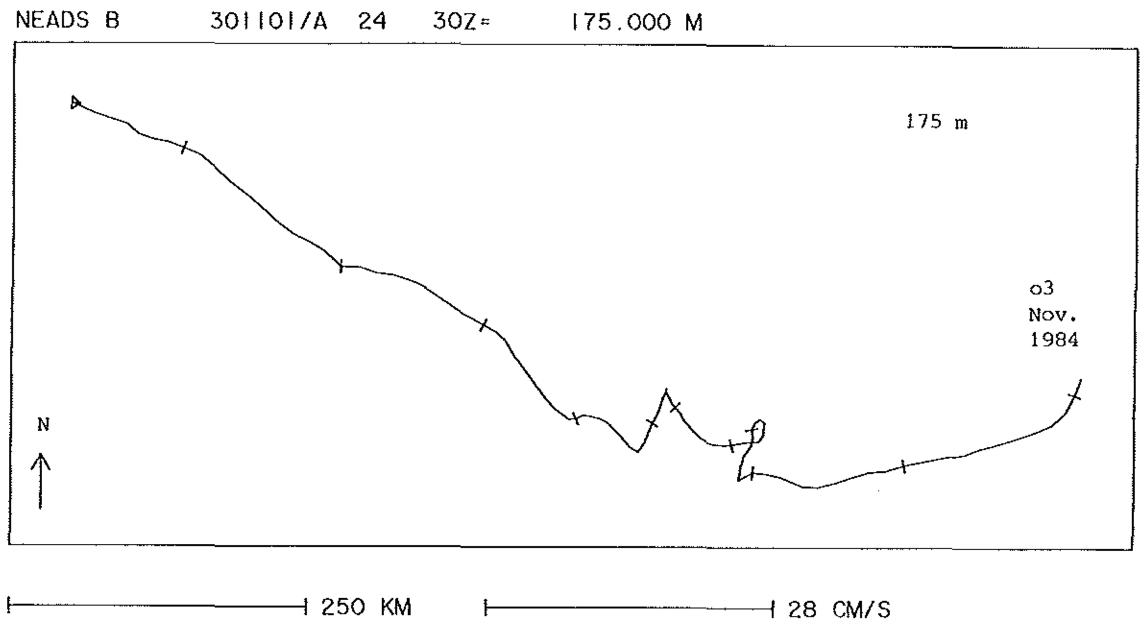
A-VT(PC) : Aanderaa current meter RCM4/5 with sensors for P and C (optional)

A-T50 : Aanderaa thermistor cable 50 m or 400 m

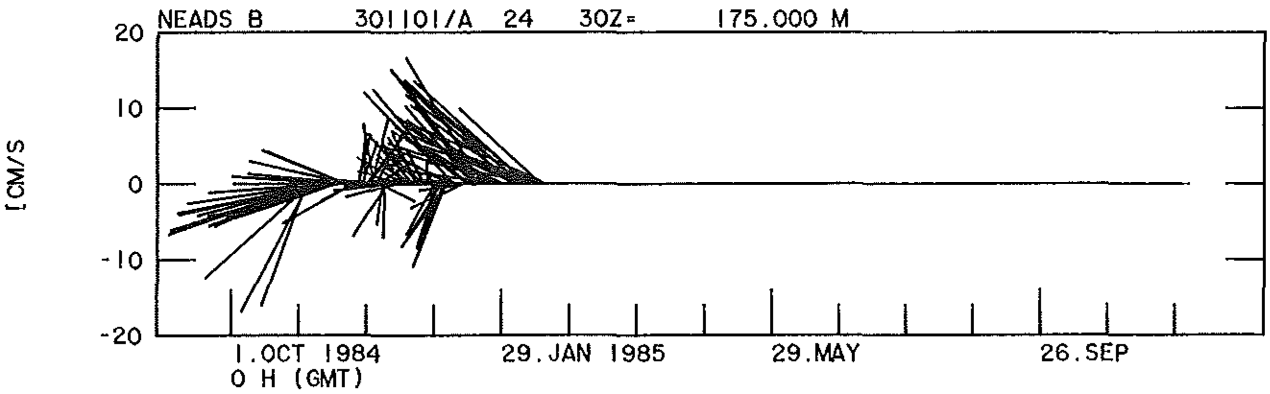
ACM-2 : Neil Brown acoustic vector averaging current meter

P, T, C, S : Pressure, temperature, conductivity, salinity

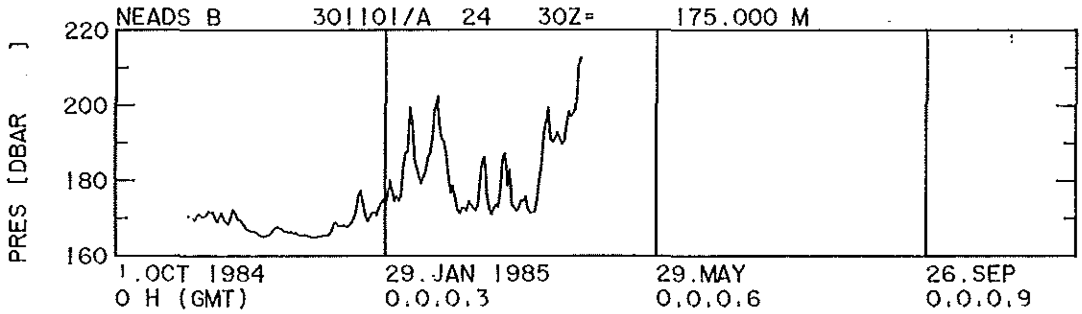
Mooring B/3o1-1:Progressive vector diagram,time increments 1o days, start date indicated.

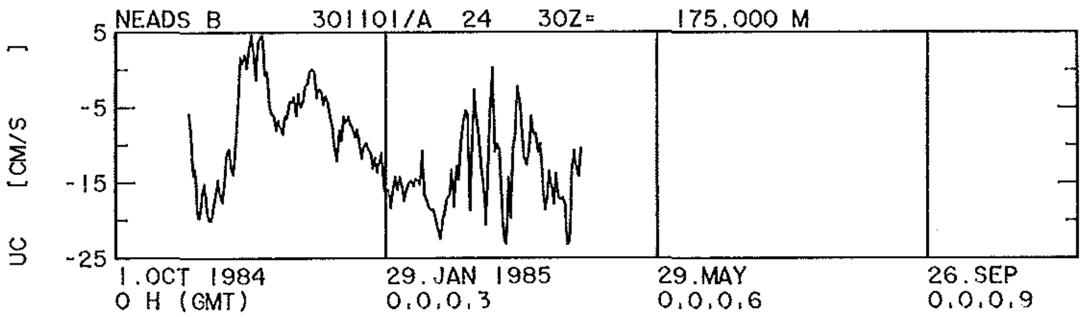


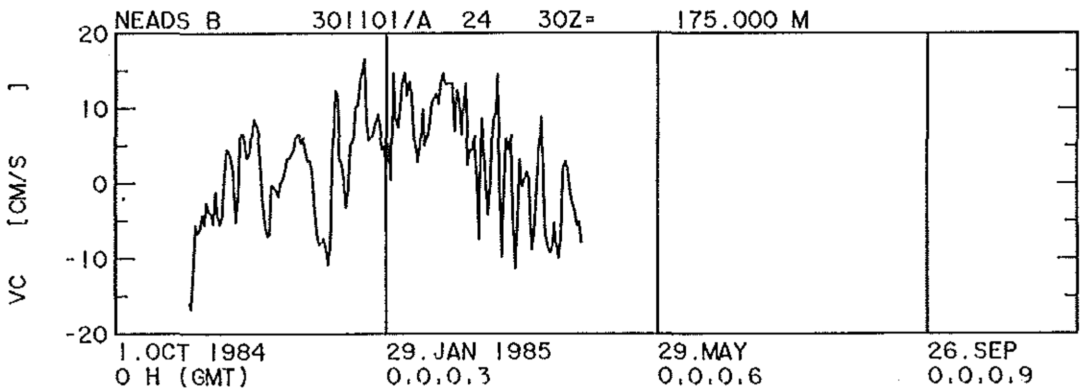
Mooring B/3o1-1:Vector time series,up is north.



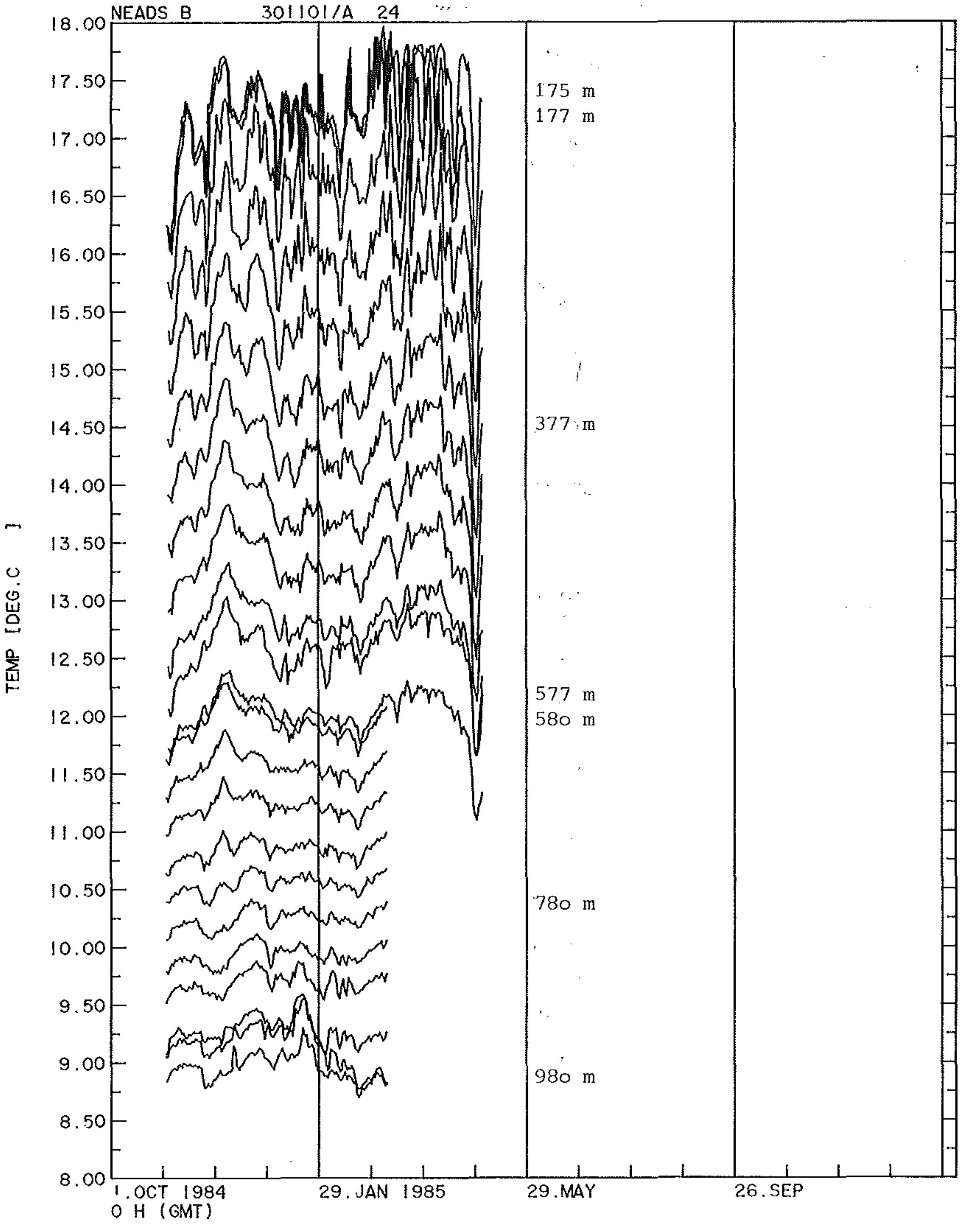
Mooring B/3o1-1:Time series of pressure and east- (uc) and north (vc) current.







Mooring B/3o1-1:Time series of temperature.



4.4 Thermistor cable mooring T/302-1

IfM mooring No: 302-1 External name: T

Latitude: 30°21.3'N Longitude: 26°29.2'W

Sounding: 4915 m Water depth: 4958 m

Deployed: 31-Oct-84 Recovered: 20-Nov-85

Start of record: 31-Oct-84, 22:45 Z End of record: 20-Nov-85, 06:45 Z

Remarks:

Identi-fication	instrument				Remarks
	type	No	depth (m)	sampling (min.)	
302101	A-VTP	125	123	60	no temperature data P stop 16-Aug-85 rotor stop 10-Feb-85
302102	A-T400	802/ 1137	165-565	120	
302103	A-T400	187/ 1131	580-980	120	

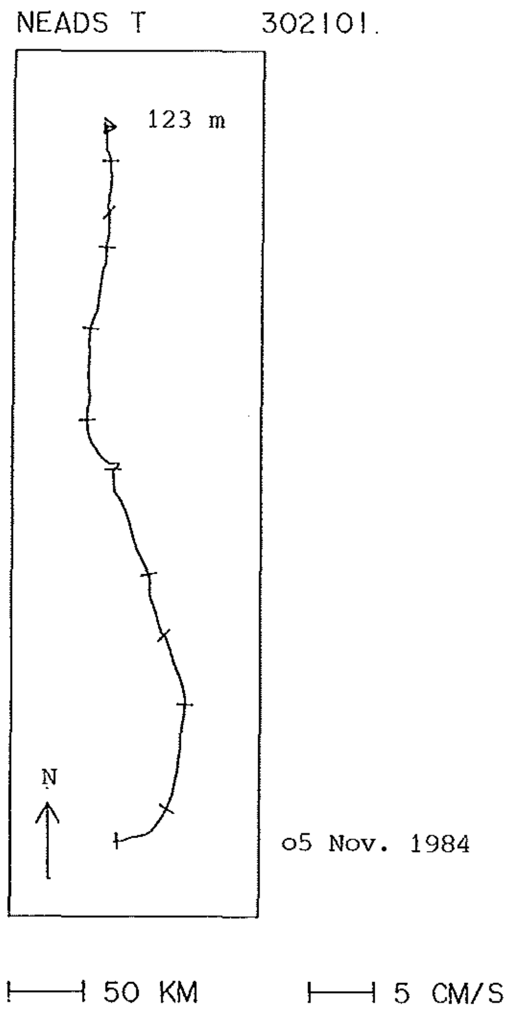
A-VT(PC) : Aanderaa current meter RCM4/5 with sensors for P and C (optional)

A-T50 : Aanderaa thermistor cable 50 m or 400 m

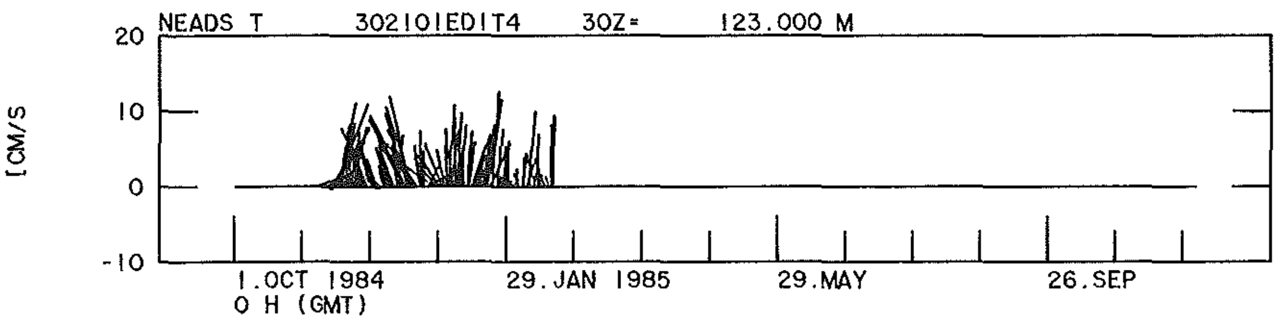
ACM-2 : Neil Brown acoustic vector averaging current meter

P, T, C, S : Pressure, temperature, conductivity, salinity

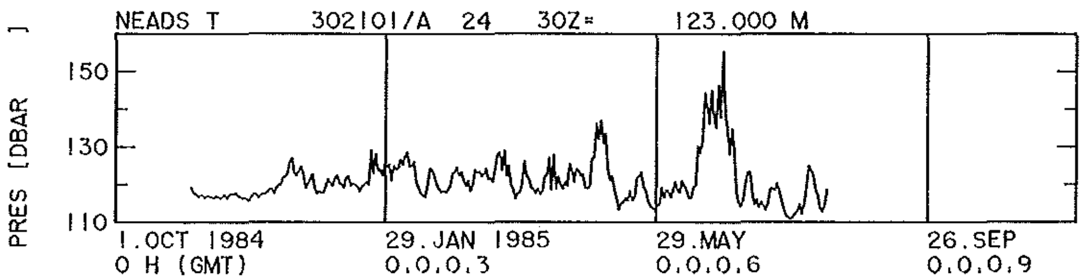
Mooring T/3o2-1: Progressive vector diagram, time increments 1o days, start date is indicated.

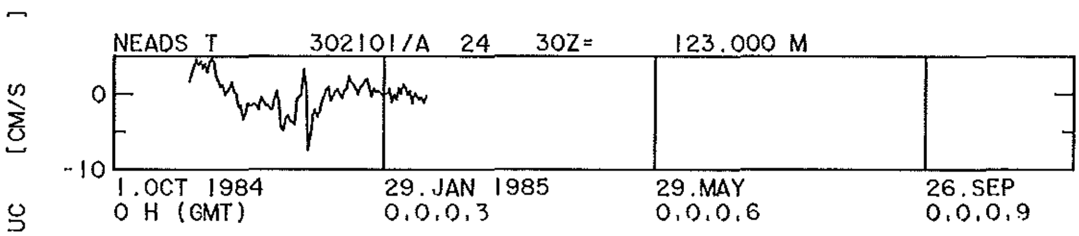


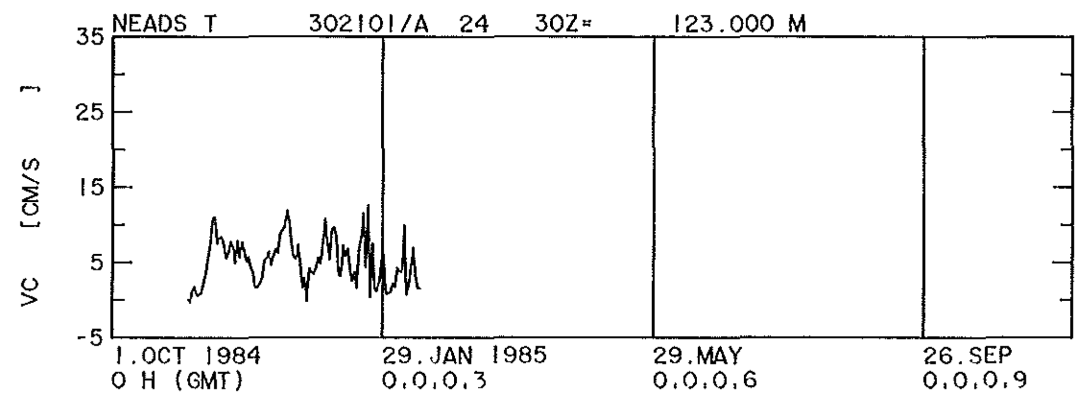
Mooring T/3o2-1: Vector time series, up is north.



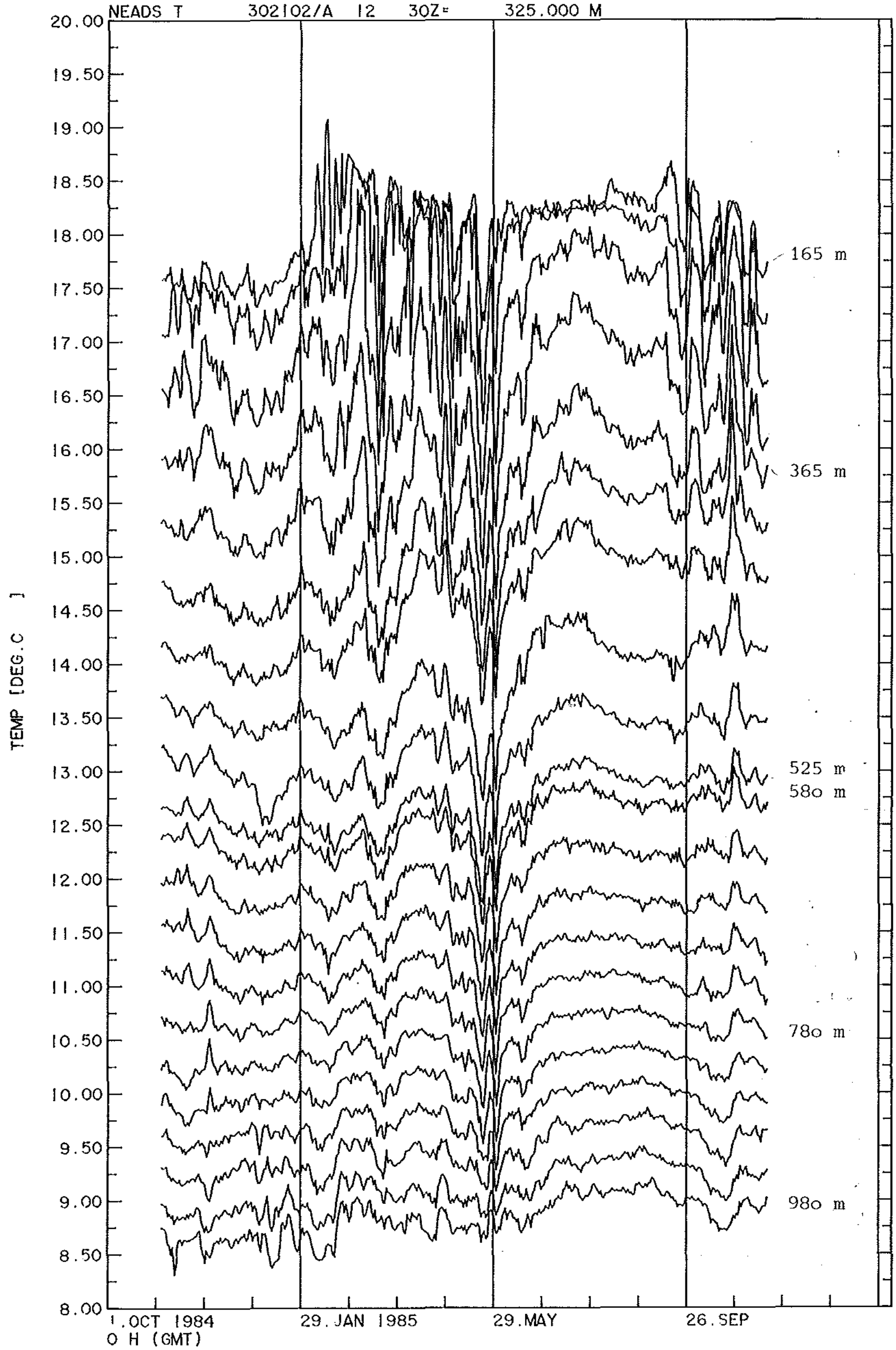
Mooring T/3o2-1:Time series of pressure and east (uc) and north (vc) current.







Mooring T/3o2-1:Time series of temperature.



4.5 Thermistor cable mooring R/297-2

IfM mooring No: 297-2 External name: R

Latitude: 28°00.4'N Longitude: 26°29.1'W

Sounding: 5180 m Water depth: 5232 m

Deployed: 02-Nov-84 Recovered: 01-Oct-85

Start of record: 02-Nov-84, 15:00 Z End of record: 01-Oct-85, 9:00 Z

Remarks:

Identi-fication	instrument				Remarks
	type	No	depth (m)	sampling (min.)	
297201	A-VT	6051	170	60	rotor stop Jul-85
297202	A-TP400	18/984	170-570	120	channels 3-5,7,8,10-12: stop Apr-85
297203	A-T400	801/896	565-865	120	channels 2 and 12 no data

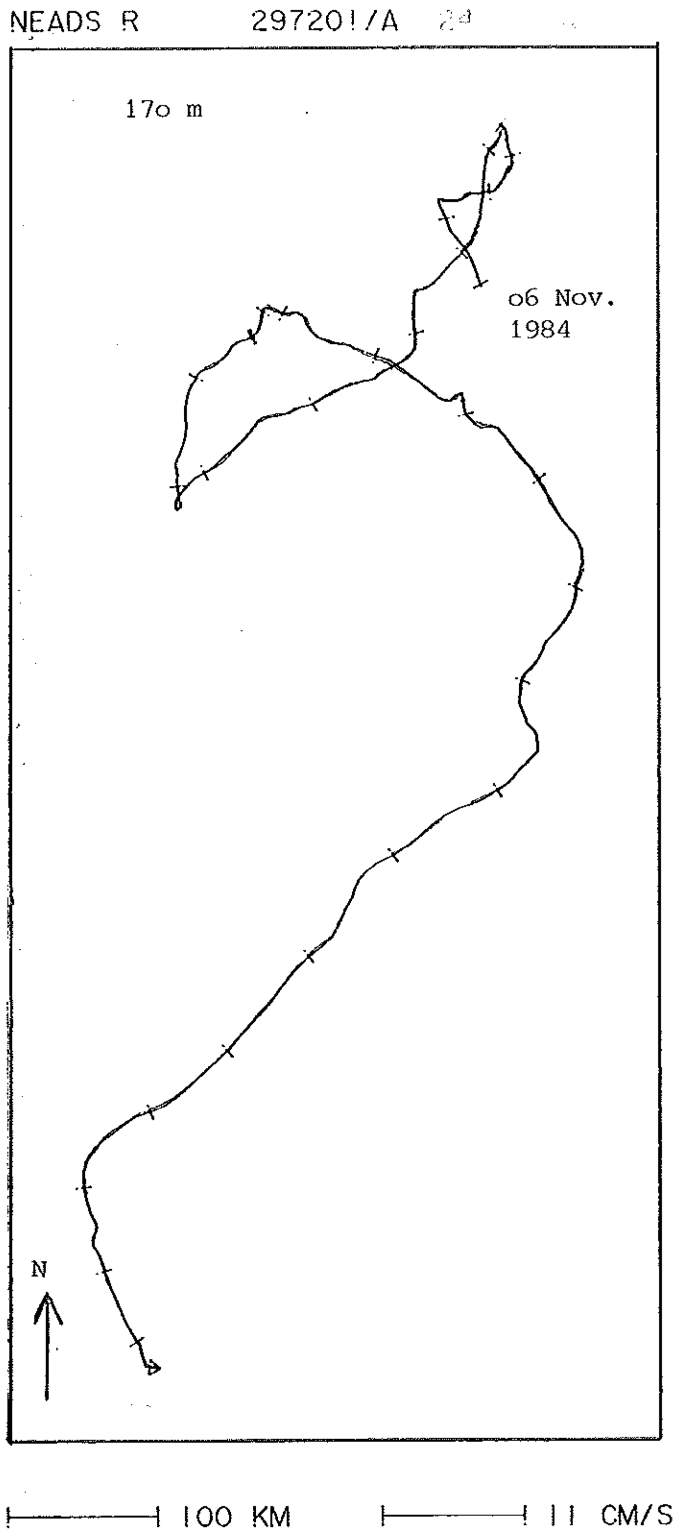
A-VT(PC) : Aanderaa current meter RCM4/5 with sensors for P and C (optional)

A-T50 : Aanderaa thermistor cable 50 m or 400 m

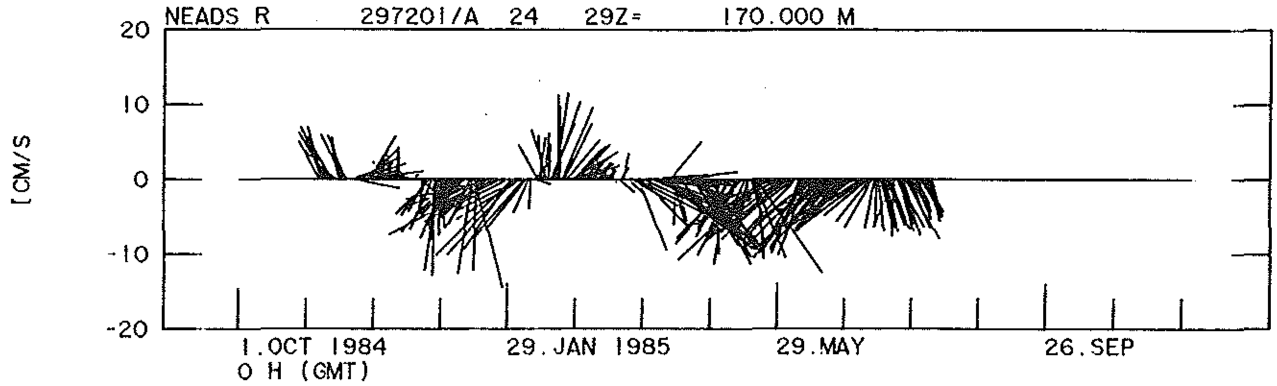
ACM-2 : Neil Brown acoustic vector averaging current meter

P, T, C, S : Pressure, temperature, conductivity, salinity

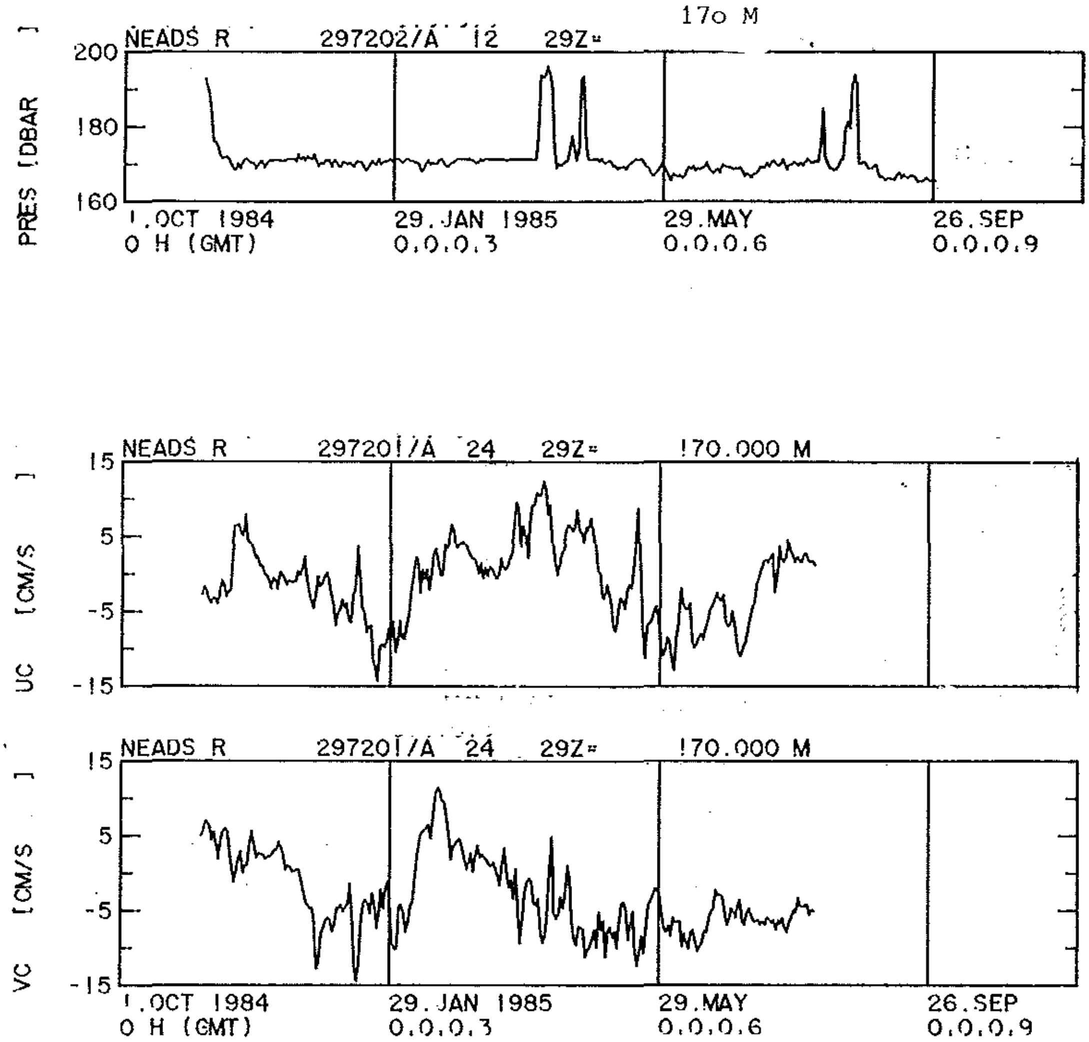
Mooring R/297-2:Progressive vector diagram,time increments 1o days,start date indicated.

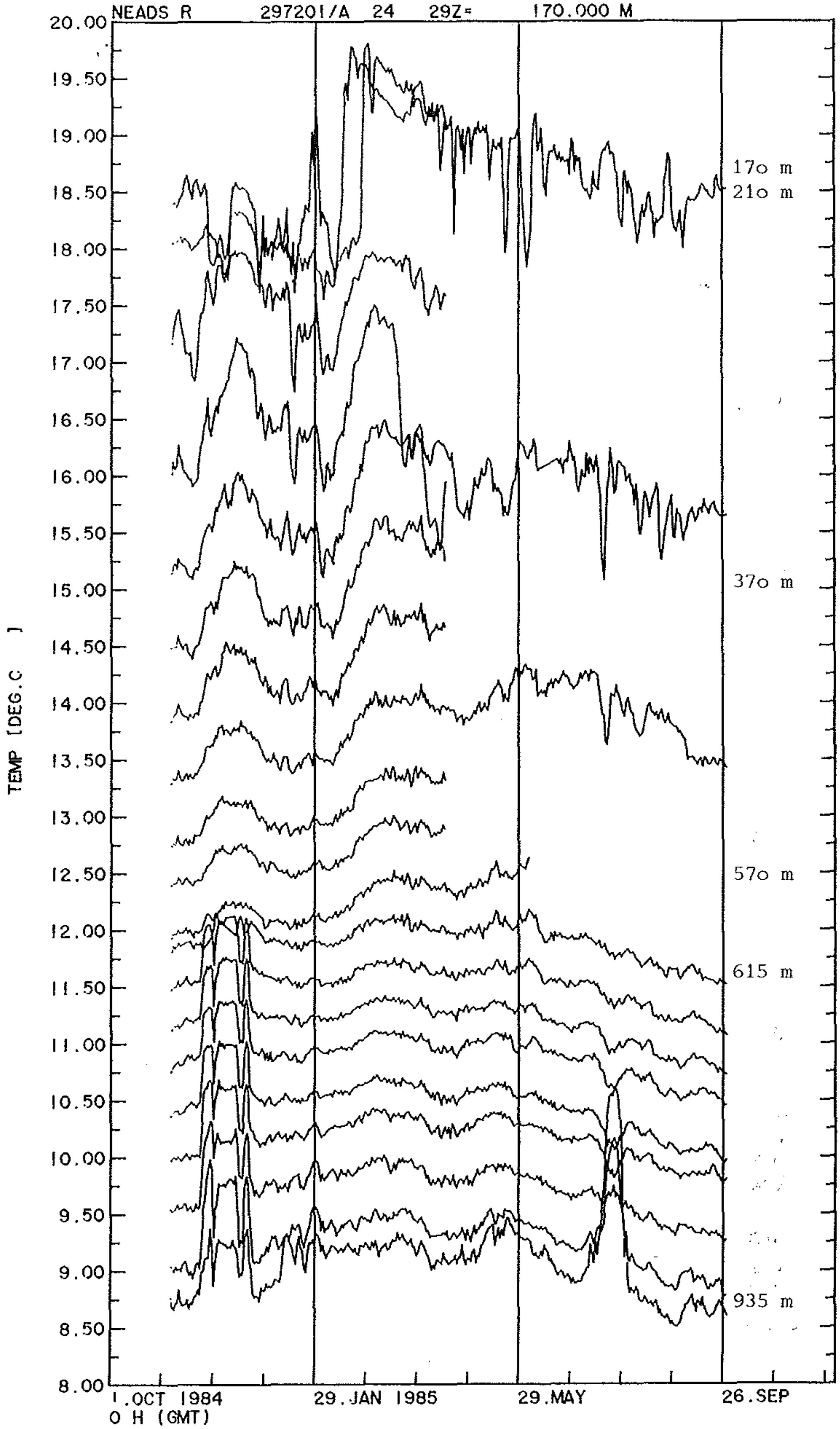


Mooring R/297-2:Vector time series of current,up is north.



Mooring R/297-2:Time series of pressure and east- (uc) and north (vc) current.





Mooring R/297-2:Time series of temperature.

4.6 Thermistor cable mooring 0/296-2

IfM mooring No: 296-2 External name: 0

Latitude: 28°00.3'N Longitude: 24°30.0'W

Sounding: 5155 m Water depth: 5205 m

Deployed: 03-Nov-84 Recovered: 02-Oct-85

Start of record: 03-Nov-84, 20:40 Z End of record: 02-Oct-85, 08:40 Z

Remarks:

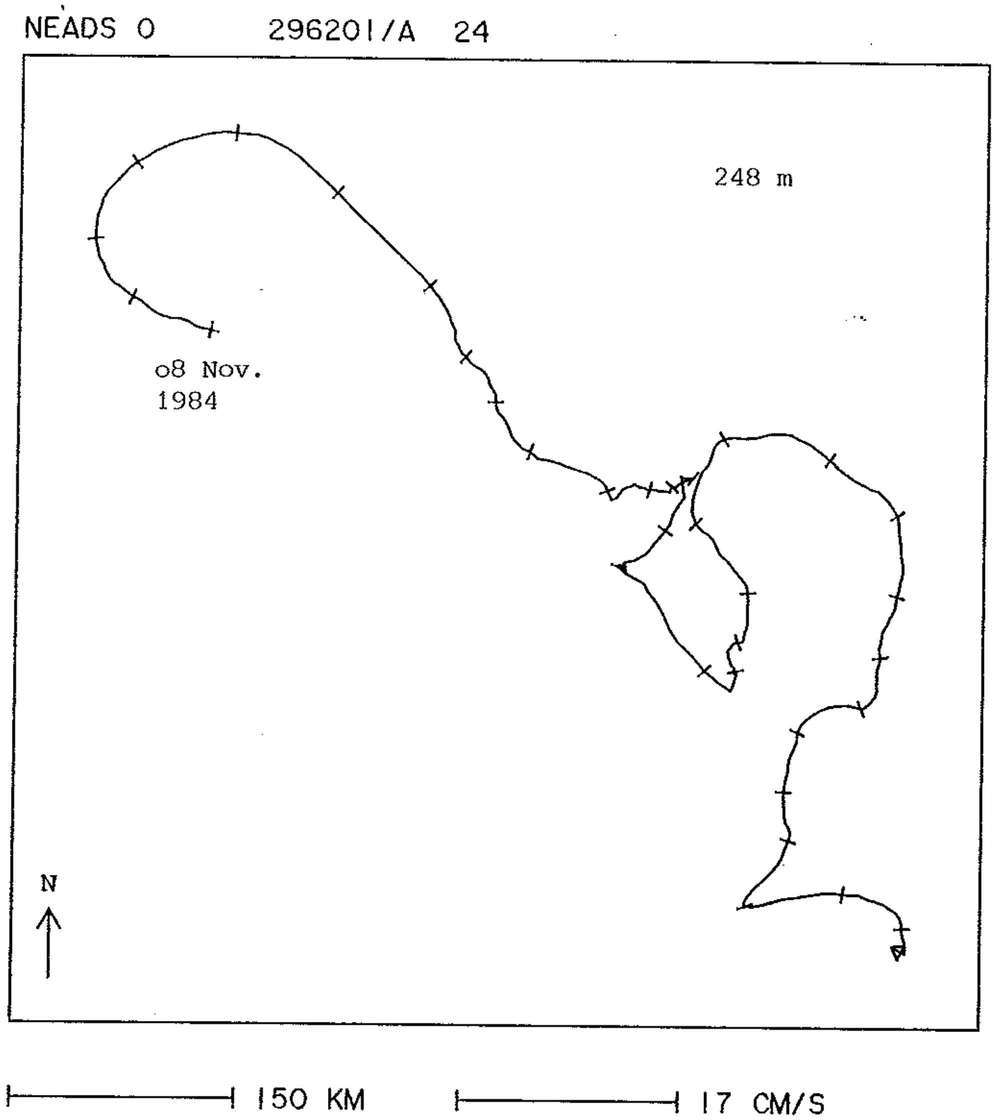
Identi-fication	instrument type	No	depth (m)	sampling (min.)	Remarks
296200	A-TP	778	175	0.50	monitor launching phase
296201	A-VT	4352	248	60	
296202	A-TP400	711/894	250-650	120	
296203	A-T400	712/ 1226	655- 1055	120	stop 17-May-85

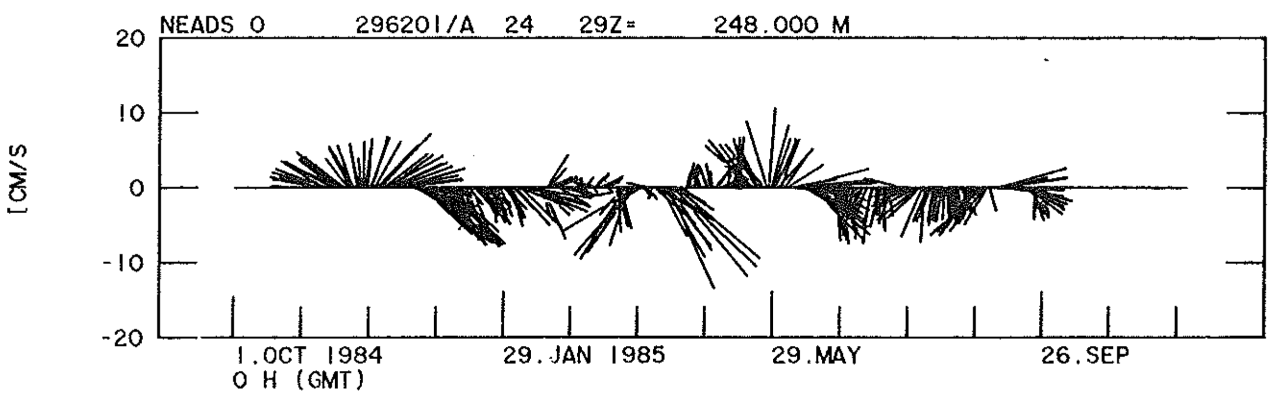
A-VT(PC) : Aanderaa current meter RCM4/5 with sensors for P and C (optional)

A-T50 : Aanderaa thermistor cable 50 m or 400 m

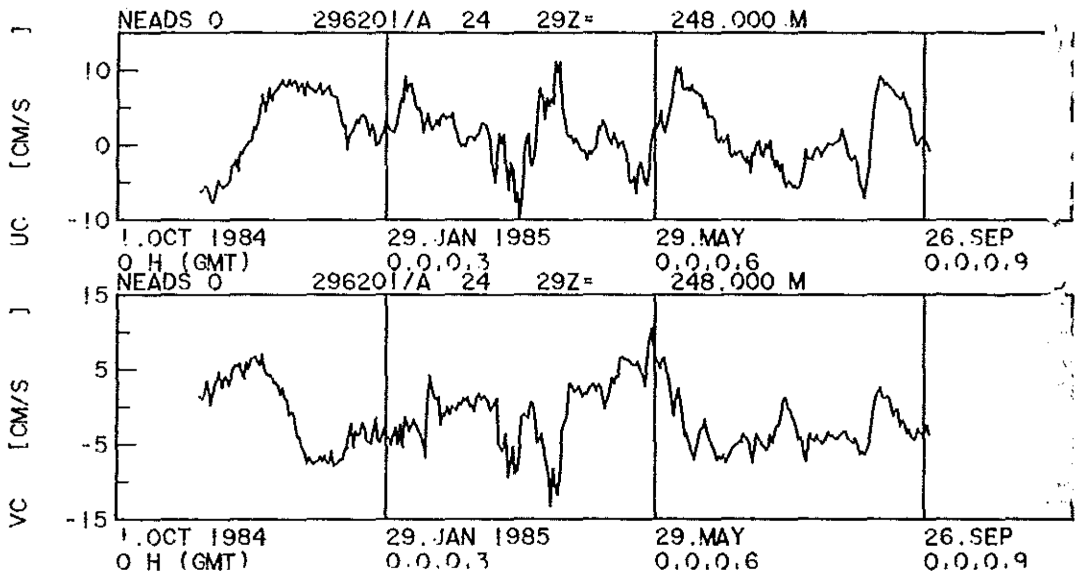
ACM-2 : Neil Brown acoustic vector averaging current meter

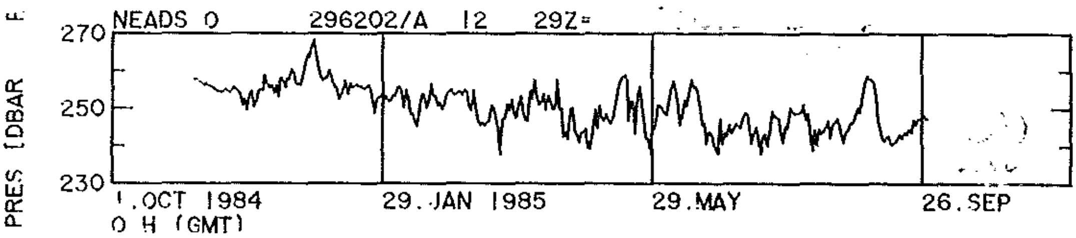
P, T, C, S : Pressure, temperature, conductivity, salinity



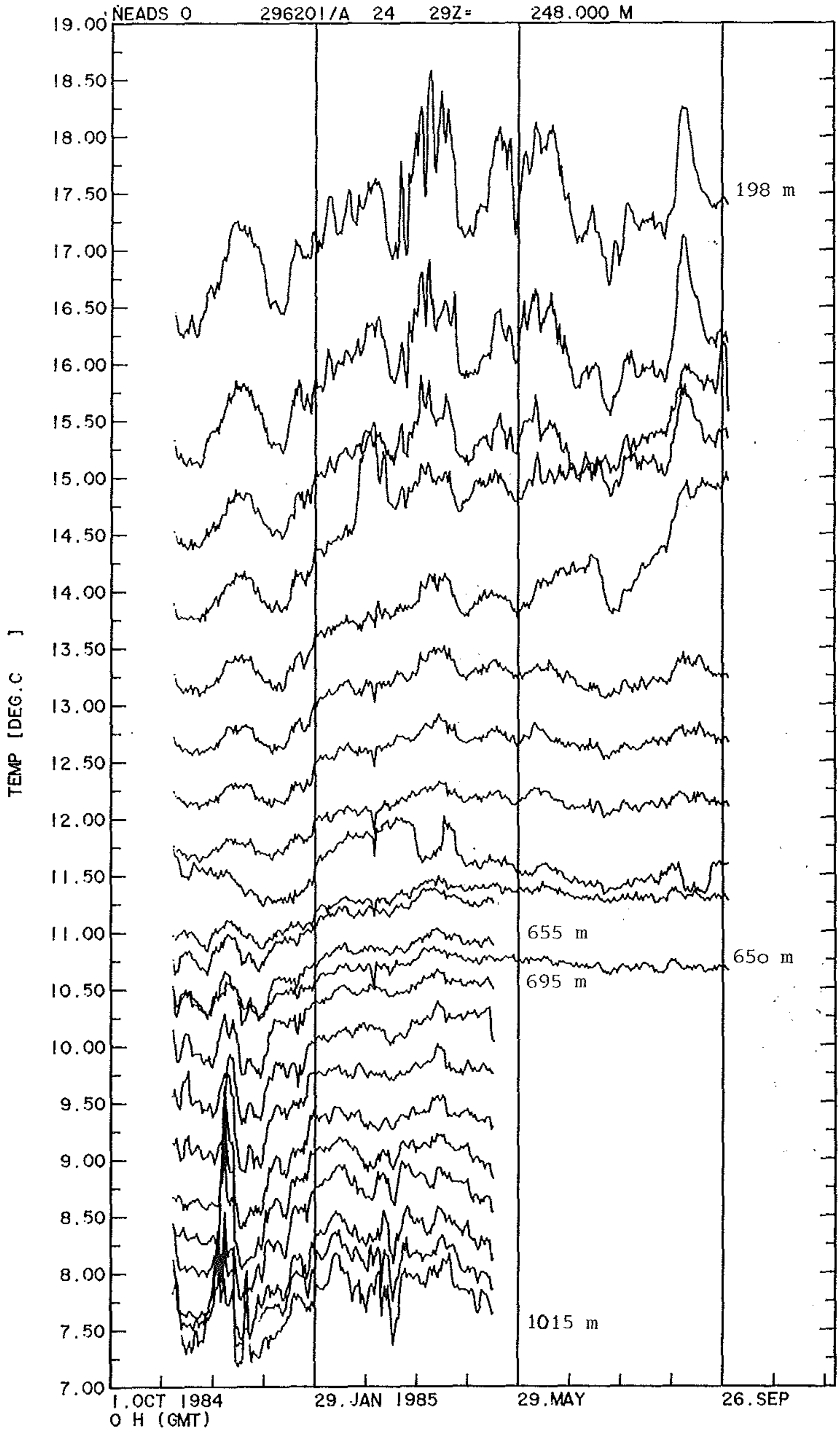


Mooring O/296-2: Progressive vector diagram of current in 248 m (upper figure) and vector time series with north upwards (lower figure).





Mooring 0/296-2:Time series of east (upper figure) north component (middle) and pressure in 248 m



Mooring O/296-2:Time series of temperature.

4.7 Thermistor cable mooring P/295-2

IfM mooring No: 295-2 External name: P

Latitude: 27°59.3'N Longitude: 22°23.4'W

Sounding: 4845 m Water depth: 4887 m

Deployed: 04-Nov-84 Recovered: 03-Oct-85

Start of record: 04-Nov-84, 21:35 Z End of record: 03-Oct-85, 07:35 Z

Remarks:

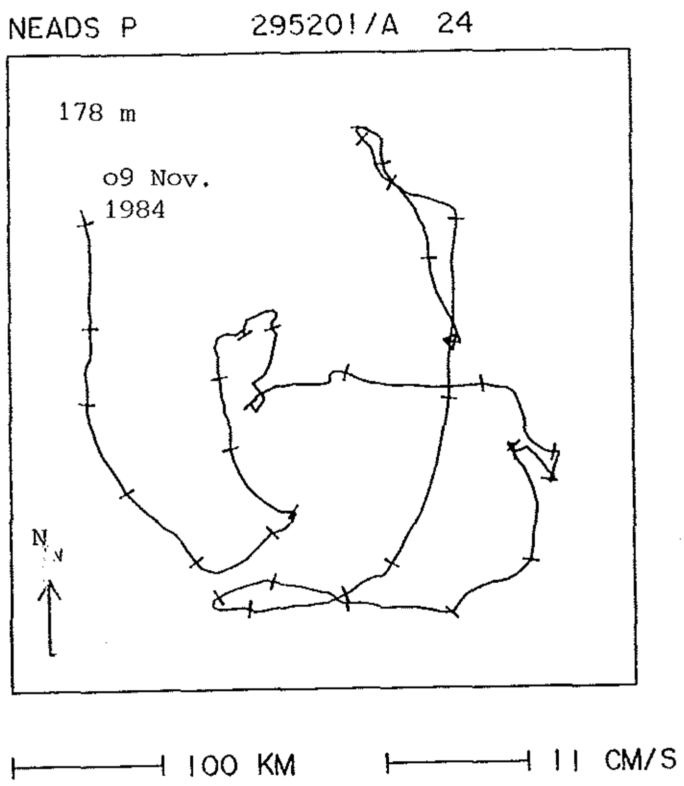
Identi-fication	instrument type	No	depth (m)	sampling (min.)	Remarks
295201	A-VTP	94	178	60	
295202	A-TP400	19/ 1069	180- 580	120	
295203	A-T400	1065/ 454	585- 985	120	channels 2,3,7-12 stop May-85 channel 5 no data

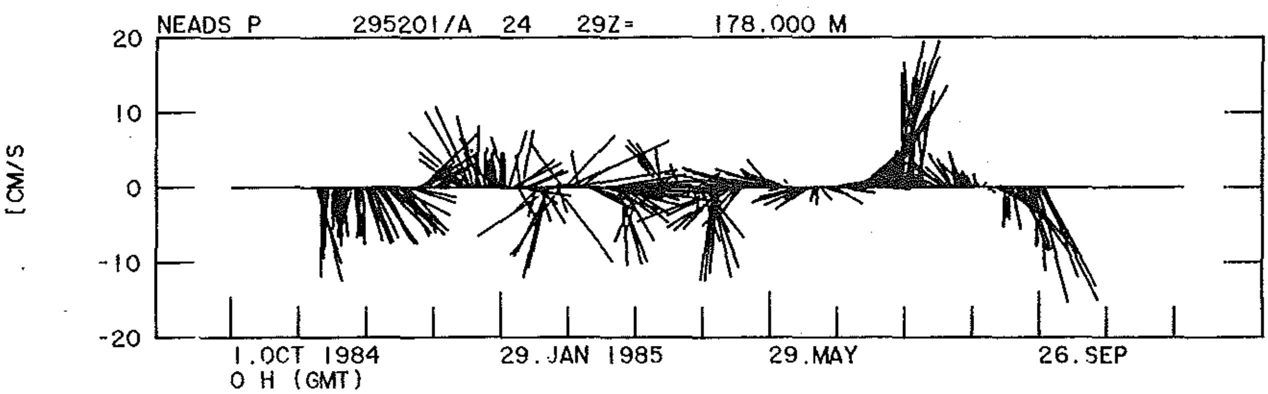
A-VT(PC) : Aanderaa current meter RCM4/5 with sensors for P and C (optional)

A-T50 : Aanderaa thermistor cable 50 m or 400 m

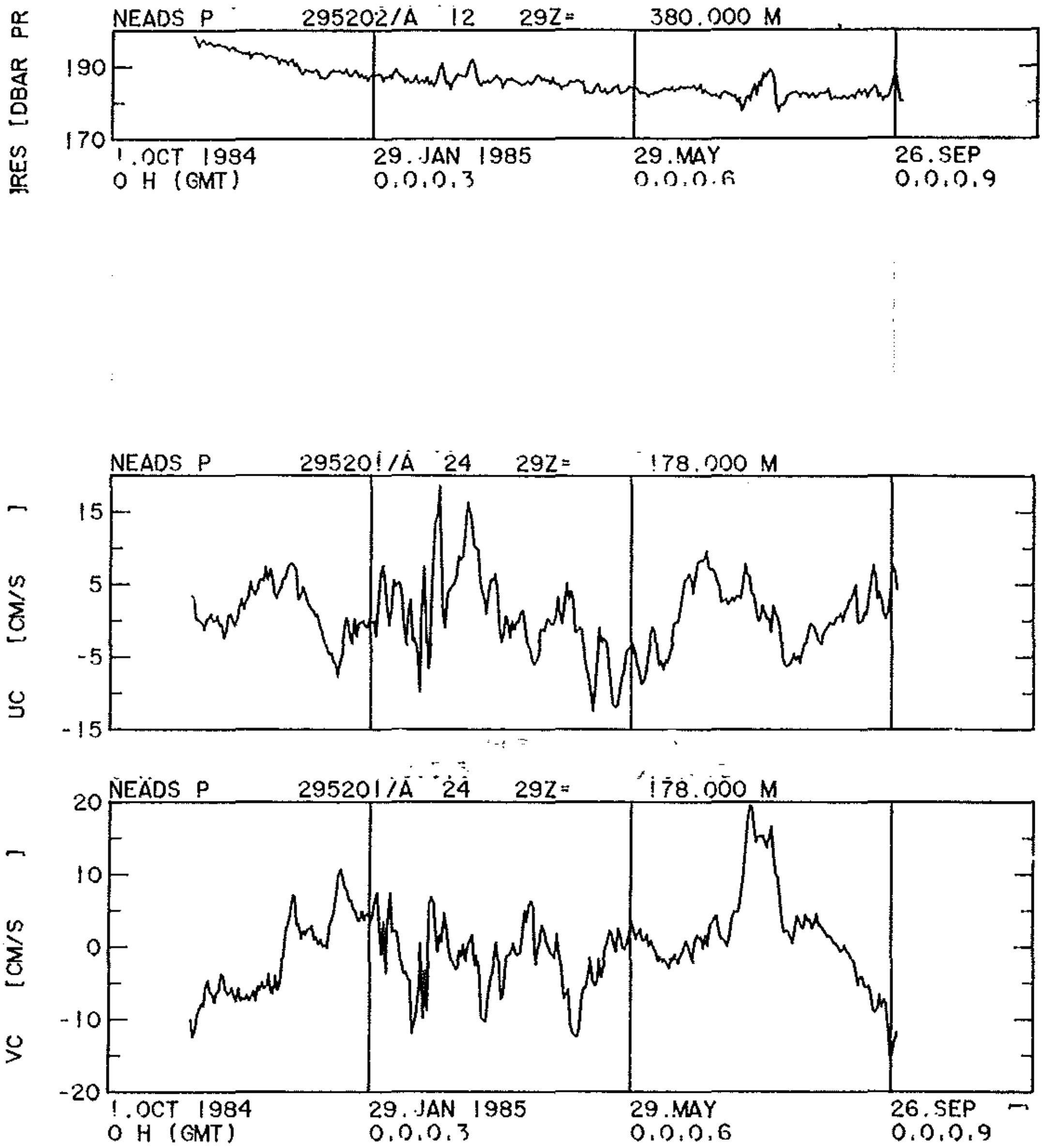
ACM-2 : Neil Brown acoustic vector averaging current meter

P, T, C, S : Pressure, temperature, conductivity, salinity

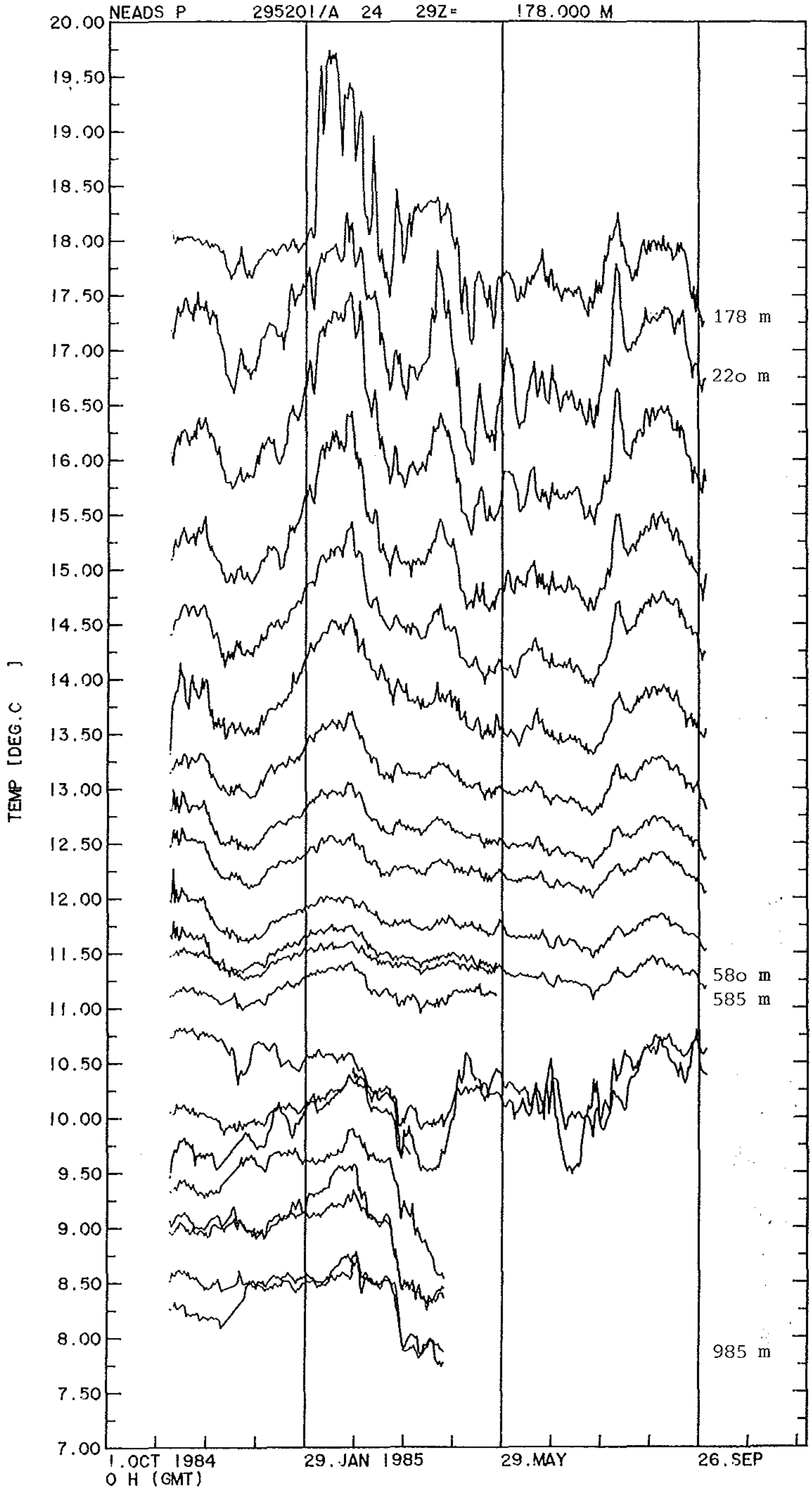




Mooring P/295-2: Progressive vector diagram, time increments 1o days and start time indicated (upper figure) and vector time series with north upwards. in 178 m.



Mooring P/295-2:Time series of pressure (upper figure), east component uc,and north component of current vc in 178 m.



Mooring P/295-2:Time series of temperature.

4.8 Thermistor cable mooring E/294-2

IfM mooring No: 294-2 External name: E

Latitude: 28°00.8'N Longitude: 20°25.5'W

Sounding: 4570 m Water depth: 4605 m

Deployed: 05-Nov-84 Recovered: 04-Oct-85

Start of record: 05-Nov-84, 23:00 Z End of record: 06-Oct-85, 04:00 Z

Remarks:

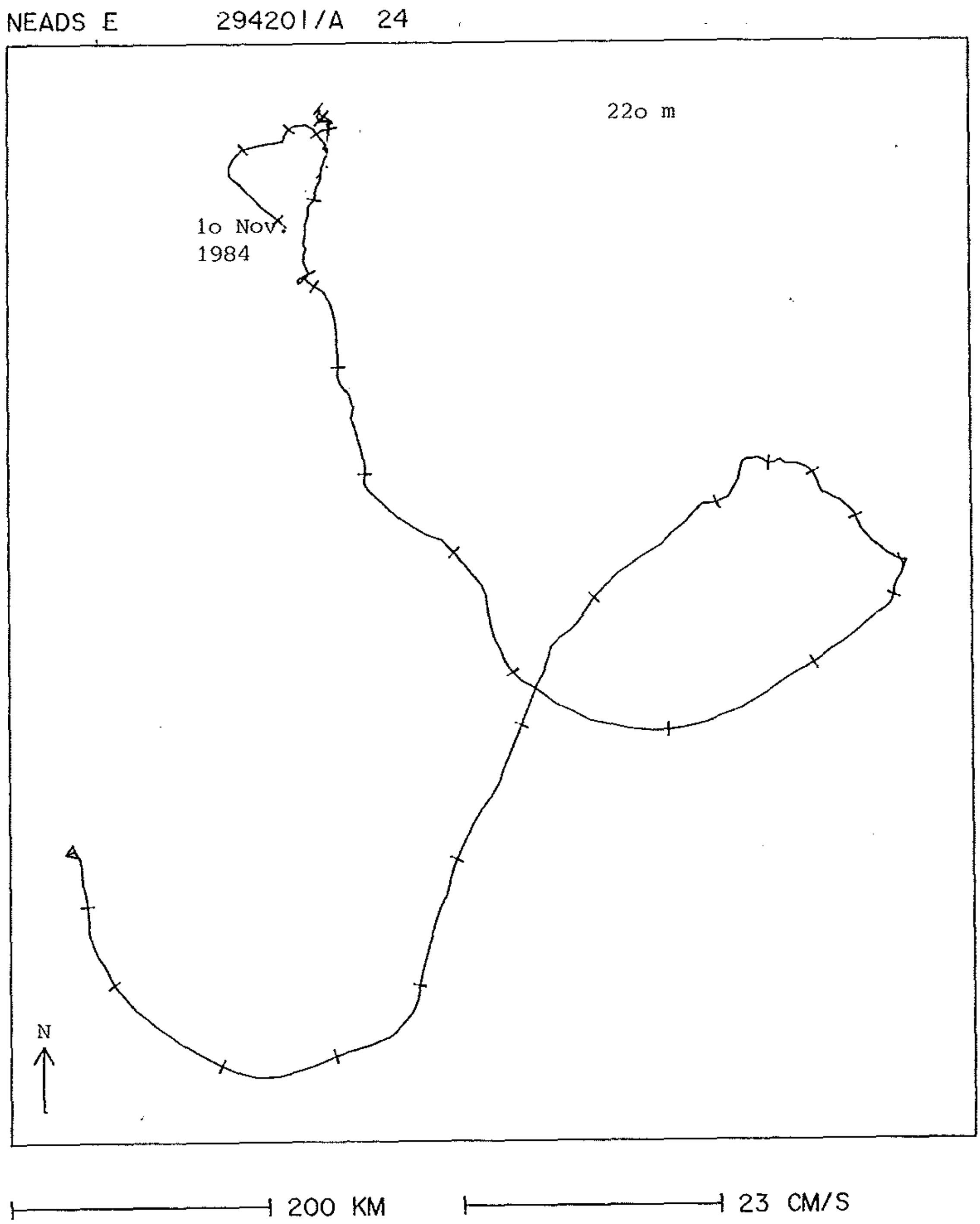
Identi-fication	instrument				Remarks
	type	No	depth (m)	sampling (min.)	
294201	A-VT	1409	220	60	
294202	A-TP400	1064/ 800	222- 622	120	stop 20-Aug-85
294203	A-T400	1065/ 464	627- 1027	120	channels 2-8,12 no data channel 5 = stop Jul-85

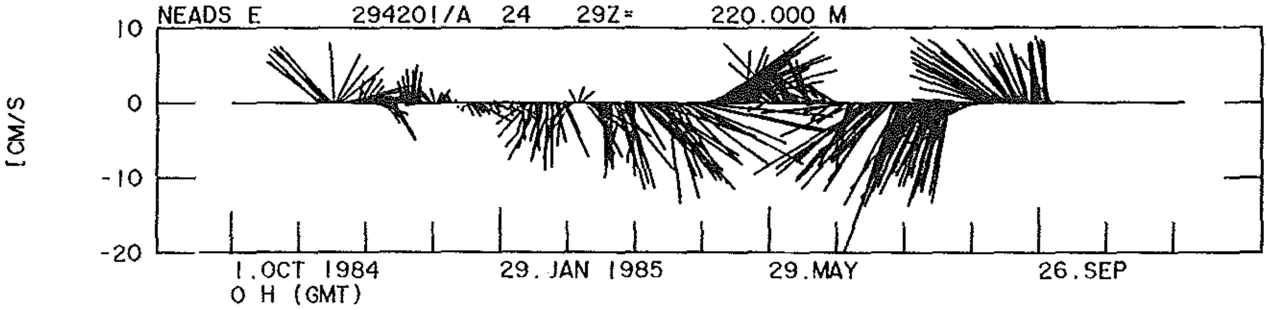
A-VT(PC) : Aanderaa current meter RCM4/5 with sensors for P and C (optional)

A-T50 : Aanderaa thermistor cable 50 m or 400 m

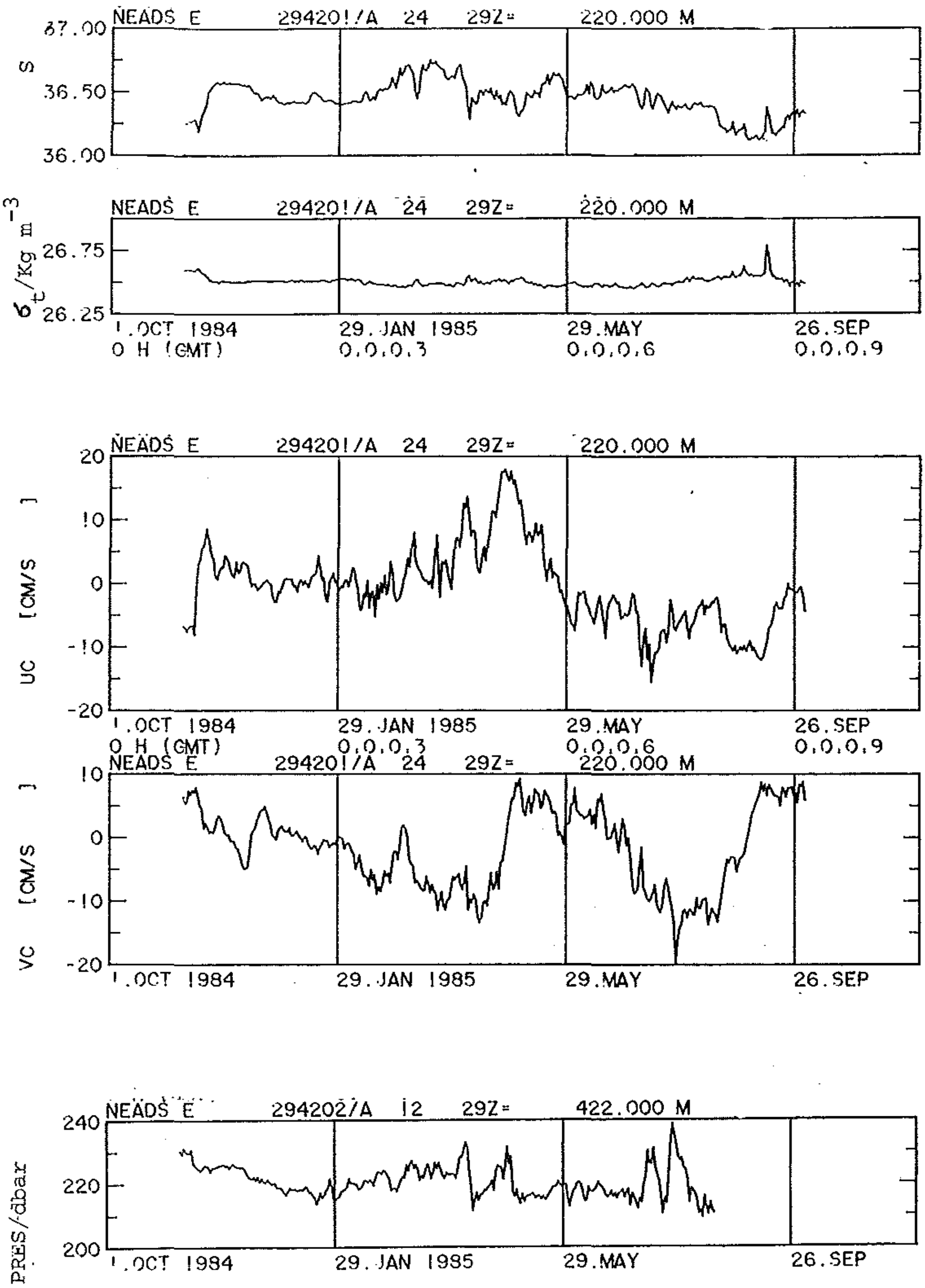
ACM-2 : Neil Brown acoustic vector averaging current meter

P, T, C, S : Pressure, temperature, conductivity, salinity

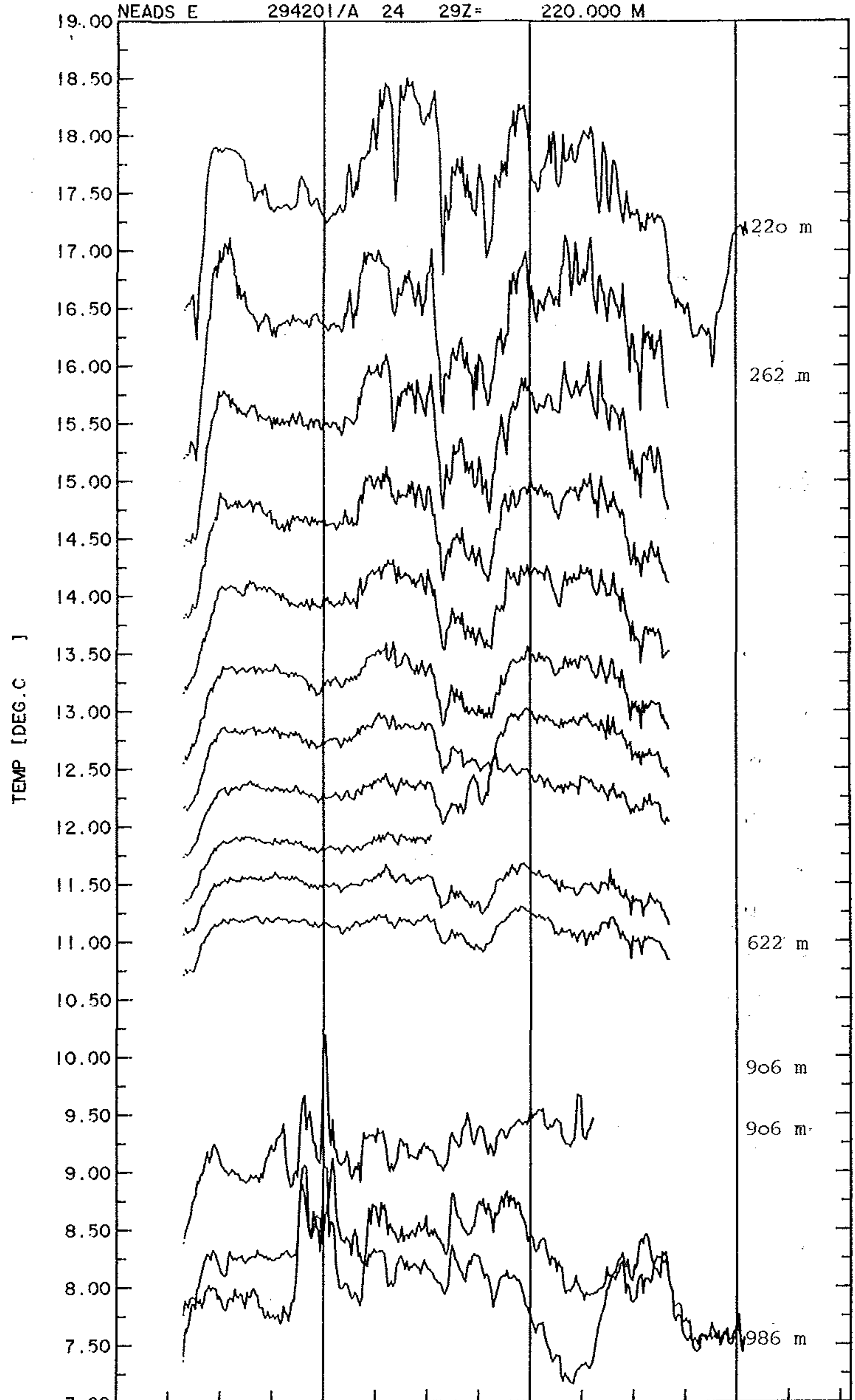




Mooring E/294-2: Progressive vector diagram, time increments 1o days, start date indicated (upper figure) and vector time series of current in 22o m with north upwards.



Mooring E/294-2:Time series of salinity,density,east component, north component,and pressure (up to down) in 22o m.



Mooring E/294-2: Time series of temperature.

4.9 Thermistor cable mooring X/293-2

IfM mooring No: 293-2 External name: X

Latitude: 28°00.9'N Longitude: 18°18.3'W

Sounding: 3580 m Water depth: 3594 m

Deployed: 06-Nov-84 Recovered: 05-Oct-85

Start of record: 06-Nov-84, 23:00 Z End of record: 05-Oct-85, 07:00 Z

Remarks:

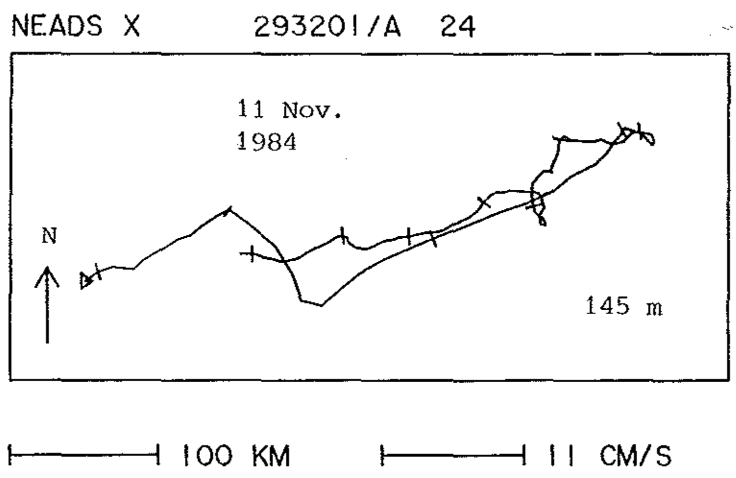
Identi-fication	instrument				Remarks
	type	No	depth (m)	sampling (min.)	
293201	A-VT	5327	145	60	stop 04-Mar-85
293202	A-TP400	1132/20	146-546	120	
293203		1070/ 673			no data

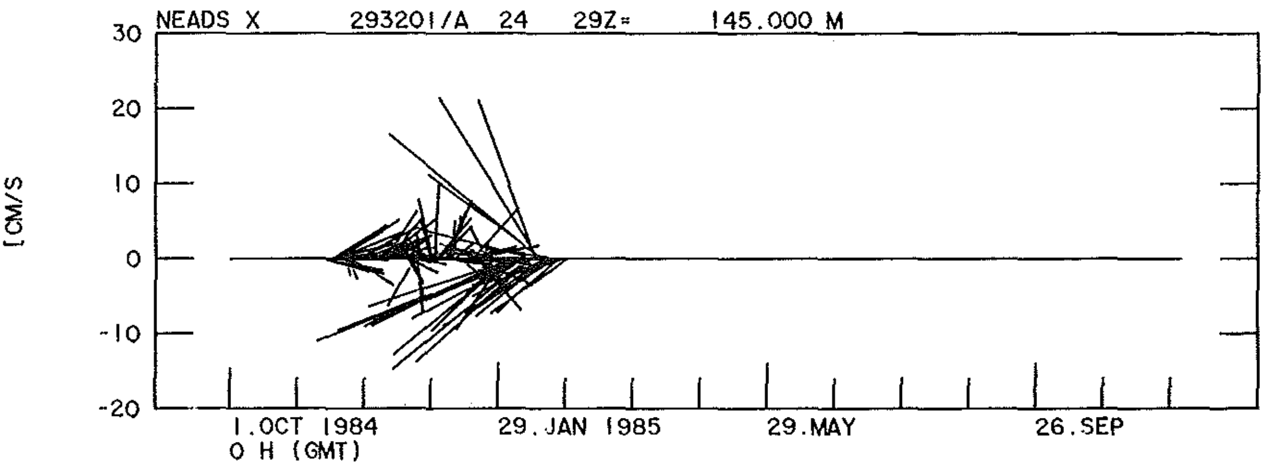
A-VT(PC) : Aanderaa current meter RCM4/5 with sensors for P and C (optional)

A-T50 : Aanderaa thermistor cable 50 m or 400 m

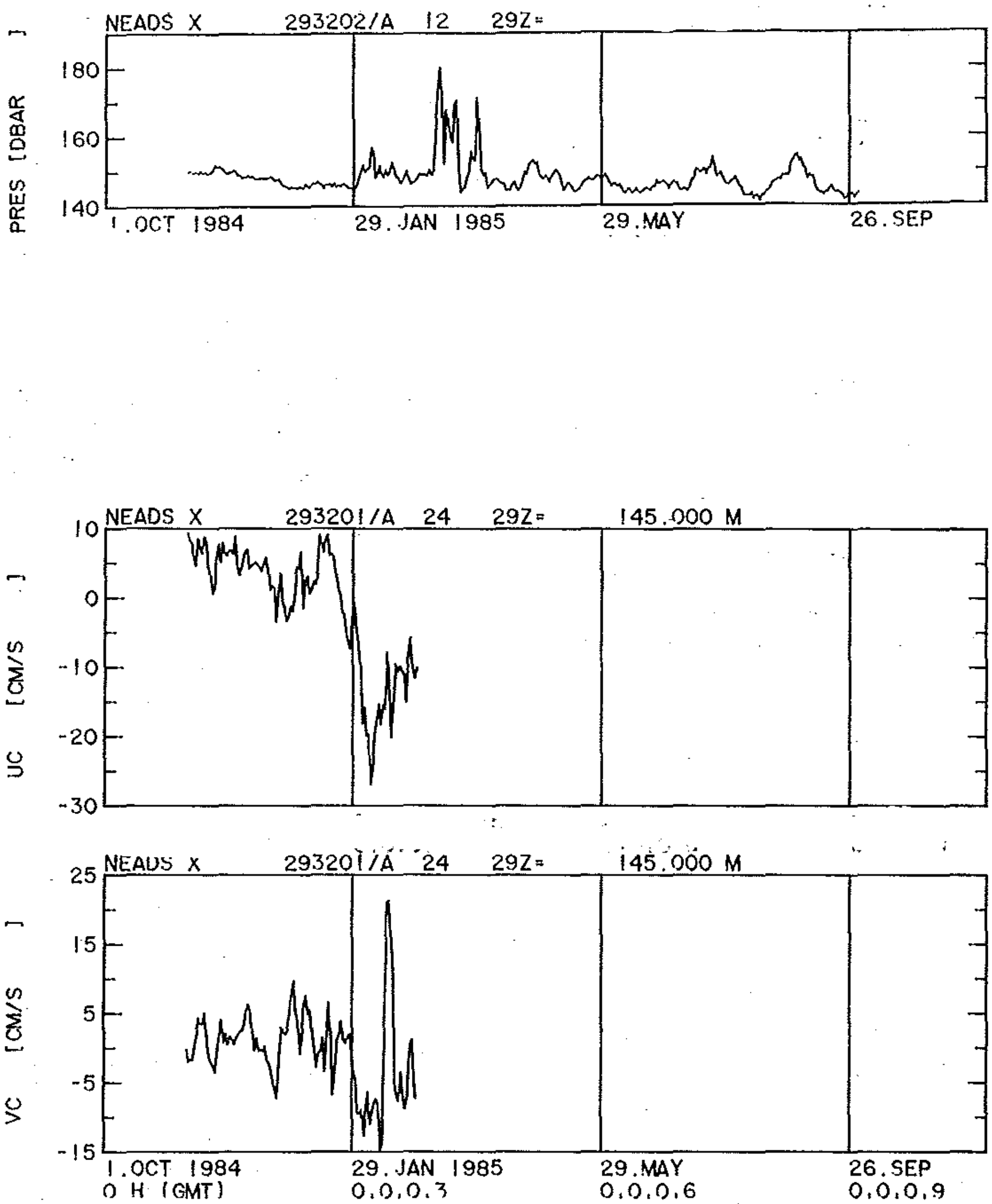
ACM-2 : Neil Brown acoustic vector averaging current meter

P, T, C, S : Pressure, temperature, conductivity, salinity

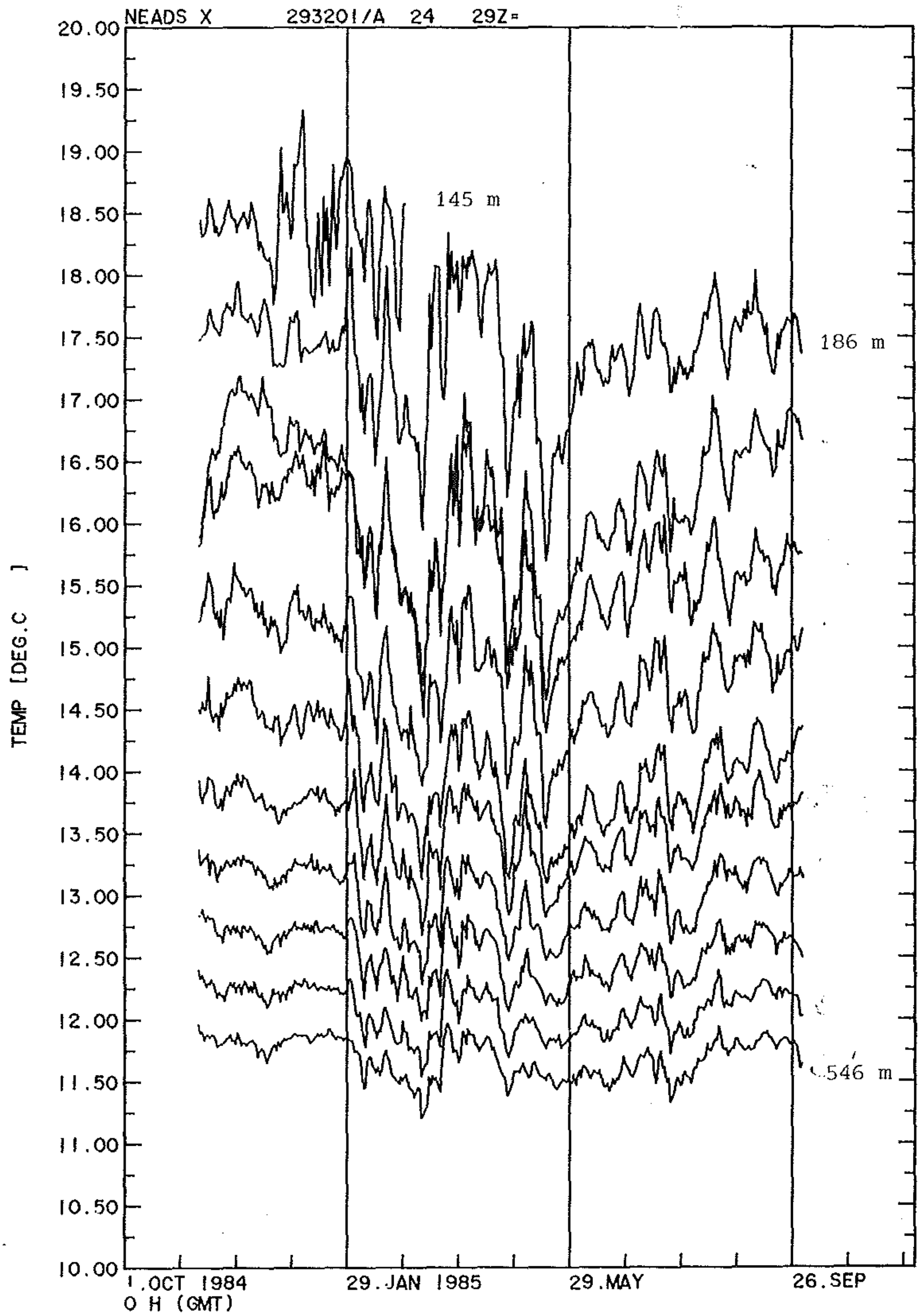




Mooring X/293-2:Progressive vector diagram,time increments 1o days, start date indicated (upper figure) and vector time series of current with north upwards in 145 m.



Mooring X/293-2:Time series of pressure (upper figure),east component (uc) and north component (vc) of current in 145 m.



Mooring X/293-2:Time series of temperature.

4.10 Current meter mooring KS1/303-1

IfM mooring No: 303-1 External name: KS1

Latitude: 26°02.3'N Longitude: 17°59.9'W

Sounding: 3430 m Water depth: 3442 m

Deployed: 12-Nov-84 Recovered: 07-Oct-85

Start of record: 12-Nov-84, 14:00 Z End of record: 07-Oct-85, 06:00 Z

Remarks:

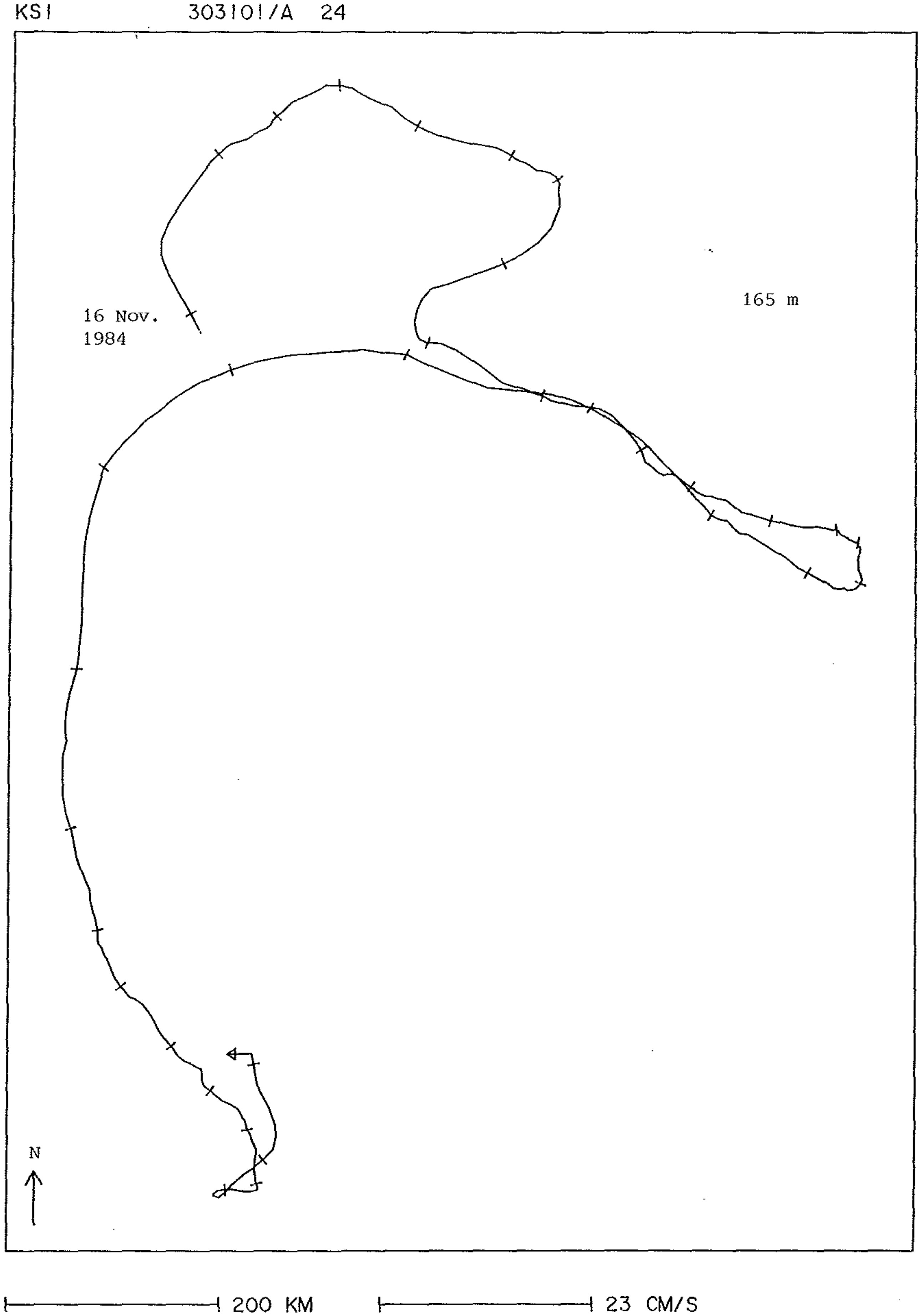
Identi-fication	instrument				Remarks
	type	No	depth (m)	sampling (min.)	
303101	A-VTP	6680	165	60	
303102	A-VTP	6682	365	60	stop Aug-85
303103	A-VT	6074	568	60	
303104	A-VT	5252	1215	60	
303105	A-VT	6122	3400	60	

A-VT(PC) : Aanderaa current meter RCM4/5 with sensors for P and C (optional)

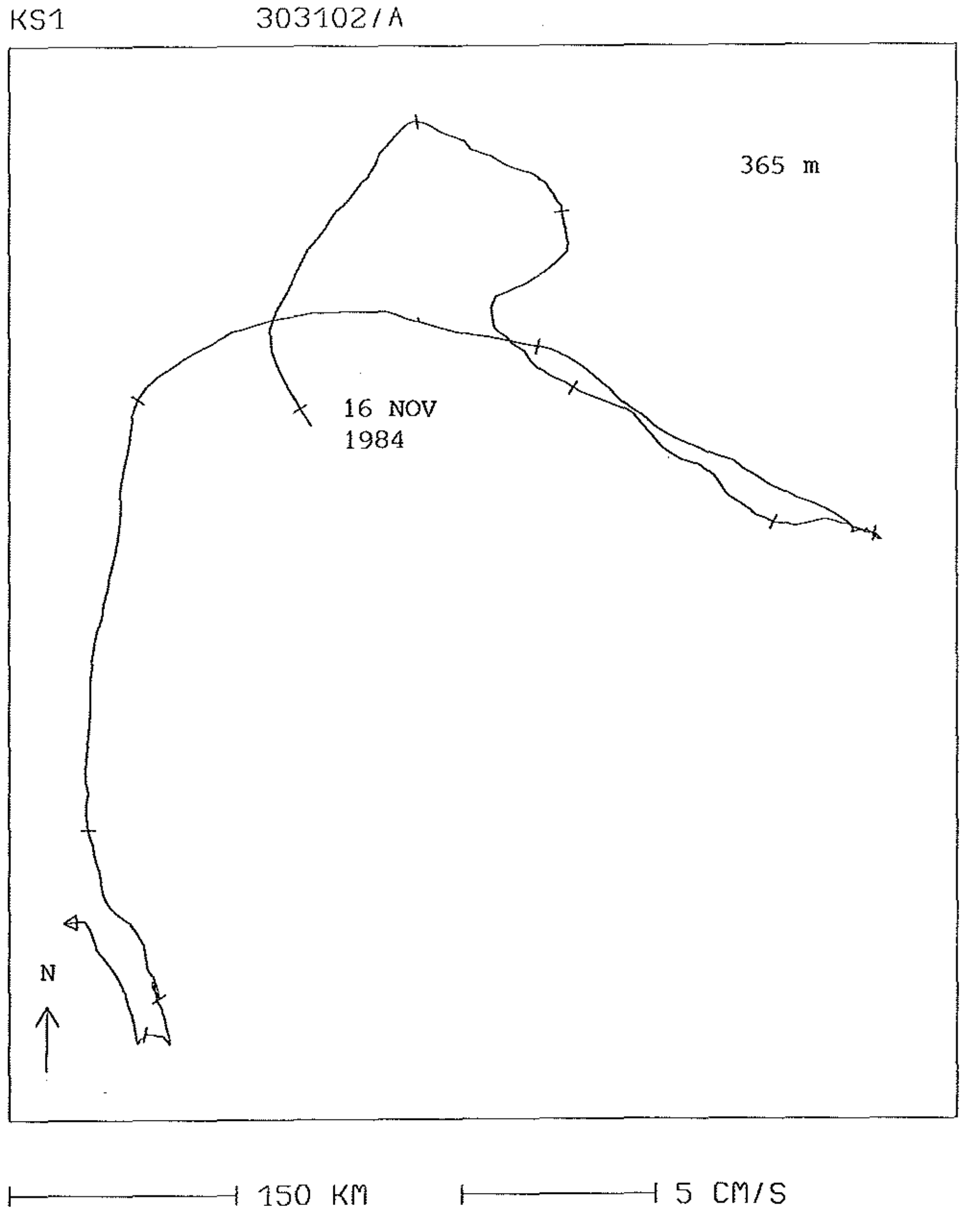
A-T50 : Aanderaa thermistor cable 50 m or 400 m

ACM-2 : Neil Brown acoustic vector averaging current meter

P, T, C, S : Pressure, temperature, conductivity, salinity

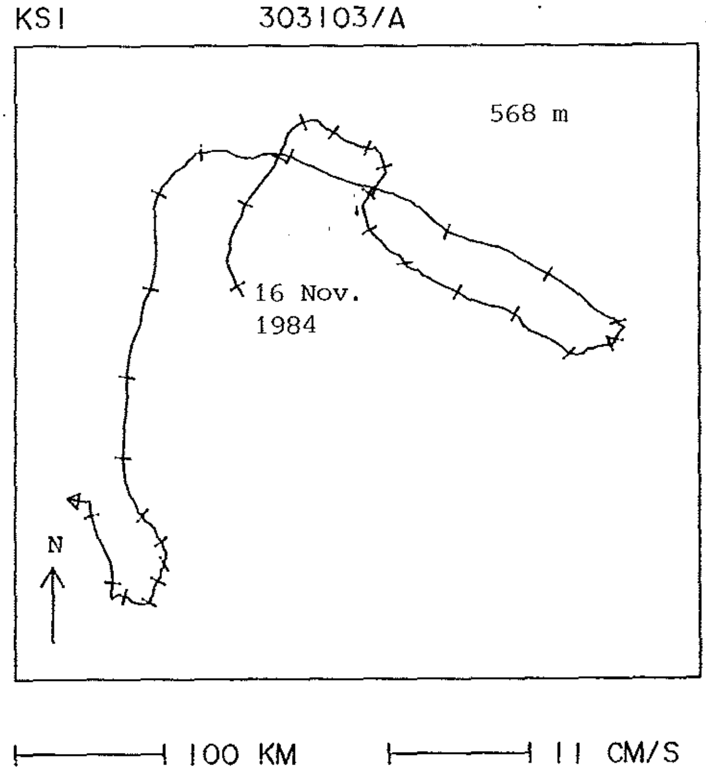


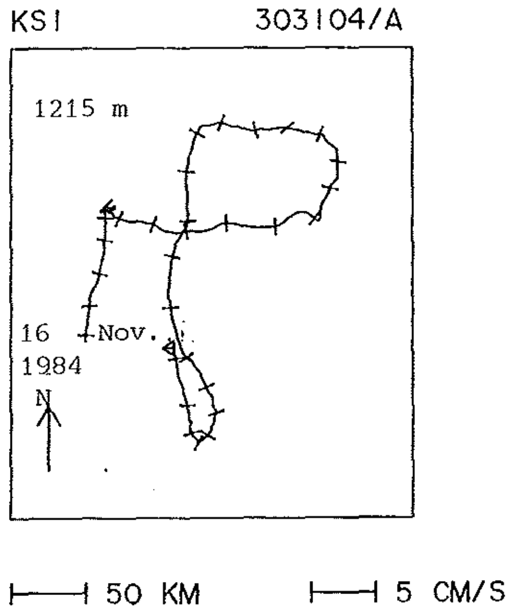
Mooring KS1/3o3-1:Progressive vector diagram of current in 165 m,time increments 1o days,start date indicated.

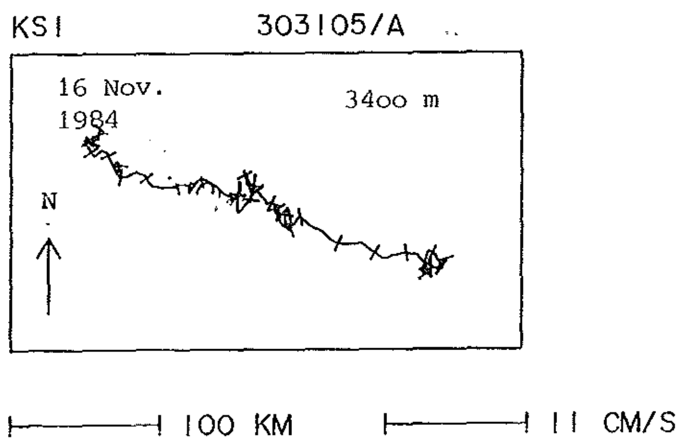


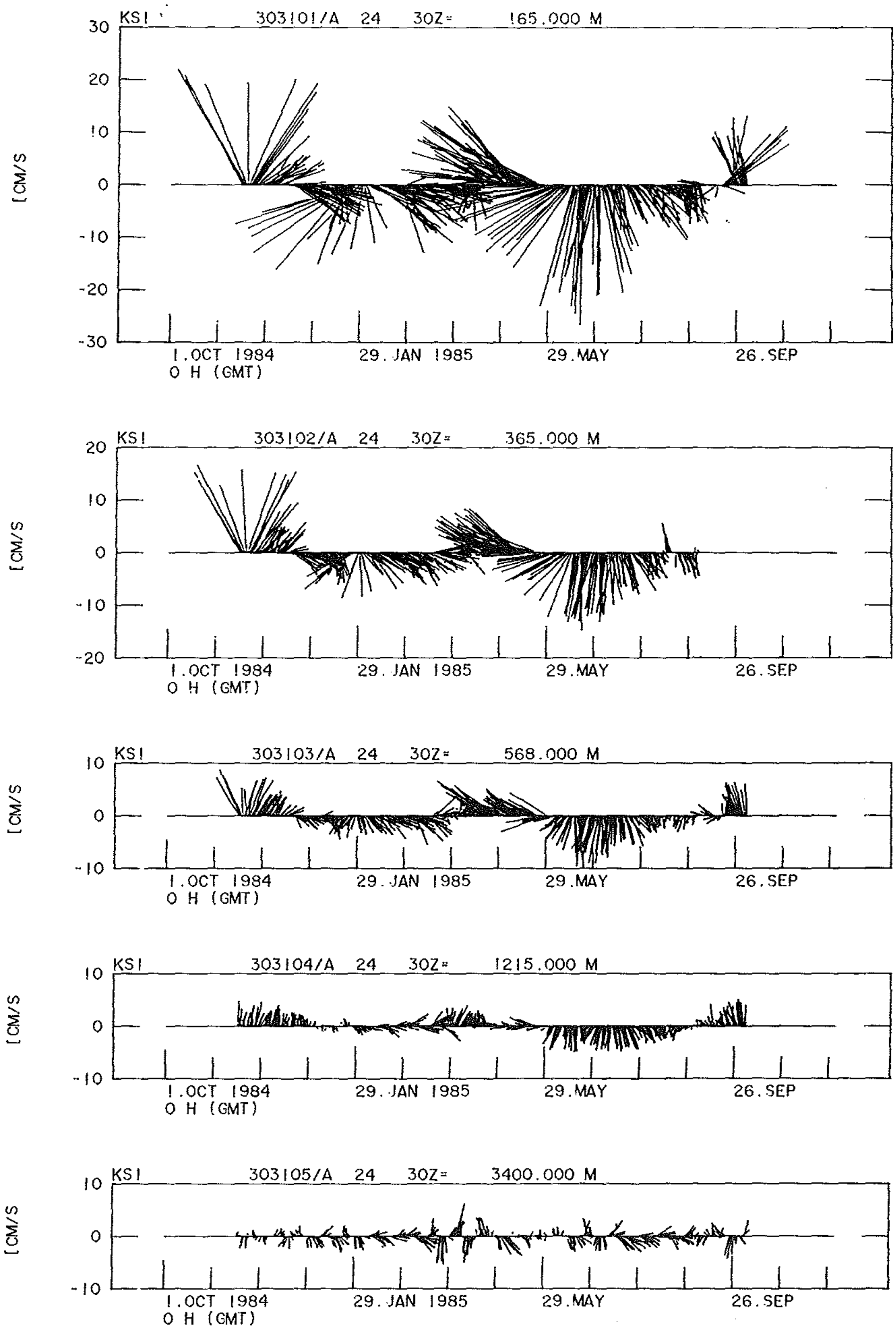
Mooring KS1/303-1: Progressive vector diagram of current in 365 m, time increments 10 days, start date indicated.

<u>Mooring KS1/3o3-1</u>: Progressive vector diagrams in 568 m, 1215 m, 34oo m. Time increments 1o days, start date indicated.

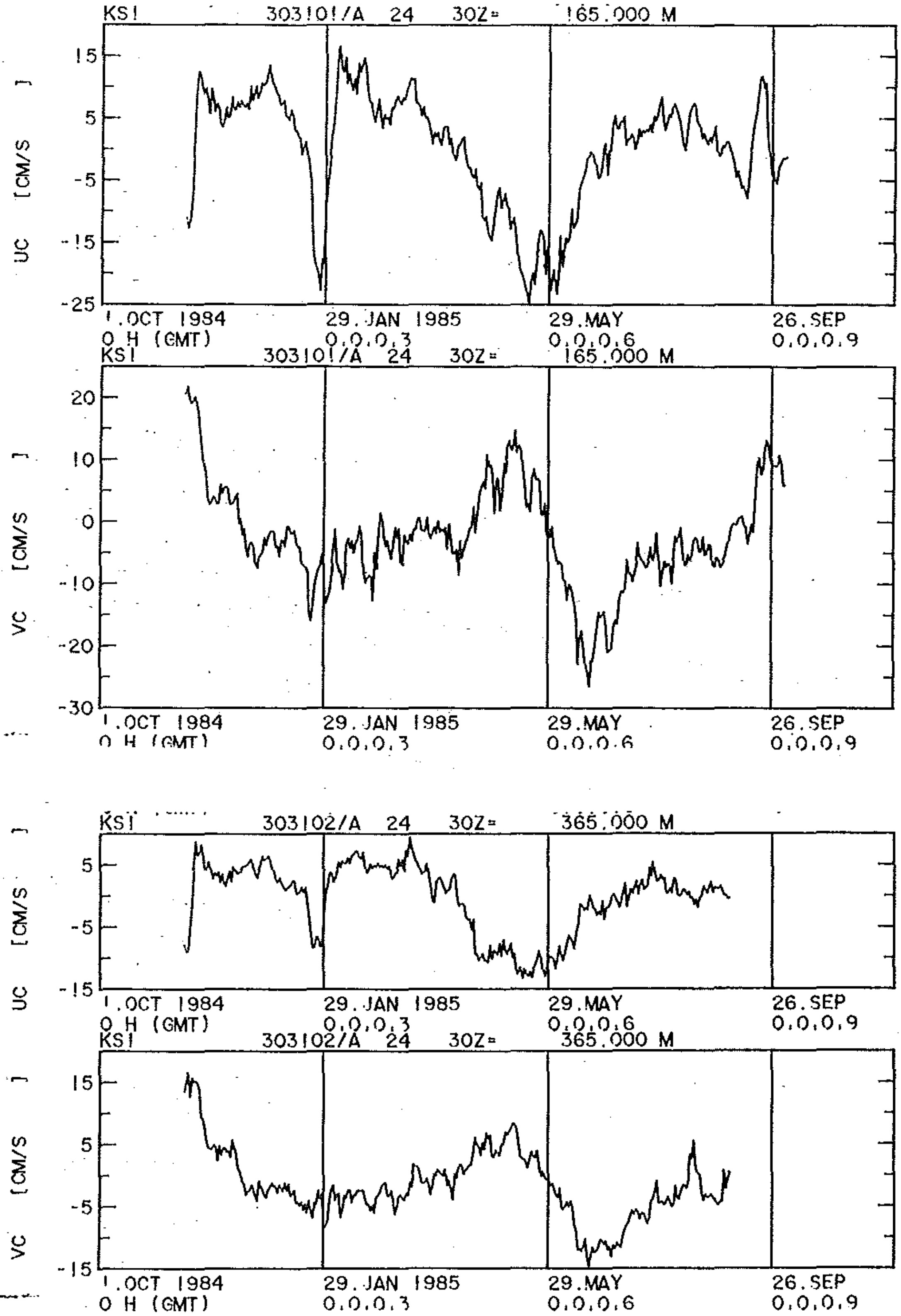




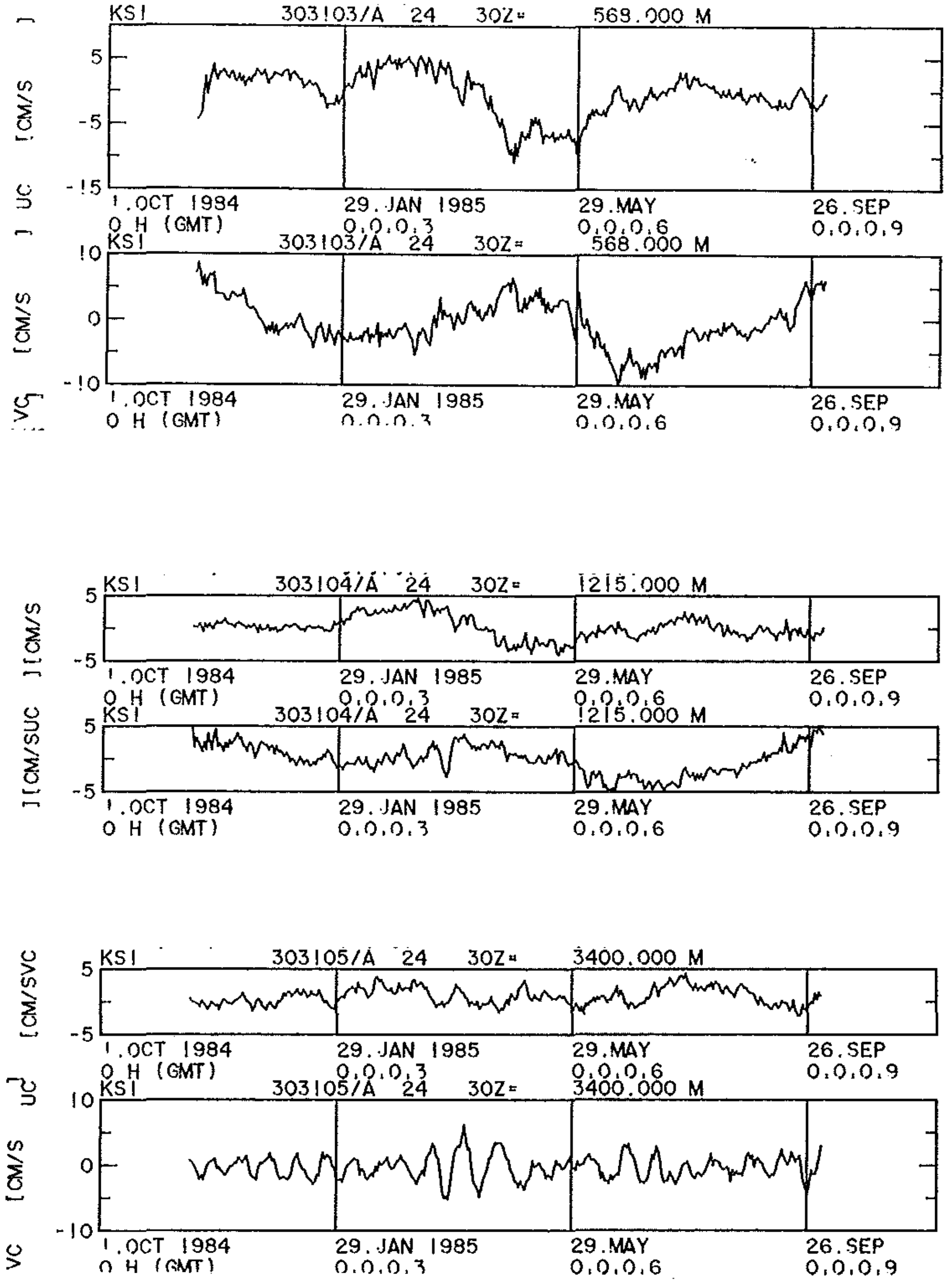




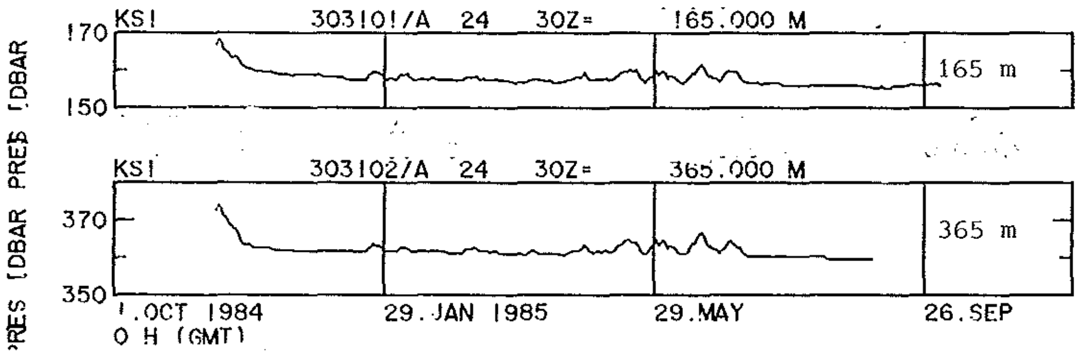
Mooring KS1/3o3-1:Vector time series,north upwards.



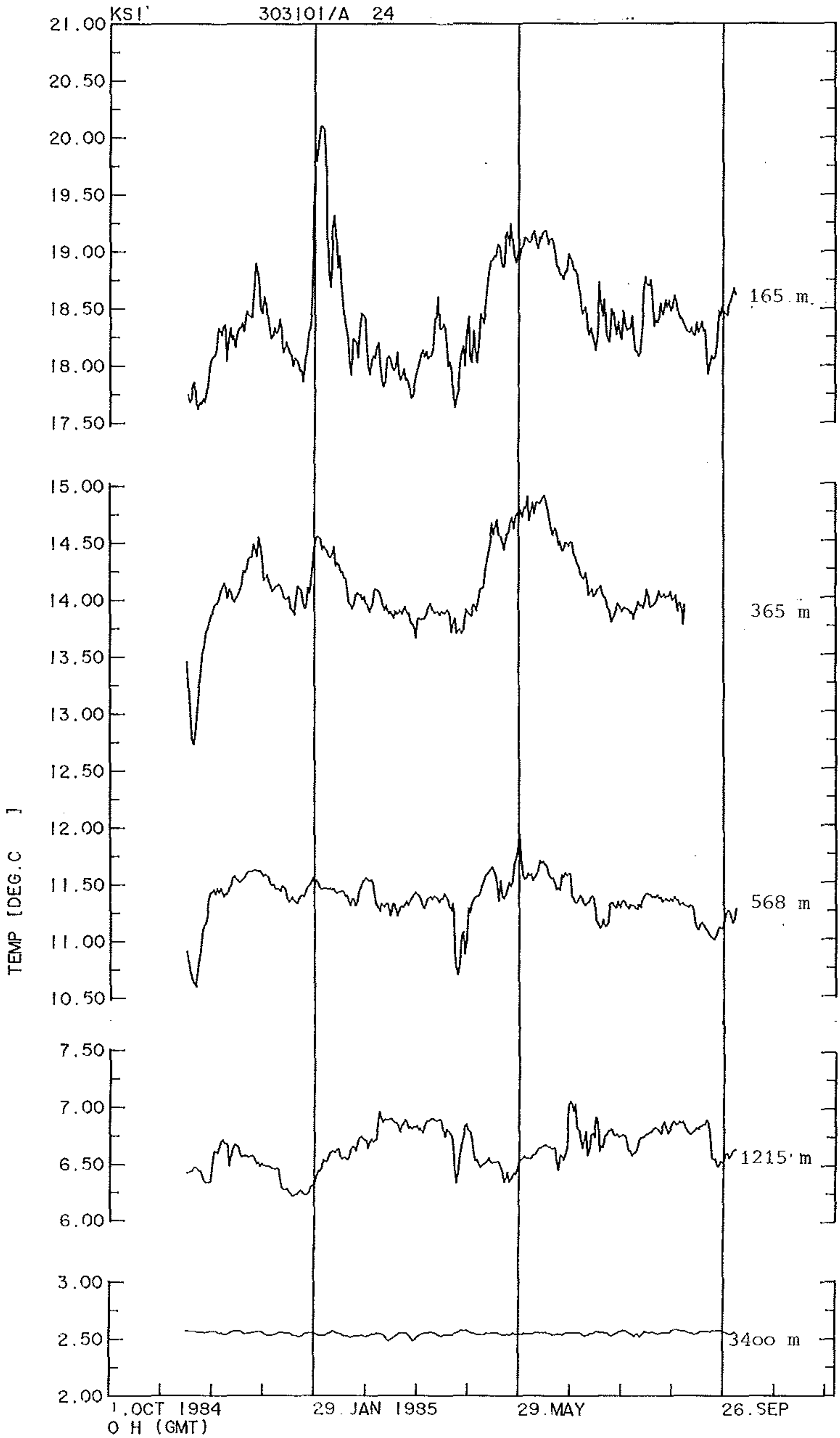
Mooring KS1/3o3-1: Time series of east (uc) and north (vc) component of current in 165 m and 365 m.



Mooring KS1/3o3-1:Time series of east (uc) and north (vc) component of current in 568 m,1215 m and 34oo m.



Mooring KS1/3o3-1:Pressure records in 165m and 365m nominal depth.



Mooring KS1/3o3-1:Time series of temperature.

4.11 Current meter mooring KS2/304-1

IfM mooring No: 304-1 External name: KS2

Latitude: 25°32.5'N Longitude: 17°03.7'W

Sounding: 3260 m Water depth: 3269 m

Deployed: 11-Nov-84 Recovered: 07-Oct-85

Start of record: 11-Nov-84, 22:00 Z End of record: 07-Oct-85, 20:00 Z

Remarks:

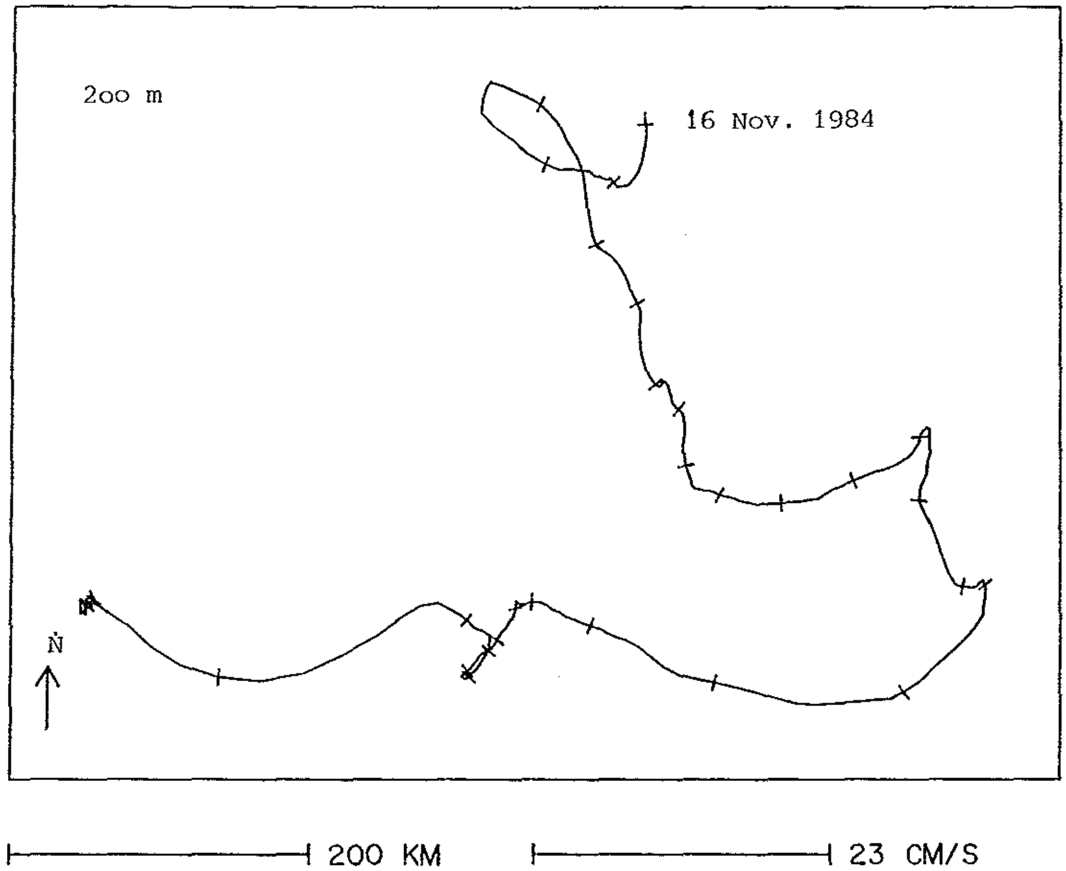
Identi- fication	instrument				Remarks
	type	No	depth (m)	sampling (min.)	
304101	A-VTP	776	200	60	rotor stop Aug-85
304102	A-VT	1407	400	60	
304103	A-VT	4563	605	60	
304104	A-VT	5882	1244	60	
304105	A-VT	6121	3150	60	no temperature stop 25-Jun-85

A-VT(PC) : Aanderaa current meter RCM4/5 with sensors for P and C (optional)

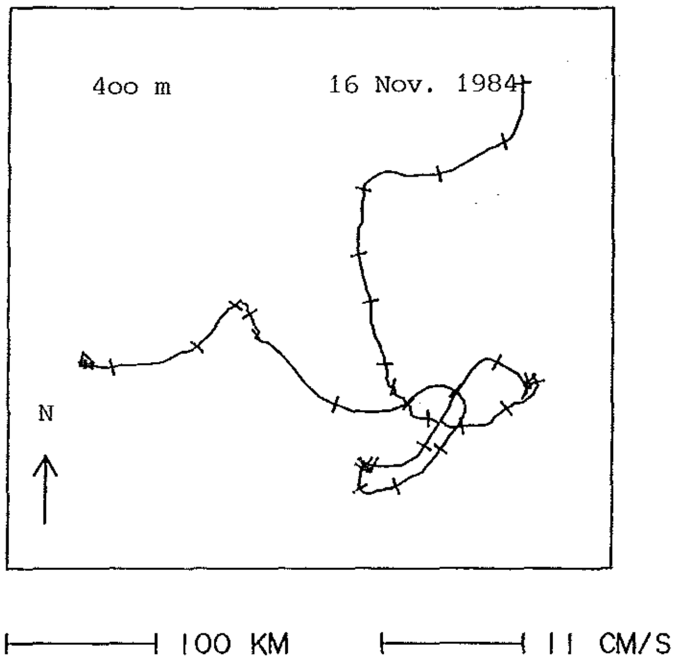
A-T50 : Aanderaa thermistor cable 50 m or 400 m

P, T, C, S : Pressure, temperature, conductivity, salinity

KS2 304101/A 24

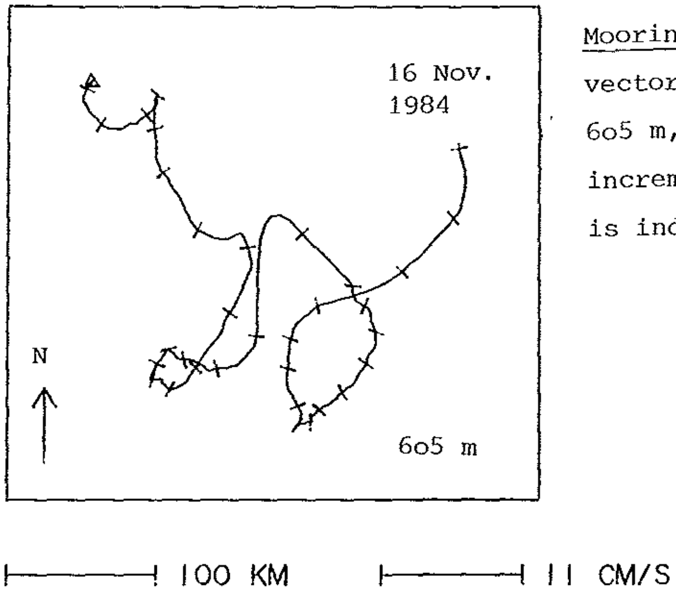


KS2 304102/A 24



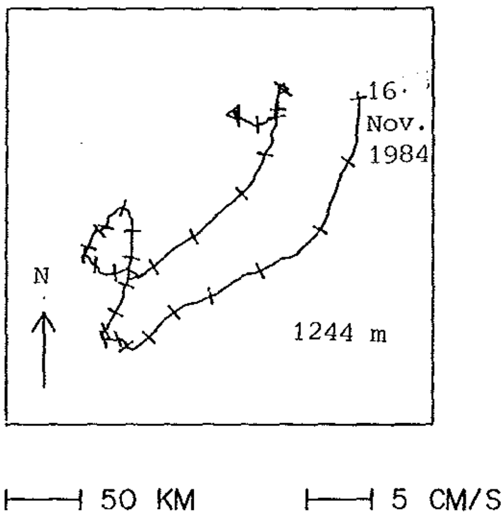
Mooring KS2/304-1: Progressive vector diagrams of currents in 200 m and 400 m depth. Time increments 10 days, start date is indicated.

KS2 304103/A

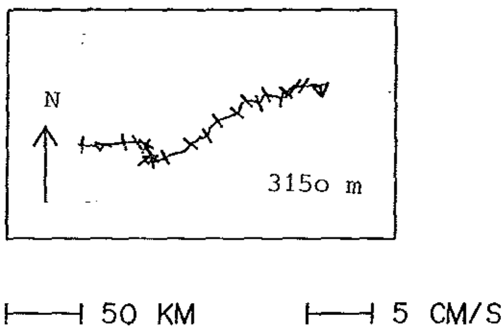


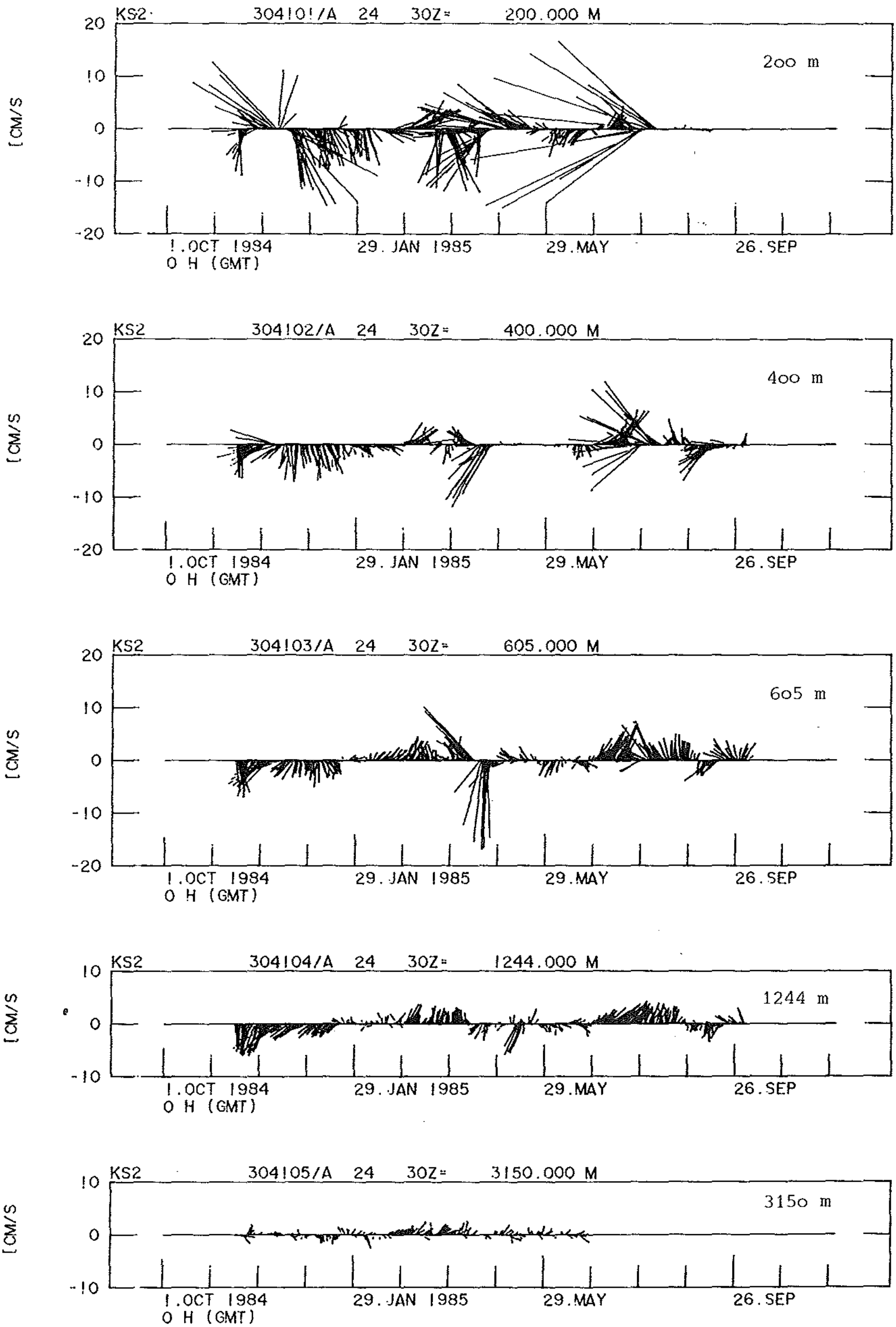
<u>Mooring KS2/3o4-1</u>:Progressive vector diagram of currents in 6o5 m,1244 m and 315o m.Time increments 1o days,start date is indicated.

KS2 304104/A

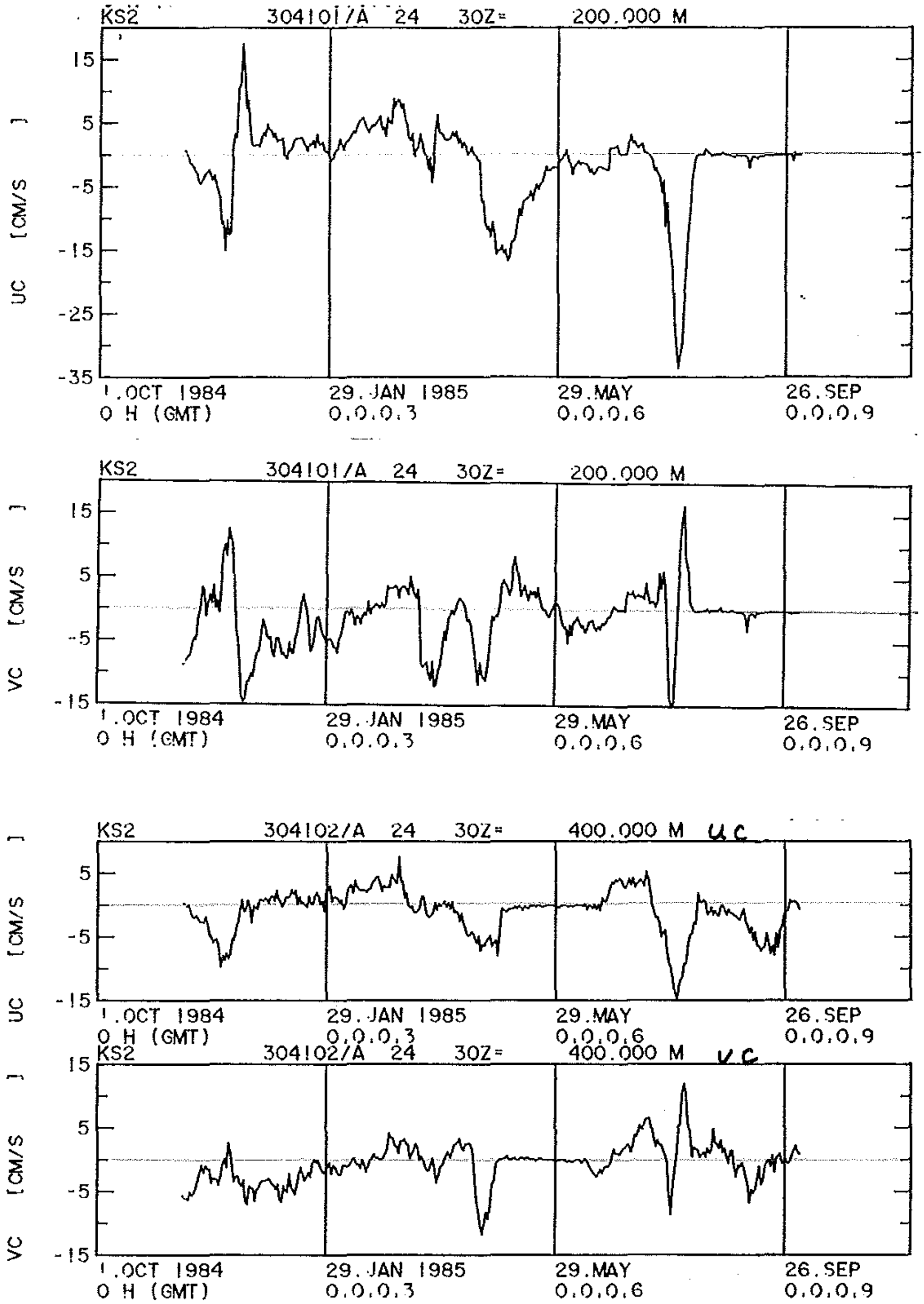


KS2 304105/A

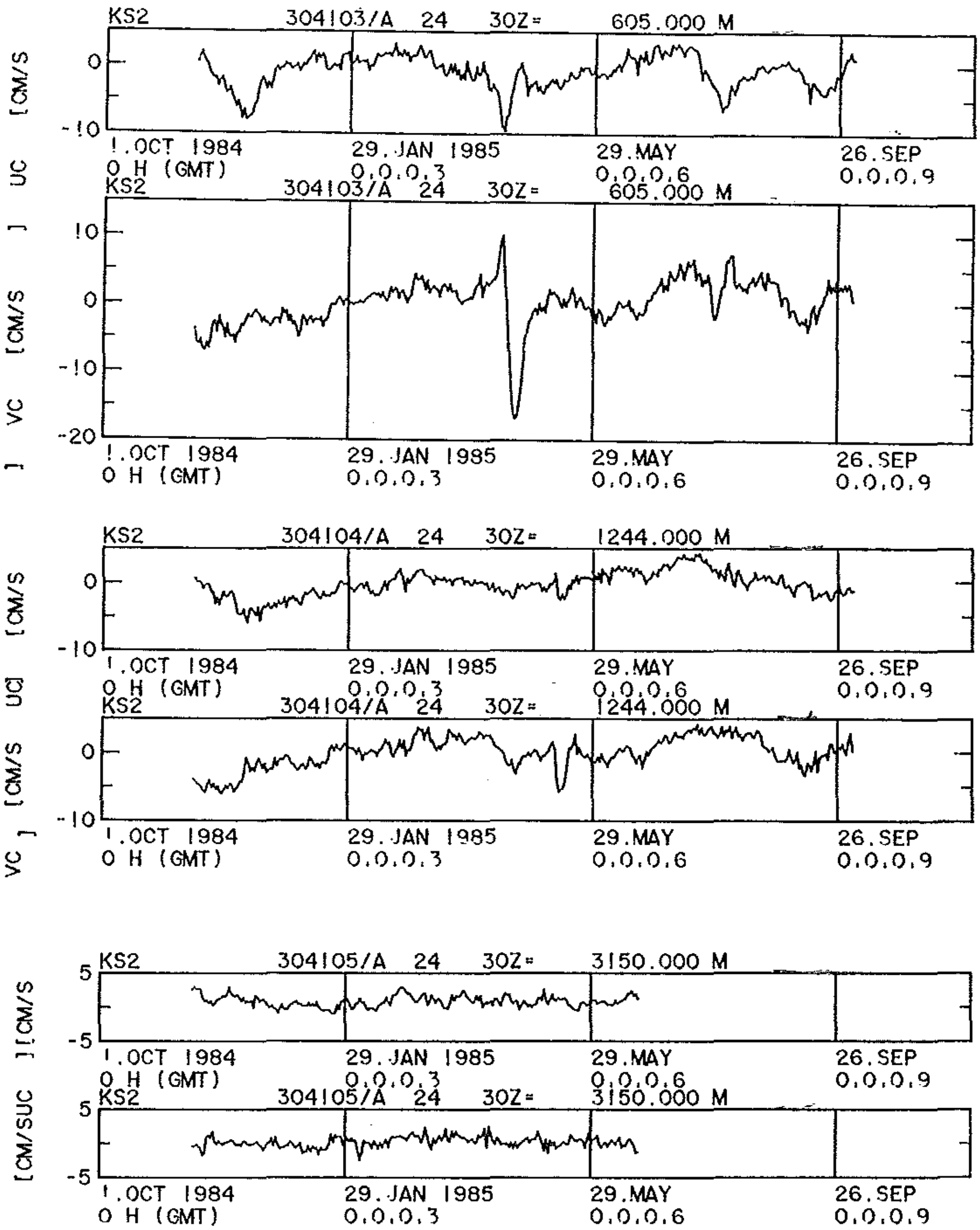




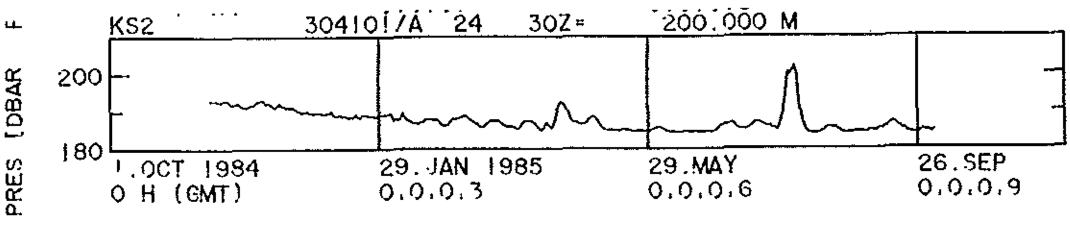
<u>Mooring KS2/3o4-1</u>:Vectortime series of currents,northwards up.

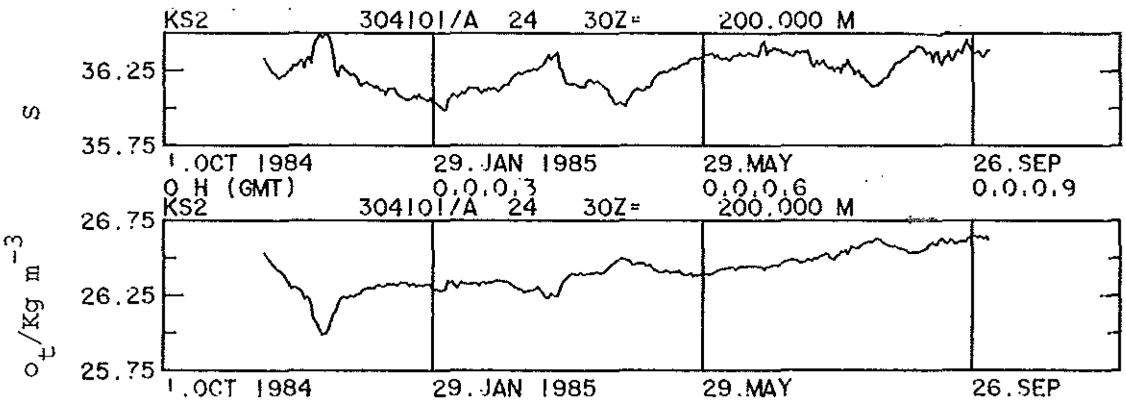


Mooring KS2/3o4-1:Time series of east (uc) and north (vc) components of currents in 2oo m and 4oo m.

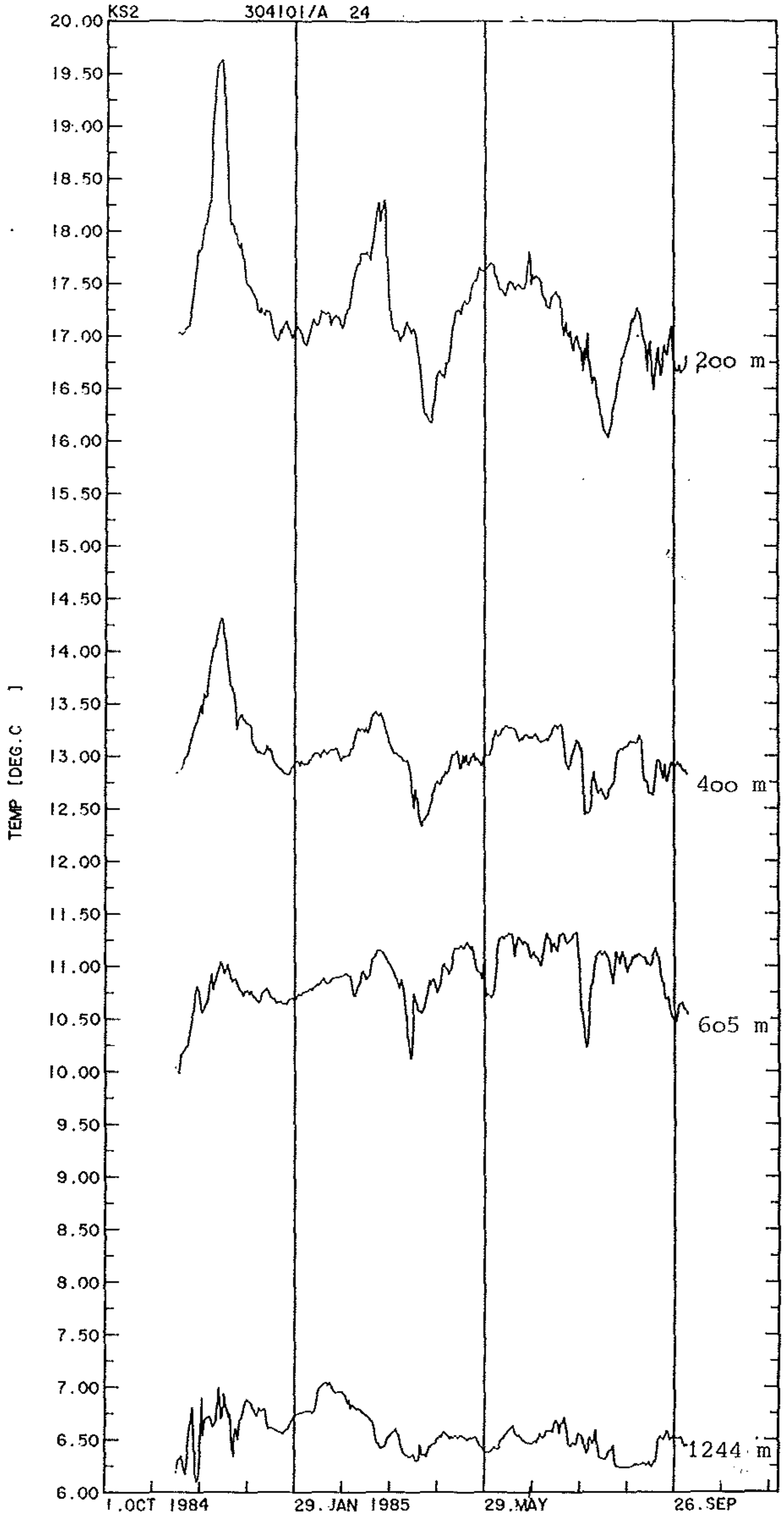


<u>Mooring KS2/3o4-1</u>:Time series of east (uc) and north (vc) components of currents in 6o5 m,1244 m, and 315o m.





<u>Mooring KS2/3o4-1</u>:Time series of pressure,salinity and density at 2oo m nominal depth.



Mooring KS2/3o4-1:Time series of temperature.

5 Lists

STATION	DATE	TIME	LATITUDE	LONGITUDE	DEPTH
8104	1-OCT-1985	16:10	28° 0.50′ N	26° 29.63′ W	5228
8106	2-OCT-1985	14:35	28° 0.53′ N	24° 30.65′ W	5217
8108	3-OCT-1985	13:45	27° 59.42′ N	22° 23.63′ W	4904
8110	10-OCT-1985	18:25	28° 2.30′ N	20° 25.23′ W	4618
8112	6-OCT-1985	18:50	27° 59.42′ N	18° 18.13′ W	3610
8114	10-OCT-1985	9:22	26° 26.93′ N	19° 21.32′ W	3839
8120	7-OCT-1985	4:00	26° 3.35′ N	18° 3.30′ W	3462
8134	8-OCT-1985	19:56	22° 56.12′ N	20° 33.68′ W	4192
8138	9-OCT-1985	15:00	21° 59.15′ N	22° 2.83′ W	4579
8148	11-OCT-1985	18:45	18° 60.43′ N	21° 57.02′ W	3433

Table 5.1: POLARSTERN cruise ANTIV/1b. CTD stations

DROP	DATE	TIME	LATITUDE	LONGITUDE
1	29-SEP-1985	1:11	27° 34.80′ N	14° 37.00′ W
2	29-SEP-1985	2:03	27° 33.60′ N	14° 46.00′ W
3	29-SEP-1985	2:59	27° 36.00′ N	14° 58.00′ W
4	29-SEP-1985	4:00	27° 31.80′ N	15° 7.00′ W
5	29-SEP-1985	4:59	27° 31.80′ N	15° 19.00′ W
6	29-SEP-1985	6:08	27° 30.60′ N	15° 33.00′ W
8	29-SEP-1985	8:01	27° 30.60′ N	15° 48.00′ W
9	29-SEP-1985	8:58	27° 30.00′ N	16° 7.00′ W
10	29-SEP-1985	9:58	27° 28.80′ N	16° 20.00′ W
11	29-SEP-1985	10:58	27° 27.00′ N	16° 32.00′ W
12	29-SEP-1985	11:58	27° 27.00′ N	16° 44.00′ W
13	29-SEP-1985	12:58	27° 25.80′ N	16° 57.00′ W
14	29-SEP-1985	13:59	27° 24.60′ N	17° 9.00′ W
18	29-SEP-1985	15:58	27° 24.00′ N	17° 33.00′ W
19	29-SEP-1985	16:58	27° 22.80′ N	17° 44.00′ W
23	29-SEP-1985	19:57	27° 22.80′ N	18° 7.00′ W
24	29-SEP-1985	20:57	27° 24.60′ N	18° 29.00′ W
25	29-SEP-1985	21:57	27° 22.80′ N	18° 20.00′ W
26	29-SEP-1985	22:57	27° 25.80′ N	18° 52.00′ W
27	29-SEP-1985	23:57	27° 27.00′ N	19° 4.00′ W
28	30-SEP-1985	0:58	27° 27.60′ N	19° 15.00′ W
29	30-SEP-1985	2:03	27° 28.80′ N	19° 27.00′ W
30	30-SEP-1985	2:59	27° 30.00′ N	19° 42.00′ W
31	30-SEP-1985	4:00	27° 30.60′ N	19° 57.00′ W
32	30-SEP-1985	4:58	27° 31.80′ N	20° 10.00′ W
33	30-SEP-1985	5:58	27° 33.00′ N	20° 26.00′ W
34	30-SEP-1985	7:26	27° 33.60′ N	20° 49.00′ W
35	30-SEP-1985	8:56	27° 36.00′ N	21° 14.00′ W
36	30-SEP-1985	10:27	27° 37.80′ N	21° 35.00′ W

Table 5.2: POLARSTERN cruise ANTIV/1b. XBT drops

DROP	DATE	TIME	LATITUDE	LONGITUDE
38	30-SEP-1985	12:11	27° 39.60′ N	22° 1.00′ W
39	30-SEP-1985	13:28	27° 42.60′ N	22° 21.00′ W
40	30-SEP-1985	15:00	27° 42.60′ N	22° 44.00′ W
41	30-SEP-1985	16:29	27° 45.60′ N	23° 6.00′ W
42	30-SEP-1985	17:59	27° 46.80′ N	23° 29.00′ W
43	30-SEP-1985	19:29	27° 48.60′ N	23° 53.00′ W
45	30-SEP-1985	21:05	27° 49.80′ N	24° 18.00′ W
46	30-SEP-1985	22:32	27° 51.60′ N	24° 40.00′ W
47	1-OCT-1985	23:59	27° 54.00′ N	25° 2.00′ W
48	1-OCT-1985	0:01	27° 54.60′ N	25° 23.00′ W
49	1-OCT-1985	3:00	27° 57.00′ N	25° 40.00′ W
50	1-OCT-1985	4:29	27° 57.60′ N	25° 57.00′ W
51	1-OCT-1985	5:59	27° 58.80′ N	26° 12.00′ W
52	1-OCT-1985	7:29	28° 0.00′ N	26° 24.00′ W
53	6-OCT-1985	19:59	26° 24.60′ N	19° 22.00′ W
54	6-OCT-1985	22:00	26° 18.60′ N	19° 3.00′ W
55	6-OCT-1985	23:57	26° 13.80′ N	18° 41.00′ W
56	7-OCT-1985	1:57	26° 7.80′ N	18° 20.00′ W
57	7-OCT-1985	9:58	26° 0.00′ N	18° 1.00′ W
59	7-OCT-1985	11:58	25° 48.60′ N	17° 36.00′ W
60	7-OCT-1985	12:58	25° 42.60′ N	17° 24.00′ W
61	7-OCT-1985	13:58	25° 36.60′ N	17° 12.00′ W
62	7-OCT-1985	17:53	25° 31.80′ N	17° 8.00′ W
63	11-OCT-1985	21:24	18° 57.60′ N	21° 55.00′ W
64	11-OCT-1985	22:12	18° 52.80′ N	21° 49.00′ W
65	11-OCT-1985	23:05	18° 46.80′ N	21° 42.00′ W
67	12-OCT-1985	0:11	18° 39.00′ N	21° 34.00′ W
69	12-OCT-1985	2:12	18° 24.00′ N	21° 18.00′ W
71	12-OCT-1985	3:58	18° 12.00′ N	21° 5.00′ W
77	12-OCT-1985	13:45	17° 43.80′ N	20° 37.00′ W
78	12-OCT-1985	14:58	17° 33.60′ N	20° 27.00′ W
80	12-OCT-1985	16:56	17° 18.00′ N	20° 10.00′ W
81	12-OCT-1985	17:56	17° 10.80′ N	20° 3.00′ W
82	12-OCT-1985	18:56	17° 3.00′ N	19° 55.00′ W
83	12-OCT-1985	19:55	16° 54.60′ N	19° 47.00′ W
85	12-OCT-1985	21:03	16° 45.60′ N	19° 39.00′ W
86	12-OCT-1985	21:53	16° 39.60′ N	19° 32.00′ W
88	13-OCT-1985	23:52	16° 25.80′ N	19° 17.00′ W
90	13-OCT-1985	1:13	16° 15.00′ N	19° 6.00′ W
91	13-OCT-1985	1:55	16° 9.00′ N	19° 6.00′ W
93	13-OCT-1985	2:56	16° 1.80′ N	18° 53.00′ W
94	13-OCT-1985	4:00	15° 54.00′ N	18° 45.00′ W
95	13-OCT-1985	4:57	15° 45.60′ N	18° 38.00′ W
96	13-OCT-1985	5:56	15° 39.00′ N	18° 31.00′ W
97	13-OCT-1985	6:55	15° 30.60′ N	18° 24.00′ W
98	13-OCT-1985	7:56	15° 24.00′ N	18° 15.00′ W
99	13-OCT-1985	8:56	15° 16.80′ N	18° 8.00′ W
100	13-OCT-1985	9:54	15° 9.00′ N	18° 0.00′ W
101	13-OCT-1985	10:53	15° 1.80′ N	17° 53.00′ W
102	13-OCT-1985	11:56	14° 54.00′ N	17° 46.00′ W

Table 5.2: cont'd

STATION	DATE	TIME	LATITUDE	LONGITUDE	PRESSURE		
504	7-NOV-1985	14:38	38 N 35.20'	9 W 49.70'	10.0	1080.0	
505	7-NOV-1985	18:44	38 N 32.00'	10 W 27.90'	10.0	2000.0	
506	7-NOV-1985	23: 4	38 N 29.20'	11 W 5.00'	10.0	1990.0	
508	8-NOV-1985	10:38	38 N 21.00'	12 W 54.70'	10.0	2040.0	
509	8-NOV-1985	16:50	38 N 17.80'	13 W 49.10'	10.0	2000.0	
510	8-NOV-1985	23:35	38 N 14.20'	14 W 52.90'	10.0	2020.0	
511	9-NOV-1985	6: 0	38 N 8.10'	15 W 56.00'	10.0	2030.0	
512	9-NOV-1985	12:20	38 N 4.70'	16 W 59.10'	10.0	2020.0	
513	9-NOV-1985	18:58	37 N 58.80'	18 W 2.10'	10.0	1840.0	
514	10-NOV-1985	1:12	37 N 54.90'	19 W 4.80'	10.0	2020.0	
515	10-NOV-1985	7:35	37 N 50.30'	20 W 8.50'	10.0	2000.0	
516	10-NOV-1985	14: 0	37 N 45.70'	21 W 11.20'	10.0	2000.0	
517	10-NOV-1985	19: 5	37 N 44.60'	22 W 0.20'	10.0	2010.0	
518	11-NOV-1985	0:11	37 N 42.30'	22 W 48.10'	10.0	2040.0	
519	11-NOV-1985	4:40	37 N 41.80'	23 W 25.80'	10.0	2070.0	
522	14-NOV-1985	2:18	37 N 25.20'	26 W 29.70'	10.0	1940.0	NUT
523	14-NOV-1985	7: 3	37 N 0.10'	26 W 29.90'	10.0	2030.0	NUT
524	14-NOV-1985	12:38	36 N 15.10'	26 W 29.90'	10.0	2000.0	NUT
525	14-NOV-1985	16:48	35 N 44.40'	26 W 28.40'	10.0	1990.0	NUT
526	14-NOV-1985	23:30	35 N 1.90'	26 W 28.90'	10.0	4200.0	NUT
531	18-NOV-1985	11: 5	34 N 10.10'	26 W 30.00'	10.0	1490.0	NUT
532	18-NOV-1985	16:22	33 N 24.80'	26 W 30.00'	10.0	1490.0	NUT
533	18-NOV-1985	21:46	32 N 40.20'	26 W 30.00'	10.0	1490.0	NUT
535	19-NOV-1985	19: 6	31 N 55.10'	26 W 29.90'	10.0	1990.0	NUT
536	20-NOV-1985	0:03	31 N 10.20'	26 W 30.00'	10.0	2005.0	NUT, no CTD
538	20-NOV-1985	12:09	30 N 21.10'	26 W 29.30'	10.0	4940.0	NUT, no CTD
539	20-NOV-1985	19:06	29 N 40.10'	26 W 30.10'	10.0	1999.0	NUT, no CTD
540	20-NOV-1985	23:59	29 N 0.10'	26 W 30.00'	10.0	1990.0	NUT
541	21-NOV-1985	8: 0	29 N 0.00'	25 W 33.00'	10.0	1990.0	NUT
542	21-NOV-1985	14:31	29 N 0.70'	24 W 37.20'	10.0	5170.0	NUT
543	22-NOV-1985	0:10	29 N 0.10'	23 W 45.20'	10.0	2000.0	NUT
544	22-NOV-1985	6:47	28 N 59.90'	22 W 50.10'	10.0	4980.0	NUT
545	22-NOV-1985	15: 4	28 N 59.90'	21 W 58.20'	10.0	1500.0	NUT
546	22-NOV-1985	20:35	29 N 00.00'	21 W 18.20'	10.0	4776.0	NUT, no CTD
547	23-NOV-1985	0:55	29 N 00.10'	20 W 38.20'	10.0	2008.0	NUT, no CTD
548	23-NOV-1985	8: 4	28 N 59.90'	20 W 0.10'	10.0	4560.0	NUT
549	23-NOV-1985	15:57	29 N 0.10'	19 W 5.20'	10.0	1990.0	NUT
550	24-NOV-1985	0: 0	28 N 59.40'	18 W 10.10'	10.0	1990.0	NUT
551	24-NOV-1985	6:25	28 N 59.90'	17 W 10.20'	10.0	1990.0	NUT
552	24-NOV-1985	11:25	28 N 59.90'	16 W 25.30'	10.0	2009.0	NUT, no CTD
553	24-NOV-1985	21:31	29 N 0.00'	15 W 35.10'	10.0	2010.0	NUT
554	25-NOV-1985	2:22	28 N 59.60'	14 W 55.10'	10.0	2000.0	NUT
555	25-NOV-1985	6:20	28 N 59.90'	14 W 23.10'	10.0	1990.0	NUT
556	25-NOV-1985	12: 0	28 N 42.90'	13 W 35.10'	10.0	1170.0	NUT
557	25-NOV-1985	14:45	28 N 35.40'	13 W 14.30'	10.0	910.0	NUT
558	25-NOV-1985	23:45	27 N 49.70'	14 W 25.10'	10.0	1880.0	
559	26-NOV-1985	4:45	27 N 29.40'	15 W 0.10'	10.0	1990.0	
560	1-DEC-1985	5:22	31 N 11.10'	16 W 41.10'	10.0	2990.0	
562	2-DEC-1985	18:32	36 N 1.80'	18 W 1.70'	10.0	2990.0	
563	3-DEC-1985	12:20	38 N 23.20'	15 W 54.60'	10.0	3020.0	
564	4-DEC-1985	8:35	41 N 13.50'	13 W 22.20'	10.0	2990.0	

Table 5.3: POSEIDON cruise 124, CTD stations. Nutrient-samples are indicated.

DROP	DATE	TIME	LATIDUDE			LONGITUDE		
1	7-NOV-1985	16:59	38	N	34.00'	10	W	7.00'
2	7-NOV-1985	21:44	38	N	31.00'	10	W	48.00'
3	8-NOV-1985	2: 9	38	N	28.00'	11	W	26.00'
4	8-NOV-1985	4:42	38	N	27.00'	11	W	44.00'
5	8-NOV-1985	7:15	38	N	25.00'	12	W	14.00'
6	8-NOV-1985	8:58	38	N	23.00'	12	W	36.00'
7	8-NOV-1985	13:57	38	N	20.00'	13	W	18.00'
8	8-NOV-1985	20:28	38	N	17.00'	14	W	17.00'
9	9-NOV-1985	3:26	38	N	10.00'	15	W	24.00'
10	9-NOV-1985	9:36	38	N	6.00'	16	W	26.00'
11	9-NOV-1985	15:56	38	N	1.00'	17	W	29.00'
12	9-NOV-1985	22:39	37	N	56.00'	18	W	33.00'
13	10-NOV-1985	4:53	37	N	53.00'	19	W	35.00'
15	10-NOV-1985	11:45	37	N	47.00'	20	W	42.00'
16	10-NOV-1985	17: 4	37	N	44.00'	21	W	35.00'
17	10-NOV-1985	22:14	37	N	43.00'	22	W	24.00'
18	11-NOV-1985	2:59	37	N	43.00'	23	W	4.00'
19	11-NOV-1985	7:29	37	N	41.00'	23	W	43.00'
20	11-NOV-1985	10:30	37	N	41.00'	24	W	5.00'
21	11-NOV-1985	11:58	37	N	40.00'	24	W	24.00'
22	11-NOV-1985	15:57	37	N	40.00'	25	W	2.00'
23	14-NOV-1985	5:28	37	N	17.00'	26	W	31.00'
24	14-NOV-1985	10:43	36	N	36.00'	26	W	30.00'
25	14-NOV-1985	15:12	36	N	1.00'	26	W	28.00'
26	14-NOV-1985	19: 0	35	N	24.00'	26	W	30.00'
27	15-NOV-1985	2:39	34	N	31.00'	26	W	29.00'
28	18-NOV-1985	14:32	33	N	46.00'	26	W	30.00'
29	18-NOV-1985	20: 3	32	N	59.00'	26	W	30.00'
30	19-NOV-1985	17:29	32	N	11.00'	26	W	33.00'
31	19-NOV-1985	22:35	31	N	32.00'	26	W	30.00'
32	20-NOV-1985	4:43	30	N	46.00'	26	W	29.00'
33	20-NOV-1985	16:26	30	N	3.00'	26	W	31.00'
35	20-NOV-1985	22:29	29	N	14.00'	26	W	31.00'
36	21-NOV-1985	5:11	29	N	0.00'	26	W	7.00'
37	21-NOV-1985	11:57	29	N	1.00'	25	W	8.00'
38	21-NOV-1985	21:52	29	N	0.00'	24	W	9.00'
39	22-NOV-1985	3:59	29	N	0.00'	23	W	21.00'
41	22-NOV-1985	12:15	29	N	0.00'	22	W	50.00'
42	22-NOV-1985	17:58	28	N	59.00'	21	W	41.00'
43	23-NOV-1985	0:58	29	N	0.00'	20	W	59.00'
44	23-NOV-1985	6:14	29	N	0.00'	20	W	19.00'
45	23-NOV-1985	12:29	29	N	1.00'	19	W	45.00'
46	23-NOV-1985	13:58	29	N	1.00'	19	W	27.00'
47	23-NOV-1985	18:59	28	N	59.00'	18	W	49.00'
48	23-NOV-1985	20:44	28	N	59.00'	18	W	26.00'
49	24-NOV-1985	3: 8	29	N	1.00'	17	W	50.00'
50	24-NOV-1985	4:58	29	N	1.00'	17	W	22.00'
51	24-NOV-1985	9:12	29	N	0.00'	16	W	51.00'
52	24-NOV-1985	10:28	29	N	0.00'	16	W	35.00'
53	24-NOV-1985	12:50	29	N	0.00'	16	W	25.00'

Table 5.4: POSEIDON cruise 124, XBT drops

DROP	DATE	TIME	LATITUDE			LONGITUDE		
54	24-NOV-1985	19:39	29	N	0.00'	15	W	58.00'
55	24-NOV-1985	20:42	29	N	0.00'	15	W	45.00'
56	25-NOV-1985	1: 6	28	N	59.00'	15	W	8.00'
57	25-NOV-1985	1:35	29	N	0.00'	15	W	2.00'
58	25-NOV-1985	4:55	29	N	0.00'	14	W	41.00'
59	25-NOV-1985	5:40	29	N	0.00'	14	W	30.00'
60	25-NOV-1985	8:43	28	N	57.00'	14	W	13.00'
61	25-NOV-1985	9:40	28	N	54.00'	14	W	3.00'
62	25-NOV-1985	10:18	28	N	51.00'	13	W	56.00'
63	25-NOV-1985	11:18	28	N	45.00'	13	W	42.00'
64	25-NOV-1995	13:35	28	N	40.00'	13	W	28.00'
65	25-NOV-1985	14: 8	28	N	38.00'	13	W	21.00'
66	25-NOV-1985	16: 6	28	N	33.00'	13	W	8.00'
67	26-NOV-1985	2:11	27	N	46.00'	14	W	35.00'
68	26-NOV-1985	2:49	27	N	42.00'	14	W	41.00'
69	26-NOV-1985	3:21	27	N	38.00'	14	W	48.00'
70	26-NOV-1985	4: 1	27	N	34.00'	14	W	54.00'
71	26-NOV-1985	7:31	27	N	36.00'	15	W	5.00'
72	26-NOV-1985	9: 8	27	N	44.00'	15	W	9.00'
73	26-NOV-1985	10:18	27	N	49.00'	15	W	12.00'
74	26-NOV-1985	11:31	27	N	55.00'	15	W	16.00'
75	30-NOV-1985	12: 0	28	N	18.00'	15	W	25.00'
76	30-NOV-1985	13: 9	28	N	23.00'	15	W	28.00'
77	30-NOV-1985	13:54	28	N	30.00'	15	W	31.00'
78	30-NOV-1985	16:22	29	N	0.00'	15	W	43.00'
79	30-NOV-1985	19:18	29	N	32.00'	15	W	54.00'
80	30-NOV-1985	22:50	30	N	6.00'	16	W	13.00'
82	1-DEC-1985	2: 9	30	N	39.00'	16	W	28.00'
83	1-DEC-1985	10:42	31	N	47.00'	16	W	59.00'
84	1-DEC-1985	13:51	32	N	19.00'	17	W	13.00'
85	1-DEC-1985	17: 1	32	N	51.00'	17	W	25.00'
86	1-DEC-1985	20:15	33	N	26.00'	17	W	32.00'
87	1-DEC-1985	23:24	34	N	0.00'	17	W	38.00'
88	2-DEC-1985	2:30	34	N	33.00'	17	W	41.00'
90	2-DEC-1985	9:20	35	N	41.00'	17	W	57.00'
91	2-DEC-1985	23:32	36	N	21.00'	17	W	35.00'
92	3-DEC-1985	2:39	36	N	57.00'	17	W	10.00'
93	3-DEC-1985	5:49	37	N	26.00'	16	W	41.00'
94	3-DEC-1985	9: 6	37	N	55.00'	16	W	21.00'
95	3-DEC-1985	16: 2	38	N	44.00'	15	W	37.00'

Table 5.4: cont'd.

STATION	DATE	TIME	LATITUDE	LONGITUDE	DEPTH
I	23-Nov-1985	17:10	28 N 17.25'	19 W 19.41'	1000
II	24-Nov-1985	7:33	27 N 30.23'	18 W 29.42'	1200
III	24-Nov-1985	15:59	27 N 30.03'	17 W 30.10'	1200
IV	25-Nov-1985	9:40	27 N 30.03'	16 W 19.89'	1000
V	25-Nov-1985	19:45	27 N 29.31'	15 W 00.89'	1200

Table 5.5: TALIARTE cruise XIV, hydrographic stations with Nansen-casts.

DROP	DATE	TIME	LATITUDE	LONGITUDE
1	22-NOV-1985	18:32	28 N 39.00'	19 W 8.00'
2	23-NOV-1985	11:16	28 N 49.00'	19 W 50.00'
3	23-NOV-1985	13:16	28 N 39.00'	19 W 39.00'
4	23-NOV-1985	15: 3	28 N 29.00'	19 W 30.00'
5	23-NOV-1985	20:34	28 N 18.00'	19 W 20.00'
6	23-NOV-1985	22:15	28 N 9.00'	19 W 10.00'
7	23-NOV-1985	23:53	28 N 1.00'	19 W 0.00'
8	24-NOV-1985	1:52	27 N 50.00'	18 W 50.00'
9	24-NOV-1985	3:55	27 N 40.00'	18 W 39.00'
10	24-NOV-1985	5:53	27 N 31.00'	18 W 30.00'
11	24-NOV-1985	10:50	27 N 30.00'	18 W 20.00'
12	24-NOV-1985	11:50	27 N 30.00'	18 W 10.00'
13	24-NOV-1985	12:52	27 N 30.00'	18 W 0.00'
14	24-NOV-1985	13:54	27 N 30.00'	17 W 50.00'
15	24-NOV-1985	14:46	27 N 30.00'	17 W 40.00'
16	24-NOV-1985	15:45	27 N 30.00'	17 W 30.00'
17	24-NOV-1985	18:34	27 N 30.00'	17 W 20.00'
18	24-NOV-1985	19:44	27 N 30.00'	17 W 10.00'
19	24-NOV-1985	20:52	27 N 30.00'	17 W 0.00'
20	24-NOV-1985	21:58	27 N 30.00'	16 W 50.00'
21	24-NOV-1985	23: 4	27 N 30.00'	16 W 40.00'
22	25-NOV-1985	0: 7	27 N 30.00'	16 W 30.00'
23	25-NOV-1985	9:45	27 N 30.00'	16 W 20.00'
24	25-NOV-1985	12:13	27 N 30.00'	16 W 10.00'
25	25-NOV-1985	13:18	27 N 30.00'	16 W 0.00'
26	25-NOV-1985	14:19	27 N 30.00'	15 W 50.00'
27	25-NOV-1985	15:27	27 N 30.00'	15 W 40.00'
28	25-NOV-1985	16:20	27 N 30.00'	15 W 30.00'
29	25-NOV-1985	17:24	27 N 30.00'	15 W 20.00'
30	25-NOV-1985	18:26	27 N 30.00'	15 W 10.00'
31	25-NOV-1985	19:26	27 N 30.00'	15 W 0.00'
32	25-NOV-1985	23: 0	27 N 30.00'	14 W 50.00'
33	26-NOV-1985	0: 5	27 N 30.00'	14 W 40.00'
34	26-NOV-1985	1:12	27 N 30.00'	14 W 30.00'

Table 5.6: TALIARTE cruise XIV, XBT drops

MOORING	IFM-NO	DATE 1985	TIME	LATITUDE N	LONGITUDE W	DEPTH	
R	297-2	1-OCT	8:11	28° 0.40′	24° 30.00′	5232	r
O	296-2	2-OCT	9:30	28° 0.30′	24° 30.00′	5205	r
P	295-2	3-OCT	8:28	27° 59.30′	22° 23.40′	4887	r
E	294-2	4-OCT	7:20	28° 0.80′	20° 25.50′	4605	r
	294-3	4-OCT	13:58	28° 2.80′	20° 25.10′	4619	d
X	293-2	5-OCT	7:17	28° 0.90′	18° 18.30′	3665	r
	293-3	5-OCT	13:13	28° 1.40′	18° 17.50′	3432	d
Y	306-1	6-OCT	14:02	26° 25.60′	19° 24.90′	3838	d
KS1	303-1	7-OCT	7:12	26° 2.30′	17° 59.90′	3442	r
KS2	304-1	7-OCT	14:56	25° 32.50′	17° 3.70′	3269	r
V	307-1	8-OCT	15:08	22° 56.70′	20° 30.70′	4146	d
Q	308-1	9-OCT	9:17	21° 59.00′	22° 02.40′	4572	d
W	309-1	11-OCT	16:00	19° 02.40′	22° 00.10′	3494	d
U	300-1	8-OCT	8:00	35° 1.80′	26° 28.90′	4185	r
KIEL276	276-6	16-NOV	11:00	33° 9.50′	21° 57.30′	5290	r
	276-7	17-NOV	8:26	33° 8.50′	21° 57.60′	5285	d
B	301-1	18-NOV	8:12	32° 38.90′	26° 30.50′	4646	r
T	302-1	20-NOV	6:45	30° 21.30′	26° 29.20′	4958	r
MW	311-1	2-DEC	18:17	36° 01.90′	18° 01.10′	5420	d

Table 5.7: POLARSTERN cruise ANTIV/1b and POSEIDON cruise 124 moorings recovered (r) and deployed (d). Mooring KIEL276 is the former position N1.

6. List of symbols

P, PRES	dbar	pressure
T, TEMP	°C	temperature
θ	°C	potential temperature
S		practical salinity 1978 scale
σ_t	kg m^{-3}	density excess over 100 kg m^{-3}
Z	m	depth
uc, vc	cm s^{-1}	east and north component of current vector
$PO_4H^=$	µmol.dm^{-3}	Phosphate concentration
NO_3^-	µmol.dm^{-3}	Nitrate concentration
$Si(OH)_4$	µmol.dm^{-3}	Silica concentration

S-106 = Vert 1- 27 ✓
S 107 " 28 - 56 ✓
S 108 " 57 - 87b ✓
S 109 " 88 - 116 ✓
S 110 " 117 - 141 ✓
S 111 " 142 - 168 ✓
S 112 " 169 - 192 ✓
S 113 " 193 - 202 ✓
S 114 = leer